

Science and Mathematics Education Centre

**Painting a Portrait of Mathematics: A Case Study of Secondary
Students' Assessment Portfolios**

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This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made.

Signature:

Date:

This thesis is dedicated to the late Malinda Yee.

Malinda is remembered as an exceptionally talented and diligent student.

Hers is one of the voices presented in this study.

My thanks goes to Professor John Malone for his patient supervision,

to Margaret Brown, my wife, for her advice and help
with transcription of interviews,

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who participated in the study.

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The title of this thesis was inspired by an article on portfolios by Robinson (1998).

ABSTRACT

This study analyses the effect of introducing student portfolios as a means of assessing the learning of mathematics. It examines the intended and the unforeseen outcomes in terms of the students, the caregivers, and the teachers involved, using quantitative data to match classroom environments with the response to the innovation. A major focus of the qualitative aspect of the study is the decision-making process that was associated with the implementation of change.

For this study, all the junior students in a New Zealand secondary school were asked to compile portfolios of their mathematical work. The portfolios were graded by the teachers, the marks contributing to the students' assessments for the year's work. At the outset, the plan was to survey the 510 students involved to determine their attitude towards mathematics, survey them again once the innovation was in place to quantify the classroom environment, then repeat the first survey. Analysis was expected to reveal whether classroom environments that approximated a "portfolio culture" (Duschl & Gitomer, 1991) contributed to an improved attitude towards mathematics. This quantitative approach was supplemented with taped interviews of students and teachers, ongoing records of less formal interactions, review of examination marks and school reports, and questionnaires mailed to the homes of a sample of the students. As the study progressed, it emerged that the major impact was on the teachers, and the focus shifted to them. For four years, follow-up surveys were conducted with teachers, including those who had transferred to other schools.

The study found that all students can benefit from portfolios, both in terms of skills and attitude towards mathematics. Portfolios legitimated the involvement of caregivers, a positive change that provided greater links between classroom activity and the world of employment. The professional practice of teachers was affected by portfolios, prompting development of new classroom resources and techniques, increased collegial cooperation, and well-informed reflection on teaching and assessment. Teachers maintain great influence on classroom culture, and for many of those involved in the study, portfolios prompted a renewed interest in the process

undertaken by students as they develop mathematical ideas, and a change in the relationship between teacher and students. The “portfolio culture” resulted in students improving in their appreciation of mathematics, and a changed role for the student within the social environment of the classroom.

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CHAPTER ONE: INTRODUCTION

“...the essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a *decision* or set of decisions: why they were taken, how they were implemented, and with what result” (Schramm, 1971, cited in and emphasis added by Yin, 1994, p. 12).

In 1998, a group of New Zealand secondary school mathematics teachers had the opportunity to make a significant decision, a decision that was to affect school policy, and ultimately the learning culture of an entire school. They chose to introduce portfolios as a form of assessment in mathematics. No extreme measures were contemplated, but 20% of the marks for the year depended upon a file of materials produced and selected by each student. This study looks at how that decision was prompted, describes the impact it made, and discusses the implications.

The Origin of this Study

No study is value-free, and the very choice of topic reflects something of any author's disposition. In itself, that choice is one of the decisions that impacted on the school in which this study took place. The choice was prompted to some extent by the availability of a suitable educational innovation in an accessible situation.

The social factors which enabled the study to take place included the attitude of the school community, the skills and propensities of the teachers, and the organisational ethos of the school administration. The school's catchment spanned the outer suburbs of a large city and a considerable rural area. The households can be described as “middle-class” as they were placed at the eighth decile of income by national census figures. Although many parents had the means to provide private schooling for their children, the government school enjoyed a good reputation and parents were satisfied with its standards. This had resulted in consistent growth in the size of the school roll over many years. The school had appointed its full quota of staff, usually attracting a large field of applicants for each position. Almost all the mathematics staff were full-time, tenured, well-qualified and experienced mathematics teachers who taught little

other than mathematics. The administration of the school was in the hands of recently-appointed people who were keen to see the school implement new practices. For example, each year a *school focus* was selected in order to provide a shared positive goal.

The local community and the staff perceived the school as a reasonably successful enterprise, an attitude which perhaps provided the basis for a self-assured administration and for Mathematics Department personnel willing to accept new ideas with confidence and enthusiasm. In particular, the Head of Department was very supportive of those developments in teaching that were seen as progressive. Some indicators of flexibility and openness were that staff meetings and departmental meetings were frequent and well-attended; that members of staff attended many professional development opportunities such as workshops and conferences, and that inter-personal relations amongst the staff were cordial, with many social events taking place outside the school. In New Zealand, all schools control the hiring of their own personnel. The Head of Department had undoubtedly stamped his influence throughout a decade of appointment decisions in a school that was widely regarded as a desirable employer.

My own background included a decade of teaching at the school, postgraduate study in sociology and psychology, development and publishing of software, and two years as editor of the local mathematics teachers' monthly journal. I saw myself as a contributor to a reasonably vibrant mathematics education community. Postgraduate study introduced me to the idea of the teacher-researcher and fostered my implementation of several educational experiments, such as the use of concept mapping (Novak, 1996) in mathematics. When the performance of New Zealand mathematics students in an international survey was criticised, I wrote a newspaper article to redress misinterpretations (Brown, 1998). In common with the vast majority of the school's mathematics staff, I felt competent in my subject and in my classroom performance, and confident in being able to make independent decisions about the best instructional and assessment strategies for my students. I was ready for a challenge.

New Zealand may be geographically isolated from the rest of the world, but it certainly is alert to overseas trends. Influences which have registered strongly include the Cockcroft Report on the teaching of mathematics in schools in the United Kingdom (Cockcroft, 1982), and the liberalisation of the non-mandatory but highly influential curriculum published by the National Council of Teachers of Mathematics (1989) in the United States. Although the New Zealand mathematics curriculum document (Ministry of Education, 1992) makes no mention of overseas practice, it attempted to implement the same teaching emphasis on problem-solving, realistic context, and communication. In particular, the “mathematical processes” section of the curriculum document made a series of requirements which resonated with international sentiment for improvement in the relevance and utility of mathematics courses. The quotation below is the full text of this section (Ministry of Education, 1992, p. 23).

The mathematics curriculum intended by this statement will provide opportunities for students to:

develop flexibility and creativity in applying mathematical ideas and techniques to unfamiliar problems arising in everyday life, and develop the ability to reflect critically on the methods they have chosen;

become effective participants in problem-solving teams, learning to express ideas, and to listen and respond to the ideas of others;

develop the skills of presentation and critical appraisal of a mathematical argument or calculation, use mathematics to explore and conjecture, and learn from mistakes as well as successes;

develop the characteristics of systematic and logical thinking, and apply these in mathematical and other contexts, including other subjects of the curriculum;

become confident and competent users of information technology in mathematical contexts;

develop the skills and confidence to use their own language, and the language of mathematics, to express mathematical ideas;

develop the knowledge and skills to interpret written presentations of mathematics.

Of the seven opportunities listed, only the final one was already widely practiced in New Zealand classrooms. The other curriculum demands were quite a challenge to New Zealand teachers, and represented a considerable amount of imposed change. Not only would the content of lessons have to change, but also the types of activities undertaken by students in the mathematics classroom. Furthermore, schools needed to assess the degree to which they were successful in implementing the new curriculum.

In summary, this study of portfolios as an assessment device in secondary mathematics was the result of imposed curriculum change, reflecting international academic opinion and local political support. The curriculum initiatives were received by a school Mathematics Department faculty sufficiently skilled and confident to be predisposed to innovation, and by myself as an individual familiar with the role of teacher-researcher and located in an environment that was supportive of experimentation.

Portfolios in the New Zealand Context

New Zealand schools had experienced a great deal of imposed change in both curricula and assessment throughout the years leading up to this study. New curricula were in place in every subject. The most recent mathematics curriculum (Ministry of Education, 1992) had just reached full implementation. It contained these comments in regard to assessment:

Assessment should, as far as possible, be integral to the normal teaching and learning programme. Continuing assessment as part of the teaching and learning programme increases the range and quality of assessment which can be carried out for good diagnosis, and avoids the artificial intrusion on

learning and teaching time which is associated with separate assessment sessions. Assessment should involve multiple techniques including written, oral, and demonstration formats. Group and team activities should also be assessed.

...teachers should report what students have been working on, what they have achieved, and how well they have achieved it. A grade, level, or mark alone is insufficient (p. 15).

In mathematics, there already existed some alternative systems of assessment. *Internally assessed* projects, marked within the school, constituted 20% of the final year statistics paper. However, the marks submitted by each school were moderated on the basis of marks in the national examination. This entailed rescaling the marks submitted by each school to the same mean and standard deviation as the examination marks achieved by that school's students. Another system of assessment was available to less-able students. They were able to study a topic-based programme in which there was no summative examination. These alternatives plainly did not satisfy all the demands of the curriculum nor the *authentic testing* movement, and many teachers were looking for other means of assessment that better enabled students to demonstrate their learning. This move was supported by the Ministry of Education by the publication of a booklet on assessment (Ministry of Education, 1994) which recommended student portfolios, among other strategies.

A recent report on assessment practice in New Zealand schools exists in the Fitzsimons (1997) longitudinal study which tracked 98 students who were interviewed regularly. Comparing the students' attitudes on assessment with those of the New Zealand Qualifications Authority, Fitzsimons (1997, p. 22) noted that "These students are all talking about assessments as tests, in contrast to what the NZQA sees as sufficient evidence such as portfolios or samples of learning activities". Thus, while the New Zealand mathematics curriculum and qualifications framework assessment initiatives recommend and facilitate new forms of assessment, it appears that traditional tests and examinations have maintained their dominance. One government proposal (Ministry of Education, 1998) was that the *basic skills* of primary school children be tested by a mixture of nationally standardized tests and by

reference to exemplar *benchmark portfolios*. Such publications indicated to New Zealand educators that they could not ignore the changes in assessment being imposed upon them.

Educators were coping with imposed change, simultaneously resisting some aspects while implementing others, and justifying the changes to students, caregivers, and employers. Change in assessment practice was a key factor in this upheaval.

Portfolios can play a pivotal role in this, both as a novel form of assessment that can be useful for the non-traditional objectives required by the new curriculum, and also as a means of reporting student performance.

Aims of the Study

The study set out to describe the impact of the implementation of portfolios as an assessment technique in a New Zealand secondary school mathematics programme. A more comprehensive statement of the techniques used appears in Chapter Three. Briefly put, the aims of the study were to:

1. Determine the extent to which portfolios provide a means of assessment of aspects of the curriculum not covered by the standard forms of assessment.
2. Determine changes effected by portfolios in the classroom and school environment.
3. Identify perceptions of the portfolio innovation by students, teachers and caregivers.
4. Investigate the utility of portfolios as a means of reporting progress in mathematics.
5. Investigate the implications for teaching and learning of using portfolios.

To accomplish these aims, data had to be gathered from the whole spectrum of the social world of the school. Several approaches were needed: questionnaires,

interviews, and examination of school reports. Also, as the innovation was implemented and the responses of those involved became apparent, I recorded my own reflections, and discussed them with my teaching colleagues. This process helped to establish research questions appropriate to each objective – these research questions are presented and discussed at the beginning of Chapter Three.

Significance of the Study

After a complete restructuring of all curricula and the introduction of a new assessment system, New Zealand secondary education was, at the time of the study, at a stage of reflection and consolidation. As Fitzsimons (1997, p. 43) observed, “A better integration of assessment with curriculum is vital.” Teachers were torn between curriculum demands for creativity, and perceived assessment demands for accountability and evidence. It was hoped that this study would provide educators with some insight into this conflict, based on the experiences of a school that embraced one promising solution. Portfolios seemed to offer a means of student creativity within a viable system of assessment.

Mathematical processes were one aspect of the mathematics curriculum that gave particular anxiety to some teachers. Mathematical processes were described as “problem-solving, reasoning, and communicating mathematical ideas” (Ministry of Education, 1992, p. 23). These activities necessitated group work, use of technology, cross-curricula applications and the development of presentation skills. This curriculum requirement created a problem because traditional written tests were inadequate measures of such skills, prompting considerable interest in alternative forms of assessment. The portfolio idea had a great appeal to the mathematics teachers of the study because it appeared to offer them a solution to this problem. The fact that the portfolio solution remained in place, virtually unchanged, for three years indicates a degree of success, and should be of interest to mathematics teachers.

The case study format was selected to enable an insightful appreciation of the impact of portfolios. The small size of the study, and relative autonomy of the school, contrasts with large-scale assessment innovations, such as those in Kentucky,

Vermont and California discussed by Daro (1996) and Myford (1999), where teachers were more remote from the locus of decision-making. The setting of the study in my workplace ensured unhindered daily access to the teachers, students, administrators and caregivers involved in the portfolios initiative. This was a considerable advantage, and one that would not be available to researchers from outside the institution. I was a participant observer, teaching two of the affected classes for the first year of the full portfolios initiative. Every effort was made to elicit the views of the students and their caregivers, a process assisted by access to mailing lists and interview facilities, as well as the many opportunities for unscheduled informal interaction. Teaching colleagues were very cooperative and open during the year. Informal discussion with teachers and with students was supplemented by a busy schedule of tape-recorded interviews and questionnaires. The extended period of contact with the teachers provided adequate time for the programme to evolve, and for the participants to reflect fully on how well it was satisfying their expectations, as well as facilitating the identification of the unexpected outcomes that the portfolios generated. Follow-up questionnaires and communication by telephone and email ensured that contact with the teachers was maintained for four years after the initial year of intensive observation.

Feedback from interviews was an important part of the follow-up sessions with the students. Similarly, information from the questionnaires completed by each class was summarised and made available to the teacher of each class as soon as possible. The quantitative surveys ensured that the views of every student played a part in the study. Again, acting as a teacher-researcher enabled me to carry out the quantitative part of the study with the maximum cooperation of the school administration and of my colleagues. Because this process was carried out quickly and continuously, there was considerable opportunity for reflection and for the development of ideas. Although student performance was monitored, the focus of the study was on the affective domain. The engagement of all parties in the programme was studied, not just that of the students. Reflective input was solicited by means of open-ended questions and unstructured interviews. The familiarity of the researcher with the subjects facilitated candid responses. By these means, the study attempted to examine the effects of portfolios at a relatively intimate level.

As the case study was set in a New Zealand school, there was little centralised bureaucracy to deal with. The school principal was the key person on whom permission to engage in the study depended. Recently promoted from the ranks of mathematics teachers at the school herself, she was very supportive. The Mathematics Department enjoyed a good deal of autonomy, the major audit being a periodic review by the Education Review Office and largely concerned with correct documentation of procedures. The department was free to vary allocation of students to classes, to determine topic emphasis and teaching order, choice of textbooks, and assessment techniques and weightings. For the junior classes that participated in the study, there was no external moderation and no externally-set examination.

The portfolio innovation was implemented conservatively and at little cost. Its impact on the running of the school was minimal, as it did not require rearrangement of classes or teachers. It made no challenge to the structural systems of the school, such as streaming students into classes of similar ability. As such, it was an innovation that was readily acceptable to the school administration. There would be additional work for the teachers, but otherwise little ramification.

The participant observer, prolonged engagement, detailed observation coupled with feedback, access to decision makers, and low administrative impact are significant aspects of the study. They distinguish it as one that placed portfolios under the microscope of close and sustained insider scrutiny.

For the research community, this study provides a trial of survey instruments, one of which is designed to quantify attitude towards mathematics, the other to quantify classroom environment. Criticism of the instruments is based on trends noticed in the coding process and on user response. This study enabled the repeated administration of the same instrument to a large cohort of students three times over the period of 12 months. A unique system of respondent-generated code numbers enabled several questionnaires to be linked, without compromising the anonymity of the students involved.

New Zealand has rated well in international comparisons of mathematics achievement. For example, in the Third International Mathematics and Science Study

(Beaton et al., 1996) there was no statistically significant difference in the mathematics scores in the year prior to entering high school between New Zealand students and those of Germany, England and the United States. New Zealand students in the final year of high school obtained a mathematics score of 525, significantly above the international mean of 500, whereas students from Germany scored 496, and the United States 471. This study of portfolios provides some indication of the endeavour that underlies this achievement, along with an extensive list of mathematics education references, many of which are specific to New Zealand.

Structure of the Thesis

This thesis is organised into six chapters. The remaining chapters present the literature review, methodology, quantitative results, qualitative results, and conclusions.

Chapter 2 Literature review

This chapter is a survey of the literature of innovation in mathematics education, with particular reference to the use of portfolios. The chapter addresses the potential use of the study to a number of audiences.

Chapter 3 Methodology.

The survey instruments are introduced and the conduct of the quantitative research of the study is detailed. The timetable of interviews and other communication with students, caregivers and teachers is explained. The quality control procedures available for studies of this kind are discussed.

Chapter 4 Quantitative results.

Results from the attitude towards mathematics instrument are given in this chapter. This survey was conducted twice with the majority of the students, three times with some, enabling a comparison over time. The same questionnaire was administered to the most junior student cohort at the beginning of the year, at the end, and at the beginning of the next year, in order to detect any seasonal effect. Results from the classroom environment instrument are also given, and these are matched to the other data.

Chapter 5 Qualitative results.

By quoting from transcribed interviews, this chapter seeks to flesh out the quantitative results and reveal the factors underlying their statistics. Assertions based on communication with the students, the caregivers and the teachers are identified and discussed.

Chapter 6 Conclusions

This chapter contains conclusions, notes on the limitations of the study, suggestions for further research, and a personal response. A triangulation of results is made, synthesising quantitative and qualitative findings. The implications of the study for the teaching and learning of mathematics are given.

CHAPTER TWO: LITERATURE REVIEW

The goals of this literature review are to clarify the terms used in the mathematics assessment discourse, to identify and summarise the key outcomes within this field of research, to explain the unique aspects of this case study that establish its place in the body of literature, and to demonstrate how the study extends that body of literature.

Clarification of Terms

The important concepts discussed in this section concern assessment, the varieties of assessment including portfolios, and the criteria that can be applied in order to judge these alternatives. The words *standards* and *outcomes* have particular significance in the recent language of mathematics education, and an account of these terms is provided.

Mathematics assessment has been the focus of a vigorous debate for many years. Recent milestones in the United States have included the release of the National Council of Teachers of Mathematics report *Curriculum and Evaluation Standards for School Mathematics* (1989), the publication of *Assessment Standards for School Mathematics* (NCTM, 1995) and the subsequent “Math Wars” backlash (Jacob, 2001). These events have shaped the terms used in the mathematics assessment debate throughout the world.

Standards may sound like a contemporary buzzword in the politics of education, but it is a word with a long history. Educational testing goes back to the beginning of state funding of education. In the 1830s Horace Mann championed standardized testing in order to avoid the bias-ridden oral examinations that were the norm. According to Mabry (1999, p. 14), “Mann’s 1846 Boston Survey was the first printed test for large-scale assessment of student achievement in geography, grammar, history, philosophy, astronomy, writing, and arithmetic.” At the end of the nineteenth century firebrand early researchers such as Joseph Mayer Rice looked for characteristics of high-achieving schools (Kilpatrick, 1992), but it was not until 1908 that “the measurement movement in arithmetic can be said to have really gained

sanction” (Kilpatrick, 1992, p. 2). The efficiency of school instruction began to be objectified, and large scale testing was undertaken. International comparisons were initiated in 1964 when the International Association for the Evaluation of Educational Achievement (IEA) began its first mathematics data collection.

In Australia and New Zealand, officially imposed standardized testing is in its infancy. However, the multi-choice Australian Mathematics Competition (AMC) operates as a de facto standardized test. The AMC has been widely supported since its introduction in 1978, with entries from 80% of Australian secondary schools in 1985, and participation by 12 other countries, mainly in the South Pacific region (Edwards, King & O’Halloran, 1986). It has since spawned similar multi-choice testing in other subjects, including Science and Information Technology. Unlike the standardized testing normally contemplated by politicians, the AMC is voluntary and relies on prizes and participation certificates to spur involvement. Because it is not a high stakes test where failure evokes negative consequences, there is little opposition to the multi-choice format of the AMC and its failure to conform to the mathematics curricula of the many countries it serves.

As claimed by Kohn (2001), for some people it is an easy transition from standardized tests to the assumption that there is a sequence of objective standards that learners accomplish during their mathematical progress. Kohn claims that this is a misconception, and that it leads to a confusion between these immutable standards and *high standards* of quality. He is critical of education administrators who apply such arguments in justification of high-stakes, norm-referenced testing.

In 1992, Collis observed that in the United States there has been “over the last decade, a move from product-oriented tests such as multiple-choice, to process-oriented tests which may include ... projects, extended tasks, open-ended questions and oral tests” (p. 7). These seem to be tasks of the type prescribed by the New Zealand curriculum and implemented during the 1990s. Collis believed that this was part of an *assessment-led* reform as embodied in the report *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989). This reform was prompted by concerns about the efficacy of traditional tests. These concerns are succinctly described by Boaler (1999):

...the current debate about standards assumes there to be one form of knowledge that is unproblematically assessed within tests. This is despite the fact that a large body of research from psychological and educational fields shows the existence of different forms of knowledge. There is also increasing evidence that students can be very successful on standard, closed tests with a knowledge that is highly inert and that they are unable to use in more unusual and demanding situations (such as those encountered in the workplace). (p. 1)

Boaler was so concerned that students could not see any connection between school mathematics and the mathematics of real situations that she set up a study comparing a *textbook* school to a *project* school. The project school saw heterogeneous groups of students working on open-ended questions and experiencing a variety of teaching methods. They did not work through textbooks. Compared with the textbook school students, the project school students “attained higher grades ... on a range of different problems and applied assessments” (Boaler, 1999, p. 3) because they experienced better retention and were more able to adapt procedures to non-routine problems.

The issues in assessment once were: *validity* (does the test measure what you think it does?), *reliability* (can the research yield roughly the same results when replicated?) and *generalizability* of results. But with post-modernism and constructivism came a rejection of the idea that a disinterested observer can successfully operate some sort of objective assessment machine (Gipps, 1994). The new test parameters are *credibility* (was there prolonged and persistent observation?), and *transferability* (is the *sending context* of the test similar to the *receiving context* where the skills are to be applied?). Gipps (1994) calls this change a paradigm shift because the reliability of a traditional test could be ascertained in a psychometric model, whereas the assessment in a constructivist model does not result in grades but in the profile of a person. Abandonment of the unidimensional psychometric model forces a reconceptualization of reliability. Gipps (1994) suggests a new term, *comparability*, (were consistent standards used in the assessment of each person?). Other considerations now include fidelity to the curriculum, range of the indicators used, and public credibility.

Whether norm-referenced (the individual compared with peers) or criterion-referenced (the individual compared against achievement benchmarks), standardized assessment has been rejected by many educators and researchers. In particular, the multiple-choice format has received heavy censure. For example, Mabry (1999) in her criticism of standardized assessment tests, notes that “It is becoming common to find claims that the tests’ influence over education extends to the disempowerment of teachers, as, increasingly, test developers determine what will be tested, which de facto determines what must be taught” (p. 26). Mabry’s arguments, which she attributes to Harold Berlak, include the observations that “the tests may claim to measure only cognitive outcomes, but there can be no confident separation of cognitive, affective and conative achievement”, and “because the tests produce rankings, but little information about what students know and can do, they are instruments not of feedback but of control and surveillance” (1999, p. 28). Mabry disparages *selected-response* tests, favouring *constructed-response* formats such as portfolios, projects and demonstrations.

Portfolios and Assessment

A portfolio is an organised collection of work that is built up as a student undertakes an educational course. Representing a student’s best work, or work valued under some system of negotiated criteria, the portfolio can be used as a form of assessment. This study took place in New Zealand, where portfolios are reported to be widely used in primary schools (Rudge, 1997). At secondary level they are most familiar in *practical* subjects, such as art and technology, and little used in *academic* subjects such as the setting of this study, in mathematics. In this regard New Zealand lags behind the United States, where there has been a move towards the use of portfolios for assessment purposes in mathematics at all levels, including tertiary (Crowley & Dunn, 1995), and in many formats, including electronic (Lankes, 1995).

Perhaps the most definitive explanation of a portfolio is that developed under the auspices of the Northwest Evaluation Association [of the United States] and provided by Arter and Spandel (1992):

...a student portfolio [is] a purposeful collection of student work that tells the story of the student’s efforts, progress, or achievement in (a) given area(s).

This collection must include student participation in selection of portfolio content; the guidelines for selection; the criteria for judging merit; and evidence of student self-reflection. This definition supports the view that assessment should be continuous, capture a rich array of what students know and can do, involve realistic contexts, communicate to students and others what is valued, portray the processes by which work is accomplished, and be integrated with instruction. (p. 36)

It would seem that, under this definition, portfolios must achieve a great number of things. Before examining the results of using portfolios in this study, it is worth noting that the unattainable idealism of this definition will be readily apparent to practicing teachers. Arter and Spandel acknowledge that such portfolios “demand a serious commitment of time and energy” (p. 39) but warn that use of portfolios for “monitoring achievement, as in large scale assessment” (p. 37) may interfere with their primary use, which is for instruction. Arter and Spandel justify the large investment of effort in formative rather than summative assessment:

Students cannot assemble a portfolio without using clearly defined targets (criteria) in a systematic way to paint a picture of their own efforts, growth and achievement. This is the essence of assessment. Thus, portfolios used in this manner provide an example of how assessment can be used to improve achievement and not merely monitor achievement. (p. 37)

Several issues are not specifically addressed by Arter and Spandel, but are raised by other contributors of implementation manuals for portfolios in assessment (Burke, 1993; Clarke, 1997; Forster and Masters, 1996). There are administration details such as rules governing redrafting, and scope for appeal of grades (if any) or completion decisions. There is the matter of audience/privacy: the portfolio can be peer-assessed, and can be addressed to the teacher, caregivers or perhaps designed for a public exhibition. Ownership also needs to be clarified: whether the student will receive back all materials, and whether the school will archive a copy. This is especially important in the case of easily duplicated electronic portfolio submissions. The issue of whether the student has copyright will also require clarification. Ethical issues include how the school will check for, and respond to, fabrication and plagiarism. Taking the latest technology into account, it could be added that student

publication by way of websites introduces a new raft of issues. The ease and immediacy of this form of publication means that control and censorship responsibilities must be clear, or individuals and the school can face the legal consequences of any defamation, breach of privacy, or infringement of intellectual property and copyright law.

The many difficulties of using portfolios are readily apparent. But there are many convincing arguments for their use, and these convinced the teachers involved in this study. Portfolios are a form of *performance testing* and are seen to be a technique favoured by the *authentic testing* movement, proponents of which eschew psychometric testing and claim that too much emphasis has been placed on narrow forms of testing, a claim which resonated well with most of the teachers in the study. The “Tyranny of Testing” (Hoffmann, 1962) was, as the title suggests, a forcefully-written attack on “testing by checkmark” (p. 7) which the author dates as widely used in the United States by the second world war. According to Gipps (1994), one of the initial authentic testing influences was Robert Glaser’s 1963 paper on criterion-referenced testing which listed some alternative assessment techniques including portfolios, problem-solving, dynamic tests of responsiveness to instruction, and reasoning tests. Broadfoot (1986) provides what almost amounts to a reform manifesto:

A resumé [*sic*] of current practice and aims with regard to School Leaving Examinations ... reveals a remarkable similarity in countries as disparate as India and Australia, Iran and Sweden. Crudely, the principal concern is to ‘humanize’ the assessment procedure; to abolish pass/fail and the fear of failure in favour of grades; to replace one-off examinations by continuous teacher assessment, to extend the scope of the assessment to include not only formal written work but oral and practical work too, and in some cases, personal qualities; to provide for assessment that will be diagnostic and detailed, increasingly cumulative and integrated with the learning process and only culminating in, not solely orientated to, a terminal evaluation. (pp. 59-60)

In the United States, Resnick and Resnick (1992) and Wiggins (1989; 1993) have taken a sustained and prominent role in promoting portfolios and other assessment

techniques which are alternatives to psychometric testing. Official support can be dated from 1987 when the Educational Testing Service published a teachers' manual for assessing higher-order thinking (National Assessment of Educational Progress, 1987). EQUALS, a mathematics equity inservice and curriculum program at the Lawrence Hall of Science, University of California, and the California Mathematics Council began to provide teachers with non-traditional materials and techniques for assessing students' thinking. This included the portfolio, a "collection of documents carefully selected by the student... to present a broad view of the students range of interests and abilities in mathematics" (Lester & Kroll, 1991, p. 282).

With regard to the implementation of portfolios, there is considerable variety of practice reported in the literature. Burke (1993) provides lists of the many management options for item selection, evaluation and use of portfolios. Often the alternatives are complementary. For example, the teacher and the student could share in the process of selecting the portfolio's contents or it could fall only to the student. Another option is that the whole portfolio could be sent home to caregivers at the end of the year, or parts of it be retained by the school. There are many evaluation options, including ongoing evaluation as each item is added, or even leaving the portfolio ungraded to "speak for itself". When the portfolio is complete it can be presented in an exhibition or at a peer conference, or perhaps shared with students of another age level. These choices did not present a problem for the teachers in this study. Some teachers made ad hoc individual decisions for their class as the need arose. Others conferred or raised matters at department meetings. Although there seemed to be little rancour about portfolios, after three years and many changes in staff there was so much inconsistency of application that the programme was suspended, reviewed, and reintroduced with clearer rules and greater shared understanding amongst the teachers. Portfolios had become part of a wider programme of formative testing coupled with a different teaching approach.

Many positive benefits are claimed of portfolios. Wolf (1989) maintains that when young students develop writing portfolios, they are able to assess better their progress as learners. Good (1996) writes that according to researchers Flood and Lapp (1989):

Parents are almost lulled to sleep by report cards that indicate, for example, that a student is getting a “C” in math the first term, the second term and the third term. Some parents have difficulty interpreting such grades and assume that their children are not learning and progressing. In contrast, portfolios can provide parents with a variety of performance measures of their children’s work. (p. 647)

Good (1996) cites Athanases (1994) as concluding that “use of student portfolios led teachers to obtain more varied and detailed records of students’ literacy development. Furthermore, many teachers became more attentive to students’ individual progress over time” (p. 648). Portfolios are also seen as a useful vehicle for developing meaningful group work, and a focus for interventions by caregivers, tutors and senior student coach/mentors (Burke, 1993; Kulm, 1994; Lambdin & Walker, 1994). These assertions became a focus in this study’s questionnaires, interviews, informal discussions and correspondence with students, teachers and caregivers over four years of data gathering. The findings, presented in Chapter Five, were that some teachers found the portfolios prompted their own renewed engagement with their students’ misconceptions, greater appreciation of their students’ creativity, and a change in professional practice towards formative testing. It was not just a matter of acceleration of the students’ learning speed, but a change to the nature of how teachers appreciated the students and movement to a more empathic relationship.

Student portfolios have been a major initiative in the Vermont education system since 1991. Koretz, Stecher, Klein, McCaffrey and Deibert (1993) report that this has had many effects, including: the amount of classroom time devoted to problem solving increased; the emphasis by teachers on mathematical communication increased; the amount of time students worked in small groups and in pairs increased; schools voluntarily expanded the use of portfolios beyond state requirements; regardless of ability level, most students performed differently on portfolio tasks than on regular mathematics assignments; the appreciation by teachers of the mathematical abilities of their students changed as a result of student portfolio work; and portfolios increased the enthusiasm of mathematics teachers for their

subject and had other positive effects on the attitudes of teachers. Again, these assertions about attitudes and behaviours guided data gathering during the study.

The performance assessment movement has not been the only recent initiative within the United States. The *standards-based* reform movement has convinced some states to increase the number of traditional tests, lower the age at which they are applied, and to increase their importance to schools and students. Such tests incorporate *high stakes* accountability as schools are ranked in published league tables, and students may be recalled to summer school to repeat failed courses (Brooks & Brooks, 1999). The tests are not just assessment of individual students, but are also used to evaluate teachers and principals, and to decide how much tax money school districts receive. “How well schools perform on these tests can even affect property values in surrounding neighbourhoods” report Henriques and Steinberg (2001, para. 8). Although NCS Pearson, the largest standardized test provider in the United States, and other testing companies have recently endured bad publicity over breakdowns in quality control that have affected tens of thousands of students, the standardized testing business is booming. Gardner (2001) claims that:

With California leading the way, the nation is going through a frenzy of testing its public school students. Never before have so many students been given so many formal standardized tests. The college-bound student can expect to take the PSAT, the SAT and an assortment of achievement and advanced-placement tests; college-bound or not, students also take state-mandated tests, as well as nationally normed instruments like the Iowa Test of Basic Skills or the Stanford 9. (para. 1)

A similar movement is occurring in other countries, including New Zealand and Australia, as *benchmark* testing is first applied in primary schools then at increasingly higher age levels. The drive for standards is given as the justification for implementation of the opposite of portfolios, a regime of high stakes, unseen, closed-question, time-constrained testing applied as a census to young people of all abilities.

California is a populous state and a key market for educational textbooks. It is often at the forefront of educational change in the United States. In 1985, California adopted a Mathematics Framework that called for an increased emphasis on contextual problem solving and promoted *teaching for understanding*. But in 1998,

the California State Board of Education adopted a revised Mathematics Framework that, according to Jacob (2000, p. 4) “promotes direct instruction leading to mastery of symbolic procedures, and stresses precision in mathematical formulation with a renewed emphasis on proof.” The Framework states “in mathematics, timed computation tests play a ‘more basic role’ in measuring understanding”. The word *standards* is now problematic, because in California it has a special meaning, connoting the topics students should study under a system where attainment depends upon giving the correct responses to specific types of questions. Elsewhere, *standards* is a political codeword for greater accountability of schools, achieved through rigorous traditional testing within a closely constrained curriculum. Although the standardized testing movement which seems to have won the “Math War”, as it is sometimes styled, does not claim the *back to basics* title, it is criticised by Jacob (p. 30) as having “resurrect[ed] the instructional approaches that were common in the U.S. in the 1980s”.

In Australia the word for *standards* is *outcomes*, although there are many shades of meaning in different contexts. In a document entitled “Outcomes and standards framework overview” the then Director-General of the Education Department of Western Australia wrote “The Curriculum Framework sets out the outcomes for all students. We believe that all students can achieve these outcomes and we have high expectations that they will achieve them” (Education Department of Western Australia, 1998). This statement seems designed to confuse the idea of minimum competency testing with the idea of assessment of high achievement by those students for whom high academic expectations are held. The only mention of standards in the document occurs in this sentence: “Standards, which indicate the proportion of students performing at particular outcome levels for specific year groups, will be developed as schools progressively implement an outcomes-focused approach” (Education Department of Western Australia, 1998, p.6). This is yet another meaning for the word *standards*, referring to a norm-referencing practice.

A similar ambivalence in the use of terms was found in New Zealand when this study was underway. In *The New Zealand Curriculum Framework* the claim is made that “It [the curriculum] provides clear learning outcomes against which students’ progress can be measured” (Ministry of Education, 1993, p. 24). But minimum

competency outcomes are either achieved or failed, no graduated measurement is possible. The idea of *outcomes* directly contradicts the assessment requirements detailed elsewhere in the New Zealand curriculum and quoted in Chapter One of this thesis. For example, the curriculum directs that “teachers should report ... *how well* [italics added] they [students] have achieved” (Ministry of Education, 1992, p. 15). The curriculum documents do not face up to the fact that national high achievement and objectively-measured success for every student are incompatible goals. This leaves teachers in a quandary: do they invest effort in non-traditional assessments that identify and foster high achievement, or in rote learning for standardized testing focusing on the basics? That question was one of the decisions faced by teachers in this study, with some teachers opting to put a great deal of personal effort, and even their own financial contribution, into practices they felt would be of largely intangible benefit to their students. Other teachers found that they were too busy preparing students for the examination to devote much time to inessential activities. The negative opinion of educational administrators towards portfolios was signalled when a new national examination system that allowed little scope for such assessment devices was implemented recently.

Key Influences Within this Field of Research

The development of scientific disciplines does not occur in a coherent and hierarchical manner. Excellent discoveries are ignored (e.g. the solar-centric astronomical model), resources are squandered on worthless lines of enquiry (e.g. astronomical methods of determining longitude at sea), and breakthroughs are made by accident (e.g. plate tectonics theories verified by equipment developed for other purposes) and in parallel (e.g. calculus). Kuhn (1962) and Lakatos (1970) discuss this situation in science and mathematics respectively. Sobel and Andrewes (1998) have recently brought the scientific establishment’s blunders over the longitude problem to popular attention. Berlinski (1997) has written a best-seller account of the parallel development of the calculus by antagonists Newton and Leibniz.

The reason for the fragmented development of scientific disciplines is that science is a human endeavour, subject to lobbying from groups with vested interests, luck, and human frailty. In the same way, a student attempting to master a scientific discipline

will encounter many obstacles, not the least of which are the student's fondly-held misconceptions and proclivity towards willful misinterpretation. This parallel between the development of scientific disciplines and the development of scientific ideas in a student is one focus of an important paper by Duschl and Gitomer (1991). Their thesis is that worthwhile education cannot be a mere accumulation of undigested knowledge and skills. Learners must take responsibility for their own restructuring of concepts, a school of thought known as constructivism. One implication of a constructivist approach to education is that traditional tests only detect shallow learning. They determine little information about true intellectual development, that haphazard process which is actually the vital business of teaching and learning.

Constructivism in education has been championed by Ernst von Glasersfeld. Whilst acknowledging a debt to Piaget (von Glasersfeld, 1995, p. 53) and even to John Locke (von Glasersfeld, 1991a), von Glasersfeld dates constructivism in mathematics education as "bursting onto the international scene" at the 11th International Conference of Mathematics Education in 1984 (von Glasersfeld, 1995, preface p. xi). "Radical constructivism is uninhibitedly instrumentalist. It replaces the notion of 'truth' (as true representation of an independent reality) with the notion of 'viability' within the subject's experiential world" wrote von Glasersfeld (1995, p. 22).

Testing poses some difficulties for teachers interested in adopting a constructivist approach. Summative testing emphasises a power relationship which the constructivist would rather play down. Furthermore, testing rarely elicits more than low-level cognitive responses. Finally, constructivist teachers do not claim that they can acquire full information about what has been learned, they can only make inferences from the learner's behaviour, interpreted in the light of their own experiences and understandings. These difficulties are acknowledged by von Glaserfeld (1995):

Clearly it is easier to orient students towards a particular area of conceptual construction if one has some idea of the conceptual structures they are using at present. In other words, in order to modify students' thinking, the teacher needs a model of how the student thinks. Because one can never get into the heads of others, these models always remain conjectural. (p. 186)

Some constructivists argue that students dislike straight-forward exposition of new material. In fact, one constructivist writer (Novak, 1996, p. 35) describes “students who are *suffering* [italics added] from a pattern of rote-mode learning.” But such distress is not always the case, and traditional transmissionist teachers may take some comfort in the qualitative results reported in this study. As several of the interviews reported in this study attest, even the best of those teachers using a constructivist approach still find it a challenge to change ingrained preinstructional misconceptions. And even the most diligent students have to make a greater effort to think for themselves in a constructivist classroom. As Duit and Confrey (1996) noted in regard to the introduction of a teaching programme designed to foster constructivist learning:

There is considerable evidence that, at first, students will be perplexed and will even resist such instruction, because they have become relatively complacent, disengaged and “pleased” with methods that allow them to learn pieces of knowledge by heart. (p. 85)

The imputed suffering of the students can in fact be aggravated by the imposition of a constructivist teaching strategy. A constructivist approach makes the students themselves the objects of study, as pre-instructional beliefs have to be clarified and even challenged. The students build on what they know by interpreting for themselves relevant new experiences. Gone are the certainties that the teacher knows everything; that the student can capture it unambiguously, and even that there is objective knowledge to be acquired. The onus is on the student to personally construct a viable set of ideas from the socially-mediated observations and symbols perceived (von Glasersfeld, 1995). The reaction of some students is that constructivist approaches demand greater mental effort, challenge their conceptual certainties, and incorporate time-consuming assessments. Students who opt for a minimum effort strategy to survive school find it disconcerting to deal with lessons designed for constructivist learning, allied with performance-based assessments, because it is difficult to gauge an acceptable minimum level of application. After all, it is the students themselves who become the arbiters of what is satisfactory, both in evaluation of theories and in production of the assessment material which reports their achievements.

One criticism of constructivism is based on social class analysis. Referring to a constructivist science syllabus, Jesson (1991) writes:

It merely changes science education from a predominantly theoretical subject to a more practical one. Its actual function may be as a way for middle-class teachers to teach working-class children ... how to be the new working class, by stressing the practical at the expense of the theoretical. (p. 43)

In mathematics, the parallel may be the move away from rigorous proof towards mere pattern-finding. Students may feel they have mastered a problem by contriving a formula for the n th case and testing it on a few known examples, but unless they can accompany their insight with a correct proof it remains a supposition of questionable value. If the mathematics teacher's role is only to encourage the students to foment a modicum of utilitarian ability in arithmetic, it is a role that leads to the dispossession of real mathematics in those students. The New Zealand curriculum document gives little support to the non-vocational aspects of mathematics. Under a heading "General Aims of Mathematics Education" there are seven dot-points. Most of them contain phrases such as "usefulness", "everyday life", "in society", and "in the world of work" (Ministry of Education, 1992, p. 8) that indicate that the study of mathematics per se is not viewed as a major imperative.

This difficulty goes to the heart of mathematics education because proof is the essential practice that sets mathematics apart from other disciplines. Mathematics is a system of reasoning that enables intellectual progress to be made in the abstract world. Not all mathematics is grounded theory that can be justified in terms of real world application. For example, Andrew Wiles' 1995 proof of Fermat's Last Theorem has no economic implications, only mathematical ones. If low-stream mathematics classes are not exposed to proof, or are exposed only to informal proofs with or without indication that a higher degree of rigor can be applied, then they have been disenfranchised of their right to be educated in mathematics. It is unsatisfactory to claim that Gödel's incompleteness theorem undermines the importance of proof. The theorem, and subsequent work by Cohen, reveals that some of the important unsolved problems of mathematics are undecidable, not that all proof is valueless

(Devlin, 1988). In fact, some writers (Knuth, 2000) are recommending far greater inclusion of formal proof in the mathematics curriculum, and recommending it for all students.

How learning which encompasses proof can be consistently achieved in a constructivist-style classroom may be hard to envisage if proof is seen as a well-defined formal statement to be rote-learned. However, this objection to a more constructivist approach has never stymied enthusiastic teachers, and it may now be falling to technological innovations. Cabri Géometre and similar computer programmes allow the user to construct acceptable geometrical proofs through trial-and-error, and symbolic manipulation software now ported into modestly-priced “computer algebra system” calculators allows similar conclusive experimentation within algebra. The way is open to check the performance of students equipped with such technology as part of mathematics assessment.

The Purposes of Assessment

In many respects the education system occupies a precarious middle ground. It has a declared aim to advantage all its clients, yet education is a major part of a screening system that rewards only those recognized as better than their peers. Schools are like a production system that certifies its products as satisfactory when they contain the required amount of specialized knowledge, yet business and education leaders agree that it is the ability to acquire and apply skills such as optimisation, not the ability to restate facts, that the education system should be supplying. This has been made clear in a New Zealand study by Knight, Arnold, Carter, Kelly and Thornley (1995). As reported in a United States context by Linn (1992):

The content of College mathematics assessment includes a brisk pace of problem solution, domain knowledge of only algebra or geometry, and a focus on mathematical relationships rather than on mathematical applications. In contrast, college courses and the workplace require individuals to engage in sustained reasoning, rely on computers for complex calculations, often use concepts from calculus, and regularly apply mathematics to naturally occurring problems. (p. 27)

Although there are always political calls for standards in education, criterion-based assessment as promoted by Glaser (1973) did not initially achieve wide implementation, although some authors would dispute this (Hambleton, 1994). It could be argued that the current standardized testing systems in use in the United States are a variant of criterion-based assessment, the criterion being that a student of minimal competence should pass. In practice, designated standards of performance are illusory because the performance of each cohort of test candidates is similar, the standards merely quantifying the percentage that are to be failed. The distinction between criterion-referenced and norm-referenced tests is, as expressed by Gipps “a false dichotomy” (1994, p. 163). However, in 1995 a survey by the New Zealand Qualifications Authority asked “Should the prime purpose of assessment be to measure individual performance against the performance of other learners in the same group?” (Barker, 1995, p. 23). Only 5% of those who responded gave support. The calls for standards demonstrate that there is not a wide appreciation of Gipps’ insight amongst members of political electorates, otherwise voters would not support political calls for standards.

Duschl and Gitomer (1991) claim that appropriate assessment is fundamental to worthwhile education. The style of assessment envisaged by Duschl and Gitomer, and by other constructivist commentators, incorporates opportunity to demonstrate the restructuring of knowledge. Such restructuring can be *weak*, akin to the incremental theory development during periods of scientific consensus, or *radical*, akin to Kuhn’s scientific revolutions during periods of dissensus within the scientific community. Duschl and Gitomer cite Laudan (1984) who distinguishes ontology, methodology and axiology as mutually dependent components of knowledge. Respectively, these components are about recognising the existence of information, developing a strategy to deal with it, and correctly valuing the items found. The restructuring of these three components can occur separately and at different periods of time. Assessment of these components can therefore not be done in a single-chance, one-point-in-time traditional test. A portfolio involves negotiation of meaning and an extended timeframe, and it is an option recommended by Duschl and Gitomer.

It is difficult to successfully implement genuine reforms in education (Lieberman, 1998). The reform discourse can be stopped in its tracks by teacher unions, delayed, distorted, and even reversed (Broadfoot, 1998). Fullan (1993) relates three stories of failed implementation from the 1970s: open-plan schools, individualized instruction, and large-scale national curriculum efforts. Inevitably, the received curriculum differs from the official curriculum. The constraints of time, funding and talent conspire to produce mere approximations of the intended reform. Political interests, such as conservative schools keen to preserve traditional examinations, also blunt the impact of educational reform.

The focus on educational change has been unrelenting in the last decade, with Fullan (1993, 1999) taking a leading role. He is critical of management initiatives and also of decentralization, claiming on the basis of many studies of failed school reform programmes that “top-down reform strategies have virtually no chance of reaching the core problems” (Fullan, 1993, p. 51). The alternative offered by Fullan is summed up in his statement that “Productive educational change at its core, is not the capacity to implement the latest policy, but rather the ability to survive the vicissitudes of planned and unplanned change while growing and developing” (1993, p. 5). The teacher is seen by Fullan as the key agent of change, and is most effective when skilled with four core capacities: “personal vision-building, inquiry, mastery and collaboration” (1993, p. 12). Educational institutions require parallel attributes: “shared vision-building, organizational structures, norms and practices of inquiry; focus on organizational development and know-how, and collaborative work cultures” (1993, p. 12). Fullan intrinsically, and sometimes specifically, acknowledges cultural priorities as the significant factors influencing educational change. A *portfolio culture* within a school, as envisaged by Duschl and Gitomer (1991) would seem to qualify as part of Fullan’s model of a school able to cope, and indeed improve, despite the unpredictable influences that will befall it. Before returning to Fullan’s exposition of the ingredients of success in those schools that achieved at least partial reform, it is worth considering what a portfolio culture might be.

The Portfolio Culture

Mass education is a relatively recent development. Only in the twentieth century was compulsory schooling made universal in the Western world. The numbers of years of participation have been extended, and there has been greater involvement in post-compulsory education. The apprenticeship model has been superseded because students in a mass education system are not all attempting to become practitioners of their discipline, but merely to benefit from its techniques. Students do not necessarily expect to participate in the development of the discipline, but they must understand how they can develop their own epistemology in order to navigate between the conflicting claims they will encounter. As stated by Duschl and Gitomer (1991):

The process of assessment ought to be one in which knowledge claims are made, evaluated, discussed, and challenged. In fact, assessment itself should be a joint product of student and teacher that, to a great extent, recapitulates scientific examinations of phenomena. Careful evaluation of student knowledge claims can help teachers design instructional experiences that will force a grappling with those beliefs, and thereby encourage conceptual restructuring. It is of paramount importance that students learn to deal with the process of evaluating or assessing knowledge claims, rather than merely learning successively more useful theories. (p. 840)

Although Duschl and Gitomer refer only to science teaching, most of their advice extends readily to the teaching of mathematics. Like any generalisation from experiments in a science laboratory, the discovery of a mathematical pattern is, for that student, a breakthrough even if it is trivial or well-known within the discipline. Mathematics teachers seek the same kind of transference and exploitation of ideas as their science colleagues. For example, once factorisation using difference of squares is mastered, it can be used to prove Pythagoras' Theorem or to empower the student in a host of tasks in other topic areas. In mathematics there are the same kind of preconceived misconceptions as in science. Just as hydro-electric power stations do not filter electricity out of the water, not all lines have gradients and not all equations have solutions. The teacher of mathematics can affect real learning by leading the student with such misconceptions to a point where the need for a change in beliefs becomes evident.

Duschl and Gitomer use the phrase “portfolio culture” (1991, p. 848) to denote a classroom where assessment is integrated within a constructivist learning environment. Although they refer to Piaget, they avoid the terms *accommodation* and *constructivism* and do not follow the line of radical constructivists such as von Glasersfeld (1995). The classroom which exhibits a portfolio culture features project work which is used for formative assessment. Instruction may not follow the strict deductive scientific method, but will foster negotiation of meaning and deep, inter-connected learning. The portfolio becomes an artifact that displays some of the current beliefs and skills of the student.

But the portfolio is not seen by Duschl and Gitomer as a static artifact. The portfolio is subject to ongoing change, in the same way as any culture. Duschl and Gitomer (1991) claim that:

The label *culture* is meant to convey an image of a classroom learning environment that reflects a comprehensive interplay between teacher, student and curriculum. Two basic and distinguishing characteristics of the portfolio culture classroom are the assessment-based interactions teachers have with students to monitor meaningful learning, and the project orientation of instructional activities and instructional tasks. (p. 848)

It would seem that Duschl and Gitomer seek to make the classroom a microcosm of the scientific community, where experiment and discourse are focused around particular project goals. The student should gain skills as a dynamic theory-builder, not just in recall of final-form knowledge.

The model of assessment envisaged by Duschl and Gitomer involves a change in the power relationship between student and teacher. The portfolio is a voluntary disclosure of what is valued by the student. It emerges from a process of interaction over a protracted time period. The portfolio is a profit-and-loss account of the earnings of a business in the course of a financial period. In contrast, a traditional test is a snapshot, a balance sheet, giving a point-in-time inventory of how much the student knows of that which the teacher delineates.

Portfolios on their own will not always satisfy the demands on the education system. They best serve as formative assessment, not as the terminal assessment that will always be required of educators. However, they represent a shift towards devolving responsibility for proof of learning to the learner. A portfolio can be an excellent means of communication, sometimes surpassing letter grades as a means of conveying information about learning. In this study, the teacher who developed the Year 10 Assessment Outline (Appendix C) included a cartoon that lampoons letter grades. An example of the benefits of a portfolio as assessment is the student who wishes to work in the travel industry, and prepares a project on travel needs and perceptions within the neighbourhood, thereby presenting as a more compelling employment prospect than someone who relies on letter grades in a variety of unrelated school subjects. Such scenarios are the consequences of the devolution of power in the granting of educational awards.

Just as a good textbook does not guarantee a good lesson, a good assessment technique does not guarantee good assessment in practice. Mabry (1999) draws up a taxonomy of assessment devices, rich with comparisons at many levels. Mabry is at pains to defend students from classification as mathematically incompetent by any assessment procedure which has inadequate construct validity – that is, which does not test what it purports to test. Such injustices occur when, for example, the student finds the assessment procedure to be an exercise in reading comprehension rather than the promised opportunity to demonstrate ability in mathematics. Mabry (1999, p. 78) offers a system for classifying assessment approaches. Such a taxonomy can also be affected by inadequate construct validity. The problem is that all assessment systems stand or fall by the detail of their implementation, no matter how well they operated for other teachers in other times and places. Just as students cannot be validly ranked in mathematical ability by tests that have narrow predetermined achievement criteria, assessment techniques *mutatis mutandis* should not be stigmatized merely by their incorporation of various technical indicators. All assessment, just like any teaching resource, is subject to the vagaries of how it is implemented in the classroom. As Fullan (1993, p.3) notes of conservative educational systems, “No amount of sophistication in strategizing for particular innovations or policies will ever work”. Mabry (1999) gives an example of this,

relating how *demonstrations of mastery* were successfully presented by students in a small school, but became trivialized and ridiculed when introduced at a large school.

The culture of the classroom must be satisfactory before *alternative* assessments can succeed. There is a central role in developing such a portfolio culture for the teacher, but school-wide and structural influences will also be significant. For example, if students are each given a mathematical term to research, an uninspired class will copy dictionary entries or do nothing at all, whereas a class more experienced in such open-ended tasks, more tolerant of each other, more prepared to take risks, and guided by a knowledgeable teacher will give valuable peer-evaluated presentations. In the hands of an able teacher this assessment may go beyond the etymology of *sine* and *surd* to a discussion of mathematical history and development. But it is an assessment task that would not work at all in many classes, regardless of its merits in any catalogue of techniques.

Formative Assessment

Fullan discusses the experiences of ten Maine schools affected positively in a “state-wide restructuring program” (Fullan, 1993, p. 60). He draws from a report by Cox and deFrees (1991) that there were common ingredients across the ten projects. These included “altering assessment to capture what students know in order to inform the next step” and involving “adults in the school and in the community talking to one another and with students about what constitutes learning and then joining forces to make it happen” (as cited in Fullan, 1993, pp. 60-61). The jargon for these attributes is that the students were engaged in formative assessment, and that learning went beyond surface skills to a social restructuring of knowledge. These seem to be two significant and recurrent themes in the literature.

Although summative assessment is demanded by *stakeholders* such as caregivers, government and potential employers, it is formative assessment which is of most value to learners and teachers. A renewed impetus focusing on formative assessment has been provided by Black, P. and Wiliam (1998) who have provided an extensive meta-analysis of the literature. One of the authors recently revealed a source of his motivation for the study:

In 1986 Harry Black reflected on the poor state of teachers' assessments that surveys in Scotland had revealed (Black, H.D., 1986, p. 7). He contrasted this with the wealth of resources devoted to external summative testing in the following passage: "Consider the amount of time, energy and money spent by both individual teachers, and schools in general, on setting and marking continuous assessment tests, end of session examinations and mock 'O' levels. Reflect on the money spent by examination boards and the number of assessment specialists employed by them. Read, if you can find a sabbatical term, the literature on the technology of assessment for reporting and certification. Compare these in turn with the complete lack of support normally given to teachers in devising and applying procedures to pinpoint their students' learning problems, with the virtual absence of outside agencies to develop formative assessment instruments and procedures, and the limited literature on the topic". (Black, P., 2001, p. 74)

Black and Wiliam's 1998 study is an examination of 681 publications from the literature of assessment and classroom learning. They define formative assessment as "all those activities undertaken by teachers, and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged" (pp. 7-8). Eight studies incorporating formative assessment are commented upon in depth. The studies are set in different countries, and use different methodologies with different sets of students from pre-school to teenage. With one very important qualification, the studies reviewed by Black and Wiliam reveal significantly improved results for students who participate in a system of formative assessment, compared with control groups. The qualification is in the nature of the feedback: giving grades can have negative motivational effects, whereas feedback directed to the objective needs produced improved performance. As stated by Black and Wiliam (1998):

Feedback ... with the assumption that each student can and will succeed, has a very different effect from that feedback which is subjective in mentioning comparison with peers, with the assumption – albeit covert – that some students are not as able as others and so cannot expect full success. (p. 17)

Black and Wiliam readily acknowledged confounding factors, one of which was that many of the studies introduced different teaching methods as well as different

assessment methods. They claim that this is in the nature of the use of formative assessment – specifically that “it is not possible to introduce formative assessment without some radical change in classroom pedagogy” (1998, p. 10). However, they found that the studies provided convincing evidence that a focus on a learning goal orientation, rather than on a performance goal orientation, leads to improved motivation and achievement among students.

Although Black and Wiliam’s aims may be laudable, it is yet to be seen how much influence they can exert compared with the lobbying power of the educational testing industry. In the USA, the power of the mass-testing organizations continues to rise, despite criticism by educational theorists (Friedrich, 2002; Winter, 2002). Similarly, in Australia the *homework generator* software that has recently appeared on the market seems heavily reliant on selected-response questions. The 2001 Mathematical Association of Victoria Conference saw presentations and displays by two organizations that provide such software, currently promoted as an additional resource to the textbooks and teacher-prepared tests that it could easily replace.

Portfolios as Homework

The commonalities in the meaning of *homework* are that it is a task set by the teacher; all students in the class get much the same task; the task is attempted when the teacher is not present; students are free to seek assistance with the task from anyone available to them whom they regard as competent; and failure to complete the task may be detected and result in some adverse repercussion. None of these are attractive features, nor the consequence of a thoroughly researched study into the most effective forms of instruction. Cooper and Valentine (2001) attempted to synthesize research and reviews of empirical studies on the effects of homework, but discovered that the evidence was untrustworthy, hampered by loose definition of the construct “homework” and by the assumption that a unidimensional variable, such as time spent on completion, can be used to quantify it.

There are many difficulties in determining the extent and quality of student engagement with homework. Incidental factors apparent to teachers and caregivers in

the study included the heavy schoolbags conveyed between school and home, the students' expert knowledge of the homework requirements of their peers, and use of the telephone to ring friends to discuss homework. But the actual behaviour of the students while purportedly doing homework was a mystery. There are major differences in styles of doing homework, from minimal concentration while watching television, to seated at a desk working to a deadline, to working cooperatively as part of a small group. As the link between doing homework and succeeding in the subject is not temporally immediate, and is subject to many intervening factors such as ability at doing tests, students often find it difficult to summon up motivation for doing homework. Extrinsic motivations, such as monetary incentives or hostile supervision, are all destined to fail in the long term. Homework seems to be a good litmus test of whether the student has actually internalised an interest in mathematics and a capacity to undertake independent and self-directed intellectual activity. Homework is "a proxy for motivation" as noted by Postlethwaite and Wiley (1992, p. 131).

The intervention of caregivers in the homework situation is also very difficult to ascertain or quantify. Although caregivers have been known to do the student's homework in place of the student, this is not the type of intervention envisioned here. Caregiver assistance can take such forms as providing encouragement to start and to persevere, arranging necessary facilities such as transport to a library, technical assistance with computers and other devices, active involvement in coaching and advice, and being the subject of research. Although an exhaustive list of caregiver involvements has been proposed in a meta-analytical study (Hoover-Dempsey et al., 2001) it was noted that the literature rarely offered more than a unidimensional account of such intervention.

As there is very little accord about what constitutes homework, some research on this topic over-reaches itself. For example, Cooper and Valentine (2001) have attempted to quantify the optimal time to spend on homework. This makes the assumptions that homework is a construct universally understood and applied, and that every student's effective gain in understanding or skill exhibits a predictable relationship with the amount of time spent on homework. These assumptions are untenable, especially when performance is gauged by student outcomes: once a distinct skill is mastered,

the task is complete, and further homework in excess of that needed for maintenance is time wasted. Cooper and Valentine's paper does not envisage homework as an activity that can be done cooperatively with caregivers or peers, and ignores the point that perceived achievement may be the causal variable that drives homework performance, rather than vice versa.

International comparisons of educational systems have particular difficulty when it comes to reported rates of homework completion. The strength of the cultural imperative to value education, to work independently, and to devote many hours to work must be an influence on the amount of homework disclosed. Researchers can never be sure that the students are accurately reporting the time spent on homework, so some surveys rely on disclosure by caregivers. Even so, the actual activity regarded by the student as being homework is culturally determined. For example, in some countries, cycling around a city taking photographs of different types of archways for later analysis as types of curves may not qualify as mathematics homework.

Systems such as portfolios involve teachers in a great deal of effort preparing tasks for home completion, providing ongoing feedback, and giving the work marks which constitute a significant portion of the students' results. If portfolio tasks can be considered to be homework, then it is homework enhanced with appropriateness, guidance and accountability.

Very rarely do schools elaborate on the rationale for homework. When they do, homework is promoted by schools as being an unmitigated good, and a duty that all students should execute on a regular basis. If pressed, teachers may defend homework with a variety of justifications such as that homework ensures that the students do more work and consequently learn more; by working at home the students develop independent work habits; homework is an opportunity for caregivers to become engaged in the students' learning process, contributing their own life-experience expertise and reinforcing the importance of working hard at school.

Concern about homework is occasionally identified by educational institutions or the media as a significant issue. For example, a newspaper article entitled “Overdoing homework gets a fail mark” (Milligan, 2002) reports Ken Purnell from Central Queensland University’s Education Department as seeing more negatives than positives in homework. Purnell is quoted as saying homework is often “pretend work or busy work” and that “It’s rote learning that provides students with little intellectual challenge”. Speaking of the homework done by 13 and 15 year-olds, Marnie O’Neill from the University of Western Australia’s Education Department is quoted as saying “I am disturbed at the number of hours some of those kids are doing each night”. O’Neill describes homework as “punitive” for struggling students. An adjoining article puts the case for replacing homework with supervised study at school, as part of a longer school day that would better suit working caregivers.

Such attacks against homework have a considerable history. Gill and Schlossman (1996) contrast the many educational issues debated in the 1990s with the strong consensus supporting homework, and make the point that it was not always so. In fact, there were regulations against the setting of homework in parts of several American states during the interwar period and “some school districts still had anti-homework regulations on the books in the early 1960s” (Gill & Schlossman, 1996, p. 56). Gill and Schlossman argue that homework was discouraged by the progressive education movement in the 1920s and 1930s. As teaching became professionalised, the ability of caregivers to assist with learning was denigrated by many commentators. Caregivers lacked the patience, the time, and expertise in the new methods of doing things. According to Gill and Schlossman, Carleton Washburne in 1937 contended that:

As conditions are, relatively few homes can set aside a study room, quiet and equipped. A crying baby, a tired father, a noisy radio, a conscientious mother unskilled in teaching and irritated by the distraction of trying, under bad conditions, to help a child with subjects long forgotten by her, make homework about as inefficient as it can be. (1996, p. 48)

Putting aside the sexism, the same arguments could be made today, except that radio has been replaced by even more compelling diversions.

Portfolio tasks were often used by teachers in the study as part of the homework requirements. Completion of the tasks often required home time in part, if not exclusively. The cognitive demands of the portfolio tasks were not adequately covered by material in the textbook, and the methods of presentation were sometimes novel. For example, students would have to collect data on supermarket pricing, calculate unit pricing indices and communicate their results effectively. Washburne could very eloquently put a case against such an activity on the grounds that the students had unequal opportunity to gather the data, that some caregivers would not have the capacity to assist with calculation of the statistics, and that the whole process requires expert guidance. Portfolios increase the homework demands on students by moving away from repetitive closed questions to non-routine tasks that require planning, creativity, and high standards of presentation. Portfolios are therefore part of the homework issue for those who wish to decrease the role of caregivers in learning.

The Longitudinal Study of American Youth (Brookhart, 1997) revealed a negative correlation between student achievement and percentage of homework corrected and returned to students. This finding was seen as counter-intuitive by the researchers, who expected such informative feedback would enhance achievement. Brookhart points out that it is possible that “homework corrected publicly created an atmosphere in which assessment was perceived as judgement instead of information for improvement” (1997, p. 329). Even when the public aspect of correction is removed, other disincentives arising from correction of homework are identified by Brookhart: “... student perceptions of their own competence, as well as emotional factors (e.g., embarrassment), would cause feedback from such corrected homework to have a *controlling* function, not an informational one” (1997, p. 329).

International studies have attempted to correlate national homework habits and national success rates. One such study, Postlethwaite and Wiley (1992), linked science achievement on a standard test, with hours of homework per week. But it is hard to be sure that homework means the same thing in each of the countries surveyed. For example, in Japan many hours are needed to rote memorise the many kanji characters, an approach to learning which may be extended to topics in mathematics and science. Rote memorisation is distinctly different from homework

tasks that demand the application of the skills learned in the classroom to novel situations, to undertaking research, or to exercising creativity in the presentation of a project. It is not helpful to coalesce all these tasks under the name *homework*.

There seems to be a dearth of research on the efficacy of homework. Perhaps this is because the history of homework is a history of political influences, not educational ones. As education moved from the province of caregivers to that of schools and professional teachers, homework was suppressed. Then, once education had become the exclusive provenance of teachers, the “Sputnik crisis” identified by Gill and Schlossman (1996) forced the resurgence of homework as a visible indication that children in the United States (and other Western countries) were working longer in order to compete with the technological advances being achieved in competitor countries.

Postlethwaite and Wiley (1992) observed that:

It is likely that the school culture, and work ethic determines how much homework is done. The teachers set the homework but at the lower levels of schooling home support is also important. The literacy of the home (number of books, use of dictionary) was influenced to some extent by the economic and educational status of the home. But, it was the literacy of the home which influenced the extent to which these students did their homework at home. (p. 162)

Disregarding the modest size of the construct effects, Postlethwaite and Wiley proceed to allocate a place for homework in a complex model of the causative influences on science achievement. These days, greater access to home computers and the ubiquitous internet perhaps disguise the literacy of the home. There may be greater access to electronic dictionaries, but this does not indicate a universal culture of support for home learning. It remains true that students who heed the advice of Postlethwaite and Wiley (1992, p. 131) to “choose good parents” will be advantaged in the educational stakes. Not all homework, and not all “doing homework” activity, is appropriate and efficient. Homework is not the great leveller, it does not allow students to overcome inequity in social background. This study found that most caregivers lacked the necessary knowledge, skills and motivation to directly assist

with secondary mathematics homework. The overt inclusion of caregivers in some of the portfolio tasks did benefit the students by revealing authentic uses of mathematics in the caregivers' workplaces, by enabling caregivers to communicate their support for learning the subject, and by directly communicating the type and standard of mathematical work that was required in high school.

The cynic may volunteer that the uninvigilated aspect of portfolios as an assessment practice "teaches the students to cheat". The argument is that the exact authorship of the documents prepared out of teacher supervision is unknown, therefore such submissions should not be part of an assessment system. Many teachers subscribe to this view, regardless of any contrary direction indicated in the curriculum. Teachers have come to model their practice on external examinations, and they are familiar with the secrecy, and "objective" marking that is a necessary part of that system. Schools often seek to emulate external, unseen, time-constrained, written examinations in any internal component of assessment. Non-traditional forms of assessment, such as tasks to be completed in teams, are seen as unreliable distractions that leave less preparation time for the external examination. The view that shared ideas cannot be assessed is a major obstacle not just to portfolios, but to any internal assessment activity that is meaningfully different from traditional examinations. It is a view that incorporates some important hidden assumptions.

The objection to portfolios as assessment is that students may consult with each other, or with perceived experts, in their preparation of items for their teacher. However, consultation is exactly the behavior clients expect of the professional practitioners they employ to develop such artifacts as architectural designs, medical and dental treatment regimes, legal proceedings, and business plans. The objection made against collaboration over mathematical portfolios is that this behavior is not appropriate in an education setting, or in a mathematical setting, or both.

In education, an attempt can be made to distinguish two aspects of classroom behaviour: learning new knowledge and skills, and proving that the learning has been accomplished. Those who accept this dichotomy can insist that the *proving* part should always be enforced as an individual activity. However, they must concede that learning is a process that involves a community of contributors and of people

who respond to the learner's attempts to demonstrate a capacity with the material. Whether the learner is a school student mastering well-known concepts, or a researcher at the cutting edge of discovery, such progression takes place within a discourse. The very words people use are ideas, all invented within a community of thought. There is a world of shared symbols vital to both the development of ideas and the communication of ideas to others. Often the enunciation of ideas is the prompt that leads to further refinement or development of the concepts and relationships under discussion. In other words, part of the *learning* process involves feedback, which is necessarily assessed in order for response to be made. Furthermore, the interchange that a teacher may designate an *assessment activity* is another exposure of the student to the symbols used in the topic, necessarily constituting another learning opportunity. In other words, part of the proving process involves learning.

As each part of the dichotomy involves the other, the distinction is not rigorous. School students are part of society, and it is artificial and misleading to always treat them as autonomous. In life outside of educational institutions, people constantly re-evaluate their perceptions of each other as they trade symbols in all forms of social interaction. The ideal in education would be a similar process of assessment, occurring continuously along with the teaching and learning interaction.

A research institution develops a good reputation by supporting its researchers and by developing strong external links with other institutions in the community. These are parallels to the psychological attributes of successful people. Ability to *network*, and to readily develop social and business connections, are valuable personal assets. However, the requirement that school assessment is solely assessment of individual performance places no value on these assets.

In reply to critics of the portfolio process, it is useful to consider the "worst-case" scenario: a take-home assessment item is given to a class of school students, some of whom work on it without collaboration, while others get together, share their understandings of the task, solicit the views of adults, critique each other's work, and submit very similar papers. Members of the collaborating group exhibit greater skills, enjoy themselves more, and are more likely to make good progress on the task. In

almost any setting outside of education, they are the most successful group. Only in educational institutions is such behaviour seen as dilatory and reprehensible.

In mathematics, there is a notion that development of new ideas can proceed by individuals operating on their own. This has been popularised recently by accounts of Andrew Wiles' (1995) historic work on Fermat's Last Theorem. For example:

Wiles describes his experience of doing mathematics in terms of a journey through a dark unexplored mansion. 'One enters the first room of the mansion and it's dark. Completely dark. One stumbles around bumping into the furniture but gradually you learn where each piece of furniture is. Finally, after six months or so, you find the light switch, you turn it on, and suddenly it's all illuminated. You can see exactly where you were. Then you move to the next room and spend another six months in the dark ...'. (Singh, 1998, p. 258)

In fact, the development of mathematics is a cooperative enterprise. Researchers such as Wiles undergo a substantial academic apprenticeship, and they are employed in large institutions. Collegial routines include preparation of papers for publication, participation in peer review, attendance at conferences, and, usually, teaching duties. Informal interactions, and access to a wide variety of journals, complete the picture of researchers who function in an intellectual community. By way of contrast, there have been many self-proclaimed mathematicians whose lack of connectedness has seen them waste a great deal of effort on delusory goals. A collection of the works of such eccentrics, appropriately entitled "Mathematical Cranks" (Dudley, 1992), reveals that the common feature to the stories is the solitary nature of the research undertaken. Despite his description of a "completely dark" mansion, Wiles acknowledges his debt to many other mathematicians, the work of Kolyvagin and Flach perhaps providing the final "light switch" (Singh, 1998).

Few mathematics students plan to become mathematical researchers. However, it is justifiable to incorporate the connectedness aspect of the professional mathematics community into classroom practice. When students are given group work, required to make an oral presentation, or given sufficient time to confer out of class about a task, vocational skills are being developed. The key part of this practice must be that

student communication and interaction is legitimated and assessed, otherwise students remain exposed to the “cheating” label.

Summary

The term *standards* represents a popular confusion about the purposes of assessment. It can mean minimum competency benchmarks in standardized tests, or high standards of scholarship as determined in performance assessments. The politically-driven rise of the standardized testing companies is associated with teaching to the test and superficial learning. Constructivist educators place greater emphasis on formative testing, using techniques such as portfolios in order to encourage judgement, creativity and self-reflection in the learners. The aim is to develop a portfolio culture – an interplay of curriculum, teachers, students and caregivers in an effort to form joint understandings. Homework is identified as a key factor in the caregivers’ decision to accept an involvement in the students’ high school mathematical progress. Students who cooperate in homework and in class acquire the connectedness that is demanded of professional practitioners, not the isolation that traditional written tests impose.

This study combined an assessment of student perception of classroom environment with assessment of attitude towards mathematics, and also monitored the attitudes and performance of teachers, as the portfolio assessment system was introduced. Those who initiated the new system hoped that portfolios would provide more authentic contexts for mathematics, would encourage the participation of caregivers in mathematics homework, and would stimulate both students and teachers to go beyond the superficial exchanges that form the basis of traditional tests. The participant-observer study capitalized on extremely good access to all parties involved, both for long-term interviews and for repeated application of the survey instruments, giving full opportunity to examine the nature of the interactions between students and teachers. Although rarely attempted in the literature, a cultural analysis can also be applied to homework, as its neglect or the manner of its completion can give an insight into the social relationships of the student.

A politically-charged debate over assessment in mathematics has been raging for many years, producing such phrases as “teaching for understanding”, “achievement benchmarks”, and “authentic testing”. This study moves beyond such single-focus issues to examine the cultural basis of mathematical assessment. It integrates the results of two survey instruments, developed for the different objectives of measuring classroom environment and individual attitude, and relates the results with opinions expressed at in-depth discussions with teachers and students.

The Next Chapter

The portfolio innovation of this study took place in a single school. In order to see if it had implications for the wider mathematics community, it had to be monitored closely. Care was taken to communicate with all the significant stakeholders in the study, examining their perceptions as the new programme unfolded, and taking a particular interest in the decisions they made. This involved both quantitative and qualitative techniques. The objectives of the study, the research methodology and quality control procedures are discussed in the next chapter.

CHAPTER THREE: METHODOLOGY

This chapter describes the means by which the research objectives were achieved. It provides details of the selection and size of the groups that completed questionnaires or were interviewed, the procedures used, the nature of the data collected, data analysis procedures, quality controls, and the interpretation of results.

Objectives

The study set out to describe the impact of the implementation of portfolios as an assessment technique in a New Zealand secondary school mathematics programme. The reader will recall that the objectives of this study, now coupled with the associated research questions, were to:

1. Determine the extent to which portfolios provide a means of assessment of aspects of the curriculum not covered by the standard forms of assessment.
What was unique about portfolios in assessment?
2. Determine changes effected by portfolios in the classroom and school environment.
Was there a detectable “portfolio culture”?
3. Identify perceptions of the portfolio innovation by students, teachers and caregivers.
What were the changes in attitude and behaviour of the participants in the programme?
4. Investigate the utility of portfolios as a means of reporting progress in mathematics.
To what extent had portfolios provided a valuable portrait of the students’ mathematics?
5. Investigate the implications for teaching and learning using portfolios.
What were the advantages and disadvantages of using portfolios?

Research Methodology

This thesis describes a case study incorporating quantitative and qualitative aspects and set in a typical New Zealand government secondary school. The significant groups in the study were 510 mixed-gender junior students, their caregivers, and the 22 teachers who became involved with portfolios.

A mathematics class consists of many individual students allied with an individual teacher. Each person in the class has their own interpretation of what occurs during lessons, and each person can be a worthwhile study in their own right. It is a convenient shorthand, often utilised by teachers, to aggregate these individual stories and refer to the attitude and performance of a class. There are obvious dangers in doing so, two of them being neglect of outlier cases of exceptional attitude or performance, and neglect of the degree of dispersion of whatever attribute is being referred to. For example, to say that a particular school class is “doing well” means that any severely misplaced student is not being recognised, and also means that the extent of variability within the class is not being reported. Treating a school class always as an entity ultimately leads to the absurdity of crediting it with biological characteristics, such as having a single conscious intelligence. For example, it may be correct to say “this is a large class”, but to say “this class is not very bright” is a linguistic convention fraught with pitfalls. For these reasons and as recommended by Yin (1994), it is appropriate to carefully delineate the unit of analysis of any educational study.

Individual teachers or students were sometimes the unit of analysis, and individual mathematics classes were the unit of analysis at other times. The survey instruments used in the study were designed to characterize classes of students. The school class was the unit of analysis used when classroom environment was under scrutiny, as students must have shared a reasonably similar experience. Of course, their perception of the experience was mitigated by their own attitudes and history. For example, a student who is alert to sexist behaviour may notice the tendency of a teacher to ask girls only closed questions, while the rest of the class remain oblivious to the behaviour and feel that boys and girls are treated equally.

There is a cultural aspect to self-disclosure which sometimes blurs the differentiation between mathematics class and individual student as the unit of analysis. The data is based on observations made by individuals, even if these observations purport to relate to activities or attitudes of the class. And often these individuals project their own biases in their account of the attributes of the class. For example, the students who most complain that the class is too noisy for them to work well are often the students who make the greatest contribution to that disruption. Their complaint stems from a psychological urge to better control a lack of focus in themselves. From personal observation, such students are sometimes uneasy in a quiet classroom and will go to great lengths in order to create a disturbance.

Other aspects of reported classroom environment may suffer the same bias. For example, if a student indicates on a questionnaire that there is insufficient teacher support, they may be voicing a conception that mathematics is a closed and incontrovertible body of knowledge, the rules of which can be memorised. The teacher who has been trying to communicate the unresolved aspects of mathematics will never satisfy this psychological need for false simplicity and closure, because teacher support is not the issue.

It is not always justifiable to make a leap from a portrayal of individual difficulties, sometimes misreported in the first instance, to the characterisation of a classroom environment. There is no way to ensure that individual informants are referring to the class, rather than confusing their own problems with those of the class and ultimately ascribing them to the teacher. Even objective measures do not guarantee a successful depiction of a social entity such as a mathematics class. For example, a record of the decibel level of a classroom will not necessarily correlate with the students' perceptions of how "noisy" the class is. The ideal would be to determine whether the students who find the classroom noisy seek out a quiet place to do their homework very efficiently, and whether they avoid noise in their other activities, such as recreation.

The small-group interviews initially elicited the students' individual views, then later in each interview an attempt was made to discuss the attitudes of the class. Because the students often lacked the maturity to differentiate popular views from their own,

this attempt to vary the unit of analysis was not very successful. In consequence, the research can be summarised as conducted with student questionnaires where both individual and class were used as the unit of analysis, and student and teacher interviews and caregiver and teacher questionnaires where the individual was the unit of analysis. The first and third objectives of the study were primarily addressed through the interviews held with students and teachers. These objectives were, respectively, to find out what is unique about portfolios in assessment, and to identify the perceptions and responses of participants in the programme.

Development of the Case Study

The study was undertaken from 1997 to 2001 in a coeducational state school of 1100 students. The school is situated in a university town and draws students from a large rural area and from the outskirts of Christchurch, a city of 350,000 people. The school offered a wide curriculum choice, but for Year 9, 10 and 11 students (ages 13 to 15, mainly) there were compulsory subjects, one of which was mathematics. The school came close to New Zealand national averages in academic performance, judged by results in the School Certificate examinations taken by almost all students at the end of Year 11, and by the Bursary examinations that were taken by the majority of Year 13 students.

In 1997, my Year 10 class (aged 12 or 13, equivalent to Year 9 in Australia) piloted the use of portfolios in mathematics at the school. The students were given a list of ten portfolio item requirements, the first three (of four) school terms in which to complete them, and a zip-seal A4 plastic bag in which to store the results. The ten items included a mathematical autobiography, a mathematical investigation, an essay on a famous mathematician, a mathematically relevant cartoon or joke, and a collection of news clippings about mathematical developments. Students were also encouraged to use the bag to store any certificates they won in competitions.

The programme was well-received by the students who provided a steady stream of creative work which was discussed and, when at an acceptable standard, was recorded as complete by the teacher and stored by the students. The portfolios were seen by caregivers at parent report meetings and commented on in the narrative

section of some of the students' reports. At the end-of-year prize-giving, a prize was presented to the student who had developed the best portfolio. All portfolios were returned ungraded to the students at the end of the year. At the end of the year, a feedback questionnaire administered to the trial class revealed a general satisfaction with the worth of the programme, and provided a number of criticisms of the items required.

In September 1997, I presented a paper (reproduced here as Appendix A) to colleagues at a Mathematics Department meeting. The paper pointed out some of the requirements of the *processes strand* section of the curriculum, and set the stage for a discussion of how it could be more fully implemented within the school. It quoted recommendations from the "Implementing Mathematical Processes" booklet for "classroom activities which give students the opportunity to question, invent, explain, experiment, discuss, and speculate..." (Ministry of Education, 1995, p. 5). It also recommended that teachers should be "listening to students talking about their learning" (p. 7). It was in this atmosphere that results from the pilot use of portfolios were provided to teachers. In late 1997 the thirteen teachers of the Mathematics Department resolved to introduce portfolios as a requirement for all Year 9 and Year 10 students in 1998 and to amend the student reports to include a section for indication of portfolio completion.

At the beginning of 1998, the Head of Department and I brainstormed on the future assessment of the junior mathematics classes, producing several pages of notes. One page was headed "Why?" and listed "placement, diagnostic, prizes and certificates, reports, development of study skills, exam practice, motivation, and feedback". A page headed "What?" listed "Content; Process – technology, logic and reasoning, communication, investigation (open ended), research (library, Internet...), presentation (artwork, acknowledgements...), group work, posing questions; Language – vocabulary, setting-out, use of mathematical symbols". And a page headed "How?" listed "open book, cheat sheets, tests, projects, investigations, examinations, portfolio (report only), and Logo [a programming language for beginners]".

Appendix B demonstrates one of the results of this brainstorming session. It contains the information sheets given to every Year 9 and Year 10 student, detailing the items their mathematical portfolio was to entail. The sheets took into account some of the suggestions from the pilot class, and included new ideas from the teachers. The sheets were designed to avoid repetition of any tasks presented in a previous year. An Assistant Head of Department produced each of the sheets, and then had the responsibility of monitoring implementation and making any necessary modifications.

To the teachers it seemed entirely necessary and natural to accompany the portfolio sheet with an assessment scheme for each year level. After brief discussion, it fell to the coordinators of each year level to produce a document that detailed all the assessment tasks, their weightings and approximate dates. No such assessment scheme had previously been provided for junior classes, so this marked the first organisational change prompted by the portfolio innovation. Without such a scheme (reproduced in Appendix C) the students would not have been able to know the weighting of the portfolio against the various tests and other assessments in mathematics. This improvement in the information flow to the students was not an anticipated feature of the use of portfolios, however, it proved to be a significant event. Not only did the teachers have to prepare assessments early, but caregivers had a reliable indication of the topics and assessment dates for their child's mathematics class. From discussion with caregivers, and from the questionnaires they completed at the end of the year, it became apparent that an assessment scheme made a good focus for caregiver intervention in some households. The assessment scheme document issued to each student was valued by many caregivers and prompted, amongst a considerable number of the students, an interest in doing well.

The Students: Instrumentation

The study involved all the students of the two most junior form levels in the school, typically, thirteen or fourteen years old. They completed up to four surveys: a baseline attitude towards mathematics questionnaire (n = 500), a classroom environment questionnaire (n = 463), a repeat of the attitude towards mathematics questionnaire (n = 463) and, for the youngest year-level, a further administration of

the attitude towards mathematics questionnaire (n = 200) at the beginning of the following year. The instruments selected used a multi-choice format that was quick to administer and easy to code, and each had a proven history as reliable, valid and internally consistent.

In order to enable correlations between these questionnaires to be made on an individual student basis, each student was asked to devise his or her own code number, to record it in their student diary and to use the number on each document. By this method anonymity was preserved, while enabling correlations to be determined on an individual basis as well as by class. This code system precluded any matching of individual questionnaire completion with examination grades, but this remained possible on a whole class basis.

A questionnaire on attitude towards mathematics was administered to all the students at the beginning of the school year, before the students were briefed on the portfolio requirements. The instrument used was a 29-item questionnaire developed by Radalj (1982), the “Mathematics Survey”, as reproduced in Appendix D. The overall results for each class were made available to teachers. Midway through the year, an *actual classroom environment* survey, the personal form of the “What is happening in this class?” (WIHIC) (Fraser, Fisher & McRobbie, 1996), was administered to all students. This questionnaire is also reproduced in Appendix D. The following term, the survey of attitude towards mathematics was administered for a second time. Repeated surveying of the same cohort enabled change of attitude towards mathematics to be compared with other variables, principally those quantified by the classroom environment instrument. This was the means by which the second study objective, quantification of changes in educational environment, was achieved.

The Students: Procedures

As work on portfolios got underway, meetings were arranged with small groups of students randomly selected from different classes. There were 19 classes involved, with one student from each class allocated to a group of four or five representing Year 9 “A” stream, Year 9 “B” stream, Year 10 “A” stream and Year 10 “B” stream. Interviews with each group were held in rotation, the discussion being audio-taped

and transcribed. Each group was interviewed twice, once in May and again later in the year. Caregivers were informed in advance that such interviews were planned, and students were removed from class only with the permission of their teachers. At the start of each session, the students were advised that attendance was voluntary and that they could leave at any time. Interviews took place in vacant classrooms or meeting rooms within the school, lasted about 30 minutes, and concluded with the students being given small chocolate bars for their participation. There was only one case where a student declined to participate: having said very little in the first round of interviews, he did not attend the second round and was replaced by another student from the same mathematics class. Interviews were loosely structured around a list of questions, but followed the thoughts of the students. An example of the list of questions used is given in Appendix F.

An attempt was made to appraise the students' contributions to their portfolios across all the different classes on a continuing basis. This could not be done systematically as access to the documents had to be arranged on an ad hoc basis with each teacher. Two of my classes, one the most academically able class in Year 9, the other the least academically able class in Year 9, were amongst the 19 junior classes required to produce portfolios, readily enabling first-hand knowledge of the portfolio contents produced the students. At the end of the year, nine of the teachers were interviewed, and this was often done as the portfolio work of the classes was being examined. This gave an opportunity to achieve the first study objective: determination of unique aspects of portfolios with regard to assessment.

The Caregivers

For two reasons it would be incorrect to identify the caregivers by the word "parents". Firstly, many students lived in reconstituted families with adults who were not both the natural parents. Secondly, the school roll included many students who boarded with local families. The majority of such students were not from New Zealand, but from Japan, Indonesia, Malaysia, and European countries.

The questionnaire reproduced as Appendix E was sent home in November of the first year of portfolios implementation, asking a random sample of caregivers to

anonymously respond to questions about their involvement with portfolios and the interest taken by the students. At first, forty forms were given to students to take home, have their caregivers complete the forms, and return the forms to school. This procedure had a low response rate, with only nine forms returned. A further forty forms were mailed to the homes of different randomly-selected students, with a stamped envelope provided for the reply, resulting in the eventual return of a total of 30 completed forms. Teachers also reported on their interaction with caregivers at report evenings and on other occasions. Formal interviews were not conducted with the caregivers.

The intention of surveying caregivers was primarily to contribute to the fourth study objective, investigation of the utility of portfolios as a means of reporting progress in mathematics. Discussion with teachers and students also addressed this objective. As the portfolios programme was implemented only in Year 9 and Year 10, the first two years of secondary school, it was not considered that potential employers were stakeholders in this issue. The school provided Year 13 school leavers with an extensive document designed for potential employers and post-compulsory education providers, and it had a declared policy that school reports were addressed to, and only intended for, the caregivers and the students.

The Teachers

Many informal opportunities arose for the discussion of the portfolios innovation, however several formal approaches were also used. In May 1998 a feedback questionnaire was administered, and in Term 2 of that year teachers were asked to complete the WIHIC survey in respect of their classes at the same time as their students. When questionnaires were mailed to caregivers, teachers were asked to predict the likely responses on a similar questionnaire. At the end of 1998, the majority of the teachers participated in audio-taped interviews and, in May 1999, a feedback questionnaire was again administered to all the participating teachers, including those who had left the school. A further questionnaire was completed by those teachers at the school at the end of 2001. Throughout my time at the school, a notebook was used to keep a record of some of the pertinent informal interactions, and of statements made at Mathematics Department meetings. After leaving the

school at the start of 1999, contact by email and by telephone was maintained with four of the teachers. The fifth study objective, investigation of implications for teaching and learning, was mainly considered in discussion with the teachers.

Quality Control Procedures

No method of data collection is without difficulties capable of affecting the veracity of the results. This section outlines the methods used in the operationalisation of the data collection in order to overcome the major anticipated quality control problems. Discussion of the degree of success of these measures is left to Chapters Four and Five where the results of the study are described.

The students completed their questionnaires during class time, under the supervision of their mathematics teachers. Several problems, such as comprehension difficulty and omission of code numbers, were foreseen and addressed in a briefing document addressed to the teachers (reproduced at the end of Appendix D). Because of the scale of the operation, it was impractical to provide independent staff to supplant the teachers, therefore, in an attempt to minimise introduced bias, the briefing notes urged that “It is important that this survey is done correctly!” and gave the actual words to be used by the teachers. The teachers were also advised that “If your students are not good readers you may need to read the statements aloud to the class.” and that they should try to do so “in a neutral fashion”. Again, this is an imperfect solution, but at least those supervising the survey were alert to one of the problems. Finally, the problem of absent students was addressed by asking the teachers to retain copies of the questionnaires for them on their return. In the perception of the absentee students involved, this may have obviated any confidentiality.

The questionnaires were discussed afterwards with the teachers and also with the students at audio-taped interviews. Two groups of the students volunteered that they did not really know what some questions meant (Appendix H p. 3, Appendix K pp. 14-19). This was because of poorly expressed questions, rather than reading difficulty. However, the students did not mention any shortcomings with the administration of the questionnaires. Teachers observed that many students did not

understand the word *seldom*, and that some confusion arose over the number of schools the students had attended. The teachers had provided appropriate interpretation to those students who sought clarification.

The school roll listed 492 junior students in December 1998. Completion figures for the three surveys administered during the year were February: 500, June: 463 and September: 463. An overall decline in the school roll over the course of the year accounted for some of the non-completion, absenteeism for almost all the remainder. No student was known to have refused to complete a questionnaire, however, some questionnaires were completed in a desultory or deliberately incorrect manner. One student was unable to cope with the literacy demands of the questionnaires, and even with adult help did not complete them fully. It is usual in statistical studies to address the problem of whether there has been an adequate questionnaire completion rate. In this study there was no such problem, but instead there was difficulty determining whether the quality of completion was adequate in a few of the questionnaires.

Within the framework of logical positivism, the usual criteria applied for judging the quality of research inquiries include internal validity, external validity, reliability and objectivity. There are considerable difficulties applying these four criteria, particularly to studies involving human subjects. In social research, the *practice effect* means that accurate replication of data gathering is impossible, therefore the major test of reliability is unavailable. Taking this study as an example, the focus of the study was *change* in attitude towards mathematics, whereas reliability assumes constancy, in the short term at least. Without reliability, validity cannot be guaranteed. If the results in the situation under analysis cannot be replicated, it is pointless attempting to generalise them with validity to other settings. Guba and Lincoln claim that internal validity “is nothing more than an assessment of the degree of isomorphism between a study’s findings and the ‘real’ world” and that external validity “can have little meaning if the ‘realities’ to which one might wish to generalize exist in different forms in different minds” (1989, p. 236). Constructivist researchers who reject a realist ontology, such as Guba and Lincoln, find the four criteria unworkable. Guba and Lincoln propose six alternative criteria: prolonged engagement, persistent observation, peer debriefing, negative case analysis,

progressive subjectivity, and member checks. Quality control in the study is discussed below in terms of Guba and Lincoln's six criteria.

1. Prolonged engagement

The study took place over four years, and contact was maintained with most of the teachers who moved to other schools or other employment. But these statistics only support the claim that engagement with the teachers occurred over a satisfactory timescale. For the students there were repeated applications of questionnaires over the course of a school year, or a little longer in the case of the youngest cohort. Those students interviewed were seen twice, usually with an interval of three months. The interviews were relatively brief, approximately thirty minutes long. The key question is whether this was sufficient time to establish rapport and to provide an immersion into the culture. A glance at the transcripts of student interviews provided as Appendices G to K, or teacher interviews provided as Appendices L to T, reveals that the discussions usually involved a good degree of candour.

2. Persistent observation

The key question in this respect is whether there was sufficient observation to identify the important aspects of the situation and to focus on them in detail. Excellent access to the teachers involved in the study facilitated this. When it became clear that portfolios were making a significant impact on the teachers, the opportunity was taken to repeatedly survey their actions and views, with questions tailored by the information received. With the students, such hermeneutic feedback was more difficult, but the second round of interviews incorporated a retelling of the significant contributions made in the first round, followed by loosely-structured questions which allowed the interviewees to express their views.

3. Peer debriefing

This is the process of testing out findings with a disinterested peer. This practice was not implemented entirely in the manner envisaged by Guba and Lincoln. Two types of debriefing were made, however. Throughout the study, ideas were shared with one

teacher at the school, but that person failed the absence of *contractual interest* test required by Guba and Lincoln. It is hard to justify the *disinterested* requirement when the quality of the debriefing is professional. The other type of debriefing was with education research colleagues, culminating with the presentation of a paper about the ongoing research at an education research conference (Brown, 2000).

4. Negative case analysis

This is the process of rejection of negative hypotheses, which is Popper's (1934) version of the *scientific method*, although given by Guba and Lincoln without acknowledgement. It was difficult to find an application of the negative case analysis process in this descriptive study.

5. Progressive subjectivity

Guba and Lincoln ask that

Prior to engaging in *any* activity at the site or in the context in which the investigation is to proceed, the inquirer records his or her a priori construction — what he or she expects to find once the study is underway — and archives that record. ... If the inquirer affords too much privilege to the original constructions (or to earlier constructions as time progresses), it is safe to assume that he or she is not paying as much attention to the constructions offered by other participants as they deserve. (1989, p. 238).

This procedure was not fully implemented, and is virtually impossible in the situation of a participant researcher who works at the site every day. Instead, a notebook was carried, enabling a diary to be kept of the significant interactions with other participants, recording new information and changes in attitudes as they became apparent. Care was taken to make verbatim records, or to make near-verbatim notes soon after unscheduled conversations, so that the assertions voiced by participants could be presented as quotations, if possible. Statements to the department as a whole were presented in written form whenever possible. Several of these statements, for example, the initial briefing memo which is presented as Appendix A, are given in

the appendices. Interviewer comments, which sometimes reveal attitudes held at that time, are presented verbatim in the transcripts.

6. Member checks

Member checks involve presenting the hypotheses, data, preliminary categories and interpretations to the stakeholding groups from whom the original constructions were collected. Guba and Lincoln rate this as “the single most crucial” technique for establishing credibility (1989, p. 239). However, this technique is not always appropriate when conducting research with children. Elements of member checking were introduced in the interviews when the students were reminded of what they had said previously (Appendix H, p. 1), or asked about trends apparent from the questionnaires (Appendix H pp. 2-5).

There was more use made of this technique with the teachers. They were given the statistics of every questionnaire they completed, and graphs that compared their students’ view of the classroom environment with their own. In one case a processing error produced a graph showing a huge difference between the students’ perception and that of their teacher. No feedback was received from the teacher, and the error was discovered only on further processing, thereby demonstrating the dangers of over-reliance on this form of quality control.

The questionnaires that were sent to teachers as the portfolios programme reached its second and third years (Appendix U) incorporated repetition of core questions to gauge changes in attitudes and practice, and also questions shaped by comments that had been made in the earlier responses. All comments were printed verbatim, but without ascription, and circulated back to the teachers with a summary of the overall trends. Not a single request was made to change any comment or aspect of the summary. This is consistent with the observation made by Guba and Lincoln that, in five extensive case studies, “of the hundreds of persons interviewed, not one single person felt compelled to challenge the interpretations finally written into case study form” (1989, p. 240). In the light of this experience, the tentative conclusion is that there is little value in member checking of information that is not current.

Interpretation was far more likely to be corrected as an interview proceeded, indeed

such negotiation of meaning is indicative of the rapport demanded by Guba and Lincoln under their first criterion, titled *prolonged engagement*.

Recently, issue has been taken with the application to practitioner research of formal requirements of the type presented by Guba and Lincoln. Anderson (2002, p. 22) argues that “insider accounts should have their own set of criteria for what makes them trustworthy or ‘valid’”. This is because the tacit knowledge that provides much of the practitioner’s insight is rejected by traditional research as *personal bias*. Anderson favours unsystematic but authentic accounts on the basis that “they are a form of knowledge production that is perhaps more generative for the reader” (2002, p. 22). In the hope that accurate reporting can yet provide inspiration, this study has attempted to provide verbatim quotations and valid statistics in support of its findings.

Interpretation of Results

Interpretation of results is a process of information matching. For example, the responses of caregivers about participation in preparing portfolio items must be compared with the questionnaire and interview responses of students on the same subject. Such matching can be on a quantitative basis such as the number of hours involved, and also on a basis of perceived utility and attitude formation. The usual name for this process in the interpretation of case studies is *triangulation* (Mathison, 1988). For Guba and Lincoln triangulation “carries too positivist an implication” (1989, p. 240) to deserve support. They feel that triangulation implies phenomena that are unchanging, not transient concepts that exist only in the minds of observers. Their view, however, does not deter pragmatic researchers from making valuable use of triangulation.

The findings of the Vermont experience (Koretz et al., 1993) were an important reference in the interpretation of results. That study found: important differences in the way teachers used the portfolios, for example, rules regarding authorship, revision and the selection of tasks; some confusion about what teachers were supposed to do with portfolios and how they were supposed to do it, and difficulty obtaining appropriate resources.

A two-stage process was employed to declare the results of interviews, both those with the students and those with the teachers. In the first stage, the interviews were examined for reference to issues such as those identified in the Vermont study. Where there were many references what could be classified as the same topic, or where there was any reference to a topic of particular interest, an *assertion* was framed. For each assertion, supporting or disconfirming evidence was collated. For the students, ten such assertions are presented, and for the teachers, nine assertions. These assertions are presented and discussed in Chapter Five. In the second stage of the process, well-supported assertions appear in the discussion of the research questions in Chapter Six.

Summary

The study utilised standard survey instruments known to produce high reliability and validity, allied with observation and interviews undertaken by the participant-observer. My involvement as initiator of the innovation, and as teacher of some of the classes involved obviated a completely disinterested approach. However, such are the constraints of case studies, as noted by Yin (1994). In fact, only a teacher within the school could have gained such a degree of access to facilities and documents within the school, to timetable repeated interviews with students who were not stressed by the experience, and to obtain the many hours of exposure to the students and teachers of the study over an extended time period.

In order to validate results as much as possible, feedback to the teachers involved was provided at each stage of the study. As the student surveys were coded, each teacher was provided with the results for his or her class; summaries of the teacher survey results were always circulated. Each group of students was interviewed twice. On the second occasion a brief recapitulation gave the opportunity for students to correct or expand on topics previously discussed. A preliminary paper about the entire study (Brown, 2000) was sent to the Head of Department and the two teachers most involved in coordinating the portfolio scheme. No adverse replies were received in response to any of this feedback.

According to Yin (1994) there are four key principles which underlie analytic quality in a case study, as in all social science. As much evidence as possible must be sought and exhaustively analysed; all major rival interpretations must be considered; the most significant aspect of the case study must be identified, and prior expert knowledge must be brought to bear. These four principles have been applied in this study. The students completed questionnaires more thorough than any they had seen previously, each student responding to a total of at least 138 questions. Many hours of taped interviews were transcribed, and annotation made of informal interviews in a major collection of evidence. The quantitative analysis involved data on such factors as gender, academic ability, teacher attitude, and aspects of classroom environment such as student cohesion, in an effort to quantify every relevant factor. As later chapters demonstrate, interpretation has been made by identifying important assertions from the words and behaviour of all the major stakeholders, and matching these together with the statistical results. Disconfirming data and rival interpretations are discussed in the study. By reference to previous studies, such as the portfolio implementation in Vermont (Koretz et al., 1993), the most pertinent questions were asked and analysed.

The Next Chapter

Quality tests, including an appraisal of internal validity, are applied to the study's two questionnaires in the next chapter. The constructs quantified by the questionnaires are described and criticised; the information given by the students is analysed, and results are produced for the mathematics classes and the individuals involved in the study.

CHAPTER FOUR: QUANTITATIVE RESULTS

Introduction

This chapter describes the two survey instruments that were employed to collect data, together with details of their factor analysis and reliability, and it presents the quantitative findings of this study. Taking the class as the unit of analysis, separate results are given for the various constructs supported by each instrument. Taking individual students as the unit of analysis, the links between the two instruments were explored, with the data analysed in terms of the gender of the students, and student placement in the system of ability-streamed classes. Discussion of the statistics focuses on differences arising from repeated administrations of an instrument, and differences between the responses of first and second year high school students. Some constructs from the two instruments were found to have small but significant correlations – results which suggest that a distinction must be drawn between different types of *liking* of mathematics. By matching together three surveys completed by students over the course of the school year, conditions which are associated with improvement in student enjoyment of, and attitude towards, mathematics are identified.

Instrumentation

The two instruments used with school students in the quantitative part of the study were the Mathematics Survey developed by Radalj (1982), and the What Is Happening In This Class? (WIHIC) developed by Fraser, Fisher and McRobbie (1996). These questionnaires were administered to students in all classes from the two year levels involved in this study. The questionnaires were completed during normal mathematics class time. Teachers attempted to administer the questionnaire to absentees during the following week.

Both instruments take the form of a large number of statements, many of which are similar, in response to which the students select one of five options. In the Mathematics Survey, the statements seek to determine the student's feelings about

mathematics lessons, for example “Mathematics is boring” (Appendix D, p. 1) and “I enjoy mathematics lessons more than other lessons” (Appendix D, p. 2). The available responses range from “strongly agree” to “strongly disagree”. Responses, once reversed for those items expressed in the negative, were accumulated to support four constructs: Enjoyment (of mathematics class), Importance (of mathematics), Stress (experienced in this class), and Desire to Improve Mathematical Skills (DIMS). The WIHIC described practices in the classroom, such as “I pay attention during this class” (Appendix D, p. 6) and “I am treated the same as other students in this class” (Appendix D, p. 7), with responses from “Almost Never” to “Almost Always”. Eight constructs were supported in the WIHIC: Student Cohesiveness (SC), Teacher Support (TS), Involvement (IN), Autonomy/Independence (AI), Investigations (IV), Task Orientation (TO), Cooperation (CO), and Equity (E). Reproductions of the questionnaires appear in Appendix D.

The five-point Likert options for responses was well understood by the 13 and 14 year-old students involved in the study. Use of the options is a technique that results in ordinal data with few non-responses. The limited range of responses ensured there was no opportunity to create outlier results that can confound factor analysis. Where more than one option was selected, or a choice in the middle of two options was indicated, the item was coded as non-response. Even with this policy in place, the rate of non-response was less than 2%.

The scales of the Mathematics Survey constructs are not consistent, the possible scores being Enjoyment 18 - 90, Importance 4 - 20, Stress 3 - 15, and DIMS 4 - 20. To facilitate comparison of the four constructs, the raw scores were adjusted to fit scales of 0 to 100. This was done by subtracting the lowest possible score from the raw score, dividing by the range, then multiplying by 100. This adjustment does not standardize the scores, but rather places them proportionally on a scale from 0 to 100. A similar adjustment was made to the WIHIC scores, where each of the eight constructs provide raw scores on a scale of 10 to 50. Throughout this chapter, scores on the 0 to 100 scale will be used for both instruments.

Two minor surveys were also conducted: a questionnaire sent to caregivers, and a third administration of The Mathematics Survey to all Year 10 students in February

1999. There were two reasons for this final administration of the Mathematics Survey. Firstly, to determine whether there was a significant *seasonal* effect within the school year, and, secondly, to enable a comparison of the two cohorts at the same time of year and when they were at the same age level. Communication with teachers, sometimes using questionnaire-style forms, is discussed in Chapter Five.

Sample Details

An attempt was made to survey every student in the two year levels involved in the study. The school enrolment for the two year levels reached a maximum of 510 during 1998. As shown in Table 4.1, the lowest response rate in the three major surveys was 91%. This figure takes into account the unused late responses received without indication of the students' class, and the few questionnaires which were not coded because they were completed in an untrustworthy manner, for example when the same numerical response was given to every question. For each construct, the Kaiser-Meyer-Olkin measure of sampling adequacy exceeded the 0.6 level which Coakes and Steed (1999) cite as evidence of factorability.

Table 4.1 Major Survey Completion Rates

<i>Survey</i>	<i>Date of administration</i>	<i>Number of responses coded</i>	<i>Response rate</i>
The Mathematics Survey	February 1998	500	98%
What Is Happening In This Class? (WIHIC)	June 1998	463	91%
The Mathematics Survey (repeated)	September 1998	463	91%

There was an almost exact gender balance of respondents to the surveys. The initial Mathematics Survey was completed by 249 male students and 250 female students, with no indication of gender given on one form. The linking process relied on the

cooperation of the students, but this did not result in a disproportionate representation of one gender. For example, of the 321 students whose initial Mathematics Survey and WIHIC were matched, 157 were male (48.9%), 163 were female (50.8%), with one questionnaire omitting indication of gender.

Analysis of Reading Age of Surveys

Some of the students interviewed after the first questionnaire was completed, and some of the teachers who administered that questionnaire, mentioned difficulties with the language of the survey instrument. Both surveys contained many confounding factors, including the placement of items, the use of negatively-worded items, and issues in logic. Although the surveys are intended for school students, the literature provided no indication of the reading age of the material.

A reading intervention programme at the school ensured that the reading level of every Year 9 student was quantified. Many students were found to be reading at a level below their chronological age. Most Year 9 students are 13 years old, yet a few are assessed each year as reading at a much younger level. The teacher in charge of the school's remedial reading programme had experimented with different tests to assess reading ability. She observed that:

The primary schools do a great job of teaching the kids and most come with the mechanical skills of reading. Some cannot comprehend what they read. I suspect that each year there are about 25 to 35 poor readers who enter [this school] and are able to be helped. They range in reading age from unable to read much at all to 11 years. Usually we have about 5 at the lowest end of the levels. (personal communication, 10 June 1999)

She also noted that these students have particular difficulties with questionnaires because such documents lack sufficient context for the students to guess the meaning of unfamiliar words.

In the light of this, the reading level of the survey instruments may be of critical importance. An assessment was made using a standard formula, the Fry Readability Estimate (Western Australian Education Department, 1987). This test, like others of its type, acknowledges that syllable and word frequency analysis deals only with

surface features of the text. Other factors affecting readability include the level of abstraction of the ideas, the inference load placed on the reader, and the use of diagrams and illustrations. If the confusing factors other than the vocabulary surface features are ignored, the WIHIC requires a reading age of 10 years and the Mathematics Survey requires a reading age of 12 years. The Mathematics Survey would cause difficulty for approximately 10% of the students in the study.

The questionnaires were circulated to teachers with conduct briefing notes that recommended “If your students are not good readers you may need to read the instructions and the statements aloud to the class. Try to do this in a neutral fashion!” (Appendix D, p. 3). After the first survey, teachers reported that reading aloud was necessary for the low stream classes, and that they had to explain some words. The word *seldom* was a particular problem, as it appeared early (item D) in the Mathematics Survey and it was unfamiliar to many students. The students met seldom again as a response option for each of the 80 WIHIC items. As noted in Chapter Four, it was a response that was not chosen very often, suggesting that the WIHIC may benefit from modification in this respect.

Factor Analysis and Reliability

Several statistical tests were performed on the data to ensure the items that constituted each construct were coherent. Factor analysis is a method of determining whether each of the questions used on the questionnaire form, the *items*, are measuring the same construct. The Mathematics Survey contained 29 items, 18 of which constituted the Enjoyment construct, 4 constituted Importance, 3 constituted Stress, and 4 constituted Desire to Improve Mathematical Skills. The WIHIC quantified the eight constructs Student Cohesiveness, Teacher Support, Involvement, Autonomy/Independence, Investigation, Task Orientation, Cooperation, and Equity. Each of the WIHIC’s constructs employed 10 items.

A principal axis factoring was performed on the two surveys. This is a data reduction technique that determines whether items consistently support the same construct, or alternatively, it enumerates the other factors and the degree to which each item is linked with each factor. If a factor analysis reveals that items support large numbers

of factors, or overlap in the factors they support, then the reliability of the instrument is called into question.

Factor Analysis: The Mathematics Survey

The first administration of the Mathematics Survey produced four factors, accounting for 49% of the variance. An extraction rotation, using varimax with Kaiser normalization, was used to further define the factor structure. The output is given as Table 4.2.

The mean correlations indicate good support for the four constructs of the Mathematics Survey. Of the 29 items, three are associated with three constructs, eleven with two constructs, and the remaining 15 are uniquely associated with the construct they were intended to measure. The three items which were the least effective at supporting a unique construct were all intended to be associated with Enjoyment. The items were: “I have never liked mathematics”, “I would enjoy school if there were no mathematics lessons” and “I do not like mathematics” (all Appendix D, p. 2). The Mathematics Survey makes heavy use of such negatively expressed items: 18 of the 29 items are so worded, as indicated in Appendix D. Not only the three items cited above, but many of the other low-correlation items are negatively worded. In the Mathematics Survey, a high score in a construct indicates that the student disagrees with those items antithetical to the construct, necessitating a reversal in the coding for those items expressed in a positive way. Although such an arrangement may diminish acquiescent behaviour by respondents, it is not recommended as best practice (Barnette, 2000) because it has been shown to lower internal consistency reliability as measured by Cronbach’s alpha. Barnette recommends only directly worded stems, with half the response options going in one direction and half in the other.

It is interesting to note the error in logic that exists in one of the items mentioned above. To score highly in the Enjoyment of mathematics construct, a student must contradict the statement “I would enjoy school if there were no mathematics lessons” (Appendix D, p. 2). This places students who enjoy all their subjects in a quandary.

Of course, it is not defensible in logic to take the rejection of causality as contradiction of the premise.

Table 4.2 Factor Analysis of The Mathematics Survey

<i>Item</i>	<i>Intended construct</i>	<i>Factor</i>			
		<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
O	Enjoyment	0.75			
N	Enjoyment	0.72			
S	Enjoyment	0.69			
G	Enjoyment	0.67			
R	Enjoyment	0.64			
AC	Enjoyment	0.62	0.43		0.32
E	DIMS	0.58		0.36	
P	Enjoyment	0.54			
F	DIMS	0.54			
AB	Enjoyment	0.54	0.51		
B	Enjoyment	0.52	0.52		
AA	Enjoyment	0.51	0.47		
W	Enjoyment	0.47	0.42		0.34
C	DIMS	0.41		0.36	
X	Enjoyment	0.40	0.37		0.33
D	Enjoyment	0.34			
Z	Enjoyment	0.31			
K	Enjoyment	0.35	0.50		
J	Enjoyment		0.48		
A	Enjoyment	0.38	0.45		
M	Enjoyment	0.41	0.42		
H	Importance			0.65	
T	Importance		0.35	0.59	
Q	Importance			0.56	
U	Importance			0.53	
I	DIMS	0.37		0.51	
Y	Stress			0.31	0.76
V	Stress				0.62
L	Stress				0.59

The items in a construct should obtain correlation coefficients greater than 0.3 (Coakes & Steed, 1999). The item that came closest to the 0.3 cutoff in the factor analysis was “I am not willing to take more than the required amount of mathematics” (Appendix D, p.2). On the face of it, this item seems relevant to Desire to Improve Mathematical Skills. However, the factor analysis uniquely associates this item with other Enjoyment items, the result intended by the author of the construct. This item is notable for including three qualifiers in a single sentence. Also, ambiguity may exist in the word *take*. If interpreted in a future tense, the item

is a statement about willingness to enrol in a non-compulsory mathematics course. If interpreted in the present tense, take may be a synonym of *receive* or *absorb*, leading to the item becoming a statement about the student's acceptance of a transmissionist teaching approach.

Mathematics Survey Constructs

A factor analysis was also applied within each construct. This was to identify any poorly performing items that did not correlate well with the other items of the construct. The analysis is discussed below, using each of the four constructs as subheadings.

Enjoyment

Almost all the correlations between items exceeded 0.3, which indicates that factor analysis is appropriate. The table of communality of the items (correlation with other items within the construct) revealed two low-scoring items: the item discussed above, "I am not willing to take more than the required amount of mathematics" (Appendix D, p. 2), and "I have seldom liked studying mathematics" (Appendix D, p. 1). During the administration of the survey, and in subsequent interviews, the word seldom was identified as a vocabulary problem for many of the students.

The factor analysis revealed that a single factor accounted for 47% of the variance explained, with a second factor accounting for a further 3%. This is to be expected with such highly-correlated items that were designed to measure a single construct. The Cronbach's alpha reliability coefficient was 0.94, which is very high. Removal of the two items discussed above would be expected to provide a marginal improvement in the Cronbach's alpha statistic.

Importance

Four items constituted this construct. Only one factor was extracted, accounting for 44% of the variance explained. The Cronbach's alpha reliability coefficient was 0.75.

In this construct the items correlated well and made consistent contributions. This is despite the fact that one item is incorrectly worded and has by far the longest word count: “I do not need to know anything else except four mathematical operations: addition, subtraction, multiplication and division of numbers” (Appendix D, p. 2). The meaning intended by Radalj most likely is “The only mathematical operations I want to know are addition, subtraction, multiplication and division”, and the polarization of the responses to this item demonstrates that the students made their choice with little confusion. However, it remains unclear whether the students are indicating, quite correctly in most cases, that those operations are all that is required by the syllabus. Alternatively, the students may be indicating that they are innocent of, or would like to avoid, any harder mathematics.

Stress

The four Stress items functioned satisfactorily and accounted for 54% of the variance explained. The Cronbach’s alpha reliability coefficient was 0.77. The Stress items went unanswered with a frequency greater than items in the other constructs, perhaps reflecting the relatively strong language used: words such as *frightens* and *scares*.

Desire to Improve Mathematical Skills

There were only three items supporting this construct, however they functioned satisfactorily and accounted for 40% of the variance explained. The Cronbach’s alpha reliability coefficient was 0.72.

Factor Analysis: What is Happening In this Class?

This survey was administered to every class five months after the initial administration of the Mathematics Survey. The WIHIC consists of 80 items, necessitating a longer completion time than the 29-item Mathematics Survey. The response format was similar, requiring the students to circle one of five options.

Scrutiny of the WIHIC results reveals adequate sampling adequacy (Kaiser-Meyer-Olkin Measure of Sampling Adequacy of 0.921) and satisfactory correlation for factor analysis. Some of the constructs were well supported by the factor analysis, giving only a single factor extracted and high levels of total variance explained. This can be seen from Table 4.3.

Table 4.3 Factor Analysis Summary for the WIHIC

<i>Construct</i>	<i>Number of factors extracted</i>	<i>Total variance explained</i>
Student Cohesiveness	2	43%
Teacher Support	1	49%
Involvement	2	48%
Autonomy/Independence	3	45%
Investigation	2	47%
Task Orientation	1	45%
Cooperation	2	48%
Equity	1	59%

WIHIC Constructs

A factor analysis was also applied within each WIHIC construct. It revealed inconsistent levels of coherence in different constructs. This is discussed below, using each of the eight constructs as subheadings.

Student Cohesiveness (SC)

In this construct, the item with the lowest communality is “I know other students in this class”. Perhaps *know* was too vague, or the responses of “Almost Never”, “Seldom”, “Sometimes”, “Often”, or “Almost Always” were inappropriate adverbs to apply to this verb. The surveys completed by teachers gave results for Student Cohesiveness which were very close to the student results, suggesting that this construct was meaningful and widely understood.

Teacher Support (TS)

This construct proved coherent. The item with the second lowest communality was “It is alright with the teacher if I am slower than other students in the class” (Appendix D, p. 5). This item can be seen as an admission of invidious self-comparison with peers, not just a statement about the performance of the teacher. Another item, “The teacher takes a personal interest in me” (Appendix D, p. 5) attracted some derisory comments when students were interviewed after the questionnaire was completed (Appendix H, p. 3), but its extracted communality statistic of 0.626 indicates that the students must have been able to interpret the question adequately. Scoring by teachers was very much higher than the class figures. For Teacher Support a major difference in perception was apparent, the mean score by teachers was 84.85, and by students was 44.78.

Involvement (IN)

Some of the items in this construct feature the student as the active subject of the sentence, and some feature the teacher or “other students”. For example, “I give my opinions during class discussions” and “The teacher asks me questions” (Appendix D, p. 5). While this seems a plausible reason for the failure of this construct to reveal a single factor, there is also another consideration. In a class of thirty students, it may not be feasible for many students to feel they “Almost Always” express themselves. Perhaps some objective criteria are needed, such as the percentage of students who raise their hand to ask or answers questions during a class period, or the frequency of the class moving into small groups. The teachers scored this construct much higher than the students, the mean difference in scores being 21.5.

Autonomy/Independence (AI)

This was the least successful of the WIHIC constructs. Three factors were identified, each contributing about one-third to the total variance explained. The factors corresponded with items phrased in a similar way: either “I have a say...”, “The teacher decides...” or “I am given a choice...”. Effectively, the three wordings produced three different constructs. Two items had very low communality scores and

did not contribute to the three factors: “I am told how to do my work” (Appendix D, p. 6) and “I work at my own pace” (Appendix D, p. 6). The item “I am told how to do my work” (Appendix D, p. 6) obtained the lowest communality score of all 80 WIHIC items. Autonomy/Independence is a construct that did not cohere well in this study and is not very meaningful. The construct Autonomy/Independence has been removed in subsequent versions of the WIHIC.

Investigation (IV)

Interviews with students after the administration of the WIHIC confirmed that some students were confused by references to *investigations* in these items. Teachers may have introduced few investigations, or perhaps did not present them by that name. For some students, the initial items “I draw conclusions from investigations” (Appendix D, p. 6) and “I carry out investigations to test my ideas” (Appendix D, p. 6) did not give sufficient context to interpret the key word. In the study, Investigation consistently obtained the lowest score of the eight constructs. Teachers and students were in close agreement in their scoring of this construct.

Task Orientation (TO)

This construct proved coherent, and every item had a good communality score. Task Orientation is a concept well understood by the students, although some of the items use everyday phrases such as “paying attention” and “know what to do” which could be associated with a transmissionist teaching approach. A class that does a considerable amount of group work may have a high task orientation, but be scored low by the students if they endorsed the impression these transmissionist items convey. In the study, teachers often rated this construct much higher than did their students, the mean difference in scores being 14.7

Cooperation (CO)

Some students commented that these items were inappropriate, as group work never occurred in their mathematics class. They felt that “Almost Never” was overstating the frequency. In response to “I cooperate with other students on class activities”

(Appendix D, p. 7), one student when interviewed retorted “What activities?!” (Appendix K, p. 18). She had indicated “Sometimes” because that was the middle choice of the five responses, as she felt there was no appropriate option available. “You’re not allowed to talk!” she expostulated.

Teachers gave lower scores for Cooperation than the students in high ability classes, but higher scores than the students in low ability classes.

Equity (E)

This construct proved coherent, and every item had a good communality score. Teachers in the study often scored the classroom Equity much higher than did the students, especially in lower streamed classes. The most extreme disparity between teacher and student scores was 69.5, part of a pattern of low scoring of all constructs by students in low ability Year 10 classes.

With one exception, all teachers also completed the questionnaire, enabling a comparison to be made between the teacher’s perception and that of the class. The results for my two Year 9 classes appear as Figure 4.1 and Figure 4.2. One class was the most able academically of the nine streamed classes of that age cohort, the other was the least able. These graphs illustrate a trend that existed in almost every class: for the most able class there is close conjunction of teacher and class figures, but with the less academic class there is significant disparity. No doubt incorrect teacher expectation played a part, but perhaps students who lack skills in mathematics also lack skills in assessing the classroom environment.

Figure 4.1 Most Academically Able Year 9 WIHIC Results (n = 27, maximum score = 100)

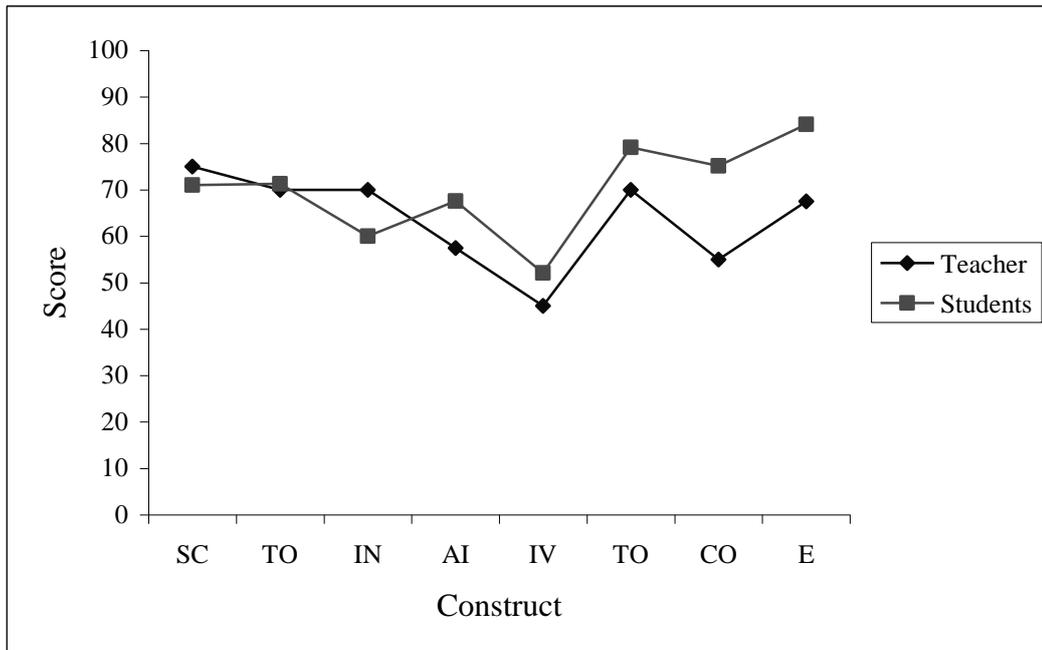
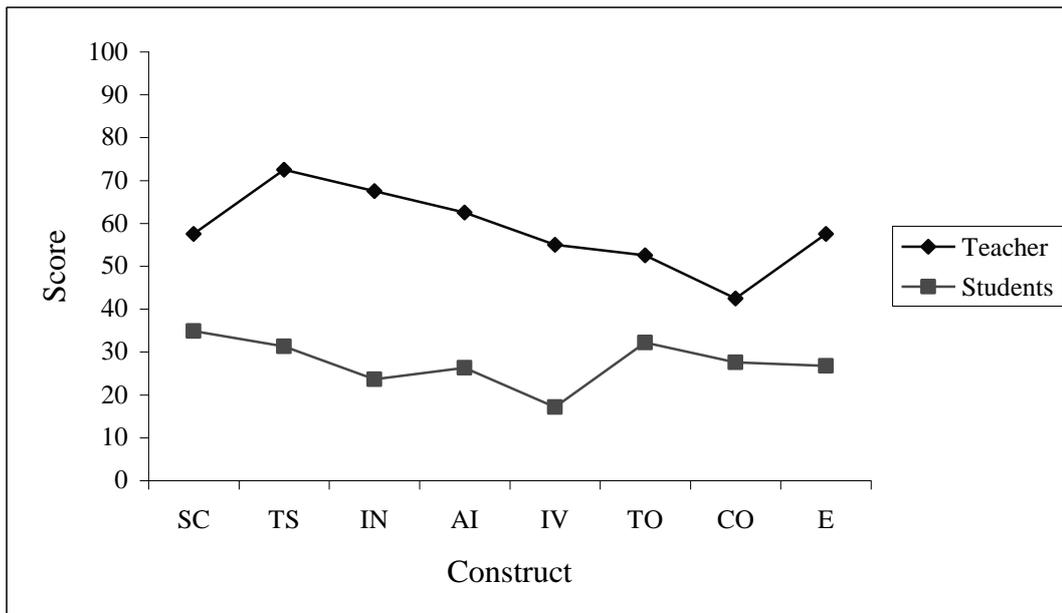


Figure 4.2 Least Academically Able Year 9 WIHIC Results (n = 20, maximum score = 100)



In the academically able class, the teacher’s scoring was very close to the mean of the students’ scoring for the majority of the constructs, but was lower for Cooperation and Equity. The more usual result was that the student scoring of every

construct was significantly lower than that of the teacher, as seen in Figure 4.2, the graph of the less able class.

A graph showing how the scores of the students compared with those of the teacher was prepared for each class and distributed to the relevant teachers. One teacher confided that he used the results to pinpoint areas for his professional development. For most classes, the students rated the Teacher Support and the Equity constructs significantly lower than did the teacher.

Repeated Administration of the Mathematics Survey

The initial Mathematics Survey results were obtained before the mathematical portfolio programme was introduced to the students. Exactly the same survey was administered in Term 3, when the portfolios were largely complete. This will be referred to as the Mathematics Survey Repeat.

The Mathematics Survey Repeat in Term 3 had been preceded by the Mathematics Survey in Term 1 and the WIHIC in Term 2, therefore it was possibly subject to a *test effect*: students may have taken less interest in the survey, and completed it rapidly without introspection. Although the students were given notice and reminded to have their code numbers with them, many were unable to supply the same number. Several of the successfully matched students gave different answers to the objective questions “Counting (this) High School, how many schools have you been at?” and “Counting yourself, how many children live at your house?”. No doubt some of the students had misinterpreted the “counting this school/counting yourself” phrase, as some zero responses were made. Although the number of children living at a house may vary or involve problematic interpretation, the students were asked to give the same response as in their first survey, and many failed to do so. This may be an indication of a lack of thoughtfulness in the responses to the repeated surveys. There were also a number of plainly deceitful responses, where the number of schools or siblings were far greater than any claimed in the first survey.

The rationale for the student-invented code number was that anonymity could be guaranteed and that this would be obvious to the students, while matching of the

different surveys to the same respondent remained possible. The positive outcomes of this policy are impossible to quantify, but it can be claimed with certainty that students knew the surveys would not affect their examinations results nor school reports, and therefore the students may have responded more truthfully than would have been the case with named questionnaire forms.

One of the negative outcomes was that students with a poor attitude to the surveys could respond deceitfully with impunity. Up to a dozen survey forms, particularly in the later surveys, were evidently insincere. For example, some contained only the most extreme responses to every item. While almost every student stayed within the restrictive format of the Likert scale, those who selected their responses from only the extreme values “1” and “5” perhaps indicated annoyance at having to do the survey yet again, rather than any mature and considered response. Particularly as the students in the study were adolescents, it may have been a good idea to provide a tick-box for “I do not wish to participate” at the top of the form.

The other major negative outcome resulting from respondent anonymity was that matching of the surveys was incomplete. Within each class a search was conducted for identical codes. Then an attempt was made to match the remaining questionnaires on the basis of the objective questions: sex, schools attended and siblings. From an initial pool of 500 respondents, 321 were matched for the first two surveys, and the matching was further reduced to 251 cases for the third survey. In part this was due to a smaller number of completed questionnaires because of increased absenteeism, but possibly there was also a reduced amount of following up by the teachers.

Those students successfully matched tended to come from the higher-streamed classes, and must have been those who were personally well-organised. These were the same kind of biases that would arise if the study had been set in a different school where entrance tests and fees excluded some students. In recognition of these biases, two levels of analysis were necessary. The matched responses involved the individual as the unit of analysis, but no responses were excluded where the class was used as the unit of analysis in the sections below.

Class Unit of Analysis: The Mathematics Survey

The Mathematics Survey was administered a third time to the more junior of the two year groups at the beginning of the next school year, in February 1999, but without the student codes which enable matching of individual responses.

Table 4.4 presents the results of the most junior cohort, students who were in their first year of high school when the survey was initially conducted in 1998. Although class designations changed the following year, there were no major changes in the class rolls, enabling a comparison to be made between figures in the same column of the table.

Table 4.4 Comparison of Three Administrations of the Mathematics Survey:
Junior Cohort, First and Second Year at High School. Scale from 0 to 100.

<i>Mathematics Survey February 1998, N = 243</i>										
	3A1	3A2	3A3	3A4	3A5	3B1	3B2	3B3	3B4	All
Enjoyment	67.4	50.7	50.5	39.8	44.9	50.4	36.8	39.9	41.8	47.4
Importance	93.5	80.4	83.6	72.8	77.9	80.6	67.2	66.4	67.4	77.3
Stress	83.9	73.6	75.9	66.7	61.9	73.9	56.3	60.1	67.1	69.2
DIMS	65.9	48.1	49.1	50.0	51.7	54.7	41.8	43.5	56.3	51.2
<i>Mathematics Survey September 1998, N = 220</i>										
	3A1	3A2	3A3	3A4	3A5	3B1	3B2	3B3	3B4	All
Enjoyment	51.9	41.4	52.5	42.4	42.3	42.4	30.3	40.1	38.4	42.7
Importance	87.5	79.6	89.8	78.9	80.7	69.3	64.6	73.0	59.4	76.6
Stress	73.3	63.9	80.3	75.6	69.2	64.3	58.7	69.3	70.4	69.4
DIMS	58.3	47.5	52.9	45.4	51.1	43.3	42.2	50.3	50.3	48.9
<i>Mathematics Survey February 1999, N = 200</i>										
	4A1	4A2	4A3	4A4	4A5	4B1	4B2	4B3	4B4	All
Enjoyment	48.9	49.6	45.4	37.8	36.7	39.0	30.1	38.5	29.2	40.6
Importance	83.2	85.6	81.5	83.8	71.6	82.1	57.8	68.4	52.9	76.2
Stress	67.3	75.0	76.5	70.0	80.3	61.4	50.0	71.1	59.0	68.8
DIMS	55.0	53.2	55.6	47.5	51.7	57.1	34.1	53.7	46.6	51.0

The same comparison is possible in Table 4.5, although this older cohort completed only two administrations of the Mathematics Survey.

Table 4.5 Comparison of Two Administrations of the Mathematics Survey:
Senior Cohort, Second Year at High School. Scale from 0 to 100.

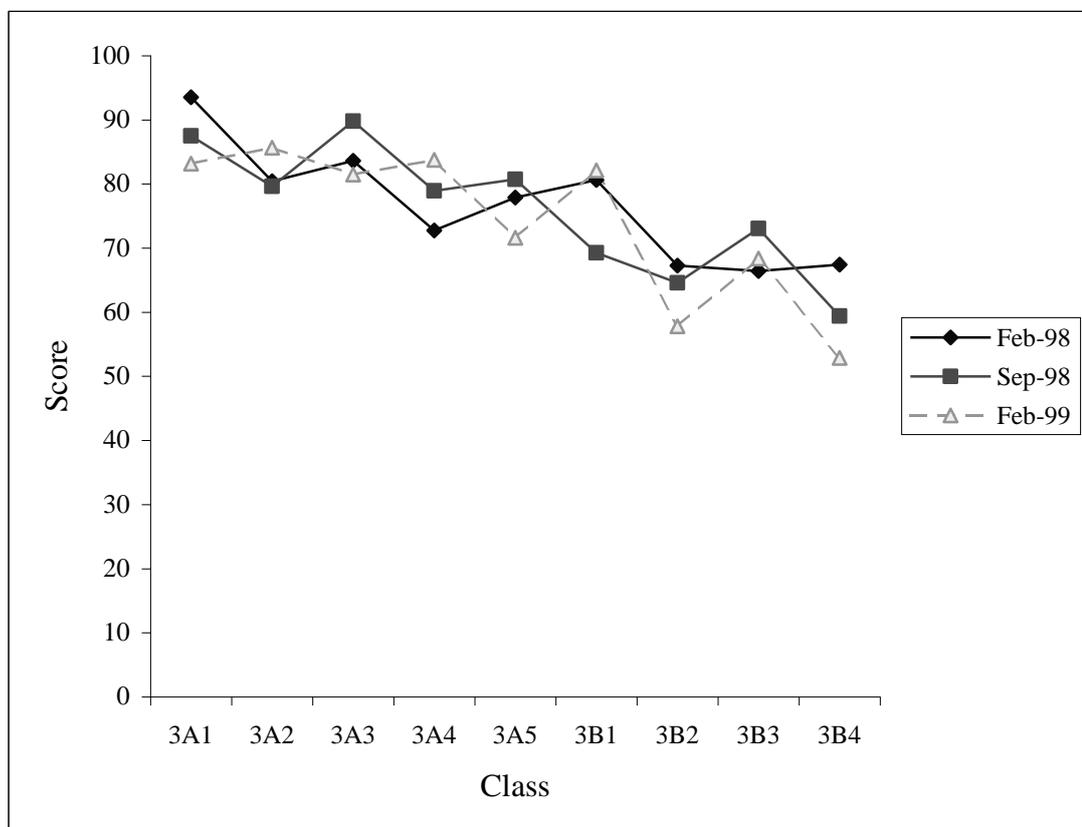
<i>Mathematics Survey February 1998, N = 257</i>											
	4A1	4A2	4A3	4A4	4A5	4B1	4B2	4B3	4B4	4B5	All
Enjoyment	47.9	41.8	40.3	35.0	47.9	27.9	41.2	38.9	49.7	42.5	41.2
Importance	80.2	79.7	75.7	67.5	74.8	71.3	72.4	74.0	74.8	72.8	74.5
Stress	77.5	74.4	74.7	63.3	68.9	62.3	74.6	65.1	65.4	69.0	69.7
DIMS	48.8	42.0	36.3	43.1	53.8	35.9	45.5	39.9	57.9	53.6	45.1
<i>Mathematics Survey September 1998, N = 243</i>											
	4A1	4A2	4A3	4A4	4A5	4B1	4B2	4B3	4B4	4B5	All
Enjoyment	39.9	36.0	29.8	39.8	45.6	33.0	35.7	38.4	49.3	27.7	37.9
Importance	83.8	71.7	64.3	69.8	69.6	65.0	62.2	73.0	73.9	49.0	69.4
Stress	72.8	68.6	57.0	70.4	59.9	62.3	61.6	67.4	66.3	60.3	65.0
DIMS	46.7	37.3	38.3	50.4	51.8	43.5	41.3	49.7	47.8	48.1	45.3

For the junior cohort, Stress was the only construct to show a mean increase between the first two administrations of the Mathematics Survey. In a meta-analysis of research on the relationship between anxiety and mathematical achievement, Ma (1999) notes that a host of other variables mediate the relationship. For able students with low mathematical anxiety, a decrease in stress may give no improvement in mathematical achievement, but for other students it may be a benefit. Ma (1999) found that the relationship between anxiety and mathematical achievement was very sensitive to the instrument used to measure achievement. An assessment based on portfolios is of a different nature to traditional examinations, measures of anxiety may provide some unexpected correlations.

The third administration revealed that attitudinal variables were little changed at the beginning of the following year. The students scored the attitudinal variables comparatively high in their first week of high school, but lower scores were returned by both cohorts at other times during their first two years. Importance of mathematics items were consistently scored more highly than those of other constructs. The fact that mathematics was the subject of an entire questionnaire may have been influential on the first occasion. The mean score given to Importance by the senior cohort declined by 5.1 between the two administrations, the greatest decline of any of the constructs, but Importance remained the most highly scored construct.

The most academically able Year 9 class, 3A1, produced a score of 93.5 for the Importance construct, so great was the students' concurrence with the four items that comprise the construct in February 1998. In the September 1998 administration of the same survey, their scoring of the Importance of mathematics fell to 87.5, as their exposure to other high school subjects increased. At the beginning of the following year, as a slightly reconstituted class 4A1, the score was 83.2. Other classes showed a less consistent decline in their scoring of Importance, although decline was the trend overall. Scoring of Importance was highly correlated with the system of streamed classes, as can be seen in Figure 4.3, and as detailed in the statistics of Tables 4.6 and 4.7.

Figure 4.3 Importance of Mathematics By Class in the Three Administrations of the Mathematics Survey (Maximum score = 100)



One interpretation of the results is to identify a low overall rating of all the constructs. This pessimistic view holds that the students do not enjoy mathematics, do not find mathematics important, are not very stressed by their mathematics lessons, and have little desire to improve their mathematical skills. Only those

students allocated to “A” stream classes in their first few days of high school depart from this disinterested attitude. From such an apparently low initial basis, it would seem that almost any educational innovation would be “doomed to success”. But the overall scores declined as the year went on, and they stayed down at the beginning of the second year of high school. Despite the portfolios innovation, the students became increasingly negative in their attitudes towards mathematics.

Another apparent feature of the results is the correlation between the indices of the Mathematics Survey constructs and the position of the class in the streaming system. The school streamed all new students by allocating them to the “A” stream or “B” stream. This was done on the basis of the academic potential apparent in interviews, and the reports from the 17 contributing primary schools. A mathematics test that incorporated elements of problem-solving was administered to all students on their first day at school. This was the basis for further partitioning within the “A” and “B” streams to determine the mathematics classes. By this process, the least academically able mathematics classes in the “A” stream were sometimes surpassed in tests by the most academically able mathematics classes in the “B” stream. Students who emerged as greatly misplaced in mathematics were shifted during the course of the year to a more suitable class, as determined by the Head of Department. Shifting between the “A” stream and “B” stream also occurred, but required the cooperation of all subject areas and was less common. In July of the first year of this study, 10 students were shifted between mathematics classes, all of them within the “B” stream. Apart from the element of crossover between the “A” and “B” streams, the allocation to mathematics classes had been made on the basis of mathematical ability. By assigning the highest class the ranking 1, the next highest 2, and so on, the correlations with Mathematics Survey constructs were evaluated. For the junior cohort, Enjoyment and Importance both correlated highly with the class position in the streaming system, the negative sign indicating that high stream classes gave these constructs the greatest support. Table 4.6 shows this high correlation to be the case in all three administrations of the instrument. Streaming remained significant but was less influential on Stress, and on Desire To Improve Mathematical Skills.

Table 4.6 Correlations Between Class and Mathematics Survey Constructs, Junior Cohort

<i>Mathematics Survey February 1998, n = 243</i>	
Enjoyment	-0.74
Importance	-0.86
Stress	-0.73
DIMS	-0.40
<i>Mathematics Survey September 1998, n = 220</i>	
Enjoyment	-0.70
Importance	-0.86
Stress	-0.35
DIMS	-0.42
<i>Mathematics Survey February 1999, n = 200</i>	
Enjoyment	-0.88
Importance	-0.83
Stress	-0.51
DIMS	-0.42

The situation was quite different for students in the second year of high school. As Table 4.7 demonstrates, Enjoyment was uncorrelated with streaming for the senior cohort, and the correlations of other constructs were significant but low compared to those of the Year 9 cohort. All the Year 10 classes scored Enjoyment very low. It was consistently lower than Importance, and usually lower than Desire To Improve Mathematical Skills. In Year 10, students of all ability levels subscribed to views typified by the first item of the Mathematics Survey: “I avoid doing mathematics whenever possible”. Because the scale presented on the questionnaire was from “strongly agree” to “strongly disagree”, 50 is a score in the middle and represents a neutral position. For Year 10, the overall mean for Enjoyment was 41.3 in February 1998 and 37.5 in September 1998.

For the students of greatest academic ability, mathematics represented a skills area in which they had demonstrated facility. They perceived mathematics as an avenue to success and a gauge of their intellectual prowess. In the study, even academically able students admitted little enjoyment of mathematics. No doubt, there was an interplay between lack of interest and/or ability causing low achievement, and low achievement causing lack of interest, but that was not the pattern found by the Mathematics Survey. As can be seen from Table 4.4 and Table 4.5, the declared

enjoyment of mathematics, and the appraisal of the importance of mathematics, declined as time went on in almost every class.

Table 4.7 Correlations Between Class and Mathematics Survey Constructs, Senior Cohort

<i>Mathematics Survey February 1998, n = 257</i>	
Enjoyment	-0.01
Importance	-0.48
Stress	-0.54
DIMS	0.39
<i>Mathematics Survey September 1998, n = 243</i>	
Enjoyment	0.00
Importance	-0.57
Stress	-0.36
DIMS	0.39

The scoring of the Enjoyment construct was very low in many classes, especially Year 10 classes, and it did not correlate with the class position in the streaming system. The Mathematics Survey was not designed to examine this cultural effect. That task was the domain of the What Is Happening In This Class? (“WIHIC”) survey, which is discussed below.

Class Unit of Analysis: The WIHIC Survey

The What Is Happening In This Class (WIHIC) instrument consisted of 80 items. It was designed to explore eight constructs, with 10 items allocated to each construct. A reproduction of the WIHIC in Appendix D shows how the items were arranged on the questionnaire in blocks, each of which is labelled by the initials of the relevant construct. The responses are a 1 to 5 Likert scale, but identified on the questionnaire with the narratives “Almost Never”, “Seldom”, “Sometimes”, “Often”, and “Almost Always”. The distribution of student responses is given in Table 4.8.

Table 4.8 Frequency of Each Response in the WIHIC

<i>Response</i>	<i>Almost never</i>	<i>Seldom</i>	<i>Sometimes</i>	<i>Often</i>	<i>Almost always</i>	<i>Other</i>	<i>Total</i>
Frequency	3727	5438	10788	8981	7438	588	36960
Percentage	10%	15%	29%	24%	20%	2%	

Results from the WIHIC survey, completed by 463 students in June 1998, were adjusted to a 0 to 100 scale in order to facilitate comparison with the Mathematics Survey. The results are presented in Table 4.9. As with the Mathematics Survey, the scores appear to be low. In other words, the survey items, a list of desirable attributes of a classroom environment, are most often judged by the students to occur only “Sometimes”. This low frequency even applies to those issues of basic teacher fairness that are grouped as the construct “Equity” and typified by the item “I get the same amount of help from the teacher as do other students” (Appendix D, p. 7).

The most inconsistently scored constructs indicate the areas where the individual performance of the teacher has the greatest influence. Equity (E) and Teacher Support (TS) are constructs that may be interpreted in this light. Cooperation (CO) also obtained a relatively high standard deviation between the class means. However, as discussed earlier in this chapter, Cooperation is about group work, and it would have received many “not applicable” responses if that option had been available.

Table 4.9 WIHIC Constructs by Class, Scale of 0 to 100

<i>Class</i>	<i>SC</i>	<i>TS</i>	<i>IN</i>	<i>AI</i>	<i>IV</i>	<i>TO</i>	<i>CO</i>	<i>E</i>
3A1	71.0	71.3	60.0	67.6	52.1	79.2	75.2	84.1
3A2	73.6	62.5	57.0	55.8	39.3	64.1	70.4	68.2
3A3	66.2	57.8	55.3	59.4	40.9	72.7	57.1	73.8
3A4	59.1	62.8	50.7	56.8	40.7	69.5	56.9	76.6
3A5	66.6	60.5	54.0	56.6	40.0	69.6	60.4	72.3
3B1	66.8	49.2	54.8	52.3	44.9	68.2	65.8	59.0
3B2	63.2	47.4	47.0	45.0	38.5	63.5	58.0	53.0
3B3	56.3	61.9	50.1	45.8	34.3	50.7	34.2	45.7
3B4	55.9	51.0	40.6	44.3	31.9	52.3	46.0	44.9
4A1	67.8	52.9	52.0	56.4	44.9	71.6	71.9	69.7
4A2	65.7	55.1	44.5	52.7	36.0	57.4	65.2	67.4
4A3	60.1	28.8	40.7	47.9	33.5	53.9	48.8	40.5
4A4	63.1	52.9	37.5	50.8	24.6	57.4	58.2	55.6
4A5	65.5	54.0	51.9	59.9	43.8	71.5	71.9	64.3
4B1	66.6	41.1	46.3	52.0	33.8	68.1	63.5	46.3
4B2	59.9	39.7	49.9	42.8	29.7	51.1	55.1	52.6
4B3	61.9	58.6	50.5	52.7	41.6	72.3	61.6	72.7
4B4	64.4	66.6	53.5	58.4	47.2	70.1	63.2	70.2
4B5	71.5	58.7	44.8	50.2	24.2	67.1	57.9	74.6
All classes	64.6	53.8	49.7	53.0	38.2	64.9	60.3	62.5

Student Cohesiveness (SC) demonstrated the least variation between classes. The WIHIC instructions ask the respondents to consider the frequency of each event “which could take place in this class” (Appendix D, p. 4). Although Student Cohesiveness items were intended to refer to the quality of friendship within the mathematics class, it must be remembered that mathematics classes were streamed for that subject only. Classes in other subjects consisted of different groups of students. The Student Cohesiveness index may apply to the quality of friendship throughout the peer cohort, rather than within one class of the six or seven different classes attended by students each day. Although the Equity scores correlate well with class streaming in Year 9, there seems to be little pattern in Year 10. Perhaps the first year high school students who were allocated to the most highly academic classes interpreted the equitable encouragement performance of their teachers in a favourable light. This would parallel their high scoring of the Importance of mathematics in the first administration of the Mathematics Survey. Alternatively, the teachers may have responded to the labelling of their students as high stream by giving a great deal of encouragement to quiet individuals, and providing opportunities for every student to contribute.

A striking feature of the WIHIC data is that the correlation between the Year 9 classes’ position in the streaming system and their scoring of the constructs is not replicated in Year 10. The location of a Year 9 class in the streaming system is strongly related to the attitudes expressed by its members in the survey. For example, low stream classes report less Cooperation between their members than do high stream classes. The streaming is determined on a perceived basis of ability to do mathematics, but the result appears to be a division of Year 9 students on social performance attributes. The statistics, given in Table 4.10, show that this observation applies strongly and across all eight of the WIHIC constructs. The WIHIC data shows little correlation for the Year 10 classes. Across all the streamed classes, the Year 10 students were consistent in their WIHIC responses.

Table 4.10 Correlations Between Class and Scoring of the WIHIC Constructs

	<i>SC</i>	<i>TS</i>	<i>IN</i>	<i>AI</i>	<i>IV</i>	<i>TO</i>	<i>CO</i>	<i>E</i>	<i>Overall</i>
Year 9	-0.81	-0.69	-0.87	-0.93	-0.75	-0.83	-0.79	-0.92	-0.82
Year 10	0.13	0.38	0.27	-0.09	-0.14	0.27	-0.24	0.31	0.11

Correlations between the WIHIC constructs, shown in Table 4.11 and Table 4.12, were found to be high, reflecting the trend of high ability classes rating all the items generously and low ability classes being more conservative. For Year 9 students, Cooperation (CO) did not correlate well with Teacher Support (TS), the items relating to interaction with peers not being very relevant to interaction with the teacher. The helpfulness attributes which are the subject of Student Cohesiveness (SC) are similarly irrelevant to the self-reliance attributes of Teacher Support.

Table 4.11 Correlations Between WIHIC Constructs, Year 9 Class Means

	<i>SC</i>	<i>TS</i>	<i>IN</i>	<i>AI</i>	<i>IV</i>	<i>TO</i>	<i>CO</i>	<i>E</i>
Student Cohesiveness	—	0.34	0.83	0.69	0.69	0.70	0.89	0.65
Teacher Support		—	0.63	0.74	0.46	0.41	0.27	0.67
Involvement			—	0.85	0.81	0.76	0.70	0.77
Autonomy/Independence				—	0.84	0.89	0.72	0.96
Investigation					—	0.89	0.81	0.77
Task Orientation						—	0.82	0.92
Cooperation							—	0.73
Equity								—

For Year 10 students, the correlations were generally lower than those of their younger peers, and in two instances were virtually negligible. These were between Student Cohesiveness and Involvement (IN), and between Student Cohesiveness and Investigation (IV). The Year 10 students, as mentioned above, were more forthright in their opinions. They indicated the weakness and inappropriateness of the Investigation construct by scoring it very low, and not consistent with their scoring of other constructs.

Table 4.12 Correlations Between WIHIC Constructs, Year 10 Class Means

	<i>SC</i>	<i>TS</i>	<i>IN</i>	<i>AI</i>	<i>IV</i>	<i>TO</i>	<i>CO</i>	<i>E</i>
Student Cohesiveness	—	0.48	0.11	0.43		0.55	0.50	0.54
Teacher Support		—	0.42	0.64	0.36	0.62	0.55	0.91
Involvement			—	0.49	0.78	0.61	0.60	0.49
Autonomy/Independence				—	0.75	0.80	0.81	0.52
Investigation					—	0.62	0.64	0.35
Task Orientation						—	0.71	0.61
Cooperation							—	0.55
Equity								—

Note. Correlations less than 0.05 have been omitted.

Gender Effects

The study was undertaken at a coeducational school where boys and girls were represented almost equally in the total enrolment. However, the gender distribution was not symmetrical throughout the streamed class system, because girls constituted a higher proportion of the most academically able classes. Only 21% of the students in the least academically able Year 9 class were female. Consequently, class allocation and gender effects combine in the associations discussed in this chapter. Table 4.13 and Table 4.14 give separate analyses of the Mathematics Survey and the WIHIC for each gender.

Table 4.13 Gender Effects in the Mathematics Survey

<i>Female (n = 250)</i>	<i>Enjoyment</i>	<i>Importance</i>	<i>Stress</i>	<i>DIMS</i>	<i>n</i>
Year 9 "A" Stream	50.45	83.11	71.40	56.42	74
Year 9 "B" Stream	39.96	70.36	66.67	50.54	35
Year 10 "A" Stream	39.06	75.28	69.85	43.68	89
Year 10 "B" Stream	35.44	67.31	67.63	40.02	52
Overall (weighted)	41.81	75.25	69.40	47.65	
<i>Male (n = 249)</i>	<i>Enjoyment</i>	<i>Importance</i>	<i>Stress</i>	<i>DIMS</i>	<i>n</i>
Year 9 "A" Stream	51.33	80.33	74.02	49.26	68
Year 9 "B" Stream	43.69	71.21	63.01	47.63	66
Year 10 "A" Stream	48.19	76.06	75.00	46.58	53
Year 10 "B" Stream	43.01	78.33	66.26	50.60	62
Overall (weighted)	46.56	76.51	69.38	48.59	
<i>Difference as %</i>	<i>Enjoyment</i>	<i>Importance</i>	<i>Stress</i>	<i>DIMS</i>	
Year 9 "A" Stream	2%	-3%	4%	-13%	
Year 9 "B" Stream	9%	1%	-5%	-6%	
Year 10 "A" Stream	23%	1%	7%	7%	
Year 10 "B" Stream	21%	16%	-2%	26%	
Overall (weighted)	11%	2%	0%	2%	

Boys reported greater enjoyment of mathematics than girls, particularly once they reached the second year of high school. Their desire to improve mathematical skills lagged behind that of girls in Year 9, but was significantly higher in Year 10, especially in "B" stream classes. Table 4.13 reveals that girls on reaching high school were better at mathematics than boys, as nearly twice as many girls were allocated to "A" stream classes rather than "B" stream, whereas boys were equally represented. But girls were less inclined to express the attitudinal attributes of enjoyment of

mathematics, acknowledgement of the importance of mathematics and desire to improve mathematical skills.

The WIHIC detected little difference in the responses of male and female students in most constructs. The constructs which demonstrated the greatest differences were Cooperation (CO), where female students gave scores 15% higher than those of their male counterparts, and in Student Cohesiveness (SC), where female students gave scores 12% higher. This may indicate different communities of students, the female group better at working collaboratively, rather than different perceptions of the overall class community based on the gender of the observer. This is not an effect that the instrument was developed to measure, and may be an aspect of classroom dynamics that should be considered in future development of the WIHIC.

Table 4.14 Gender of Student Effects in the WIHIC

	<i>SC</i>	<i>TS</i>	<i>IN</i>	<i>AI</i>	<i>IV</i>	<i>TO</i>	<i>CO</i>	<i>E</i>
Male	60.73	53.93	51.16	52.62	39.84	64.66	55.85	63.20
Female	69.08	53.93	48.67	53.90	36.99	65.61	65.34	61.91
Difference as %	-12%	0%	5%	-2%	8%	-1%	-15%	2%

The Involvement (IN) results are particularly interesting as they result from such statements as “The teacher asks me questions” and “I discuss ideas in class” (Appendix D, p. 5). Boys scored these statements 5% higher than girls. Of the 19 classes involved in the study, 10 were taught by male teachers, seven by female teachers and two were subject to change to a teacher of different gender during 1998. In order to ascertain whether the gender of the teacher influenced the Involvement construct, separate statistics were drawn up according to the gender of the teacher. The results, presented in Table 4.15, are distorted by the fact that the 12 male teachers had been allocated the majority of the high stream classes.

Table 4.15 Gender of Teacher Effects in the WIHIC

	<i>SC</i>	<i>TS</i>	<i>IN</i>	<i>AI</i>	<i>IV</i>	<i>TO</i>	<i>CO</i>	<i>E</i>
Male	65.70	55.17	51.87	54.76	39.93	67.77	63.44	65.82
Female	63.28	51.90	46.34	50.49	35.63	60.50	55.37	57.40
Difference as %	4%	6%	12%	8%	12%	12%	15%	15%

There may be causal relationships between gender of student, gender of teacher, position in the class streaming system, and attitude towards mathematics, but in this study they are small and too complex to be completely accounted for. Although gender is a convenient variable to utilise in data exploration, it would be disingenuous to assert that teacher gender designated some stereotypical style of interaction. Any teacher gender effect would indicate the need for further analysis, to find if it was the result of different styles of classroom presentation, or different response by the students. More prosaic explanations such as age, length of teaching experience, and quality of lesson planning would also have to be tested. Commenting on the imposition of pre-packaged and pre-specified regimes for teachers, Apple & Jungck (1992) claimed:

As a number of commentators have suggested, the real lives of many women teachers, when seen close up, are complicated by the fact that they often return home exhausted after being in the intensified setting of the classroom, only then to face the emotional and physical demands of housework, cooking, childcare, and so on. Since many women teachers are already doing two jobs, their caution and 'lack of enthusiasm' towards taking on additional work is anything but a simplistic response to 'innovation'. Rather it is a realistic strategy for dealing with the complications in the objective reality that they face daily. (p. 39)

In the study there was no random assignment of teachers to classes, and the small data set precluded any rigorous analysis. The female teachers involved in the study could be rightly offended by any suggestion that the performance of their professional duties had been inadequate due to sexual inequalities in their home lives.

The statistics of this study reveal that girls achieved higher placings in the streaming system than boys. Girls reported slightly lower scores for attitudinal variables such as enjoyment of mathematics, and they rated student cohesion and cooperation slightly more highly than the boys in their classes.

Linking the Two Surveys

On both the Mathematics Survey and the WIHIC questionnaires, a place was provided for a six-digit code number. The students were asked to devise a code number for themselves, record it in their student diaries, and use it on each questionnaire. This was done in order to preserve respondent anonymity yet enable correlations to be made between the two surveys.

The code number system had several drawbacks. One teacher ignored the instructions given in a briefing and in written survey administration notes, and instructed two classes not to complete the code number box. Although it was suggested to students that their code numbers could be based on their phone number or date of birth, within some classes several students used the same number: 123456. Students were supposed to bring their diaries to school each day, and reminders to do so were given in school notices prior to each survey, but some students either did not bring the diaries or failed to record their code numbers in their diaries. Some students made transposition errors in copying their code numbers.

Partly in anticipation of these difficulties, three questions had been added to each questionnaire: “You are male/female”, “Counting (this) High School, how many schools have you been at?” and “Counting yourself, how many children live at your house?”. Except for the first survey, students were told “To help match this up with the survey you did last term, please answer these questions the same way you did last term” (Appendix D, p. 4). The questions were sometimes answered incorrectly. For example, thirty-one students reported attending only one school although the minimum possible number is two.

Five hundred students completed the initial Mathematics Survey, and 463 WIHIC questionnaires were coded. Those who did not complete the WIHIC were either absent or unwilling to participate. Some absentees could have been engaged in other school activities during their normal mathematics lesson, for example music tuition or remedial reading tuition. Some unwilling students made their attitude evident in their manner of completing the questionnaire. Such questionnaires were not coded if they displayed three or more examples of unwilling completion: for example,

indication that the code number was the same as used in the previous survey when no such number was so used, personal information details which were not feasible or different to any in the previous survey, or hostile comments written on the questionnaire.

By use of the code numbers and the three personal information questions, 321 questionnaires were matched together. The cases not matched included fifty students in two classes who were erroneously told by their teacher not to put code numbers in the first survey, and those students unable to find their code numbers. Also, in some classes matching was not possible for students who used the same code number as someone else with the same personal information profile. In some cases the personal information profile enabled matching even where code numbers were unavailable. Consequently, the 321 matched respondents represent an imperfect sample. As the mathematics classes are streamed by ability, Table 4.16 gives an indication of the sampling bias, showing the extent to which some classes are over-represented, especially those classes that obtained high test marks. The mean marks given are those of the year-end examination, where all classes of the same year level sat the same paper. Classes with a 3 prefix are Year 9, 4 prefix are Year 10. Ignoring for the moment the poor performance of many students, the marks indicate that the streaming of classes on mathematics ability has been effective, with some cross-over in the classes of middle ability of each year level. The students whose surveys were successfully matched together come from the full spectrum of ability levels, although higher-ability classes are over-represented.

Table 4.16 Distribution of Matched Surveys

<i>Class</i>	<i>Mean mark</i>	<i>Standard deviation</i>	<i>Class size</i>	<i>Number matched</i>
3A1	75%	7%	29	25
3A2	64%	8%	30	28
3A3	55%	10%	29	29
3A4	48%	8%	28	21
3A5	43%	8%	26	22
3B1	47%	11%	30	24
3B2	38%	10%	28	15
3B3	29%	7%	24	10
3B4	23%	9%	19	14
4A1	75%	10%	30	19
4A2	66%	12%	30	16
4A3	46%	12%	29	19
4A4	35%	8%	30	23
4A5	28%	14%	27	3
4B1	40%	12%	27	1
4B2	30%	10%	27	17
4B3	23%	10%	27	17
4B4	23%	8%	26	11
4B5	10%	6%	14	7

Several of the 321 matched questionnaires gave no responses to some items. Such situations further lowered the number of cases available for the correlation statistics. The smallest number of effective cases was 309, in the correlations of Equity with Autonomy/Independence and also in Equity with Investigation. The correlation coefficients are given in Table 4.17.

Table 4.17 Correlations Between Initial Administration of the Mathematics Survey Constructs and WIHIC Constructs. n= 321

	<i>Enjoyment</i>	<i>Importance</i>	<i>Stress</i>	<i>DIMS</i>
Student Cohesiveness		0.11		
Teacher Support	0.24	0.16		0.21
Involvement	0.20	0.11		
Autonomy/Independence	0.17	0.26	0.09	0.10
Investigation	0.39	0.22	0.16	0.26
Task Orientation	0.42	0.34	0.25	0.33
Cooperation	0.14	0.20	0.13	0.09
Equity	0.26	0.21	0.18	0.18

Note. Correlations less than 0.05 have been omitted.

The strongest association was between Enjoyment and Task Orientation. The Investigation and the Task Orientation constructs were the most strongly associated

with the attitudinal variables of the Mathematics Survey. This is a surprising finding, as the two constructs seem antithetical. Task Orientation consists of items such as “Class assignments are clear so I know what to do”, whereas Investigation consists of items such as “I carry out investigations to answer questions coming from discussions”. The Investigation construct is related to ideas known by the titles “processes strand”, “authentic testing” and “student outcomes”, as discussed in Chapter Two. It is based on items such as “I solve problems by using information obtained from my own investigations”, “I carry out investigations to test my ideas” and “I solve problems by obtaining information from the library”. These are not descriptions of traditional teaching. The Task Orientation construct at first seems to be the polar opposite of Investigation. Task Orientation is based on items such as “I pay attention during this class”, “I know what has to be done in this class” and “Class assignments are clear so I know what to do”. This does sound like a traditional teacher-directed learning environment. It may be that extreme approaches at either end of the constructivist classroom spectrum can be associated with high scoring of attitudinal variables.

The Third International Mathematics and Science Study indicated that “within nearly every country, a clear positive relationship can be observed between a stronger liking of mathematics and higher achievement” (Beaton et al., 1996, Chapter 4). This *liking* is the focus of the majority of the Mathematics Survey’s items, constituting the Enjoyment construct. On the face of it, enjoyment is something worth fostering in mathematics classrooms. But this study found there is a curiously low association between the constructs Student Cohesiveness and Enjoyment of Mathematics. This is as if “I make friendships among students in this class” is unrelated to “I look forward to mathematics lessons”. Perhaps to the respondents the nature of the enjoyment is the intrinsic appreciation of mathematics, not the friendship context in which lessons are received.

A possible explanation of this result is that there are two types of “liking of mathematics”. One is the satisfaction of following a routine, perhaps building up physical notes and demonstrable skills, behaving in a business-like manner motivated by vocational imperatives, and obtaining surface mastery of the topics delivered. Another is the satisfaction of being self-reliant, obtaining personal satisfaction by

overcoming difficulties and solving problems by forging a way through. The difference between these two perceptions is that the first is more of a liking of mathematics class, the second is more of a liking of mathematics per se, as held by its practitioners.

As discussed earlier in this section, a liking of mathematics class is distinct from the Student Cohesiveness focus on friendliness with other students. Liking of mathematics class was related to the Task Orientation focus on knowing the task and making progress at it. To improve the liking of mathematics class, tasks should be clear and delimited. In contrast, to improve the liking of mathematics per se, students should pursue the tasks identified in the Investigation construct. That is, they should have the opportunity to investigate, undertake research, and to think about the evidence they acquire. If these two scenarios can coexist, the environment of the mathematics classroom should reach maximum effectiveness.

Individual Unit of Analysis: Three Matched Surveys

An objective of this study was to determine whether the *change* in the constructs measured by the Mathematics Survey was linked to the *classroom environment*, as measured by the WIHIC. There was small but significant change in the support for the constructs between the two administrations of the Mathematics Survey. As detailed earlier in this chapter, the high streamed classes tended to give higher scores to the constructs, also, scores were more consistent among classes in the second year of high school. The statistics reported in Table 4.18, calculated from the class means, show small declines in the scoring of the constructs, the declines more pronounced for the senior cohort.

Table 4.18 Change in Class Scores for Mathematics Survey Constructs Between First and Second Administrations, February 1998 and September 1998. Scale from 0 to 100.

	<i>Junior Cohort, n = 220</i>		<i>Senior Cohort, n = 243</i>	
	<u>Mean</u>	<u>Std Dev.</u>	<u>Mean</u>	<u>Std Dev.</u>
Enjoyment	4.49	5.58	3.87	6.07
Importance	0.79	6.33	6.08	7.61
Stress	-0.64	7.81	4.87	7.18
DIMS	2.23	5.43	0.20	6.26

The junior cohort showed further change when they completed the same survey again in February 1999. The greatest change was a continued decline by 2.97 in Enjoyment, bringing their scores close to those of the second administration of the instrument with the senior cohort. Importance declined by 1.78, Stress by 1.61 and Desire to Improve Mathematical Skills rose by 1.49. In order to avoid any effect that timing differences might provide, analysis of change was made only between the February 1998 administration and the September 1999 administration of the Mathematics Survey.

By a further process of matching the individual code numbers, all three of the major surveys were collated. This exercise provided 251 matched cases. The correlations between the decline in the Mathematics Survey scores and the scores those individuals gave to WIHIC constructs were quite small, as given in Table 4.19 and Table 4.20.

Table 4.19 Correlations Between Change in Mathematics Survey Constructs and WIHIC Constructs, Junior Cohort. n = 152

	<i>Enjoyment</i>	<i>Importance</i>	<i>Stress</i>	<i>DIMS</i>
Student Cohesiveness	0.08	0.09	0.08	0.09
Teacher Support			0.08	
Involvement		-0.09	0.14	-0.09
Autonomy/Independence	0.10	0.15	0.14	
Investigation	0.16		0.18	0.07
Task Orientation	0.14		0.10	
Cooperation	0.24	0.05	0.17	
Equity	0.18	-0.09	0.14	-0.06

Note. Correlations less than 0.05 have been omitted.

A positive correlation indicates that a high score in the WIHIC construct is associated with a decline in the scoring of the Mathematics Survey construct. Although these figures are significant, they tend to mask the underlying fact that it was those students who experienced the most severe decline in Enjoyment, Importance, and Desire to Improve Mathematical Skills who scored these constructs very highly in the first place. This is especially the case for the younger cohort of Table 4.18, as these were students in their first year of high school.

Table 4.20 Correlations Between Change in Mathematics Survey Constructs and WIHIC Constructs, Senior Cohort. n = 99

	<i>Enjoyment</i>	<i>Importance</i>	<i>Stress</i>	<i>DIMS</i>
Student Cohesiveness	-0.05			
Teacher Support		-0.25	-0.19	0.10
Involvement	-0.12	-0.18		
Autonomy/Independence	0.07	-0.10		-0.07
Investigation		-0.17		
Task Orientation		-0.16		0.07
Cooperation	0.13	0.06	0.13	0.14
Equity	0.07	-0.07	-0.08	0.15

Note. Correlations less than 0.05 have been omitted.

Involvement is the only construct which is consistently associated with improvement in the Enjoyment and the Importance of mathematics. This finding applies to both cohorts. Involvement items feature communication, using verbs such as *discuss*, *ask* and *explain*. This communication is specifically between teacher and student in two items, amongst students in two items, and unspecified in the other six items. It involves the student as an active participant, the centre of attention, and a source of ideas.

In contrast, Cooperation correlates with a decline in the Mathematics Survey constructs. Cooperation items feature group work, and learning from other students. As mentioned earlier in this chapter, formal group work was not a frequent experience for many of the students. However, those students who reported the greatest level of group work in their classrooms also reported decline in their Enjoyment of mathematics and in its Importance to them.

Conclusions

Year 9 students who were placed in the most academically able classes were the most enthusiastic about the Importance of mathematics. They produced the highest scores for Enjoyment of mathematics, Desire to Improve Mathematical Skills, and also, rather incongruously, to Stress. These junior students demonstrated a strong association between class position in the streaming system and scoring of all four Mathematics Survey constructs. Their peers one year more senior were less generous

in scoring the constructs, and showed a considerably reduced correlation between class position in the streaming system and the constructs, especially Enjoyment.

The methods used in the streaming decision may in themselves have been gender-biased and/or an inaccurate means of assessment for other reasons. They may have rewarded the avoidance of mistakes more greatly than intellectual risk-taking, may have unfairly penalised those disorganised students who failed to bring the correct equipment, may have been unfairly swayed by quality of presentation, and may have relied on reading and comprehension skills beyond the ability of some students. As discussed earlier in this chapter, boys suffered the greatest deficits in reading ability. However, on the basis of further mathematics tests during the year the Mathematics Department conducted a reallocation between classes. In 1998 this resulted in only 10 changes, six boys being moved up, one boy and three girls moved down. Traditional testing methods incontrovertibly placed girls ahead of boys in mathematical ability, even though the Mathematics Survey revealed that boys experienced a greater enjoyment of mathematics.

In the WIHIC the most popular response was “Sometimes”. Perhaps this reflected a reluctance to choose the word seldom, which challenged the vocabulary of some students. The other adjacent alternative, “Often”, seemed to imply a major advance on “Sometimes”. Perhaps the questionnaire would allow greater variety of response if the individual descriptor terms were omitted, enabling the respondents to select values from 1 to 5 from “Never” to “Always”. After all, processing of the data is done on a numerical basis as if there are equal graduations between each selection. When faced with an item such as “I have a say in how my class time is used” the students found it difficult to assess what frequency would constitute “Often”. Students who realised that the item is designed to elicit their feelings could opt for extreme responses such as “Almost Never” or “Almost Always”, whereas objectively “Sometimes” is the only appropriate answer as no time scale is specified. The same criticism applies to many other items.

A transition from enthusiastic newcomers to apathetic veterans of the classroom might have taken place in the first 30 weeks of high school. That is how adolescent self-reporting would have it. However, many factors beyond the mathematics

teaching and assessment programme may be influential, and it may not be wise to rely solely on the expressed attitudes of junior students. For example, the school maintained a high retention rate for non-compulsory advanced mathematics courses in senior school, therefore the apparently low “desire to improve mathematical skills” was either misreported, misinterpreted, or it was an aberration that was reversed as students matured. Also, the increase in negativity was smaller in scale than the effect of class position in the streaming system. This suggests that the most persuasive factors may have been the social and cultural traits associated with intelligence scores.

To determine student attitudes towards mathematics requires a contextual framework. At the very least, enjoyment of mathematics should be compared with enjoyment of science. It would be useful to also quantify the students’ enjoyment of sport, enjoyment of television, and other important and easily delineated events in their lives. Only when the effort spent on mathematics can be compared with the effort spent on other activities do the indices become meaningful. Comparison over time is valuable (Forbes, 1999), but to identify useful techniques in mathematics teaching and assessment it is necessary to isolate the influences at work during time on mathematics and those during other activities. Without knowledge of the factors that produced them, the constructs of the Mathematics Survey cannot be interpreted as relatively high or low. The most that can be reported with certainty is that the indices declined during the first few weeks of high school. The results provide no information on whether similar decline was experienced in other school subject areas, or indeed in any other areas of the lives of the adolescents involved.

Some of the WIHIC constructs lacked full validity, or were inappropriate. Factor analysis revealed that Autonomy/Independence did not cohere well. The vocabulary demands of the Investigation construct confused some students and it was scored low. Students were critical of the Cooperation construct, indicating in interviews that the forced responses were inadequate because some classes did not employ the group work envisioned by the items. The highest scoring constructs were Task Orientation and Student Cohesiveness, the latter scored consistently across the year groups.

As with the Mathematics Survey, data from the WIHIC reveals that the correlation between the Year 9 classes' position in the streaming system and their scoring of the constructs is not replicated in Year 10. It may be that the classroom environments of Year 10 classes were more uniform than those of the first year students. Also, the older students may have been less influenced by the personal labelling involved in the streaming of classes, and more able to make objective classifications of their classroom experiences. The Year 9 students were new to the high school system, and perhaps lacked the confidence to make extreme responses, even in an anonymous questionnaire.

Significant correlations were found between WIHIC constructs and those of the initial Mathematics Survey. The Enjoyment construct, focus of the majority of the Mathematics Survey items, was most strongly associated with two apparently antithetical WIHIC constructs: Investigation and Task Orientation. It is proposed that a discrimination needs to be made between "liking of mathematics class" and "liking of mathematics per se" within the Enjoyment construct.

Association between WIHIC constructs and change in the Mathematics Survey constructs was also tested. A classroom environment centred on the individual student was associated with improved scores in the Enjoyment and the Importance of mathematics. Group work, fairness and helpfulness of teachers, friendship between the students, and clear classroom rules did not consistently promote improved scores in the Enjoyment and the Importance of mathematics constructs. Those students who initially gave the highest scores to the affective variables of the Mathematics Survey were the ones who showed the greatest scoring decline in later administrations. Because of this factor, only limited attention should be given to correlations between the decline in affective scores and other constructs.

Although a quantitative analysis reveals with reasonable certainty the views held by students, it cannot indicate how the students came to hold such views. On the initial assignment to streamed classes there is a strong correlation between attitude to mathematics and class placement, but this diminishes with time. Those students who most enjoyed mathematics valued a class that possessed a good work ethic, and they also valued the opportunity to explore ideas for themselves.

The Next Chapter

Students in the first two years of the high school mathematics course sat common final examinations. The marks of many of the weakest students were very low; seven of the 19 classes obtained mean examination marks of 30% or less. While traditional assessments deliver this unequivocal message, alternative forms of assessment such as portfolios may be irrelevant to disheartened students. Discussion with groups of the students was initiated in order to allow such opinions to be expressed. The outcomes of these discussions are reported in the next chapter, and linked, where appropriate, with insights drawn from the quantitative data.

CHAPTER FIVE: QUALITATIVE RESULTS

Introduction

In order to ascertain the true impact of the implementation of portfolios as an aspect of assessment it was decided to make recorded interviews of as many of the students and teachers involved as possible, and to maintain records of informal interactions. The responses of caregivers were determined by questioning teachers about their interactions with caregivers, and by a survey of randomly selected families. Transcriptions of interviews with nineteen students appear as Appendices G to K, and with nine teachers as Appendices L to T. In this chapter, assertions made in these interviews are enunciated, linked with quantitative information, and discussed. A chronological analysis is made, drawing on studies of change in educational settings. The history of the portfolios innovation is recounted, and the factors that were associated with a successful implementation are identified.

The Students: Introduction

Audio-taped interviews were conducted with groups of three or four students at a time, the participants randomly selected from each of the nineteen participating classes. Each group was interviewed twice, for approximately thirty minutes on both occasions, in an attempt to validate information from the questionnaires and to provide a forum for unanticipated student ideas. I was known to the students as a teacher at the school and, although I attempted to conduct the interviews in an informal manner, I did have a duty of care responsibility. The assertions reported in the next few paragraphs are drawn from the interviews recorded during the first year of the portfolio implementation, the transcripts of which are given as Appendices G to J. Recording difficulties prevented transcription of three of the sessions, and in the transcribed interviews there are many ellipsis marks indicating speech too indistinct to interpret.

A few conventions are used in the transcriptions: a new paragraph indicates that there has been a change in speaker; the interviewer's words are given in upper case; "Mmm" denotes the sound speakers make to usually indicate uncommitted

agreement. Unfortunately, it is impossible to record every nuance of body language, hesitation, tone of voice, glances between speakers, and gestures – only a few such annotations are provided in the transcripts.

Within the interviews a number of terms are used that may have little meaning outside New Zealand, some of which have now been superseded:

“Form 3” was the equivalent class to Year 8 in Australia, Form 4 to Year 9;

“School Cert” was the Form 5 School Certificate national examination in New Zealand which consisted of five three-hour papers, including one paper in Mathematics;

“unit standards” was a pass/fail system of discrete courses, implemented throughout New Zealand in the late 1990s then abandoned within two years;

“Cantamath” is an annual mathematics promotion involving about fifty high schools and many primary schools in the region. Schools are invited to submit the best project work from classes or individual students for public display. Cantamath also involves a very competitive inter-school team competition.

During the interviews, the students often repeated remarks made by others, or indicated their consensus non-verbally. The transcripts do not reveal all the interplay between the students, for example when a lull in the conversation would have permitted voicing of disagreement had there been any. Frequently the students answered in turn, this process sometimes dominated by one or two individuals, with others listening and sometimes nodding their accord. There was no obvious imbalance in the contributions made by boys and by girls. Although the students were brought together by a process of random selection, one from each of the mathematics classes, they knew each other’s names and a little about each others’ background. In the case of the Form 4 students, they had been at high school together for nearly a year and a half. The students often knew each other from attending the same primary school, living on the same military base, travelling together on school buses, or playing in school or external sports teams. On arrival at high school all students had experienced a major orientation programme which allied small groups of new students with senior students who took them through a series of trust and self-esteem building activities. This culminated in three days of demanding outdoor

activities. The orientation programme provided opportunities for the students to get to know and trust each other. At the interviews, the students seemed unguarded and accepting of each other and little rancour was heard. The verbatim transcripts reveal the informal language used, also that the students were prepared to laugh together, and that they were sufficiently relaxed with the interviewer to be frank about their teachers. They helped each other by suggesting phrases when the speaker was forgetful, and by searching documents together. On the whole, they heard each other out without interruption, but on the occasions when they were interrupted they tended to speak again to fully express their point.

I conducted all the interviews. The students were interviewed during class time, in classrooms or offices within the school. The students were assured at the start of each interview that their confidentiality would be preserved, that their comments would not influence their marks, and that they could leave the interview at any time. There did not seem to have been much reticence on the part of the students, judging by the candour of the disclosures made. For example, named teachers were criticised for lack of knowledge (Appendix G, p. 10), and for pettiness (Appendix I, p. 12), and students admitted being disorganised (Appendix H, p. 14) and disclosed marks they were embarrassed about (Appendix J, p. 13).

The interviews were loosely structured, based on a list of questions and a few resources as prompts. The questions, prepared in advance for each of the two cycles of interviews, are given in Appendix F. The students were shown work samples on a “frogs” investigation published by the University of London Examinations and Assessment Council (1994, pp. 57-73), and were asked questions which arose from studies in New Zealand (Fitzsimons, 1997) and Vermont, U.S.A. (Koretz et al., 1993).

Student-based Assertions

Ten assertions based on the behaviour and remarks of the students are discussed in this section. These assertions are:

- A. *Portfolios are just normal schoolwork.*
- B. *Teachers are inconsistent in their implementation of portfolios.*
- C. *Students dislike homework.*
- D. *Tests are seen as the only real assessment.*
- E. *Students are sensitive to unfairness.*
- F. *Mathematics is valued only for vocational skills.*
- G. *The portfolio grading system confused the students.*
- H. *Results as letter grades are preferred over percentages.*
- I. *Students appreciate the 'advanced organiser'.*
- J. *Teacher attitude is important.*

Student-based Assertion A

Portfolios are just normal schoolwork.

Interviews with students revealed that portfolios had little declared impact. The portfolio tasks called on investigation and presentation skills already honed in primary school and used in other subject areas. The students accepted the innovation as a normal part of their school lives, and compared it with projects undertaken in other subjects “I reckon Social Studies is way better, and Science, because we’re doing a project at the moment for Science and we’re allowed to choose it” (Appendix J, p. 15). “I don’t think they [other students in the class] mind too much” (Appendix G, p. 9). “...you just get like through another project we’ve got to do. Go home and do this” (Appendix I, p. 9). “...I just think of it as like another topic thing, the assignment” (Appendix J, p. 10). Some students found portfolio tasks “more interesting” while other preferred “ordinary” mathematics because it was less time-consuming (Appendix G, p. 9).

While students recognised the portfolio tasks to be appropriate homework activities, there was some dissatisfaction about the inter-disciplinary nature of the skills being assessed. “We do writing in English, it’s not maths. And, like, I got marked down for

spelling. That's unfair. Because you're actually not meant to be doing spelling. That's for English, not for maths" (Appendix I, p. 10).

Student-based Assertion B

Teachers are inconsistent in their implementation of portfolios.

There was inconsistent treatment of the portfolios by the teachers in respect of the information given, class time devoted to doing the tasks, marking, and storage of the accumulating work. "...he said people who do it on computer, it would be neater and you might get more marks" (Appendix J, p. 18), "if he had said that we write ten pages you'll get A⁺, we just weren't sure what we needed to do" (Appendix G, p. 8). Possibly this reflected the inexperience of the teachers, as teachers in other disciplines usually indicated word limits for written assignments. The portfolio tasks used in the first year of full implementation (Appendix B) specified neither word nor page limits. The tasks were intended for the entire year group, but the academic levels of the streamed classes were very different, therefore identical prescribed limits for the classes were thought to be inappropriate.

Many of the students were confused about what tasks they had completed, and whether they had handed them in or not. "Teachers collect them in and then they get lost forever" (Appendix K, p. 4). In particular, the absence of clear policy shared by all the teachers about regrading of revised work was a difficulty for the students. "I think we should be told. If we handed it up to him and he'd say 'well, do some more of this you'll get a higher mark'..." (Appendix G, p. 8).

Inconsistency is perhaps too pejorative a term for the variation detected by the students. The teachers necessarily differed in their enthusiasm, in how well they organised resources, in their understanding of what portfolios meant, and in how they incorporated portfolios into their individual teaching approaches. Perhaps the most important aspect of the students' message is that the students took considerable notice of how their teacher dealt with portfolios, not just notice of the portfolios themselves.

Student-based Assertion C

Students dislike homework.

Mathematics homework has no clear definition, and can take many forms, from self-directed revision to highly prescribed repetitive printed problems, with or without given solutions. Teachers may direct students to finish the textbook exercises begun in class, or may go to the trouble of preparing regular revision worksheets (Appendix J, p. 9). The portfolio tasks were at the more creative end of the spectrum of homework activities, as they involved research, construction of physical objects, synthesis of ideas from multiple sources, and unusual means of presentation. The students sometimes referred to this as “project” work, rather than “homework” (Appendix I, p. 9).

Many students indicated that homework, especially mathematics homework, was not institutionalised in their lives. Although high-achieving students spent a great deal of time and effort on homework, many students claimed to do no homework at all most nights. Some of the questionnaires completed by caregivers (see Appendix E) were positive about homework, with such comments as “She enjoys mathematics there is no problem in doing homework” and “receives weekly homework which presented no difficulties ... Always completes any work set to good standard”. However, many of the caregiver comments were critical of homework, indicating either that very little mathematics homework was attempted or that the students found difficulty with it. 20% of the caregivers chose the lowest rating, from the five offered, to the question “How much interest does your son/daughter take in their mathematics homework?”, and 20% chose the highest rating. The impression given by students interviewed in front of their peers was that little mathematics homework was being done at all, but this was at variance with the figures compiled from the survey of caregivers. One noteworthy point of agreement is that, for a sizeable minority of the students, very little, if any, mathematics homework is completed at home or at all.

The students enjoyed working together on portfolio projects in class, whereas set homework was “boring” and often not attempted at home. “I don’t do maths homework very often” (Appendix J, p. 9). “It should be your time instead of doing stuff for school” (Appendix I, p. 4).

Student-based Assertion D

Tests are seen as the only real assessment.

Written tests were sometimes preferred to extended-time project tasks because tests took less time and were not subject to thoughtful revision. Although the students described tests as “boring”, they acknowledged that tests took less of their time (Appendix J, p. 11). Portfolio tasks were preferred to tests when “if you know how to do that you can just do it and you won’t have to like think much” (Appendix J, p. 11). This attitude is that of the disengaged and complacent students described by Duit and Confrey (1996) in Chapter Two of this thesis.

New Zealand students are reported to equate assessment with tests (Fitzsimons, 1997), and the students in the study seemed oblivious to the idea that their portfolio work also influenced their real marks and ultimately their life chances. Even in the middle of the school year, one group voiced surprise that the portfolio marks counted towards their overall assessment, one student saying “I just didn’t realise” (Appendix J, p. 17).

This focus solely on tests was not universal. One student observed that “I reckon it’s quite good when you’ve done, like, some of the investigations and stuff, that it goes towards your end of year mark and an exam. So you’ve sort of got a bit of both, and if you’re no good at one you’ve still got that mark to go on the end of year mark. ... I guess it’s learning in a different way” (Appendix H, pp. 7-8).

Student-based Assertion E

Students are sensitive to unfairness.

The students were anxious about unfairness: that students with access to computers at home might get better marks for neatness (Appendix I, p. 13), that uncooperative caregivers may not enable high-scoring interviews (Appendix I, p. 2), and that rural students do not have access to the junk mail that was the subject of one task. Teachers who “pick” on students were vilified (Appendix I p. 10 and p. 12, Appendix K, p. 22).

The second year “B” stream students interviewed were unanimous in the opinion that teachers were not unbiased when they undertook subjective marking. Appendix I p. 12 records an animated section of an interview when all four students (distinguished here with dot points) were expressing this opinion:

- If you, like, aren't very good then they look at your work and take like a look back and say like he's done this and this and this so I'll just pick every little thing. Sometimes you might get marked for your working out but the teacher might go, oh I don't want to and just do that just because of like something you might have done. Arguing or something.
- Its just like, in our XX class um Mr. XX he um every little thing he makes you, he rubs it out like half a drawing out, he makes you go back and draw it again.
- [Interviewer] But he'd do that the same for everyone?
- No, he doesn't. He just sort of like picks on the same people.
- ... Really you've got to have a good first impression on the teachers.
- Yeah, they respect you if you work but if you're like naughty...
- Sometimes you've got to stand up for yourself, with some teachers.

These students obviously had little faith in the marking practices of their teachers when it came to the assessment of extended-response portfolio tasks. Of course, this problem is frequently faced by those teachers in other subject areas who routinely assess essay-style student work, and perhaps are more conscious of maintaining student credibility in their objectivity.

Student-based Assertion F

Mathematics is valued only for vocational skills.

The students voiced a very functional view of mathematics, and relegated analysis and synthesis tasks to other subject areas. The need to do mathematics was primarily seen in terms of getting a job, as illustrated by this exchange between two fourteen-year-olds:

- I just think there's not much point in doing like algebra and all that. ...
The jobs you want to do, they don't need maths skills or anything. Like, the algebra and all that should be optional for the kids that want to do it.
 - Yeah, if they've already made up the decision what sort of job they want to do they should go and do like that sort of maths. What's required for that job.
- (Appendix I, p. 6)

Justifying a lack of interest in algebra, one thirteen-year-old said "Other than being a maths teacher or a school teacher, what other kind of jobs use that?" (Appendix H, p. 10). In a different interview, one member of the older cohort said "You need maths for some jobs ... like an engineer..." (Appendix I, p. 6). Another of the Year 10 students thought she would study senior mathematics although she did not like mathematics. When challenged, she indicated that mathematics was important for accounting. She realised that a job may not utilise all the "complicated things" learned in mathematics class, but felt that a mathematics qualification was necessary in order to meet selection criteria (Appendix K, p. 12).

Student-based Assertion G

The portfolio grading system confused the students.

Students were not sure of the standards for a good grade in their portfolio work. They realised that volume of work was not the criterion, that they had to produce "quality" (Appendix G, p. 7), that the task "gets your mind working" (Appendix G, p. 11) and the student should be "creating ideas and stuff" (Appendix G, p. 11). The difficulty for students was to know whether their ideas were good enough to obtain a satisfactory grade.

Some grade systems confused the students. For example, one student did not understand that there was no "excellence" category under one system which merely recorded completion of work (Appendix G, p. 6). Another student related that when she received an "E" for Excellent grade "I went home saying 'Mum and Dad I got an E' you know, they're like 'Are you sure?' ... They wouldn't believe me that E was the top" (Appendix H, p. 11).

Student-based Assertion H

Results as letter grades are preferred over percentages.

The students seemed to understand letter grades, and most preferred them to the daunting accuracy of percentage marks. Percentages implied that a quantifiable amount of the work was wrong, whereas letter grades grouped achievement into comprehensible categories. In reply to the question of whether the students would prefer to have a percentage mark one student said “Yeah ... It would be good sometimes so that know where you were like B⁺ isn’t exactly the same ... so you’d sort of know like where you were” (Appendix G, p. 7). Letter grades were intuitive. One student said “... it looks nice if you get an A⁺ ...” and another student added “Yeah, you see an A you think ‘Aw wow, gee I did good’ then you see 90% so you can see I could have got higher” (Appendix G, p. 7).

When creative work is being marked there is a limit to the reliable differentiation a marker can make. Percentage marks are a claim that two significant figures of accuracy are possible, whereas subjective marking is really a classification within a finite number of categories. Possibly, the students realised that accurate marks could not be determined for their portfolio work. They were happy with descriptors, and letter codes were well known to them. Narrative systems such as “good”, “very good” and “credit” were less favoured because the scale’s progression was obscure and students were unsure what the highest and lowest descriptors were. This criticism also applied to “pass” and “fail” as the descriptors, because it is not evident from the marked assignment alone how many descriptors were available to the marker, that is, whether there were higher or lower categories possible.

Student-based Assertion I

Students appreciate the ‘advanced organiser’.

The students liked to know what was coming up next, and used the advance warning to accumulate materials for their portfolios. They contrasted this with their experience of primary school, where they did not know what topics to expect from one week to the next. “...if you don’t have to have it done for a few months you can just pick up things that might be useful for it, rather than just finding out a project

that's due in next week" (Appendix G, p. 10). Students mentioned that at secondary school age they have other commitments, specifically sport.

A Year 10 student made the point that "when you're at high school all general teachers give you homework and they don't know how much you've got from other teachers" (Appendix J, p. 2). If this was already a problem in junior high school, the increased workload in the senior years was going to be onerous, no matter how it was scheduled. My observation was that many students made efficient use of their diaries, liked to tick off scheduled tasks and to use portfolio folders. It was an opportunity to be business-like and adult.

Student-based Assertion J

Teacher attitude is important.

In two of the interviews, students put forward the contention that their enjoyment of mathematics class was related to the attitude of the teacher. One group took a very personal account of whether the teacher was "nice", "cool", "good" or "evil" (Appendix K, p. 23). Another group (Appendix I, p. 8) had this discussion when asked what makes a teacher an interesting teacher:

- Attitude.
- Yeah eh. Attitude.
- They're not just giving home detentions out for just no reason.
- Yeah, the way they approach it.
- If they let you like discuss it between yourselves.
- The way you approach maths.

One of these students commended a teacher who played games and gave prizes in class. Another teacher had impressed a student because he "helped me write to be more descriptive" and "you can stay behind just for a couple of minutes after the bell goes and he helps you" (Appendix G, p. 8). Teachers were urged to "... make it fun then everyone will get involved" and to allow students to work together, to assess verbal presentations, to organise games, and to allow writing in groups (Appendix I,

p. 9). Such approaches may be unlikely to succeed with some students, as they declare they “hate” the subject (Appendix K, p. 23), rather than the teacher or the teaching approach.

Discussion of Student-based Assertions

Interviewing four students at a time seemed a successful strategy in terms of fostering the students’ confidence and obtaining frank disclosure. The students often indicated whether there was consensus or not about particular remarks. It could be argued that this limited the ideas expressed to conventional peer-approved wisdom, rather than being true disclosure. The recorded interview sessions were an unusual event for the students and piqued their interest. The interviews made it apparent that young people sometimes felt powerless, and they operated in a world of restricted information and limited options. Junior students were obliged to study mathematics, regardless of whether they understood it or valued it. One commented in regard to homework that “If it was all wrong I wouldn’t care” (Appendix J, p. 9). Some, however, were very happy in school. One mentioned that if she received a low mark for an assignment “I’d be disappointed and want to re-write it and know that I’d done well” (Appendix G, p. 6).

The students were transparently honest about their classes and about their own performance and aspirations. At times they were naïve, swayed by their peers, or shallow, but for the most part they were charming and very straightforward in what they expressed. Some sought to survive school by a path of least resistance, preferring easily accomplished tasks that did not intrude into their personal time. But the majority enjoyed the stimulation of new ideas, especially when teachers made it “fun” (Appendix I, p. 9). The older cohort were very self-confident and expressed some mischievously cynical opinions, mirroring the confident selection of extreme responses by Year 10 students completing the Mathematics Survey and the WIHIC, but in fact they were prepared to attempt the assignments set for them and to do their best.

There was considerable resistance to the idea that quality of communication is an essential component of mathematics. This reflected a strong underlying attitude that

mathematics is a set of functional skills in basic numeracy. Some students in the study were aware of mathematics that for them entailed no vocational application, and they felt such material should be presented only to those students who opted for an academic pathway. They were aware of abstract thinking, but, at thirteen years of age, voiced a rejection of it. Although there were several recorded conversations where non-vocational mathematics topics were reviled, or the use in mathematics of skills from other subject areas was denounced, this narrow view was not universal. For example, the concept of *thinking mathematically* was accepted by one group (Appendix G, p. 11).

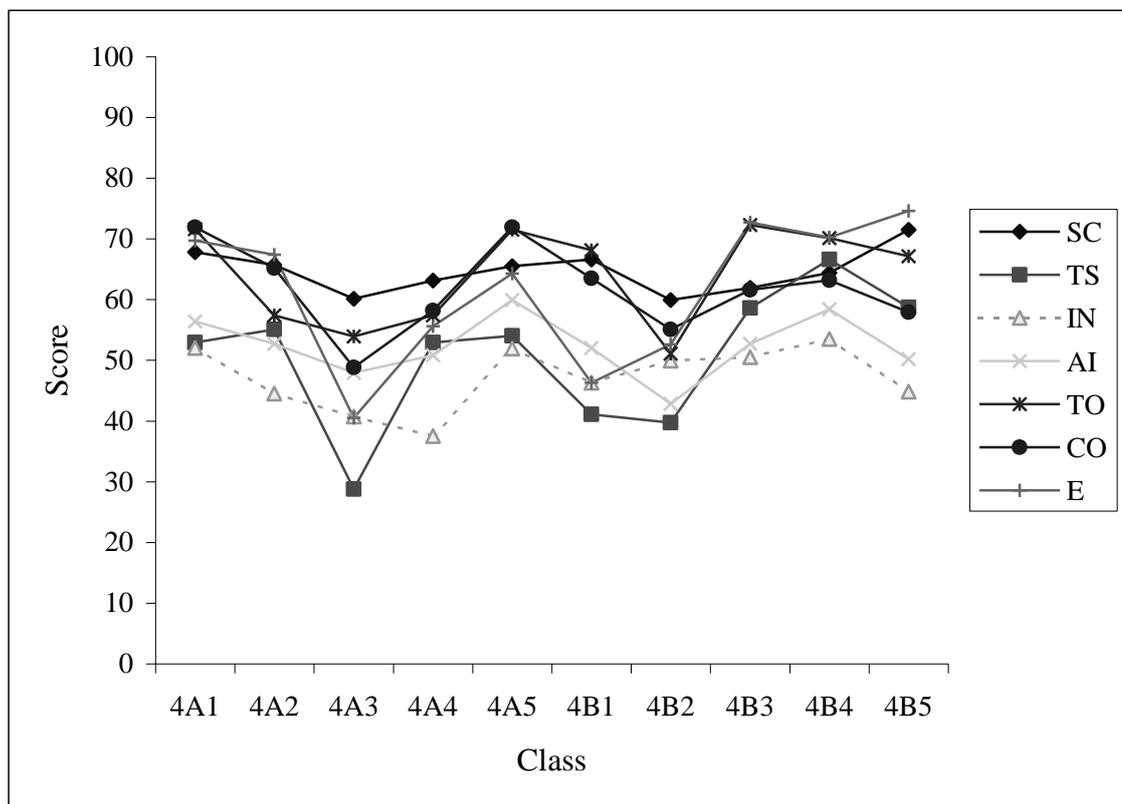
The students did not see portfolios as any different to other schoolwork. In part, this was because the self-reflective aspects of accumulating a meaningful body of work were not stressed by many of the teachers. The novelty of portfolios was also eroded by similar projects in other subject areas. Some students simply did not comprehend that the portfolio marks would constitute part of their assessment for the year, affecting their report grade and class placement for the following year. Others understood this, and felt that this was a fair assessment activity as it gave a chance for those who were good at project work to get some recognition of their endeavors. Traditional assessment objectifies students to a place on a single, ranked scale. When the students in the study voiced a preference for letter grades, they were acknowledging that a 100-point scale claims a greater degree of accuracy than the assessment instrument is capable of delivering. While the students felt it was more realistic to group achievement into bands, they did not go as far as rebelling against the unidimensional nature of the single grade as a description of achievement in mathematics. It is interesting to note the parallel provided by the TIMSS and other international comparisons of mathematics performance: across the many characteristics considered, countries are ranked, but then allocated into clusters on the basis that differences are not statistically significant. Such acknowledgement of the multi-faceted nature of the test subject, and need to indicate the accuracy capability of the test instrument, is rarely afforded to school students. Perhaps the young people who were interviewed had already developed an inkling of the reform manifesto provided by Broadfoot (1986) that was quoted in Chapter Two (refer p. 17).

There was considerable variation in the students' responses to portfolios as homework. For a start, some students do not attempt much homework at all: as stated by one student, "It should like be your time instead of doing stuff for school" (Appendix I, p. 4). Once this avoidance behaviour is institutionalised in their lives, when any inducements and all punishments fail to alter the situation, they have adopted a deviant educational lifestyle. Teachers may be well aware that certain students are not complying with the institution's homework requirements, but rarely do schools respond to such a state of affairs with anything other than pressure on individuals. Once the messages about the importance of homework are seen to be hollow, the student may be less inclined to unquestioningly accept other messages that the school delivers on such topics as healthy lifestyle choices and good vocational preparation. Lack of homework completion is perhaps an early indicator that the student will abandon studies in that subject or in all education, sometimes prematurely and without certification of educational capabilities. For the student who diligently attempts it, homework operates at a social/psychological level to adopt an academic persona. The desk and the home office in miniature are icons that broadcast the student's identity as a full-time scholar. Some students enjoy homework. They can find it to be a comforting habit, providing an alternative entertainment that reduces reliance on other family members while conferring an increase in their own status. Between these extremes lies a rarely studied spectrum of responses to homework.

Some students have little choice in the matter, their time required for caring tasks within the family or for work commitments. For example, in a rural community certain times of the year are labour-intensive for farmers, and some young people find themselves performing long hours of physical work as well as attending school. Other students are keen to engage in part-time work, and this is facilitated if they have a comparatively wealthy family with the right connections. The family poverty scenario envisioned by Cooper and Valentine (2001) is not the only stereotype. When it comes to homework, some students are closely monitored by caregivers, encouraged, and provided with perceived advantages such as tutoring, while other students are not. When economic imperatives and social factors impinge on assessments made by the school, the family circumstances of the student unfairly influence a process that ideally should be objective. But, such is the case with almost all homework: there is not equality of access to resources, help and time.

The What Is Happening In This Class? (WIHIC) survey results presented in Chapter Four lend support to the assertion that teacher attitude is important. For example, some of the Year 10 statistics provided in Table 4.9 are graphed in Table 5.1. Considerable variation in scoring between different classes is evident. Students of two classes, 4A3 and 4B2, seem to have scored the WIHIC constructs lower than did their peers in adjacent classes in the streaming system. The students of 4A5 seem to have higher scores than comparable classes. While the teachers are not the only influence that could account for these differences, they must be a major factor.

Figure 5.1 Comparison Between Year 10 Classes of WIHIC Construct Scoring (Maximum score = 100)



The students were striving to become adults. They demanded to be treated with fairness, and they enjoyed using the tools of business: schedules, folders, checklists and computers. They rose to the challenge of the novel system, but lacked the experience to make reliable self-assessment of their creative output. More than completing a mathematics course, they were engaging with the teacher: determining the teacher's attitude, and capacity to help or punish. Portfolios enabled the students

to make a certain amount of self-disclosure, and the students looked for reciprocity from the teacher.

The Teachers: Introduction

One teacher, when asked to describe any unanticipated advantages in using portfolios, replied “The enthusiasm that has taken students beyond my anticipated level of achievement” (Appendix W, p. 2). Another teacher acknowledged that portfolios had changed his teaching practice. He was unperturbed by what he perceived as the failure of his class at one portfolio task, commenting:

I know I need to report on the mathematical processes and there’s all sorts of ways in which it could be done. I’ve had no problem with the items in the portfolio being prescribed, in the sense that there should be a statistical investigation done at some stage, some formal writing, I have no problems with that at all. It may be that the suggestion which is made for the formal writing I don’t take up, and I want to take up one of my own, but I think that saying “there should be something particular called formal writing” included: I’m very happy to live with that. (Appendix Q, p. 5)

He was indicating that he felt confident he could replace inappropriate portfolio tasks with tasks of his own creation. This is more than recognition of the success or failure of the innovation, constituting a self-acknowledgement of the teacher’s professional ability. Such self-assessment is a goal in the development of any capable teacher.

Faced with implementation difficulties in the first year of the portfolio innovation, the response of most of the teachers was to take charge, and to vary the system when this seemed necessary for their classes. Some teachers altered or replaced the tasks (Appendix M, p. 2; Appendix S, p. 2 and p. 7), or the amount of class time and teacher input, sometimes extending the deadlines for their class (Appendix M, p. 2; Appendix Q, p. 3; Appendix T, p. 7). These variations were accepted by the Head of Department, but changes to the portfolio marking schedule caused a problem. At least four teachers made major changes to the marking schedule (Appendix L, p.6; Appendix M, p.8; Appendix Q, p. 2; Appendix T, p. 2), instituting less stringent requirements, bonus marks, or a cap on the possible mark that could be obtained.

Because of inconsistent application of the marking schedule, the portfolio marks were moderated rather than contributing directly to each student's overall mark for the year.

From the outset, portfolios were used as a vehicle to incorporate new experiences into the mathematics classroom programme. Some of this was overt, such as a mandatory computer programming task and a statistics assignment that had to be completed on the computer, but much of it was by extension of the allowable responses of the students. Exhortation and a long lead time resulted in many students using a wordprocessor to complete projects at home. Other technologies used included the internet, still photography, collage and model construction using hot glue guns, and presentation folders. Many of the portfolio items completed by the students incorporated novice attempts at using display technologies such as scanning, clipart, Powerpoint, and colour printing. Some mathematics teachers conceded that portfolios had obliged them to take classes to the school library to undertake research, to do role plays in class, to *brainstorm* in class, and to teach formal writing skills. Teachers also encouraged student self-assessment, a procedure that was little used previously. Collectively, this is an extensive list of innovations by teachers and students. Perhaps the greatest novelty was the presentation aspect: anyone who read the students' portfolios received a major insight into the work done in mathematics. The latent effect of this was to legitimise and foster experimentation by both teachers and students in subsequent years.

It had long been the policy of the Mathematics Department to encourage all junior students to enter a poster or project in the annual regional school competition, Cantamath. The level of participation and of project quality varied greatly, and the classes of some teachers produced very little. With the introduction of portfolios as part of the assessment scheme, an entry for the annual competition became one of the tasks required of every student. In the first year of implementation the Head of Department used three classrooms to display the projects, and five hundred students toured the exhibition. This invasion of teaching spaces certainly drove home the point that every student and, more significantly, every teacher had to attempt the task.

It transpired from interviews with the students that one teacher had not given the students their sheet of portfolio tasks. Although the interviews were not intended as a monitoring exercise, student information-sharing produced a demand for equal treatment from the teachers and the problem was soon remedied. These observations demonstrate that there was immediate pressure on the teachers when the portfolio system was introduced. After three months of the programme, a questionnaire was given to all the teachers involved, and was completed by teachers of 15 of the 19 junior classes. An analysis of responses appears in Appendix U. Comments were mainly positive, coupled with numerous suggestions for improved administration of the portfolio tasks. Several teachers reported that the students were “keen” to do portfolio work, and other comments indicate achievement of curriculum objectives that were not covered by previous assessment. For example: “I found the autobiographies very helpful. Most of the kids were honest about where they were at with maths and that opened up some useful disclosure that is not normally possible in the classroom format” (Appendix U, p. 2).

One year later, the same questionnaire was administered to the relevant teachers, obtaining a 100% response rate. The responses (Appendix V) were less sanguine about whether the students had satisfactorily completed the portfolio work due, with three of the four teachers new to the school reporting that their students had not done the work required, however, there was considerable variation in the sentiments expressed. One new teacher noted that “I’m not sure of the value of these portfolios, whether they enhance the kids’ maths skills/attitudes or whether its just a dressing up exercise” (Appendix V, p. 3), suggesting that the teacher saw no self-assessment aspect to the portfolios. Other teachers described superficial completion as a problem. Perhaps there had been a reduction in student enthusiasm, but there had also been considerable turnover of staff and some loss of teacher knowledge of the objectives of the programme. In several cases, portfolios seemed to have been subverted into allowing the teacher a quiet time while the students produced tidy work: “Peaceful periods in the afternoon as low ability classes colour in or join the dots” (Appendix W, p. 2).

During the second year of using portfolios, nine of the 12 teachers involved reported that the innovation prompted them to engage in focused discussion with colleagues.

This took such forms as joint scrutiny of the work of students from two classes, brainstorming items for future use, planning programmes for weaker students, and sharing teaching strategies. Much of this was voluntary and not centrally organised. Two coordinators were charged with drawing up the portfolio tasks, keeping everyone on track, and collating the portfolio marks for the students of the two year levels involved. The coordinators developed substantial teaching resources, for example a complete teaching programme for a week on spreadsheets. On one occasion I was requested, in my role as a coordinator, to address another teacher's class to explain the requirements of some portfolio items. The other coordinator and I noted inconsistent implementation and marking of portfolios, in accord with student-based Assertion B. We also shared the observation that some teachers felt "pushed" into using portfolios. The other coordinator considered that the portfolio programme was worth continuing because it developed the students' pride in their work. The coordinator system seems to have demonstrated the three components of Glatthorn's (1987) cooperative professional development: colleague consultation, coaching and reflection about practice.

Curiously, none of the other teachers acknowledged the help of the coordinators, their comments in interviews and questionnaires steadfastly focused on their own performance and that of their students. Kent (1985) found that "facilitators sometimes encountered jealousies of teachers who were not moving into new roles, because of the additional training and teamwork provided for these new roles" (as summarised by Nisbet, Dole and Warren, 1997, p. 369). No such jealousies were disclosed to me in this study, perhaps because I was one of the coordinators in the first year of the implementation, or perhaps because there was no training provided for the coordinators. Rather than secretive and competitive behaviour, there was a considerable sharing of resources and ideas. For example, teachers would volunteer to give departmental meeting presentations about portfolio items that had worked well with their classes.

Teacher-based Assertions

Each teacher develops his or her own idea of what a portfolio should be. In some cases this could be a rather meaningless collection of projects and worksheets, indicating the subversion of the portfolios programme. However, when interviewed,

the teachers in the study each described new insights into the thinking of their students from the portfolio work. The statements reported in the next few paragraphs are drawn from interviews recorded at the end of the first year of the portfolio implementation. They are chosen to range across the issues and the insights which frequently arose, with each statement demonstrating an outcome attributed to the portfolios innovation. In this section there are nine assertions derived from questionnaires and discussion, both formal and informal, with the teachers:

- A. *Portfolios stimulate improved completion of tasks through competition between peers.*
- B. *Portfolios inspire some students to produce a greater quantity and quality of work.*
- C. *Students' misconceptions are readily apparent in their portfolio work.*
- D. *Teachers expect portfolio work to be of the highest quality.*
- E. *Success with portfolios requires that students are selective about the items included.*
- F. *Portfolio work is interesting to read.*
- G. *Portfolios prompt some teachers to reflect on and change their teaching practice.*
- H. *Portfolios enable students to see a 'before and after' comparison.*
- I. *Teachers feel that caregivers enjoy being involved through portfolios.*

Teacher-based Assertion A

Portfolios stimulate improved completion of tasks through competition between peers.

Completion rate was one of the topics often raised by the teachers. Many teachers mentioned that extracting satisfactory homework from the students in some classes was a major difficulty. However, when it came to producing portfolio work which was going to be displayed on the classroom wall and later archived in the student's special portfolio folder, there was improved participation. The same victory over reluctance applied to computer use: huge organisational difficulties had to be surmounted so that students were given the same "fair go" as their friends in other classes. The students wanted to master the tasks at the same level as their peers. This is the sort of behaviour anticipated by von Glasersfeld:

A thinking subject has no reason to change his or her way of thinking as long as there is no awareness of failure. But there are many shades and forms of failure, and the one most common in conventional schools — when the teacher declares that the student is “wrong” — is the least effective in bringing about a change in the student’s way of thinking. Far more powerful is the failure to gain the agreement of peers who are struggling with or have solved the same problem. (1991b, p. xviii)

This was very much apparent to one teacher who observed that

Peer assessment could be built into portfolios much more. Peer assessment, not just self-assessment. That’s important, but then others discuss each others, evaluate, mark each others to some degree. They are harder on each other than we are and they’ll take it from each other, won’t they? They talk the same language. They make allowances that they don’t think we make, and so they’ll listen more. (Appendix N, p. 19).

Not every student was motivated by portfolios. One teacher characterised a class as “couldn’t care two hoots” (Appendix L, p. 4) as they knew promotion to the next year level was automatic, and it would be three years before those students undertook the final school examinations. However, portfolios were seen as different and they did prompt most students to a new level of conation. As one teacher remarked, they were “just something a bit different from straight classroom work all the time” (Appendix O, p. 6).

Teacher-based Assertion B

Portfolios inspire some students to produce a greater quantity and quality of work.

Many of the recorded interviews took place as the teacher looked through the large collection of student portfolio work the class had produced during the year. One project that aroused interest concerned population growth in China. Although the project contained the usual material, including a graph, the presentation was novel. The need for China to control its population was discussed on a fictional television talk show, with mathematical ideas presented in a dialogue about a national

contraception policy. The teacher indicated he was impressed that someone who was “not a top student” (Appendix N, p. 7) had successfully presented an argument. The project scored highly, despite obvious mistakes such as how quickly a contraception policy would affect population growth. The teacher recognised that “her heart is in it” (Appendix N, p. 7) and he was prepared to reward highly the effort the student had put into communication of ideas.

In a different class, one student’s portfolio work prompted the teacher to comment that “...you lower your expectations depending on what sort of class you have and then you get a student like (named student) who really exceeds what you could ever have imagined they could have produced for you” (Appendix S, p. 3). Another teacher commented that “...I find it difficult to get homework out of the kids, I didn’t find it so difficult to get this [portfolio work]” (Appendix O, p. 6). Teachers are not easily impressed, and one veteran summed up the student feedback about portfolios with the words “Some are inspired, most are indifferent” (Appendix V, p. 2).

Increased enthusiasm in the students was one of the outcomes mentioned in reports of the Vermont study (Koretz et al., 1993), as discussed in Chapter Two, a finding which also applies to this study. While there was a range of student response, the use of a different kind of assessment provided motivation for some students who would not otherwise have been as enthusiastic.

Teacher-based Assertion C

Students’ misconceptions are readily apparent in their portfolio work.

One portfolio task was to study the mathematics of spider webs. The supposedly transcribed pictures of webs drawn by students were remarkably symmetrical, typically concentric regular hexagons. Few students realised that such webs are quite rare, and that, as described by Dawkins (1996), most spiders produce spiral webs which lack symmetrical structure. Having reviewed the faulty sketches of many students, one teacher was moved to comment “This represents their thinking though, doesn’t it, a Euclidean model of a non-Euclidean world” (Appendix N, p. 18).

Assessment of some, but not all, of the portfolio tasks was accomplished more easily than expected. In particular, the computer-based activities were designed to facilitate

rapid marking, allowing much of the marking to be made while the class undertook the tasks. Student presentations to the class were also straightforward to assess, as it only required a judgement between a restricted number of options in each of the criteria. The teachers were not familiar with assessment of essay-style submissions, and initially required guidance with this. 87% of teachers in May 1998 requested more direction about how to mark portfolio items (Appendix U, p. 1), but this declined to 17% by May 1999 (Appendix V, p. 1). Apprehension about new styles of marking declined as it became apparent to the teachers that the students' levels of achievement could be easily perceived from their submissions.

Not only were portfolios effective at revealing student achievement, but they provided opportunities for frank communication that was not previously possible. As one teacher noted: "I found the autobiographies were very helpful. Most of the kids were honest about where they were at with maths and that opened up some useful disclosure that is not normally possible in the classroom format" (Appendix U, p. 2). Another teacher, describing the unanticipated spinoffs from using portfolios, wrote: "You see aspects of students you weren't aware of. You can get more 'personal' with students – ie. good opportunity to, possibly, talk to kids on a one-to-one basis – perhaps about pet interests of theirs" (Appendix X, p. 2).

Teacher-based Assertion D

Teachers expect portfolio work to be of the highest quality.

The teacher of one low-streamed class paid from his own pocket for some attractive folders to house his students' portfolios. He commented

...for me it was less to do with assessment and more to do with motivation. With actually handing [in] something that at the end of it the kids could look at the folder and say 'well, I actually achieved a few nice things throughout the year'. ... when I'd marked something or when they'd done something like that and I'd put it in the folder they were keen to look in their folders. As ongoing motivation, I don't know whether it made a great deal of difference. I certainly felt happy that there was at least one thing that they had which was not crappy, you know – which was not scruffy. (Appendix R, p. 2)

He added that the folders had not solved the problem of getting homework done, that for these students work was either completed in class or not at all. Another teacher emphasised that “It would have to be done very early in the year so you get the message across that we’re striving for quality” (Appendix N, p. 19). Teachers noticed that the quality of their own output was often reflected in the quality of the student work. For example, if a worksheet was carefully typeset and well illustrated, many of the responses produced by the students were carefully crafted in the same way.

Several of the teachers found that deficiencies in the English skills of some students caused major problems. As one teacher said of his “B” stream class:

A few were confident and quite happy to do a sort of project thing with nice formal writing and all done on the computer and so on, but a lot of them don’t have English skills, and to try and combine English with Maths. I think some of them were quite threatened by it. I’m not sure. I mean, it’s *important*. It gets them thinking beyond just “Exercise Thirteen”. I wouldn’t want to give up on it. (Appendix N, p. 12)

This *best work* policy is reflected in comments made by the students. In some cases the students were aware that teachers were taking a genuine interest in their creative output. “Yeah, [named teacher] says he doesn’t want pages and pages at all, he just wants something interesting and good quality. He said he liked marking them because they were quite interesting to read” (Appendix G, p. 7). This remark was made about the teacher quoted in the previous paragraph.

Other teachers despaired of ever achieving satisfactory written communication of mathematics with their classes. The survey which teachers completed in the middle of the second year of implementation (Appendix V) revealed a wide range of responses to the question “Are you satisfied with the standard of your students’ portfolio work?”. The negative responses highlighted the literacy divide between classes in the different streams. “[I] Would not recommend them [portfolios] for use with lower ability classes. At least would recommend different tasks to be done compared with higher stream classes” (Appendix W, p. 2). The work of one low-stream class was described by the teacher as “mediocre – totally unacceptable”

(Appendix V, p. 1). This teacher also taught a more able class, and endorsed portfolios as “not a bad idea for ‘higher ability’ students” (Appendix v, p. 2). Another teacher commented “For a low level class the task of doing a mathematics autobiography for most of them only highlights the negative experiences they have had. The tasks involve writing and reading which many of them find difficult” (Appendix V, p. 3). There was less mention of this problem in later surveys. Teacher expectations could have lowered, student performance could have improved, the tasks may have demanded less of the students’ literacy proficiency, or teachers may have tired of reporting their concerns.

The “formal writing” task had disappeared from the portfolios schedule in 2000, replaced by a multitude of options including “designing an ark and building it”, “a study into the works of Maurice [*sic*] Escher” and “investigation into Maths and Music”. These tasks are less prescribed and do not require completion in a particular literary genre. They may well have led to the endorsement by one teacher in October 2001 that portfolios were “A good way to assess more creative work. A chance for the less able to do well” (Appendix X, p. 1). Another teacher wrote “I would recommend them [portfolios] to other teachers as a good way to encourage work that can be kept & looked at at the end of the year. Quite a few take much pride in presentation” (Appendix X, p. 1). “Particularly useful to help identify or confirm gifted students” (Appendix X, p. 4) noted one teacher. These remarks exemplify the diversity of opinion that the teachers, after three years of implementation, held on the utility of portfolios. The “less able” (Appendix X, p. 1) students, “students who enjoy the challenge of ‘extra’ work” (Appendix X, p. 1), students of “different skills” (Appendix X, p. 3) and “gifted” (Appendix X, p. 4) students were all mentioned as benefiting from portfolio work.

Teacher-based Assertion E

Success with portfolios requires that students are selective about the items included.

The teacher of one low-stream class collected up every project and worksheet done by the students throughout the year and distributed all of them back at the end of the year for inclusion in portfolios. “They were quite surprised to find they’d done so much” she discovered (Appendix M, p. 2). She required each student in the class to

“select six items that show a range of topics and a range of assessments and you’ll have to pick them out so that they best describe the year’s work” (Appendix M, p. 7). This teacher promoted a *theory-first* heuristic and was skeptical of the value of student investigations. She doubted that the items completed at home were really the result of the students’ own thinking: “I think it reflects the resources that they’ve got at home. In fact, I think that’s the single most contributing factor really” (Appendix M, p. 9). However, she had instituted a process that called on the students to exercise judgement about their work.

Some teachers were critical of the quality of the portfolio contents of some of their students, but failed to relate this to their own management of the system. Options undertaken by the more successful teachers included publishing best work as a display on the classroom wall, refusing to allow inadequate work to be placed in the portfolio folder, rewriting the tasks to match the literacy level of the class, involving caregivers, and maintaining an index of portfolio contents with student self-assessment of each item.

Teacher-based Assertion F

Portfolio work is interesting to read.

On the whole, the teachers were interested in the portfolio work, intrigued to see what the students had come up with. There is usually less enthusiasm to mark conventional tests, where assessment consists of identifying whether the correct procedure has been followed and whether the correct answer has been obtained or not. As they showed me their students’ portfolio work, teachers often pointed out pieces of work that were creative, or of exceptional quality. They obviously had a good knowledge of the work that had been handed in, and considerable interest in it.

One teacher covered the walls of her classroom with student work because:

I think that’s one thing that they like. They can walk around the room and see all their work. And, you know, for example, [named teacher] was in my room for an exam the other day and he came up to me and said ‘Oh, you’ve done some really interesting work: I’ve been looking around your walls’. I like that. You know that means people see what’s going on. (Appendix S, p. 12)

Some teachers noted an increased marking load, while others did not. A survey of teachers in May 1999 (Appendix V) specifically introduced *workload* as an issue, prompting three replies, out of eight, that indicated portfolios were extra work for the teachers. The majority of replies indicated that workload had not increased, one noting that the assignments “should be part of every maths classroom whether they are contributing to a portfolio or not” (Appendix V, p. 2).

Teacher-based Assertion G

Portfolios prompt some teachers to reflect on and change their teaching practice.

Initially wary of what he described as “trendy” (Appendix Q, p. 5) innovations such as portfolios, one teacher complied with the department’s decision to introduce the programme and presented the material to his class. Although the students had been given a rubric-style marking schedule (“complete & excellent 20, complete & good standard 15, some satisfactory work 5, poor work nil”, see Appendix C), the teacher first varied the descriptors then abandoned rubrics and relied on numerical scores. He applied “bonus marks” for students “who do that little bit extra” (Appendix Q, p. 3).

This teacher allowed class time for initial work on the items and made himself available to give guidance. He commented that:

I think one thing which I would definitely do differently next year — I’d probably give more class time, but I would think at third form level [Australian Year 8] for some of these things, because they’re not used to writing in maths, for example, I would give them some more guidance, basically. A little more teacher input. There’s got to be some sort of balance there, or alternatively do a practice one on something beforehand which is fairly well guided where it’s needed to be, and then they do their portfolio which they do more or less on their own. (Appendix Q, p. 3)

He was experienced at encouraging students to provide written explanations when they did statistical investigations, but found the Formal Writing task to be “not quite like that”. To provide greater guidance he envisioned that:

... we could do role plays in class, we could get someone to do an interview, we could talk about some questions we can ask, how-can-you open ended

questions, that sort of thing, write down some ideas on the sorts of things they could ask, do a brainstorm of the class on the sorts of questions they would ask... (Appendix Q, p. 4)

This teacher had 17 years of mathematics teaching experience, in several schools. He agreed that his teaching practice had been changed by the portfolios programme:

It has, it's partly been changed by the different school, and partly been changed by portfolios. So, yes, I would be happy to think about, you know, going back to the formal writing thing – now that I've seen the way that I did it this year didn't work out as well as I'd wanted it to – I know I have to sit down and think and say 'OK, what can I do that's going to be different?'. The sort of things which I haven't done in the past because I haven't had formal writing as part of what I have been doing with my students. So, yes, it's been really good, it's been challenging to me, which is good, and it's been new. (Appendix Q, p. 4)

Another very experienced teacher had put a great deal of work into preparing resources for portfolio tasks. Although prefacing his remarks with the statement “this is off the track of portfolios” (Appendix R, p. 5), he discussed how he had turned to thinking about pre-topic testing. In order to produce greater success in skills-based topics, he wanted to pretest the students and have them summarise their deficits for themselves. The record-keeping and self-monitoring aspects of portfolios lend themselves well to such activity.

The Head of Department was pleased with the success of the portfolio innovation on two levels. In respect of the teachers he said “there's been movement for some teachers who in the past have been reluctant to move into things beyond the conventional” (Appendix P, p. 3). He noted from processing the marks that “almost everything that was required, was done”. He observed that for other teachers the processes strand activities they have been doing in the past were now acknowledged, with the work counting towards the students' marks. In respect of the students, he recalled a scene in the computer room:

It was excellent, I've never seen so much mathematical process going on. Looking around the room and the problem-solving, communication and

group work investigations: it was all happening, all at the same time and I wasn't doing anything. It was wonderful. (Appendix P, p. 4)

Teacher-based Assertion H

Portfolios enable students to see a 'before and after' comparison.

One class was characterised by the teacher as unmotivated: "bright but blasé". She felt that poor work habits were holding the students back. When teaching isometric drawings she found it worthwhile to keep each student's first attempt and use it for comparison with later work, providing a benchmark against which the students could appreciate their own progress and gain motivation (Appendix L, p. 1). Another teacher had implemented topic pre-testing (Appendix R, p. 5), and had been thinking about having the students summarise and record the sections of the topic where their own weaknesses had shown up.

Teacher-based Assertion I

Teachers feel that caregivers enjoy being involved through portfolios.

One of the teachers had her own children at the school. She said that one thing portfolios achieved that would not have occurred otherwise was that it made students involve their parents (Appendix O, p. 5). She added that "...feedback I got from parents when I talked at interviews was they liked being involved" (Appendix O, p. 6). One of the unanticipated spinoffs one teacher described about portfolios was "opening up channels of communication with some parents" (Appendix W, p. 2). Another teacher said:

With my kids the parent involvement was very strong, they knew about this at parent interviews. I took this to parent interviews with me and ran through it with them and if they had done a piece of work I took it along and showed it to them and said this is what we're doing and have these things to do. Some parents said to me 'Oh yes I've got this up on the fridge'. (Appendix S, p. 9)

The overall response of teachers was less sanguine, many indicating that they received no feedback from caregivers. It seems that discussion between teachers and caregivers about portfolios was positive when it occurred, but that this was

infrequent. If portfolios had been a major imposition, reviled by the students and a cause of concern to caregivers, such equanimity would not have been the case. One factor that may have been at work was student reluctance to inform and involve caregivers. An incident which illustrates this was described by one teacher:

I gave them [the parent interview assignments] back because I thought they'd be pleased to show their parents as they'd talked to their parents, it was that interview one, so I thought it would be nice for the parents to see how well they did. A lot of them were just found in the rubbish tin. They walked out the door and put them in the rubbish tin. ... It's a strange dynamic in that class. (Appendix L, p. 7)

This exclusion of caregivers may be a peer-moderated behaviour, as students when interviewed reported a supportive home background: "My Mum and Dad read mine after I'd written it and just told me a few things to fix up" (Appendix G, p. 3). After all, the great majority of caregivers had consented to be interviewed about "the mathematics that they use in their home, recreational or work life" (Appendix B, p. 3).

Discussion of Teacher-based Assertions

The assertions presented above illustrate the wide variety of attitudes held by the teachers involved in the study – a range from cynical to enthusiastic. However, all the teachers were concerned, in the same way as the students, that this form of assessment should be fair to all the students.

The skills expected of the students are quite major: self-management of time and resources, literacy, identification of the mathematical elements, discerning what the teacher really wants, utilisation of techniques from many disciplines, negotiation to obtain the right help while avoiding plagiarism, managing interaction during group work, and presentation skills. On top of all these requirements, students are often urged to "think outside the square", to provide something unique and clever while remaining within the conventions of mathematics homework! Those teachers who had not given the class opportunity to practise on similar tasks, and time to discuss

ideas, were sometimes dismayed by the material produced. They found that the students had a narrow idea of what constitutes mathematics, and lacked the techniques to produce a coherent result.

The skeptical teacher of Teacher-based Assertion E instituted a crucial feature not always evident in the implementation of portfolios. The work selection was made at the end of the year: too late for students to plan further investigations to cover any shortfalls that became apparent to them. But at least it was done, whereas students in some other classes were not required to exercise the same self-criticism.

Modern Western school systems are a relatively recent development (Collins, Brown & Newman, 1989). Only since the twentieth century has learning been associated uniquely with schooling, where skills and knowledge are abstracted from their uses in the world. Previously, learning was associated with apprenticeship: “embedded in social and functional context” as Collins, Brown and Newman put it (p. 453).

Knowledge is divided into mutually-exclusive school subjects, its transmission in timed bursts of school periods, to age-graded groups isolated in separate rooms. The consequences, according to one researcher, are that:

...within high schools one dominant value among teachers is prizing the freedom to act as a solo practitioner who closes the classroom door and teaches a class unimpeded by supervisors, other teachers, or community members. When that value gets wedded to the common belief among teachers trained in subject-matter disciplines that students must learn content first before they can analyze and solve problems, instructional practices get shaped quietly and powerfully. (Cuban, 1995, p. 9)

In this study there have been indications that the portfolios innovation prompted a move away from the *solo practitioner* mentality. There was formal and informal discussion on how to manage the innovation, and collaboration over student work and the development of new resources.

At the instigation of the Head of Department, student reports from the first year of the implementation contained a section specifically referring to portfolios, thereby obliging teachers to acknowledge portfolios in every communication of student

results, even if it was only to give a 1 to 5 grade. In the first year of implementation, few teachers referred to portfolios in the comments section of the student reports, and those who did so referred to them in very few instances. Twenty randomly-selected mid-year reports were scrutinised before a report comment that specifically mentioned portfolios was found. This may indicate that teachers were initially uncertain of what to expect of student portfolio work, or that teachers did not have much trust in the reliability of portfolio results. Whether teachers were becoming more prepared to incorporate portfolios into their reporting as time went on is part of the larger question of whether teachers were increasingly accepting of portfolios, and had really made their own decision to embrace a portfolio culture. Such a question needs to be carefully delineated, and a framework for doing this is described in the next section.

Chronological Analysis of Teachers' Responses

The responses of teachers to the portfolio system were idiosyncratic, and varied greatly depending on the predisposition of individuals towards change. Because this study enjoyed excellent access to teachers over a protracted period, it provided an opportunity to examine the nature of the responses of individual teachers over time.

In order to quantify any movement of teachers towards acceptance of portfolios, an attempt has been made to categorise the results of the many interviews and questionnaires. The categories are drawn from the "three stages of concern about innovation" of Hall, George and Rutherford (1979). This typology is a hierarchy of the prime anxieties of teachers who are involved in a changed system: impact on self, impact on task, and impact on students. Hall, George and Rutherford's typology allows for a graduated transition through these stages of concern as teachers respond to imposed change. Many alternative typologies of change in education exist. For example, Rogers developed a six-stage model of "awareness, interest, trial, evaluation, ... adoption, ... discontinuance" (as cited in Gross, Giacuinta & Bernstein, 1971, p. 21). The Hall, George and Rutherford model was chosen because of the simplicity of its three-category approach, and because its participant-centred *concerns* were in sympathy with the comments made by teachers in the study. For studies of change in educational settings it is not always appropriate to make a

presumption of individual choice at each stage, because choice is not always available to collaborative teachers in a hierarchy-driven education system. The location of a teacher in the typology can be assigned by reference to the factors outlined in Table 5.1.

Table 5.1 Prime Anxieties of Teachers Involved in Educational Change

	<i>Indications</i>	<i>Related factors</i>
Impact on self	This may be evidenced by workload concerns. There may be anxiety about learning new course content or techniques.	Personality characteristics such as empathy, dogmatism, and intelligence may correlate. The person's perception of "having a choice in the matter" may be significant.
Impact on task	The teacher focuses on whether there is adequate resourcing of the change, for example, in the provision of textbooks. There may be reassessment of corollary issues such as reporting.	The extent of teacher networking, and the responsiveness of institutions, may be significant intervening variables.
Impact on students	Concern centres on outcomes for individual students. There may be a reassessment of programmes for particular groups.	Teachers may express a sense of ownership, perhaps taking pride in the new arrangement.

This study involved gathering data from the teachers over a period of four years, during which time there was a considerable amount of staff turnover. Attempts were made to keep in touch with teachers who left the school, and there was a considerable amount of informal communication with all of the staff, in addition to the use of the formal questionnaires and interviews reported here. The teacher codes used are the same as those applied to the interview transcripts of Appendices L through to T. The completion of each of the surveys is summarised in Table 5.2.

Table 5.2 Summary of Formal Surveys of Teachers

<i>Teacher</i>	<i>Q/naire May 98</i>	<i>WIHIC June 98</i>	<i>Interview Dec 98</i>	<i>Q/naire May 99</i>	<i>Q/naire Oct 99</i>	<i>Q/naire Oct 01</i>
AA	1	1	1	x	x	x
BB	1		1	1	1	1
CC	1	1	1	x	x	x
DD	1	1	1			
EE		1	1			x
FF	1	1	1			
GG		1	1	1	1	
HH	1	1	1	1	1	x
II		1	1	1	1	1
JJ	1	1		x	x	x
KK	1	1		1	1	
LL	1	1		1	1	1
MM		1		1	1	1
NN	0	0	0	1		
OO	0	0	0	1	1	
PP	0	0	0	1	1	
QQ	0	0	0	1	1	
RR	0	0	0	1	1	1
SS	0	0	0	0	0	1
TT	0	0	0	0	0	1
Total	9	12	10	12	11	7

Note. 1 = Completed the survey; 0 = Not yet employed at the school at that time; x = No longer employed at the school at that time.

The table shows that no teacher participated in all of the formal surveys, although there was a high participation rate in each of the surveys. The 60 documented teacher surveys were categorised according to the “three stages of concern” typology. For each document, the decision came down to which of the three stages occupied the greatest amount of attention. Some responses were hard to categorise because they did not easily fit the typology, or because the responses gave little information pertinent to this analysis. In addition, some of the teachers surveyed were less involved with the innovation than others, due to being part-time, having started work at the school only recently, or seeing themselves as *belonging* to another department and therefore not being mathematics specialists. Where no categorisation was possible a “?” symbol was used. It was also found that completion of the WIHIC

questionnaire was insufficient to enable a typology categorisation to be made, therefore it is omitted from the table of results. However, reliable allocations to a *stage* could usually be made, the text receiving the same judgment when the process was repeated. Table 5.3 gives the results of the categorisations made.

These results are equivocal. The numbers of “A”s, “B”s, “C”s and “?”s are approximately equal. Of the 20 teachers involved, 12 showed no obvious change, six went “up” the stages of concern, and two went “down”. Some teachers demonstrated strong persistence in the stage scoring they registered, others discussed different aspects of the implementation in each survey and therefore their scoring varied. In a comparison of this coding with the Teacher Support construct of the “what is happening in this class?” (WIHIC) survey, large discrepancies were noted. For example, the teacher who obtained the second largest difference between the teacher’s scoring of Teacher Support and that of the class, rated a “C” in the stages of concern typology. Plainly, the attitude of the class did not correspond with the self-assessment of the teacher, nor with the teacher’s rating obtained from interviews and questionnaires. The triangulation of teacher and student perception of concern and support may have been stymied by the influence of the class streaming system. As the Table 4.10 of Chapter Four reveals, for the junior cohort there is a high correlation (0.82) between the WIHIC constructs and the class placement in the streaming system, the performance of the teacher having little influence.

The only justifiable conclusion is that this process does not reliably reveal a progression through the three stages of concern. In fact, *anxiety* and *concern* did not typify the tenor of the questionnaires and interviews. Rather, the teachers were confident and well-informed. They were aware of the actions and attitudes of their colleagues, and they spoke freely about the variations they had made, or intended to make, in their own implementation of portfolios.

Table 5.3 Categorisation of Responses in the “Three Stages of Concern” Typology

<i>Teacher</i>	<i>Q/naire</i> <i>May-98</i>	<i>Interview</i> <i>Dec 98</i>	<i>Q/naire</i> <i>May-99</i>	<i>Q/naire</i> <i>Oct-99</i>	<i>Q/naire</i> <i>Oct-01</i>
AA	C	C			
BB	A	B	A	A	B
CC	B	C			
DD	?	A			
EE		B			
FF	?	C			
GG		B	A	?	
HH	B	C	B	?	
II		C	C	C	C
JJ	?				
KK	A		B	C	
LL	?		?	A	B
MM			A	A	C
NN			C		
OO			A	B	
PP			B	C	
QQ			B	A	
RR			?	?	C
SS					?
TT					?

Note. A = Mainly discussed impact on self; B = Mainly discussed impact on task; C = Mainly discussed impact on students; ? = Could not be ascertained.

Portfolios had motivated some teachers to change aspects of their teaching and assessment practice, and some teachers were enthusiastic about portfolios. However, there had been staff turnover of approximately 50% in the years from 1998 to 2001, and major changes in national assessment structures, which prevented any clear picture from emerging. The teachers who remained at the school throughout this period were not always consistently located in the stages of concern typology. In some cases this may be because they reinterpreted the portfolio programme, modifying it in the light of their experiences. Ultimately this would lead to inconsistent application of the programme, lacking a coherent *culture*.

Perhaps the most interesting effects of the portfolio programme are quite personal to the teachers involved: a renewed interest in how the students thinking is developed, a

commitment to improve teaching and assessment, and the motivation to experiment with modifications in their own professional performance. Communication with teachers who had left the school generally indicated that these personal effects were salient, even when there was little opportunity to implement a full portfolio-like system in their new teaching positions. In this respect, the portfolio innovation was successful – it provided a powerful mechanism for the professional development of the teachers involved.

The Caregivers

Holmes (1998, pp. 256-257) noted a trend in education “over the last twenty or so years” towards “denying the legitimacy of parents helping their children”. Fink and Stoll (1998, pp. 299-300) discussed the community *contextural network* of schools and concluded that “innovations often fail because of the educators’ inability or unwillingness to involve parents in meaningful ways in their development and implementation”. The portfolio activities in this study sought to involve caregivers directly by such methods as mandating students to interview their caregivers about the mathematics adults actually use at work, and indirectly by providing shareware for home computer use and by requiring observations, such as sketching spiderwebs, to be recorded at home.

A postal survey of caregivers was conducted at the end of the first year of implementation. (The questionnaire is reproduced as Appendix E.) On a score of 1 (*Nothing*) to 5 (*Lots*), the mean caregiver response to “How much involvement do you have with your son/daughter’s mathematics homework?” was 2.19, with a modal score of 1. This was very close to a prediction survey conducted with the teachers. Comments by the caregivers included “maths homework doesn’t seem to encourage parental involvement”, and that caregivers “do not always understand the maths homework”. The only personal contribution to the student’s homework contemplated by four of the 30 caregivers who replied was to consider hiring a private tutor for the student. However, seven caregivers did report actually assisting with homework. This took many forms, from being interviewed for a portfolio project, to assisting with mathematical research on the internet. Caregivers appreciated knowing what

was coming up in tests and projects, and commented that the portfolio briefing documents (Appendix B) and assessment schedules (Appendix C) were helpful.

Many caregivers did not return the questionnaire sent to them, generating a return rate of only 38%. Caution must be taken with the results, as this is effectively a self-selected sample. Few of the caregivers who completed the questionnaire acknowledged any major involvement with the mathematical study undertaken by the students. By their silence, caregivers may be seen as sanctioning the stilted conversation of the examination script rather than the richer transactions of socially-embedded learning as envisioned by Fullan (1993). But it may be that the students also have a part to play in this, by “carelessly” losing communications from school to home in a tradition of concealing homework requirements and partitioning of the comforts of life at home from the stringencies of schoolwork. Some evidence for this is found in the low return rate (23%) of the first 40 questionnaires sent home by hand, compared with the greatly improved rate (53%) when the questionnaires were mailed. It is impossible to quantify, however, the extent to which caregivers were influenced by the more official mechanism for delivery of the questionnaires.

Many different suggestions were made by the 30 caregivers who responded to the survey. Three gave unsolicited support for such surveys, and two others wanted a greater frequency of written school reports, indicating that communication between home and school could be improved. When asked how much they were aware of what their son/daughter was studying at school, only four of the 30 selected the least aware level of the five options, but none selected the other extreme response. For many caregivers it was the first year their child had been at high school, and some had noticed a big jump in the standard of work required. The key question “How much involvement do you have with your son/daughter’s mathematics homework?” evoked nine neutral and only two positive replies, with 10 caregivers selecting the lowest level of the five options. This was reinforced with several comments about caregivers having inadequate skills to help with high school mathematics. Homework seemed to function as a major part of the communication from school to home, although few caregivers were actively involved in assisting with its completion. Five caregivers mentioned portfolio projects, taking a positive view of the way they legitimated caregiver involvement.

Adolescent students are beginning to assert their independence, and many caregivers readily declare very readily that they do not have sufficient mathematical skills to be of assistance with homework. This was the case with eight of the thirty caregivers who completed the postal survey. But these caregivers were indicating that they were conversant with the contents of the homework, and they may have been a positive influence through such monitoring. Some of those caregivers who did not declare their inadequacy at mathematics may have been taking little interest in the homework endeavours of their sons and daughters: only one-third of such respondents mentioned that they do actually help with homework.

Many teachers reported no discussion with caregivers about portfolios, but those who raised this topic sometimes received very supportive feedback. After a parent evening, one teacher spoke of her enthusiasm for portfolios and her delight that “At parents evening every parent said something *positive* about mathematics.” Her students had recently completed their Mathematical Autobiographies, apparently with a good deal of caregiver involvement. This matched with the experience of my own class, where one of the caregivers expressed great enthusiasm for portfolios and volunteered that the Mathematical Autobiography (“Experiences, teachers, books, experiments and activities which have shaped your mathematical progress. Give examples...”, refer Appendix B, p. 1) made her son “think in ways he never has before”.

Factors Influential to Implementation of Portfolios

The portfolios innovation did not produce better marks for the participating students in the traditionally-styled final examination. The same examination paper was used on two successive years, the second of which was the year portfolios were introduced for all classes. There was little discernable change in the examination results of the portfolio cohort, a result that was not of any great influence for the teachers involved. After all, the curriculum was being delivered, most of the students had generated impressive files of “personal best” completed work, and as was found in the Vermont study (Koretz et al., 1993), there had been a greater emphasis on problem-solving. Some of the teachers felt that formative assessment, as represented by portfolios, had led to less superficial learning, making mathematics more “real”

(Appendix V, p. 3; Appendix W, p. 4). The act of constructing a portfolio was a tangible acknowledgement of a more constructivist approach in the classroom.

The decision to use portfolios became more securely established by promotion of some teachers to positions that specifically involved the coordination of portfolio resources and duties, exposure of the students to what would be expected of them in future years, and the irreversible commitment of publishing the assessment scheme to caregivers at the beginning of the year.

Many teachers have reservations about portfolios, for example regarding them as unsuitable for low-ability students. Literacy problems and inability to undertake independent research rendered investigation-style tasks daunting for such students. As a consequence of this, many different approaches were taken by the teachers: ignoring or modifying the tasks, giving practise tasks first, strongly directing how to proceed in the investigations, and writing different marking schemes more appropriate to the level of the class. One teacher felt that his students had produced better project work in previous years. He felt that the portfolio programme included more items and greater emphasis on presentation, but it needed tasks specifically tailored to what was happening in class and more detailed assessment statements in order to stimulate deeper thinking in the students.

The portfolios programme was presented to the teachers as prescriptive. It required the teachers' initial consent at a decision made at a departmental meeting, and was then promulgated in school newsletters and written assessment schemes given to every student. The portfolios programme was implemented with nominated tasks and deadlines to be applied to all the students in the two year levels, and it was incorporated into the reporting and assessment programme. But teachers varied the programme in many ways. Sometimes this was forced by such exigencies as delay in access to computer facilities, but mainly the variations were the day-to-day pragmatic decisions of the classroom teachers.

A number of the teachers taught the same class levels in other subjects such as Technical Drawing and Physical Education. This may have given them a better appreciation of the skills to expect of the students when it came to written prose,

collating information from a variety of sources, and independent investigation. No formal comparison was made between written work in Mathematics portfolios and that in Social Studies or English.

Mathematics teachers are familiar with the expected results of an investigation. But they may have little on which to base their expectations of students' investigation and communication skills. At times this may result in confusion, with teachers impatient about the unexpected digressions of their students, and students who feel their creative work is undervalued. There was no evidence in the study that teachers scrutinised the written work their students produced in other subject areas.

1998 was the first year of full implementation of the portfolios innovation. Portfolios continued to be used in mathematics assessment at the school, with the system virtually unchanged throughout 1999 and 2000. This implementation of portfolios in mathematics assessment allowed a great deal of scope for teachers to vary the programme for their individual classes. They could substitute the tasks, vary the marking schemes, collaborate with other mathematics teachers, and call on the expertise and encouragement of nominated expert colleagues. In short, the teachers were empowered. This is unlike the state-wide implementation in Vermont (Koretz, Stecher, Klein, McCaffrey & Diebert, 1993, p. 86) which was closely moderated but which found better correlation between writing proficiency and the portfolio scores than between mathematical proficiency and the portfolio scores.

Teachers in the study did not only face a curriculum demand for changes in teaching practice, but they had to deal with year-level coordinators who required marks for the stipulated tasks to be entered into a computer in time to produce the student reports. The teachers were conscious of the research programme being undertaken and were also reminded of their responsibilities at frequent departmental meetings. Intrusion into classrooms reached a higher level, and there was more professional discussion focused on the students' learning. The immediacy of this monitoring was vital in overcoming resistance to change.

Those caregivers who took an interest found their involvement legitimated by appropriate tasks. Many found their non-mathematical expertise was called upon, for

example, recalling the names of teachers who featured in the students' mathematical autobiographies. Caregivers appreciated publication of the assessment scheme and were pleased to see home computers put to good use.

The students were outwardly indifferent to portfolios in mathematics. Some threw their completed portfolios into the rubbish bin when they received them at the end of the year. Others had invested greater effort into their portfolio and saw it as an interesting artifact to preserve. Many enjoyed the opportunity to be creative and to employ novel means of presentation for their mathematical work. Some even pursued mathematical investigations far beyond the expectations of their teachers. Many escaped the need to make judgements about their own work, their teachers not insisting on a declared rationale and careful selection of portfolio items.

The streaming of mathematics classes by ability accounted for a considerable amount of the variation in the students' responses to portfolios. But the influence of the teachers was also significant, a conclusion which is supported by research over many years (Hall, George & Rutherford, 1979). Although required to implement the change, each teacher adapted the programme to the needs of his or her students. Between teachers, inconsistencies in implementation became so great that the Head of Department decided the portfolio marks had to be rescaled to the same mean and standard deviation as the class examination marks. But this was not seen as the failure of the programme.

It is notable that many factors did not impact on the implementation of portfolios. There was no externally-sourced professional development for the teachers, the only resourcing being a more focused application of the usual management salary increments that are allocated to staff within the Mathematics Department. The school administration played little role in the implementation. The indifferent response of most students and many caregivers made no impression. Other departments within the school, including the remedial reading programme, were not consulted. Some mathematics staff became persuaded of the benefits of portfolios, while others retained serious reservations but worked to modify the programme to be useful for their students.

In the two years following 1998 the three staff members most closely associated with the introduction of portfolios left for positions in other teaching institutions. A new Head of Department was appointed and became familiar with the school's use of portfolios during the year 2000. In 2000 an external review of the school commended the Mathematics Department for leading the way with portfolios, but noted that there were many teachers who were uncomfortable with their use. In a private communication, one teacher indicated that the prevailing industrial climate had promoted "a general feeling that people won't do anything unless they are getting paid for it", the implication being that development of the portfolios system was seen as an unpaid burden. Also mentioned was the "real problem with part-timers teaching maths as the students recognise that they don't have the same enthusiasm or knowledge".

In 2001 the programme was suspended as part of a review of the junior mathematics teaching scheme, and because of inconsistent implementation by the staff.

Commenting in a questionnaire, the (new) Head of Department noted that "Some [teachers] don't do it. Marking styles vary. Tasks vary." (Appendix X, p.3). He said his recommendation to other schools is "Only introduce them [portfolios] if you are going to use them properly and have a clear shared purpose. Unless all staff are on board then the purpose gets lost in some classes" (Appendix X, p.1). He reintroduced portfolios in 2002 "having built them into the assessment programme and with the assistance of marking exemplars and some staff training" (personal communication, 1 March 2002).

Conclusions

It is hard to know whether a portfolio culture (Duschl & Gitomer, 1991) flourished, however briefly, in some classrooms. This would require that the students truly understood why portfolios were used, and had internalised a self-critical approach to their own learning. The test of whether a portfolio culture existed is the test of all formative assessment: did the teachers and students change their teaching and learning activities as a result of the assessment information they had obtained? (Black & Wiliam, 1998). In this study the teachers often spoke of changing their

practice, and there may have been more of a culture of collegiality, but there was little evidence that the students undertook self-directed activity.

The factors which appear to have been most significant were the professionalism of the teachers and the openness with which the programme was managed. This accords with the observation by Fullan (1993), quoted in Chapter Two, that teachers are the key agent of change. Implicit in many of the responses from the teachers involved was the idea that the teacher felt no compunction to deliver precisely the same programme as everyone else. The expertise of the teacher and the needs of the class were always factored into planned activities. Initiatives taken by teachers were shared formally and informally, and given a positive reception. Just as the portfolios were a celebration of the students' judgement and creativity, the implementation permitted the use of the same skills by the teachers.

The Next Chapter

In order to address the five aims of the study that were introduced in Chapter One, and their associated research questions, the final chapter presents a synthesis of quantitative and qualitative results. It also covers the limitations of the study, suggestions for further research, and a statement of my personal response to the issues raised in the study.

CHAPTER SIX: CONCLUSION

Introduction

This chapter presents the findings drawn from the research questions in the light of the quantitative and qualitative results obtained in the study. The implications of the study for the teaching and learning of mathematics are also presented, as well as the limitations of the study, and areas for further research. A personal response to the issues raised in the study is also provided. The first part of this chapter is presented under italicised subheadings – specifically the five objectives presented in Chapter One.

Objective One:

Determine the extent to which portfolios provide a means of assessment of aspects of the curriculum not covered by the standard forms of assessment. What was unique about portfolios in assessment?

Portfolios were instituted in order to satisfy new requirements in the revised curriculum. In particular, the curriculum declared a set of mathematical processes objectives that are not easily-defined areas of factual knowledge, but are the operating skills students should be exercising as they undertake realistic mathematical tasks. On the whole, portfolios were a successful means of enabling students to demonstrate such skills. Many of the portfolios produced provided evidence that students were developing the skills envisaged by the new curriculum document (as quoted in Chapter One). However, there were some students who did not put serious effort into their portfolio work.

The curriculum did not delineate practical skills to be mastered, but required that students participated in various activities. The portfolios often provided a record of such events: group work, notes for oral presentations, and printouts of graphics created by the use of a specialised computer programming language. Such artifacts are not percentage marks, but they do constitute evidence that the students have been engaged in the required activities. From this perspective, assessment is redefined.

Rather than checking that the student has passed the prescribed series of checkpoints, assessment is made of the teaching programme of the school and the classroom practice of individual teachers. The artifacts not only enabled caregivers to be aware of the mathematical topics and approaches taken by their children, but also enabled a type of internal auditing whereby the work of individual teachers was apparent to their colleagues and to the school administration.

Sometimes individual students found the “everyday life” context, which was an emphasis in the curriculum, difficult to capture in a portfolio. For example, students lacked the sketching skills necessary to adequately record spiderwebs. This was overcome through discussion and sharing of alternative approaches, such as photographing dew-covered webs. Success in the sharing process was one of the goals envisioned in the curriculum, documented in the expression: “become effective participants in problem-solving teams” (Ministry of Education, 1992, p. 23). This study has demonstrated that most students responded positively when given opportunities to collaborate, and that teachers, after initial skepticism, valued the programme and did not find it difficult to manage.

Although some open-ended problems go unresolved, or fail to involve overtly mathematical procedures, they do exercise important vocational skills. For all the difficulties, portfolios allowed students to attempt truly unfamiliar “everyday life” problems, whereas traditional known-answer tests do not. This led students to apply new approaches to presentation, and new ways of attacking problems. “I guess it’s learning in a different way” (Appendix H, p. 8) was one student’s conclusion about the value of mathematical investigations. An important outcome for the students was a renewed interest in obtaining the mathematical techniques that would enable them to make headway with such problems. The difficulties inherent in unformatted problems also inspired creativity in the teachers, an issue discussed in the next section.

When constructing a portfolio, materials must be amassed. The consequences of this are that some sort of structure in which to present the items is required, as is some sort of process to determine which materials are included and which are rejected. The situation is the same as building up a stamp collection – more than simple accretion,

the approach needs to be disciplined with careful custodianship and purposeful development. There are several skills involved in such an activity, probably best described in the terminology of librarianship: sourcing, cataloguing, accession, binding, shelving, retrieval, circulation, purging and archiving. These are neither archaic nor unimportant skills, and they transfer readily to electronic database management. School curricula may not explicitly specify these skills, but they are part of the skills of modern life as people filter information, keeping records only of those items considered appropriate. In the excerpt of the mathematics curriculum given in Chapter One (Ministry of Education, 1992, p. 23), the phrases “logical and systematic thinking” and “critical appraisal” would apply to the database aspect of portfolios. The curriculum makes a direct reference to “information technology”, which would usually be interpreted as use of the internet and computer databases, but the phrase also encompasses the low technology skills of manually selecting and filing.

For some students in the study, it was a new skill to store documents properly, and the requirement to produce mathematical work of excellent presentation quality led to the employment of techniques and materials not previously used. Whether the portfolios were physical or electronic, the discipline of quality record-keeping would remain a learning objective. One of the valuable characteristics of a portfolio is that student work is effectively published for all to see. Novel approaches and creative use of technology can be rewarded by showing the portfolio to other students, to senior staff, and to caregivers. Teachers can stimulate the quality of student accomplishment by retaining copies of excellent work for use as exemplars. In the study, several teachers made use of this technique. Now that there is a greater awareness of the internet, publication can be achieved by the development and maintenance of websites, another new skill beyond the reach of traditional assessments.

Many of the mathematical processes skills required by the curriculum relate to performance. For example, students are to: “listen and respond to the ideas of others” (Ministry of Education, 1992, p. 23). Other parts of the curriculum specify physical performance tasks, such as using measuring devices, as part of the required learning experience. Although it may seem that a portfolio is irrelevant to this, in many cases

it can play a significant role. Part of the portfolio can become a “photo album” record of students undertaking such tasks, accompanied by working drawings, and any calculations made. When listening to each other giving class presentations, students can be scoring each group against criteria they have developed, ultimately filing the scoring sheets in their portfolios. The contents of the portfolio can thus include such “souvenirs”, not just as final drafts of written work, but as valuable memory prompts.

When portfolios are used for assessment, three aspects can be considered. Firstly, the portfolio should contain evidence that performance aspects of the course have been undertaken. Such evidence may be in the form of speech notes, preliminary drawings, or assessment sheets. Secondly, self-reflection should be part of the portfolio. This gives the student an opportunity to demonstrate otherwise elusive evidence of critical thinking, transfer of skills between contexts, responding to the ideas of other people, and other metacognitive skills. Thirdly, appraisal of the student’s attitude towards mathematics, the *affective component* of the course, can be gleaned from the extent new ideas have been pursued, and the diligence with which the portfolio has been constructed. In the study, the portfolios earned a single numerical mark. This was instituted in order to combine the portfolio with other assessment activities, thereby stressing its importance to the students, and also ensuring that the teachers implemented the new system. This policy allowed some teachers to view portfolios as a form of “super homework”, to be graded in the traditional manner with reference only to whether the answers were correct or not. Such misinterpretation would not arise if the purpose of the portfolios was clarified with mathematics staff on an on-going basis. In the study, several teachers found portfolios a useful technique for the assessment of performance tasks and metacognitive ability.

Teacher/student conferencing, opportunities for redrafting, and group work on parts of the portfolio all offer formative assessment opportunities to the teacher. When the skills being assessed are the skills of collaboration and processing information, the teacher is not restricted to marking only the final draft. Although assessment at intermediate stages was used only informally in the study, it is a technique that could enhance the effectiveness of portfolios.

The implementation of portfolios in the assessment of mathematics led to changes in the classroom performance of the teachers, with an increased emphasis on open-ended questions, assessment of student performance, and topic pretesting. Several of the participating teachers acknowledged this as a significant milestone in their professional lives. For some teachers, taking a mathematics class to the library or computer room was a new experience. The assertions made by teachers, presented in Chapter Five, include several important observations: the quality of the students' work was improved, the work was interesting to mark, and students were exhibiting the skills of self-reflection and selectivity. For the teachers who were alert to these developments, and who perhaps fostered them, portfolios were the vehicle for a new appreciation of the self-organisation and self-revelation aspects of learning and communicating undertaken by the students. Other teachers found that some students enjoyed constructing a folder of well-presented work, but the teachers were not sure what this indicated. The Mathematics Department's decision to work with portfolios had become subject to the ratification of individual teachers, some of whom felt inadequately briefed as to the true scope and purpose of the portfolio system.

A problem encountered in the study was the failure by a few students to adequately complete portfolio work. In May 1998 thirteen teachers, out of the fifteen involved (87%), responded in the affirmative to "On the whole, have your students done the [portfolio] items due to date?" (Appendix U, p. 1). In May 1999 this declined to seven teachers out of twelve (58%) (Appendix V, p. 1). In the October 1999 survey seven teachers, of the 11 who responded, (64%) made no mention of having to "chase up" students to complete the work (Appendix W). Perhaps the problem of student reluctance arose because the unique features of portfolios had become undervalued by the teachers, or were not well communicated to the students. The teachers did not mention any other means by which the communication, critical thinking and creativity components of the mathematics course were being assessed.

In 2001, portfolios having been in use for three years, the entire assessment programme was reviewed. A new Head of Department had observed the operation of the mathematics assessment system during the year 2000, and he had become concerned that there was a lack of understanding of purpose amongst the staff and that variation of marking styles was a problem. He felt that the portfolio programme

should continue, but that staff needed training and marking exemplars to which they could refer. After the review, sweeping changes were introduced. Overlaps within the curriculum were eliminated, and a new approach was introduced. This saw collaboration between mathematics and other subject areas in a project-based approach, coupled with ongoing formative testing. The streaming system was also changed to provide a greater mix of ability in most classes. Although portfolios continued, they existed as a system for gathering documents, and were no longer assessed as a collection.

Although it was foreseen by the Head of Department as “an excuse” (Appendix X, p. 4) for not maintaining enthusiasm for portfolios in the junior classes, a new “National Certificate in Educational Attainment” (NCEA) for senior classes has demanded the time and energy of teachers since 2001. The National Certificate in Educational Attainment makes no provision for assessment of senior students by portfolios, thereby limiting the extent to which portfolios can be used within schools.

In summary, portfolios were found to deliver effective assessment of several non-traditional mathematical skills. These skills included ability at *everyday context* problems; the use of novel technologies; oral presentations; the data handling skills usually associated with librarianship; response to the ideas of other people, including peers; the development of understanding over time; and the undertaking of extended and self-directed investigation. Some very well-constructed portfolios clearly indicated the positive attitude towards mathematics held by their authors. Failure to complete portfolio tasks prompted teachers to issue reminders and to be very mindful of the work deficits of some students. The different form of assessment had a different impact profile, placing new literacy demands on a mainly male group of poor readers, and rewarding those non-academic students who were prepared to use imaginative means of presentation. Even before the 2001 review, the portfolios in the study showed little evidence of overtly self-reflective writing, but this was not a priority of the teachers involved.

Objective Two:

Determine changes effected by portfolios in the classroom and school environment.

Is there a detectable "portfolio culture"?

The teachers involved in the study reported new styles of interaction with their students. Part of this was the introduction of previously disregarded or underused technologies, such as photography and computers. But, beyond these visibly different changes, classrooms also became the scene of brainstorming, a new emphasis on self-reflection, recognition of students' presentation skills, and a value placed on creative student work. These indications suggest a change in the role of teachers from authority figure towards facilitator.

For the teachers involved, the creative and experimental approaches they had been taking with their classes were legitimated by the use of portfolios. This was evident from discussion with teachers who were keen to display such atypical assessment work as posters and extended statistical investigations. To a degree not previously experienced, teachers volunteered their experiences of different tasks and techniques at formal and informal meetings. Interviews with teachers revealed that a great deal of thought had been given to review and improvement of the portfolio implementation and tasks. Contemplated improvements included revised tasks, increased guidance, and conferencing while the task was underway (Appendix Q); improved instructions and timing, with intermediate *marker points* to ensure students are on task (Appendix R); display of student work on classroom walls (Appendix S), and increased selectivity by students (Appendix T). This was summed up by one teacher: "I'm very happy to continue running with them [portfolios], and for me personally to do it differently and better next year, given what I've learnt myself" (Appendix Q, p. 5).

When interviewed, the matters raised by teachers often related to the nature of the relationships they developed with students. For example, criticism of the portfolio rating procedure was frequently referenced to the impact on particular individuals. For example, one teacher was anxious that diligent individuals should not be disadvantaged in comparison with a class that was "slack" (Appendix L, p. 3). Teachers were concerned not to become alienated from their students, but tried to

keep their students motivated. They also spoke of the class as an entity, describing it as “low ability” or “bright”. Sometimes the entire class was typified by the teacher, for example “It’s not a class that is very motivated and they’re not a class that’s very proud” (Appendix L, p. 7). Reference to the class in both the plural and the singular perhaps gives an indication of the teacher’s ambivalence to recognising a class as an identity in itself. One teacher said “... you lower your expectations depending on what sort of class you have ...” (Appendix S, p. 3), but she had been surprised by the good work produced by the class and admitted she was “quite proud of them” (Appendix S, p. 11). These relationships constitute a cultural phenomenon. The teachers were attributing to their classes the personality characteristics of self-aware entities, a shorthand way of acknowledging the culture that had been adopted by their students.

When students embark on extended-response tasks, such as those incorporated in the portfolio programme, they reveal the detail of their own understandings. The restructured knowledge of the students will necessarily vary from the tenets of scientific and mathematical disciplines. For example, students may be able to describe the symmetry of two-dimensional figures, but be unable to recognize the same properties in house roofs photographed in a real estate brochure. In a portfolio culture (Duschl & Gitomer, 1991) this should lead to a grappling with the earlier knowledge, and application of mathematical “ways of knowing”, to break down the difficulty with three-dimensional shapes and to extend the student’s concept of symmetry. Duschl and Gitomer describe different schools of thought regarding conditions for change in students’ conceptions, from piecemeal restructuring to dissatisfaction leading to revolutionary change. Beliefs, methods of learning, and systems for assessing beliefs can change separately. The important aspect for Duschl and Gitomer is that the student is an active agent in the change, engaged in an interplay with the teacher and the curriculum.

To some extent, classrooms in the study did witness such a portfolio culture: students came to trust that their creative decisions would be treated with respect, their misconceptions were more evident to the teachers, there was class discussion arising from ideas presented by the students, and teachers changed their professional practice in favour of open-ended questions and formative testing. Changes on the

teachers' part may not always have been attributed to portfolios, but many developments would have been unlikely to occur without the new system. For example, there was experience with rubric-based marking and the devolution of control to students in unfamiliar areas, both physical such as the computer room, and intellectual such as producing biographies of mathematicians. My perception is that the proportion of class time devoted to problem solving activities increased, as experienced in the Vermont study described in Chapter Two. Assessment of the students with a unidimensional mark remained the practice during the first three years of the study, but 20% of that mark was obtained through the portfolios, and the portfolio itself became part of the communication to caregivers. This was at least a partial fulfillment of Broadfoot's (1998) manifesto demands (refer p. 17). Through the use of portfolios, teachers were exposed to formative testing, and this proved a positive factor when the even more heavily formative project-based system of assessment was introduced in 2002.

Objective Three:

Identify perceptions of the portfolio innovation by students, teachers and caregivers. What were the changes, if any, in attitude and behaviour of the participants in the programme?

The Students

Many of the students responded very positively to the portfolios. This was evident from the many thoroughly-prepared portfolio pieces submitted. Students were also positive about being the subject of research. They completed questionnaires without complaint, and most of those interviewed were enthusiastic to share their ideas.

Some students voiced a very traditional view of mathematics assessment, affirming that "We do writing in English, it's not maths" (Appendix I, p. 10). For a minority of students, neither encouragement nor admonition persuaded them to submit portfolio items of any quality. They consequently lost marks that affected their grade for the year. Some students remained unaware for months that portfolio marks contributed to their final grade, so resolute were they in their misapprehension that traditional tests were the only form of assessment. The vast majority of the students accepted

portfolios as an appropriate activity in mathematics, and they responded well to the opportunity of presenting intelligent, original work of the highest quality they could achieve.

Girls were found to have a very low participation rate in the school's remedial reading programme, "1 or 2 in a hundred" (personal communication from the teacher in charge of remedial reading, 10 June 1999). The students who had difficulty with reading were almost always boys. Those students who were interviewed were oblivious of this fact. Although they professed a strong demand for fairness, they failed to mention that there would be one gender particularly handicapped by the literacy demands of portfolios. A few students were alert to the idea that portfolios rewarded aptitudes different from those applied to normal schoolwork, and that "some people are better at other things than investigations and stuff" (Appendix H, p. 7), but they did not link this to an unfairness biased against one gender. Teachers were aware that some students in lower streamed classes had considerable literacy problems: "They find it difficult to read a lot of instructions" (Appendix V, p. 2). "For a low level class the task of doing a mathematics autobiography for most of them highlights the negative experiences they have had. The tasks involve writing and reading which many of them find difficult" (Appendix V, p. 3). On the other hand, most of the students did have satisfactory literary ability, teachers often reporting that portfolios prompted an increased pride in the work (Appendix N, p. 5; Appendix V, p. 2; Appendix W, p. 1 and p. 4; Appendix X, p. 1 and p. 2). As the teachers gained greater experience with portfolios, they designed tasks that avoided literacy pitfalls, and they ensured that the least able students had a correct understanding of the tasks.

Four of the ten assertions based on observations of the students relate to the shortcomings of portfolios. The students disliked homework, they knew aspects of the portfolio implementation were inconsistent or unfair, and they found the grading system confusing. However, one assertion stands out: the attitude taken by the teacher made a big difference to how the class functioned, and to the worth of portfolios.

The Caregivers

A great deal of the impetus for authentic assessment and better reporting derives from the perceived audience. The manifest target of all teaching interventions is the student, but where adolescents are involved it is often caregiver demands which are influential in changing programmes.

In the past it has been easy for some caregivers to decry poor communication by the schools and to take little involvement in school affairs. It will be interesting to see if schools attempt to overcome this in future by use of the internet, for example to publish homework requirements, and the extent to which caregivers download and act on the information available.

Many of the teachers reported little communication with caregivers about portfolios, and many of the caregivers reported little communications with their children about mathematics. However, the portfolios all incorporated tasks which overtly sought caregiver involvement, and there was overwhelming compliance to complete these tasks. A substantial number of caregivers made extremely positive comments about portfolios, enjoying their participation and welcoming the increased communication.

The Teachers

Portfolios certainly caused frustration for some teachers. The programme struck structural difficulties such as inadequate access to computer facilities, but more telling were the small annoyances that teachers found hard to live with. For example, good records had to be kept and tardy work chased up. Some teachers were comfortable taking a hard line – “quite a lot of my kids got zero because they didn’t do anything” (Appendix T, p. 4), while others expended a great deal of energy trying to get work in from students. Some tasks were inappropriate for students whose literacy skills were poor, and teachers were not always able to bridge the gap.

Extended tasks, especially when there is a long completion timeframe, involve an aspect of transferring power to the student. No longer does the teacher know the

whole task intimately, including how much time it requires and the expected solution. It was up to the student to determine the direction to be taken by an investigation, and the level of mental energy to invest in it. Pressure by a teacher may result in improved presentation, but is unlikely to stimulate deeper thought. For that the student's interest must be piqued, the student must realise that there are ways to proceed, and the student must decide to devote time and effort in the pursuit of this abstract and loosely-defined goal. To set such a task is to ask a lot of the student, but it also involves a devolution of power by the teacher. *Mentor* is an unfamiliar role to some teachers, and it is a role that cannot be accommodated within a relationship structure modelled on authority and discipline. The same devolution of teacher authority occurs when a mathematics class is taken to an unfamiliar location, such as a library or computer room, or to the school swimming pool to trial model boats. The class will maximise the benefit of the learning experience if there is a high level of peer cooperation, a factor that is not entirely within the teachers' control.

In the study, teachers were assisted to use the computer room by the provision of structured and immediately-assessed tasks, the occasional help of other staff when timetables allowed, and by the knowledge that every class was required to undertake the same computer-based tasks. In particular, it was the universality of the imposed change that increased its acceptability. If such non-traditional activities were optional, time devoted to them would equate to less time preparing for the examination than other classes received. Students were also well aware of this trade-off and, like the teachers, monitored what their peers were doing in their mathematics time.

Teachers increasingly came to accept portfolios as a worthwhile activity for their classes. As they gained experience, they found that portfolio organisation and marking was not as onerous as they had initially feared. Teachers who left the school spoke of their enthusiasm to introduce a portfolio system in their new schools. Those teachers who remained at the school for the first three years of portfolios developed labour-saving routines, such as sharing potential portfolio tasks in a designated computer file. There was little impetus to develop the self-reflective aspect of portfolios, and insufficient department-wide moderation of routines led eventually to unacceptable large variation in perception and practice. Minor inconsistencies over

such issues as opportunity for redrafting were very apparent to the students, and did not promote harmonious acceptance. Some initially skeptical teachers had developed a favourable attitude towards portfolios, but the system could not continue unchanged because there was not enough cohesion, consistency and shared goals for portfolios amongst all the mathematics teachers.

Objective Four:

Investigate the utility of portfolios as a means of reporting progress in mathematics. To what extent had portfolios provided a valuable portrait of the students' mathematics?

This implementation of portfolios was top-down enforced change, but it was accomplished without an authoritarian style. Teaching resources, advice and opportunity to visit other classrooms were available to the teachers. Ongoing positive feedback was provided at regular meetings of the Mathematics Department, and teachers were encouraged to develop and share ideas and resources. At the end of the first year of implementation, when the time came for portfolio marks to be processed, it became apparent to the Head of Department that inconsistencies in the marking schemes had become too great. He decided to scale the portfolio marks to match the mean and standard deviation of class examination marks. As a means of assessment in the traditional manner of providing unidimensional marks, portfolios were unsuccessful even within a single institution. Arter and Spandel (1992, p. 37) recommend that "portfolios contain several features that might make them very attractive for large-scale assessment", primarily the multiple samples of student work and realistic context for their generation. However, in practice these advantages do not outweigh the factor that inconsistent implementation impedes reliable ranking of the students. If assessment is the process of ranking students from "best" to "worst", then portfolios are an inadequate means of achieving it.

Several other variations on the original plan also become accepted by teachers during the initial implementation. The portfolios became just another type of homework, not a partial replacement for traditional testing. Students were submitting items without the self-reflection aspect that was intended to enable the portfolio to become a meaningful collection of evidence of progress. Variations between classes in

timelines, lack of policy about redrafting, and lack of exemplars were generating concern about the fairness of the system. Because there were no timetabled portfolio conferencing sessions with caregivers, nor any checking that completed portfolios had been taken home and shown to caregivers, portfolios were never considered a real part of the school reporting system.

For many students, however, the portfolios were a repository of the best mathematical work they had ever produced. Some of the work submitted was excellent, and sometimes the product of a great deal of dedication and original thinking by the students. Teachers often remarked that items demonstrated taking a pride in the work, or that the students had put their hearts into the work. In part, this reflected the commitment of the teachers. For example, the teacher who had the least able Year 10 class went to considerable trouble and personal expense to ensure the portfolio folders were attractive, not “scruffy” like the students’ exercise books. He commented that:

For me it was less to do with assessment, but more to do with motivation
With actually handing [in] something that at the end of it the kids could look
at the folder and say ‘well, I actually achieved a few nice things throughout
the year’. (Appendix R, p. 2)

Essentially, the difference that portfolios represent is the same as the distinction between selected-response and constructed-response systems of assessment, as described by Mabry (1999) in Chapter Two of this thesis. Students find mathematics lessons, and especially mathematics homework, to be “boring” when they are merely following in the teacher’s footsteps. Multi-choice and other known-answer tests are too uninspiring to merit being the high point of a mathematics course. Given the freedom to produce their own portraits of mathematics, the students took pride in their work and often developed impressive submissions for their portfolios.

There are many technical difficulties in using portfolios as a reporting technique. The students could not be relied on to file their portfolio items correctly, consequently teachers were reluctant to allow marked work to be taken home for inspection by caregivers. The release of the completed portfolios at the end of the year was uncoordinated, with no publicity that would alert caregivers to its significance. This

obstacle could have been surmounted if portfolios were distributed at one of the regular parent/teacher evenings, or the end-of-year prizegiving. At first, exemplary portfolio work received little recognition. Later, grades were awarded on the school report form. Teachers began to retain copies of some portfolio work in order to show future classes the standard that could be achieved. The reporting aspect of portfolios was not well implemented at the start of the programme, but it was slowly developing. Of course, the most important opinion is that of the person who prepared the portfolio: most students did produce well-presented portfolios and they were keen to retain them at the end of the year. Students knew the portfolio was like a photograph album of their mathematics, and they valued its depiction of themselves. Even if the portfolio did not contain overtly pre-instructional or post-instructional items indicative of progress in mathematics, the students' interest in preserving their portfolio demonstrates that they were aware it constituted a milestone they could refer to for future comparison.

Objective Five:

Investigate the implications for teaching and learning using portfolios. What were the advantages and disadvantages of using portfolios?

During the three years before portfolios were reviewed, seven of the 13 teachers who were first involved had left the school. These included the Head of Department and the two programme coordinators. Several of the staff remaining at the school became less involved with mathematics due to administrative duties or by teaching requirements in other subject areas. The programme had effectively completed a three year life-cycle. At no time during the three years could the portfolios programme be described as fully and harmoniously implemented. Teachers new to the school had misgivings about its utility, and teachers with portfolio experience had made idiosyncratic adaptations. But reservations about implementation did not bring about the termination of the programme because of the many positive benefits imputed to portfolios by the teachers. The teacher-based assertions discussed in the previous chapter denote that students exhibited an improvement in the completion of tasks, and produced a greater quantity and quality of work. Portfolios were also credited with improving teaching practice, raising standards, and generating student work that was more interesting and meaningful to mark. Teachers also felt that

caregivers appreciated their involvement in the mathematical learning of the students. When portfolios were ascribed with all these benefits, it is easy to see why implementation shortfalls were tolerated in the medium term.

Although the school administration supported this study, even providing a grant to cover photocopying expenses, no commitment was made to change examination and reporting practice. Portfolios were seen as an extra, neither a replacement for examinations nor for traditional school reports. In fact, when it came time to combine the portfolio marks with marks from traditional tests and examinations, the Head of Department found it necessary to abandon the published assessment model. Instead of the raw marks being added together, giving portfolios a weighting of 20% of the mark for the year, the portfolio marks were first scaled to the same mean and standard deviation as the test marks for each class. This was because of a perception that, in the first year of implementation, teachers had been too inconsistent in their marking and that poor portfolio marks could make a significant difference to the class placement of students whose tests marks were higher.

The change to how portfolio marks were initially used does not necessarily indicate inadequate support for portfolios by the school authorities. It may be the sort of “teething problem” which is to be expected when staff undertake a new system, particularly when no formal professional development was provided to guide teachers to score consistently. The Vermont experience (Koretz et al., 1993) demonstrated that such problems occur even when a high level of support and moderation is provided. Perhaps in some schools the need to scale the portfolio marks would never disappear, even when all the teachers were familiar with the system. This would lend support to the contention of Marzano (2000, p. 99):

“Although portfolios are not the best tools for large-scale assessment, they are very useful in the classroom... I believe they are best used for student self-assessment...”.

The school which is the subject of this study continued to use portfolios in the assessment of mathematics for three years, despite significant turnover of key personnel. Teachers reported that portfolios became less work than they were initially, once a library of suggestions for appropriate portfolio items was available. The school administration regarded marking variability between teachers to be

within acceptable bounds. Presumably, it was felt that portfolios would not be seen as important by the students unless they contributed to the year's grade. Perhaps the 20% weighting given to portfolios satisfies Marzano's (2000) concerns as well as enabling a satisfactory implementation.

At the end of 1998, teachers returned the completed and assessed portfolios to the students, but there was no system to monitor that the portfolios were taken home for caregivers to see, as there is with school reports. There was no caregiver/teacher conferencing about the portfolios. In subsequent years, the students were required to purchase special folders for their portfolios at the start of the year, thereby alerting caregivers to the special nature of this part of their child's mathematical assessment. School reports half way through and at the end of the year incorporated a special category for portfolio results, and caregivers could anticipate the arrival home of the mathematical portfolio folder at the end of the year. However, the response of caregivers to the portfolios remained unmonitored by the school administration, which means that there was no systematic means of knowing whether the portfolio was delivered to the caregivers at all.

Portfolios are not a goal in themselves, just a device to facilitate better teaching, learning, assessment and reporting. Some schools, especially primary schools, require their students to purchase large and elaborate folders to house the portfolios they develop each year. The product is voluminous, but carefully groomed by the teachers to contain only tidy and correct work. Such an artifact reveals more about the teacher than it does about the student. The portfolios produced by secondary students in the study often contained unguarded, original and individual work that gave an insight into the personality of the student and identified their degree of mathematical interest and development.

Findings: Introduction

The decisions to implement portfolios in the mathematics curriculum, to modify them, to review the programme, and to reinstate portfolios as part of a wider strategy, were made by a variety of authorities. Initially, it was the national curriculum authority that mandated variation from traditional practice. Although use of

portfolios was named as one suitable technique for providing the required innovative learning practices, it was left to individual schools to find their particular solution. The school in which this study took place was fortunate to have an experienced and confident mathematics staff, led by an innovative Head of Department. The decision to implement portfolios was made by the Head of Department after consultation with some of the mathematics teachers. It was well supported by the staff, several of whom invested considerable personal effort in the development of teaching resources for portfolios. In hindsight, it is clear that the absence of intensive scrutiny of each teacher's implementation left the programme open for individual decision-making in regard to several significant factors. These factors included the amount of class time to be devoted to portfolio tasks, the level of teacher assistance, and the permissible opportunities for redrafting. Also, idiosyncratic decisions were made by many of the teachers on how the tasks were scored, often at variance with the published guidelines. Decision-making at the level of the classroom teacher, or between informal groups of teachers, led to unsustainable variation in assessment quality. This variation was detected during a routine audit of school procedures by an outside body, the Education Review Office. However, the problems with assessment by portfolios were already apparent to the new Head of Department, and he took steps to correct the situation. The change decision remained within the school, the Mathematics Department maintaining independent control of its assessment procedures.

The portfolios programme could be described as never being fully implemented within the school. It did not effectively supplant other forms of assessment – there was no commitment to use the marks generated by portfolios without scaling them to the parameters of traditional examinations, and publication of the portfolios was never a priority. Comprehensive staff training was not attempted, even for teachers joining the school during the time the programme was underway. In this regard, the school paralleled the experience of Kentucky schools (Myford, 1999) where staff professional development of US\$23 per student was spent, amounting to a cumulative total of US\$26 million, before the programme was abandoned. Myford (1999, p. 7) notes “Yet, researchers who have studied the efforts of Kentucky teachers to implement standards-based education have concluded that the limited

staff training provided has not been sufficient to bring about the deeper changes in instruction that policymakers expected”. Those at the vanguard of the change have a clear vision of what they want to achieve, but this is not universally held, and is subject to ongoing variation. Without very close monitoring and communication, this leads to inconsistency that is hard to control in any large or diverse setting. In the study, the small size of the setting meant that corrections could be instigated within a short time frame, thereby avoiding the expensive failures of larger and more bureaucratic programmes. An important lesson from this case study is that allocation of responsibility to the local level shortens the timeframe of change, enabling responsive control as the programme develops.

In conclusion, five findings about portfolios are presented. These findings are my interpretation of the data produced in the study, particularly the assertions which originated from comments made by the students and teachers. These findings hold for the setting of the study and may be generalised to other implementations should those settings not vary significantly in the key variables of teacher, student and caregiver attitude and ability.

First finding: Completing a portfolio benefits mathematics students.

The students found portfolios to be appropriate and acceptable activities in mathematics. They associated them with projects in other subject areas, and felt their primary schools had prepared them well for such work. Many teachers noticed improved performance by their classes, both in the amount of work produced and in the pride the students took in their work. Portfolios incorporated a structure that permitted comparison over time, demonstrating an improvement in skills that was of interest to caregivers and was motivating to students. The librarianship skills intrinsic to portfolio use are not fully addressed in other parts of the school curriculum.

Teachers were not consistent in their appraisal of how portfolios should be implemented. The “less able” students, “keen” students, and “gifted” students were all mentioned as benefiting from portfolio work. Some teachers expressed reservations about using extended tasks in “low ability” classes, particularly because the literacy demands might exacerbate learning difficulties. However, those teachers

who modified the programme for their classes were pleased with the results. Successful changes included providing more class time for portfolio work, giving increased guidance and opportunities for redrafting, showing exemplars, brainstorming in class before students produced their individual work, and designing tasks that made low literacy demands. Some teachers pointed out that extended tasks were a good thing for non-academic students, as they gave these students opportunity to excel by means of their talents in creative communication and presentation.

The study revealed that on entry to high school, girls are better at mathematics than boys, and girls have a different experience of the classroom, their community being more cohesive and collaborative than that of boys. On the other hand, boys enter high school weaker at mathematics, and their need for remedial literacy assistance takes up almost all of the available resources. However, boys express a stronger enjoyment of mathematics, and their desire to improve mathematical skills increases sharply during their first year of high school. Portfolios may appeal to those students, especially girls, who enjoy project work and may build mathematical self-esteem to more closely match such students' mathematical ability. This may help to make gender less of a factor in the retention of students in post-compulsory mathematics courses.

The students appreciated the opportunity to demonstrate different areas of their expertise, and they were happy that non-examination events contributed to their assessment. One student observed that:

I reckon it's quite good when you've done, like, some of the investigations and stuff, that it goes towards your end of year mark and an exam. So you've sort of got a bit of both, and if you're no good at one you've still got that mark to go on the end of year mark. ... I guess it's learning in a different way. (Appendix H, pp. 7-8)

Second finding: Portfolios can legitimate caregiver involvement in homework.

The forms of homework are widely varied, encompassing catch-up textbook work, commercially-produced time-fillers, extended-response assignments that can be unlimited in scope, and revision in any form imagined by the student. The functions

of homework are also diverse, from extending the school hours, providing a social role for keen students, and indicating to caregivers the current topics being taught. One of the few consistent factors with regard to homework, as mentioned in Chapter Two, is that homework can enable caregivers to assist in the child's motivation and learning. A strong link has been found in international studies between measures of literacy in the home and academic achievement. Students and teachers in the study also acknowledged that caregiver involvement has positive results.

The portfolio activities in this study overtly sought to involve caregivers in the homework, with the objective of linking mathematical study to vocational and other real-world activities. This was achieved directly by mandating students to interview their caregivers about the mathematics adults actually use at work, and indirectly by providing shareware for home computer use, also by requiring observations such as sketching spider webs, to be recorded at home.

The result was that many caregivers were actively involved in the mathematics homework, and they were interested in how the portfolio would be received by the teachers. Few caregivers felt very confident about helping with secondary mathematics homework, but they were supportive when it came to such things as recalling their child's early learning experiences, and the names of their teachers, in order to help write a mathematical autobiography. Obviously, the extent of caregiver involvement must be controlled if the portfolio is to truly be the work of the student, and this can be problematical unless there is ongoing teacher conferencing as tasks are completed. Secondary school students are keen to take editorial responsibility, and they are mature enough to understand the concept of plagiarism. Acknowledgement of sources and assistance may be a new skill for them, but it is not beyond their capacity, as many demonstrated in the portfolio work they produced.

Caregivers gleaned most of what they knew about their child's studies from the homework attempted by their children. As revealed in a postal survey, and discussed in Teacher-based Assertion I, caregivers in the study expressed appreciation for the overt recognition they were given in portfolio tasks, and for the published schedule of topics and due dates.

Third finding: Portfolios can change the professional practice of teachers.

An important finding of this study was that portfolios led to a more professional approach by the teachers involved. A significant indicator of this was the acceptance and publication of assessment schedules for junior classes at the beginning of the school year. This was a new development and it entailed an increase in teacher preparation for the courses, but it was seen to be necessary and was implemented with apparent equanimity. Another indicator of heightened professionalism was the frequent and pertinent informal discussion between teachers about their classes. Teachers were aware of an increased need to make inter-class comparisons, moderate their marking decisions, share teaching ideas, and to cooperate on matters such as disseminating computer expertise and maintaining records.

Several of the teachers involved have adopted portfolio approaches in the presentation of their own curriculum vitae, supplementing the usual documentation with a collection of some of the significant teaching and assessment resources that they have developed.

Because of portfolios, teachers needed to adopt a rubric-style marking system. Some teachers took classes to the computer room for the first time in their lives, they gave advice on library research, did role-plays in class, scored student speeches, and wrote or researched tasks that utilised group work for problem solving.

Those who were not specialist mathematics teachers found it the hardest to devote time and energy to portfolios, but every teacher responded to the programme. As acknowledged by the Head of Department, there was movement for some teachers who in the past had been reluctant to change their practice. A reduction was made in the number and length of written tests, but many teachers were not very conscious of this.

In this study, there were indications that the portfolios innovation prompted a move away from a solo practitioner mentality amongst the teachers. Teachers worked together to plan portfolio tasks and compare the responses of their classes. They showed exemplary student work to each other informally and at departmental

meetings, and collaborated over assessment of student work and the development of new resources. Portfolio marks were produced for every student; the teachers indicating support for the validity of such assessment, while noting that a poor work ethic resulted in low marks. Some teachers explicitly acknowledged changing their professional practice as a result of portfolios, mentioning an increased emphasis on open-ended questions and valuing the creative responses of students.

Fourth finding: Portfolios can change the relationship between students and teachers.

Portfolios necessarily involve an aspect of trusting disclosure by the student. This occurs as students seek help from the teacher while undertaking the extended tasks, and when the students make self-critical reflection on the finished work. Inevitably, the teacher becomes a mentor, a resource of useful ideas, a provider of technical help and equipment, and a facilitator of communication between students. Several of the teacher-based assertions relate to this point: the students' misconceptions are readily apparent in their portfolio work, teachers expected portfolio work to be of the highest quality, and portfolio work was interesting to read.

This situation contrasts with the defender role played by teachers in the administration of unseen, time-constrained, written examinations. There, the answers must be kept secret from the students, and the message to students is to not communicate amongst each other, and to finish quickly. There is little emotional involvement for an examination marker. Feedback to the student is usually single-event, one-way communication and generally limited to correction.

Because it calls on the subject knowledge and professional skills of the teacher, the assessment of student portfolios is interesting to do: an experience that surprised some of the teachers in the study. Because portfolios reveal how the student is thinking, portfolios foster the development of positive, collaborative relationships between teachers and students.

The portfolios innovation led to a greater teacher insight into the response of the students. Partly this was because of the structure of portfolios, providing a narrative

by the students that often contained candid self-reflection. This was a self-perpetuating phenomenon, in that it also increased the teachers' interest in the response of the students and generated other ways of tapping into this response. Portfolios are not the only means of obtaining a measure of student response, and it would not matter if portfolios were discontinued – teachers could continue to satisfy their heightened interest in student response by formal or informal surveys. Such surveys need not be in the form of written questionnaires. One teacher described how he regularly selects four students at random from his class list, and has a quick discussion with this sample at the end of a class period. Other teachers make it their practice, when homework is to be submitted, for the students to draw up two boxes, one for student comments and the other for the teacher's response.

A classroom exhibits a portfolio culture, according to Duschl and Gitomer (1991) when it is characterised by “assessment-based interactions teachers have with students to monitor meaningful learning, and the project orientation of instructional activities and instructional tasks” (p. 848). One indication of such a culture may be the use of formative testing. When teachers are alert to the reality of student thinking, assessment that reveals what needs to be taught is more useful than summative tests at the end of the topic. Formative testing improves student enjoyment and achievement in mathematics by preserving an orderly environment, while promoting investigation, creativity and self-reflection in the students. As Black and Wiliam (1998) concluded, innovations such as portfolios that result in improved quality and frequency of feedback to students lead to substantial learning gains. Although the term “portfolios” has been retained, the school featured in this study eventually moved beyond the portfolios system as initially implemented, to a model promoted by Atkin (2003). This is a programme that incorporates project-based learning, group work, and a greater emphasis on formative assessment. This development was not a rejection of portfolios, but a move to an even stronger culture of learning-enhancing reciprocity between teachers and students.

The history of assessment, as outlined in Chapter Two, is the story of an increasing objectification of those tested. As the tests become more demanding and more comprehensive, it seems as though there is little beyond the test result that the candidate can claim is a worthwhile part of themselves. They have become the cipher

produced by the test. The personalisation through portfolio assessment, noted by many of the teachers, is the opposite of this objectification. Rather than allocating candidates into predetermined categories, the teachers participated in ongoing learning and disclosure. The students came to know themselves better, and they produced portfolios that conveyed a great deal about themselves.

Fifth finding: Liking of mathematics has a dual nature

The Third International Mathematics and Science Study indicated that “within nearly every country, a clear positive relationship can be observed between a stronger liking of mathematics and higher achievement” (Beaton, Mullis, Martin, Gonzalez, Kelly and Smith, 1996, Chapter Four). This liking was the focus of the majority of the Mathematics Survey’s items, constituting the Enjoyment construct. Codes on the questionnaires completed by students in the study enabled the attitude towards mathematics survey to be compared with the classroom environment survey. This revealed significant correlations between Enjoyment of mathematics and each of two quite dissimilar classroom environment constructs. The Investigation and the Task Orientation constructs were the most strongly associated with Enjoyment, with correlation coefficients of 0.39 and 0.42 respectively. This is a surprising finding, as the two classroom environment constructs seem antithetical. The Investigation construct is related to ideas generally known by the titles “processes strand”, “authentic testing” or “student outcomes”. It is based on items such as “I solve problems by using information obtained from my own investigations”, “I carry out investigations to test my ideas”, “I am asked to think about the evidence for statements”, and “I solve problems by obtaining information from the library” (Appendix D, p. 6). These are not descriptions of traditional teaching. The Task Orientation construct at first seems to be the polar opposite of Investigation. Task Orientation is based on items such as “I pay attention during this class”, “I know what has to be done in this class” and “Class assignments are clear so I know what to do” (Appendix D, p. 6). This does sound like a traditional teacher-directed learning environment.

These statistics show that extreme approaches at either end of the constructivist classroom spectrum can be associated with high scoring of attitudinal variables. A

possible explanation of this result is that there are two types of liking of mathematics. One is the satisfaction of following a routine, perhaps building up physical notes and demonstrable skills, behaving in a business-like manner motivated by vocational imperatives, and obtaining surface mastery of the topics delivered. Another is the satisfaction of being self-reliant, obtaining personal satisfaction by overcoming difficulties and solving problems by forging a way through and obtaining a personal understanding. The difference between these two perceptions is that the first is more of a liking of mathematics class, the second is more of a liking of mathematics per se, as held by its practitioners.

To improve the liking of mathematics class, tasks should be clear and delimited. The student-based assertion that teachers were inconsistent in their implementation of portfolios is really a call for this type of certainty. For example, word limits can be set for written work. In contrast, to improve the liking of mathematics per se, students should have the opportunity to make their own investigations, to think about the evidence they acquire, to test ideas with other people, and to communicate in whatever manner is most effective. The ideal classroom allows two situations to coexist: an orderly environment, and support for independent thinking. The portfolio mirrors this, providing a tidy format within which the students record an unpredictable exploration of ideas.

Limitations

All research in social science has an impact on its subject. Teachers and students were aware that their behaviour was under scrutiny. Consciously or unconsciously, they modified their expressed attitudes and actions in response to this. Such reciprocation is an inescapable aspect of participant-observer case study research. Proponents of scientific method in social science research may describe this as evidence of flawed methodology, but interpretation is vital if understanding of human social behaviour is to be achieved. A focus of this study has been the attempt to develop a shared understanding between all the parties involved.

The teachers restricted their discussion of portfolios to the changes apparent in the societies within their classrooms. Any study of teacher initiatives in assessment

conveys the implicit assumption that individual teachers have the potential to effect significant improvements by their own actions. Such a study removes the focus from more global influences such as class size; the efficacy of streaming; resourcing of such things as buildings and reprographic facilities; pre-service and in-service professional development of teachers; the selection and assignment of classes; the workload, accountability and reward of teachers; structuring of schools into subject departments; and the inconsistent application of the curriculum within school districts. These influences are beyond the control of individual teachers, but may be more significant to the learning process than any change in the performance of individual teachers. The questionnaires completed in October 1999 and October 2001 included the question “What are the reasons you would recommend or not recommend portfolios to teachers at other schools?” (Appendix W p. 1; Appendix X, p. 1). No response identified that such change avoids consideration of the global influences mentioned above, suggesting that the teachers envisioned improvement as solely incumbent on their individual actions.

School assessment necessarily involves political issues within the wider community. Some of the issues which should exercise the minds of teachers are: the validity of traditional time-constrained written examinations as a filter to occupations which require no such skills; the denial of access to the technology universally used by practitioners when students sit examinations; and the unequal access to qualified teachers as a greying profession copes with a surge in student numbers. These issues did not arise during the discussions about portfolios. Although portfolios provided a useful forum for professional discussion, it was within a restricted and apolitical window.

Practical considerations limited the scope of the study. Resource considerations confined the study to a single site, and time did not allow every teacher at the school to be interviewed. The two survey instruments used with the students were designed in a multi-choice format, thereby precluding gathering the richness of information that can be obtained through open-ended questions. For example, it was evident from the items about liking of mathematics that quite different interpretations were made by the students, but this was not provided for in the questionnaire. Sometimes the given alternatives were inappropriate or insufficient, for example in the items that

referred to perception of student cohesiveness respondents were asked to identify how frequently such feelings arose, rather than identifying the strength of the feelings. There was no opportunity to record that the question concerned a situation that did not apply to the respondent's classroom. A number of faults were identified in the survey instruments: factor analysis revealed that some constructs did not cohere well; the use of negatively-worded stems is not recommended, and the questionnaires should allow for "I do not wish to participate" and "My classroom does not experience the activity described" in the given responses. The reading level of the survey instruments was found to be too great for some junior high school students, suggesting that the development of questionnaires should include assessment of reading age, and that suitable notification of reading age should accompany publication.

Attitudinal variables such as anxiety have a complex relationship with mathematical achievement. The measurement of such variables is sensitive to the instruments used, and subject to many effects including mathematical ability, the timing of assessment events, and the attitude of peers. Although the study linked responses obtained by two quite different instruments at an individual level of analysis, no links were available to individual examination results, nor to membership of social groups. Although the teachers were followed up for an extended period of up to four years, data from the students was gathered over a period of only twelve months.

Unlike the study described by Boaler (1999), portfolios were introduced in conjunction with normal textbook work. There was no opportunity to programme truly heterogenous, unstreamed class groups, nor to provide "extremely relaxed" (Boaler, 1999, p.1) discipline. Summative testing remained unchanged, without any attempt to revisit tasks undertaken in the portfolios. There was not even any staff training beyond a quick verbal briefing. It was not the implementation of a radically different system, but a cheap and uncontroversial variation. It was the type of implementation that is readily understood and likely to be accepted widely, not a dramatic experiment.

Suggestions For Further Research

Caregivers are not greatly acknowledged in the research literature of mathematics education, yet they can play a key role in motivation and learning. It was found in this study that considerable difficulties inhibit research on caregivers, and no attempt was made to follow the responses of caregivers over time as the implementation of portfolios became established. Questionnaires were mailed to caregivers during the study, but the 38% response rate was disappointing. Other forms of communication are expensive and subject to self-selection bias. It could be valuable to conduct further research with caregivers on how portfolios are perceived, both as tasks and as reporting devices. It may be that work on portfolio tasks is counter-productive in some households, reviled as not really being a mathematical activity. Students in low-ability streams, uncooperative students, and highly academic students perhaps receive quite different messages about homework in general and portfolio tasks in particular. Caregivers may find portfolios hard to interpret, or may not believe that the portfolios reflect the students' abilities. Considering the amount of time and effort required of teachers to institute and grade portfolios, it could be worthwhile to conduct a reliable appraisal of consumer benefits by undertaking research with an intensive focus on caregivers.

Similarly, homework can occupy students for many hours, perhaps an additional 50% of the time spent in class. Research on homework seems to have been hampered by over-reliance on quantitative technique, dependence on student self-declaration, and an assumption of shared meaning across different subject areas, teaching approaches, and even different countries. Whether it is traditional repetitious *skills reinforcement*, or non-delimited *open-ended* discovery tasks, homework can be a considerable disincentive for students. Research on homework seems sparse, and it is deficient in the scrutiny applied to what the students are actually achieving, how homework relates to school performance and to students' self-perceptions and educational choices. A significant gender effect seems to apply to many of the important variables that govern mathematical progress. For example, this study reveals that boys express greater enjoyment of mathematics although girls are better at solving mathematical problems. Research on the origin and maintenance of such

socially-mediated self-perceptions seems crucial to an understanding of mathematical learning.

One issue that arose from the interviews in this study was the preference of some students for imprecise grade descriptors, avoiding the implication that excellent work still contained a small percentage of incorrect answers. This is discussed as Student-based Assertion H in Chapter Five. The students favoured letter grades — an intuitive system, with a clear, finite hierarchy of grades and without narration. It would be interesting to relate such reporting devices, in different educational systems and for different age levels, to the students' perceptions of success.

Motivated teachers were found to be a significant factor in determining how effectively the portfolio culture developed in a classroom. For some teachers, the techniques demanded by portfolio assessment were not new, while others began to adopt new roles as they devolved power to the students and served as mentors. Such change in professional practice is never easy to engender, nor is it easy to research. The three stages of concern typology was chosen for the study because it is relatively unsophisticated and seemed to provide appropriate and easily ascribed categories. But, as Fullan (1993) relates, there is a complex interplay between the personal vision building of individual teachers and the modernisation of institutions. Although our understandings in this area may always be incomplete, further research can extend our knowledge by recording both successful and unsuccessful implementations of strategies for change, especially if participant observation is employed.

Portfolios represented a move towards formative assessment, richer communication within the classroom, and aspects of a constructivist teaching environment. Students, caregivers, teachers and administrators responded to this change in a variety of ways, not always positively. It is an ongoing priority for the teaching profession to determine the factors that facilitate or inhibit the implementation of novel teaching and learning strategies. The portfolio culture envisioned by Duschl and Gitomer (1991) features emphases on overcoming student misconceptions, on the transference and generalisation of skills, and on a learning environment that values restructuring

of knowledge. Models of conceptual development seem to be a valuable area for further investigation.

The study found that student performance in an ordinary time-constrained mathematics examination was not significantly affected by the implementation of portfolios. Many teachers were not concerned by this, but wanted to retain portfolios because they were of benefit to students in other respects. These benefits include performance factors, such as improved interaction with peers and the utilisation of a wide range of technologies, and affective factors, such as appreciation of mathematics, enthusiasm, and desire to continue studying mathematics. These and many other factors may be contingent on portfolio use in mathematics, and research on their identification and extent could be valuable. One interesting result from this study was that Involvement was the only construct that was consistently associated with improvement in the constructs Enjoyment and Importance of mathematics (refer Table 4.20). It would be interesting to explore the communication aspects of Involvement in greater detail, and also the factors which contributed to the dissociation of mathematical success with the Enjoyment construct.

Finally, there seems to be a need for the development of an appropriate research instrument that is specific to portfolio use. Some of the constructs that it might support include self-management skills, enhanced communication skills, and metacognitive strategies as mathematical learning is made and represented in the context of a portfolio. It could also determine the contributions to the learning enterprise of inter-personal relationships with other students and with the teacher.

Personal Response

A great deal of a teacher's work does not occur in front of a class. Myford (1999, p. 9) cites several studies that suggest "the typical teacher spends between a third and half of his or her time engaged in assessment-related activities". She goes on to quote from a 1999 survey of teacher licensing standards in the United States that "only 25 of the 50 states require teachers to meet a set of competencies related to assessment, or, at the very least, to complete coursework in assessment as part of their teacher preparation program (Stiggins, 1999)" (Myford, 1999, p. 9). Training in assessment

seems, in my experience, to also be a neglected area of teacher preparation in Australia and New Zealand.

In 1998, as I commuted to work I played tapes of the interviews I had conducted with the students of this study. I felt that I must be the only teacher in the world doing such a thing! The taped interviews made me very conscious of how my students perceived their experience at school. At a very impressionable age, the students were finely attuned to any role model messages. They wanted to know if mathematics was for them, which meant they wanted to know how intelligent they were. They cast up signals that awaited confirmation, either by producing outstanding work or by producing work plainly inferior to their ability. I do not think that examination marks alone can provide the ongoing personal encouragement they sought. Interaction with teachers, as portfolios were formulated and constructed, was much more convincing for them. Portfolios gave an opportunity for teachers to engage more closely with their students, and to deliver the personal communication that was needed. This is what Duschl and Gitomer (1991) meant by the *negotiation of meaning* over an extended timeframe.

I enjoyed doing this research. It resulted in a huge amount of professional development within the Mathematics Department. It prompted me to read very widely in mathematics education, to attend many interesting academic presentations, and to present papers myself. It introduced me to many of the innovators in mathematics education, and gave me a better appreciation of the work of my teaching colleagues. Mirroring the development we sought in the students, the teachers worked together well on portfolios and came to know and appreciate each other's strengths. As we urged the students to extend themselves and to develop creative approaches, we found ourselves doing exactly these things. For us, portfolios stimulated an appetite for intellectual adventure, striving for quality, and need for self-reflection, just as they did in the students. I am grateful to my colleagues for their cooperation over many years, and for their helpful and candid communication of ideas.

Progress in educational practice is difficult to implement and can be evanescent, especially on the departure of those who initiate changes. Hargreaves and Fink

(2003) discuss components of the educational leadership that promotes sustainability in educational change. These components include a focus on learning, and a culture of distributed leadership. The portfolio programme of this study was not *maintained* as if perfect and inviolate, but I believe that its objectives were *sustained* in the sense intended by Hargreaves and Fink.

There can be a disjunction between academic research on education, and classroom practice. It falls to classroom teachers to bridge this gap by creating professional learning communities that promote research and sustain worthwhile initiatives.

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APPENDICES

Appendix A

Incorporating the Processes Strand in the Year 9 and Year 10 Schemes

What is the Processes strand?

"classroom activities which give students the opportunity to question, invent, explain, experiment, discuss, and speculate..." (p. 5 of Implementing Mathematical Processes booklet, 1995).

The use of calculators, computers and "other equipment" is a specified requirement.

Students should be working both cooperatively and individually. Teachers should be "listening to students talking about their learning" (*ibid.*, p. 7).

What's it got to do with the scheme?

If it's not in the scheme we don't do it.

The present schemes make no mention of Processes Strand activities in the Outlines, but include some references in the body of the scheme notes. For example, Form 3 Algebra 1 includes "Problem solving technique 3 - find a pattern", and Form 4 Statistics 1 includes "Predict the outcome of a simple probability experiment, test it, and explain the results".

The scheme is also the base on which we plan assessments.

Do we have to assess Processes strand events?

I think so, otherwise they are just time-fillers. And the assessments should be part of the reports.

What do other schools do?

I don't know. Maybe the NZAMT Conference would be a good place to find out.

What is the least we can get away with?

1. **Computer use** should occupy a few periods each year. We can cycle students past the single computers in classrooms, maybe nick extra computers from other rooms and have half-a-dozen students on machines at the same time. Fairly hard to sustain. I'd prefer timetabled access to the computer rooms, maybe with:

5+ periods of Logo for Year 9

5+ periods of Spreadsheets for Year 10

2. We now have **calculators** to be in use from Day 1. The consequences are that we need to develop worksheets where the inputs and the answers are not always whole numbers. And we need to bring the organisers of calculator-banned competitions such as Aussie Maths and Cantamaths into line.

Graphics calculators already seem well-used, especially for Sixth Form Certificate. But juniors could benefit too, especially for graphing. It is possible to have just one graphics calculator (and manual) in the classroom: an interesting prize for fast-finishers which leads to having a few expert helpers when you use the class set. Three fourth formers have bought their own Sharp graphics calculators already this year. We need a policy of regularly turning over our class sets rather than being saddled with ancient models. The latest models have colour screens: let's buy 30.

3. **Activities.** Form 3 Measurement 1 already requires "carry out practical measuring tasks". The Curriculum nominates (p. 71) use of "lasers, decibel meters, and so on". God knows, we lose enough metre rulers already. We could work with the Science Department to set up a meteorological station, build a variety of sundials, have field trips to a service station to see car servicing equipment... Suddenly the option of spending money on better measuring devices for the Resource Room looks attractive. We could accumulate a pile of inefficiently-packaged groceries for students to do measurements and calculations on (idea by Rachel: see Jan 91 Consumer magazine for details, eg. Cyclax moisturiser). What equipment do we actually want all students to use?

4. Cantamaths has traditionally been a big outlet for **creative student work**. Are we going to affirm the policy of "every Year 9/10 student does a Cantamaths project"?

5. The Library is worth a visit for: all manner of statistical data, a considerable section of good recreational maths books and booklets, Intranet and other computer goodies. (It also contains three relatively unused laptops which can be borrowed for classroom use. The Apple laptop is loaded with the Pythagoras/Trig stack.).

I personally was disappointed with one aspect of the Science Fair entries: they seemed to lack any literature search. It's often the same with our statistics projects. A **Research Skills** unit should be part of any course which encourages independent project work. It could include a requirement to examine our Intranet or the Internet.

6. "**Meaningful contexts**" is well exemplified by putting compass work (bearings, map reading) in the setting of the Third Form camp. We should keep up a good liaison with the organisers to ensure that Maths objectives are being met. It probably needs some sort of assessment once the students are back at school: perhaps a map-reading tour of the school, using the same compasses as on camp. (George knows lots about orienteering...). What other meaningful contexts, if any, should be specified?

7. **Group work.** Can be on projects, investigations, competitions, constructing things... We not only have to implement this, but have to assess students' abilities to work together. Does anyone know how to do this?

What a list! Is anything left off?

1. Portfolios, class presentations, debates, "casinos", team games... are used by some teachers. We each of us have to do something to satisfy the "range of learning styles" requirement (p. 7 of the Processes booklet) whilst retaining some grip on our sanity. I don't think it is worth specifying this sort of thing in the scheme. Like the seating arrangements, it seems personal to the teacher. Do you agree?
2. Problem solving. This is not just for the bright classes. At the moment various strategies are scattered throughout the scheme. This does not work for me. I personally favour doing a concentrated unit of problem solving where the range of approaches are shown to students, in order to widen their horizons. A few good homework sheets and short tests using a variety of strategies would be valuable. Then refer to the notes and posters about this as we use the strategies throughout the year. I do not detect wide support for this. Am I correct? We have to do something, so what is it to be?

And how do we make it happen?

Assessment must cover the Processes parts of the scheme. For example, "every Year 9 student must hand in a printout of a pattern produced using repeated instructions in Logo, and a grade for Logo use will appear on the Year 9 report".

We had a "Maths Task" as well as a "Maths Test" for year 9 and 10 earlier this year. But the results of the Task didn't go anywhere. Pencil-and-paper tasks are not the best system anyway.

I think that most of the tests cluttering the Resource Room don't fully assess the students' understanding. I would like to see more questions where the words used are "explain...", "clearly show...", and "why does..." (just like in School Cert). Concept Maps get to a deeper level, as do essays. This involves lots of work.

Paul Brown, 1 September 97

Appendix B

Lincoln High School, Year 9

Name:

MATHEMATICAL PORTFOLIO

1. A mathematical **autobiography**: experiences, teachers, books, experiments and activities which have shaped your mathematical progress. Give examples, such as explaining how to play the card game your Aunt taught you. You may include excellent projects or bookwork from earlier years.

Due: 26 March

2. A printout of your own **Logo design**, created using the Logo computer language.

Due: 30 July

3. A collection of **found shapes** which have an interesting mathematical feature, with written commentary. Examples include:

- symmetrical company logos,
- spider webs (sketched or photographed),
- seashells.

Due: 18 June

4. A piece of **formal writing** which communicates mathematics. Examples: a newspaper report on the mathematics used in their work by people you interview, a consumer test of a product, a letter to the local Council about new ways of arranging car parking.

Due: 18 June

5. Show that you can do **Library research** by taking a mathematical topic (such as pi, navigation, pyramids...), and writing a page about it, giving at least two references. You must search an electronic library catalogue, and can use CD-ROM, Intranet and other sources of information.

Due: 10 Sept

6. Give a talk in class about a mathematical topic, book, problem or news item. You must use written notes for this **class presentation**, and the notes go into your Portfolio.

Due: 10 Sept

7. One mathematical **investigation**: from the supplied starting point a discovery of patterns and rules which has been extended, analyzed and generalised as far as possible. Only your best one may be placed in your Portfolio.

Examples of investigations:

- a microwave has buttons for increasing by 1 minute, 5 minutes and 10 minutes. How many different times can be set by pushing three buttons?
- when you build a shape using Lego blocks, what pattern does the number of corners, edges and faces make?
- digital clocks display digits made up from seven bars of light. Which bars get the most use?

Due: 10 Sept

Your teacher is available to help you to build up your Portfolio.

Your Portfolio is your property and will be returned to you at the end of the year. Any Certificates obtained in mathematical competitions throughout the year, or issued in recognition of excellent mathematical work in class, may be included with your Portfolio.

Portfolios are assessed work. At the end of the year you will be asked to complete a self-assessment of your Portfolio. A grade for your Portfolio will appear on your final report, and this gives you 20% of your final mark.

Year 10 (“Form 4”)

Mathematics Portfolio

The work in your portfolio is expected to be your best work.

Interview

You are to interview an adult and write about the mathematics that they use in their home, recreational or work life. You should show a plan of their approach including the person they are interviewing and the types of questions they are asking. The report should include **documents** illustrating the use of mathematics.

Due: 20 March

Value for Money Investigation

Are you getting value for money. Choose an item or a family of items and decide in some way what is the best value. You may compare for example: coffee prices, stereos, takeaways, pizzas, washing machines.... You must decide how you will quantify the value of the item and make recommendations to a potential buyer.

Due: 6 April

Geometrical Investigation

You are to complete an investigation with a geometrical theme. This may take the form of a report or 2D or 3D constructions and writing to explain your investigation. Some examples include:

- Design a park in a prescribed area. Detail your decision process in arriving at your design.
- Design packaging for an object. Describe the process in arriving at your finished product.
- Write a computer program for visualizing four-dimensional space. Explain your calculations.
- Make stick models of the regular four dimensional solids. Describe them.
- Sew topological surfaces and maps.
- Design and make a sundial.
- Calendars: Perpetual, lunar, eclipse.....

Due: 29 June

Statistical Display on Spreadsheet

Propose a question and collect appropriate data to answer your question. Be careful in doing surveys across other classes and groups as they are not always appreciated. Calculate statistics and display information in appropriate forms using the spreadsheet. Make conclusions about your data. Brainstorm questions and ask your teacher for advice on the choice of question before launching into the collection of data.

Due: 3 July

Cantamath Item

You are expected to produce an item that would be suitable for entry into Cantamath 98. Your teacher will give you more information nearer the time.

Due: 6 August

News Research

Students are to select a news item from the newspaper dated during the week Monday 17 August to Sunday 23 August that involves the use of mathematics. The mathematics involved should be discussed and the description of mathematics extended in some way. **Eg Staff lay-offs hit Hanmer drug centre:** What are the costs of employing staff? What is the average wage? How many people are employed in the health sector? **New Zealand top 20 Singles:** How are the pop charts created? **Building to be demolished:** What volume of concrete is in a building? How many trailer loads of concrete is this? **Eight Years Jail for Car Smash:** How many hours, days minutes is this. How are our prisons populated?

Due: 11 September

Best investigation

As part of your mathematics course you will do a number of investigations. Choose the one you consider the best of these to include in your portfolio.

Due: 11 November

Appendix C

FORM 3 MATHEMATICS ASSESSMENT 1998

This is how the Year 9 report marks will be calculated.

<u>Set Tasks</u>			<u>Portfolio</u>
Term 1	Due	%	
* Investigation	19 Mar	5	* Autobiography
* Common test	6 Apl	5	* Own Logo design
Term 2			
* Levels test	29 June	5	* Shapes collection
* Logo task	30 July	5	* Formal writing
Term 3			
* Cantamath item	6 Aug	5	* Library research
* Levels test	4 Sept	5	* Classpresentation
* Statistics project	21 Sept	5	* Best investigation
Term 4			
* Examination	mid Nov	45	
* Portfolio		20	

Portfolio grades:

Complete & excellent	20%
Complete & good standard	15%
Some satisfactory work	5%
Poor work	nil

Form 4 Mathematics Assessment 1998

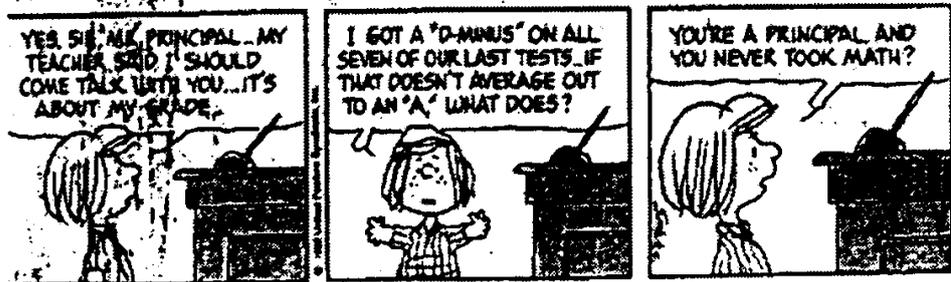
This is how the Year 10 report marks will be calculated.

Set Tasks			Portfolio	
	Due	%		Due Date
Term 1				
• Investigation	20 Mar	5	Interview	20 Mar
• Common Test	6 Apr	5	Value for Money investigation	6 April
Term 2				
• Levels Test	29 June	5	Geometrical Investigation/Display	29 June
• Spreadsheet Task	3 July	5	Statistical Display on Spreadsheet	3 Jul
Term 3				
• Levels Test	4 Sept	5	Cantamath item	6 Aug
• Geometry Task	21 Sept	5	News Research	11 Sept
Term 4				
• Examination	mid Nov	50	Best Investigation	11 Nov
• Portfolio		20		

Portfolio grades:

Complete and excellent	20%
Complete and good standard	15%
Some satisfactory work	5%
Poor work	nil

PEANUTS By Charles M. Schulz



Appendix D

THE MATHEMATICS SURVEY

Your code number:

Don't write your name on this. This survey is to find out how the class feels about mathematics.

Please circle one number for each statement.

	strongly agree				strongly disagree
A. I avoid doing mathematics whenever possible. Enjoyment	1	2	3	4	5
B. Mathematics is boring. Enjoyment	1	2	3	4	5
C. I plan to take as much mathematics as I can during my education. Desire to Improve Mathematical Skills - Reversal	1	2	3	4	5
D. I have seldom liked studying mathematics. Enjoyment	1	2	3	4	5
E. I want to study mathematics more. Desire to Improve Mathematical Skills - Reversal	1	2	3	4	5
F. I am willing to spend some of my free time studying mathematics. Desire to Improve Mathematical Skills - Reversal	1	2	3	4	5
G. I look forward to mathematics lessons. Enjoyment - Reversal	1	2	3	4	5
H. I cannot see much value in mathematics. Importance	1	2	3	4	5
I. I want to develop my mathematical skills more. Desire to Improve Mathematical Skills - Reversal	1	2	3	4	5
J. Very often I feel like skipping mathematics lessons. Enjoyment	1	2	3	4	5
K. I hate doing mathematics at home. Enjoyment	1	2	3	4	5
L. The thought of having to go to the next mathematics lesson frightens me. Stress	1	2	3	4	5
M. I do not understand why some students think that mathematics is a subject of enjoyment. Enjoyment	1	2	3	4	5
N. I enjoy mathematics. Enjoyment - Reversal	1	2	3	4	5
O. Mathematics is very interesting to me. Enjoyment - Reversal	1	2	3	4	5
P. I think about mathematics problems outside school and like to work them out. Enjoyment - Reversal	1	2	3	4	5

please turn over

	strongly agree		strongly disagree		
Q. Mathematics is a necessary subject. Importance - Reversal	1	2	3	4	5
R. I enjoy mathematics lessons more than other lessons. Enjoyment - Reversal	1	2	3	4	5
S. Mathematics is enjoyable and stimulating to me. Enjoyment - Reversal	1	2	3	4	5
T. Doing mathematics is a waste of time. Importance	1	2	3	4	5
U. I do not need to know anything else except four mathematical operations: addition, subtraction, multiplication and division of numbers. Importance	1	2	3	4	5
V. Mathematics makes me nervous or uncomfortable. Stress	1	2	3	4	5
W. I have never liked mathematics. Enjoyment	1	2	3	4	5
X. I would enjoy school if there were no mathematics lessons. Enjoyment	1	2	3	4	5
Y. It scares me to have to take mathematics. Stress	1	2	3	4	5
Z. I am not willing to take more than the required amount of mathematics. Enjoyment	1	2	3	4	5
AA. Doing mathematics problems is boring. Enjoyment	1	2	3	4	5
AB. I find mathematics dull. Enjoyment	1	2	3	4	5
AC. I do not like mathematics. Enjoyment	1	2	3	4	5

You are: male female

Counting Lincoln High School, how many schools have you been at?

Counting yourself, how many children live at your house?

The annotations in bold below each question did not appear on the version of the questionnaire completed by the students.

The annotations in bold indicate the four Mathematics Survey constructs, one of which is associated with each item. A high score in a construct indicates that the student disagrees with those items antithetical to the construct. A reversal in the coding is therefore necessary for those items expressed in a positive way.

THE MATHEMATICS SURVEY: Notes for teachers

It is important that this survey is done correctly!

The questionnaire may look unusual, but it is carefully designed and has been useful in many schools.

I would like to conduct the survey on Wednesday 18 Feb for Form 4, and on Thursday 19 Feb for Form 3. On those days the teachers involved should find sufficient copies of the survey (on coloured paper) in their pigeonholes.

Conducting the Survey

At the beginning of the period ask the students to take out their school diaries and a pen.

"Each of you has to make up your own six digit code number and write it next to your name in your diary. You can use digits from your phone number or date of birth."

"This year you will be doing four surveys. So that sheets filled in by the same person can be put together, you have to use that same six-digit code number each time. Because no-one but you will know your six-digit code number, your identity will be private. Are there any questions?"

Give out the questionnaires.

"Write your six digit code number in the boxes on the sheet."

"Don't write your name on the sheet. This survey is to find out how the class feels about mathematics. Please circle one number for each statement."

If your students are not good readers you may need to read the statements aloud to the class. Try to do this in a neutral fashion!

Walk around the classroom to ensure that code numbers have been entered, that students complete the questionnaire independently, and that one number is circled for every statement.

You may need to set work for the fast finishers to get on with.

Please retain questionnaires for any absent students. When you have them all, please put the completed questionnaires, in the labelled plastic bag, in my pigeonhole.

Thank you. Paul Brown

What is happening in this class?

Personal Form

Directions

This questionnaire contains statements about practices which could take place in this class. You will be asked how often each practice takes place.

There are no 'right' or 'wrong' answers. Your opinion is what is wanted.

Think about how well each statement describes what this class is like for you.

Draw a circle around

1	if the practice takes place	Almost Never
2	if the practice takes place	Seldom
3	if the practice takes place	Sometimes
4	if the practice takes place	Often
5	if the practice takes place	Almost Always

Be sure to give an answer for all questions. If you change your mind about an answer, just cross it out and circle another.

Some statements in this questionnaire are fairly similar to other statements. Don't worry about this. Simply give your opinion about all statements.

Practice Example

Suppose that you were given the statement: "I choose my partners for group discussion." You would need to decide whether you think you choose your partners 'Almost Never', 'Seldom', 'Sometimes', 'Often' or 'Almost Always'. For example, if you selected 'Often', you would circle the number 4 on your questionnaire.

Don't write your name on this survey form. Instead, use the code number you made up for the last maths survey and recorded in your Student Diary. If you have not got that code number today then make up a new code number. Don't use "123456". Use six numbers taken from your phone number and street address. Record your code number in your Student Diary for use again next term!

Your code number:

Did you have to make up a new code number? Yes No

To help match this up with the survey you did last term, please answer these questions the same way you did last term.

You are: male female

Counting [the school], how many schools have you been at?

Counting yourself, how many children live at your house?

SC		Almost Never	Seldom	Some- times	Often	Almost Always
1.	I make friendships among students in this class.	1	2	3	4	5
2.	I know other students in this class.	1	2	3	4	5
3.	I do favours for members of this class.	1	2	3	4	5
4.	Members of the class are my friends.	1	2	3	4	5
5.	Students help me with my homework.	1	2	3	4	5
6.	Students help me in this class.	1	2	3	4	5
7.	I work well with other class members.	1	2	3	4	5
8.	I help other class members who are having trouble with their work.	1	2	3	4	5
9.	Students in this class like me.	1	2	3	4	5
10.	In this class, I am able to depend on other students for help.	1	2	3	4	5
IS		Almost Never	Seldom	Some- times	Often	Almost Always
11.	The teacher takes a personal interest in me.	1	2	3	4	5
12.	The teacher goes out of his/her way to help me.	1	2	3	4	5
13.	The teacher considers my feelings.	1	2	3	4	5
14.	The teacher helps me when I have trouble with the work.	1	2	3	4	5
15.	The teacher talks with me.	1	2	3	4	5
16.	The teacher is interested in my problems.	1	2	3	4	5
17.	The teacher moves about the class to talk with me.	1	2	3	4	5
18.	It is alright for me to tell the teacher that I do not understand.	1	2	3	4	5
19.	The teacher's questions help me to understand.	1	2	3	4	5
20.	It is alright with the teacher if I am slower than other students in the class.	1	2	3	4	5
IN		Almost Never	Seldom	Some- times	Often	Almost Always
21.	I discuss ideas in class.	1	2	3	4	5
22.	I give my opinions during class discussions.	1	2	3	4	5
23.	The teacher asks me questions.	1	2	3	4	5
24.	My ideas and suggestions are used during classroom discussions.	1	2	3	4	5
25.	I ask the teacher questions.	1	2	3	4	5
26.	I explain my ideas to other students.	1	2	3	4	5
27.	Students discuss with me how to go about solving problems.	1	2	3	4	5
28.	When starting a new topic, I discuss what I already know about it.	1	2	3	4	5
29.	I am asked to explain how I solve problems.	1	2	3	4	5
30.	I discuss different answers to questions.	1	2	3	4	5

AI		Almost Never	Seldom	Some- times	Often	Almost Always
31.	I have a say in how my class time is used.	1	2	3	4	5
32.	I have a say in deciding what activities I do.	1	2	3	4	5
33.	I have a say in deciding how my learning is assessed.	1	2	3	4	5
34.	I am told how to do my work.	1	2	3	4	5
35.	The teacher decides when I am to be tested.	1	2	3	4	5
36.	The teacher decides how much movement and talk I am allowed.	1	2	3	4	5
37.	The teacher decides when I move on to a new topic.	1	2	3	4	5
38.	I am given a choice of topics for assignments.	1	2	3	4	5
39.	I am given a choice in which investigations I do.	1	2	3	4	5
40.	I work at my own pace.	1	2	3	4	5
IV		Almost Never	Seldom	Some- times	Often	Almost Always
41.	I draw conclusions from investigations.	1	2	3	4	5
42.	I carry out investigations to test my ideas.	1	2	3	4	5
43.	I am asked to think about the evidence for statements.	1	2	3	4	5
44.	I carry out investigations to answer questions coming from discussions.	1	2	3	4	5
45.	I explain the meaning of statements, diagrams and graphs.	1	2	3	4	5
46.	I carry out investigations to answer questions which puzzle me.	1	2	3	4	5
47.	I carry out investigations to answer the teacher's questions.	1	2	3	4	5
48.	I solve problems by obtaining information from the library.	1	2	3	4	5
49.	I find out answers to questions by doing investigations.	1	2	3	4	5
50.	I solve problems by using information obtained from my own investigations.	1	2	3	4	5
TO		Almost Never	Seldom	Some- times	Often	Almost Always
51.	I know what has to be done in this class.	1	2	3	4	5
52.	Getting a certain amount of work done is important to me.	1	2	3	4	5
53.	Class assignments are clear so I know what to do.	1	2	3	4	5
54.	I do as much as I set out to do.	1	2	3	4	5
55.	I know the goals for this class.	1	2	3	4	5
56.	I am ready to start this class on time.	1	2	3	4	5
57.	I know what I am trying to accomplish in this class.	1	2	3	4	5
58.	I pay attention during this class.	1	2	3	4	5
59.	I try to understand the work in this class.	1	2	3	4	5
60.	I know how much work I have to do.	1	2	3	4	5

CO		Almost Never	Seldom	Some- times	Often	Almost Always
61.	I cooperate with other students when doing assignment work.	1	2	3	4	5
62.	I share my books and resources with other students when doing assignments.	1	2	3	4	5
63.	When I work in groups in this class, there is teamwork.	1	2	3	4	5
64.	I work with other students on projects in this class.	1	2	3	4	5
65.	I learn from other students in this class.	1	2	3	4	5
66.	I work with other students in this class.	1	2	3	4	5
67.	I cooperate with other students on class activities.	1	2	3	4	5
68.	Students work with me to achieve class goals.	1	2	3	4	5
69.	I work in groups in this class.	1	2	3	4	5
70.	During group work, I do my share of the work.	1	2	3	4	5
E		Almost Never	Seldom	Some- times	Often	Almost Always
71.	The teacher gives as much attention to my questions as to other students' questions.	1	2	3	4	5
72.	I get to use the equipment as much as other students.	1	2	3	4	5
73.	I get the same amount of help from the teacher as do other students.	1	2	3	4	5
74.	I have the same amount of say in this class as other students.	1	2	3	4	5
75.	I am treated the same as other students in this class.	1	2	3	4	5
76.	I receive the same encouragement from the teacher as other students do.	1	2	3	4	5
77.	I get the same opportunity to contribute to class discussions as other students.	1	2	3	4	5
78.	I am asked about the same number of questions as other students.	1	2	3	4	5
79.	My work receives as much praise as other students' work.	1	2	3	4	5
80.	I get the same opportunity to answer questions as other students.	1	2	3	4	5

Appendix E

This questionnaire was printed on school letterhead paper.

Dear Parents/Caregivers,

This survey has been sent to the parents/caregivers of forty randomly-selected students. Please post it back to me in the enclosed envelope, by Friday 20th November if possible. **No stamp is needed.** Your reply will help us to shape the future of the assessment system used in mathematics. The strictest confidentiality will apply and nothing from this survey will influence the marks of your son/daughter.

Paul Brown
Assistant Head of Department, Mathematics

Please circle one number for each of these questions. 1 = Nothing, 5 = Lots
(For any comment you wish to make, please use the small space or the back of this sheet.)

How much are you aware of what your son/daughter is studying at school? 1 2 3 4 5

Comments:

How much involvement do you have with your son/daughter's mathematics homework? 1 2 3 4 5

Comments:

How much interest does your son/daughter take in their mathematics homework? 1 2 3 4 5

Comments:

How would you describe your son/daughter's attitude to mathematics this year?

If attitude to mathematics has changed this year, what do you think caused the change?

Please turn over

If you have had any particularly interesting discussions or experiences with the mathematics homework of your son/daughter this year please outline them here:

Please give your views on how the school has handled the assessment and reporting of your son/daughter's progress in mathematics this year.

Thank you for completing this survey.

Appendix F

PORTFOLIO INTERVIEWS - interviewer's guidelines.

Cycle 1, May 1998

Attendance is voluntary. Can leave at any time. Anonymity will be preserved. What is said will not affect grades, reports. A small reward will be given for participation.

1. What do you know about portfolios?
2. How have you been informed? Any reminders?
3. What portfolio work have you done so far? Tell me about it. Was it hard to do?
4. What help have you had with portfolios? Did the school supply everything that you needed?
5. Are you working on a portfolio task at the moment? How is it going? Were you allowed time in class to do it? How was it graded? Were you allowed to revise it? Were you allowed to alter the task at all? What do you think of the portfolio tasks? Why? Did you think the marking was fair, was helpful? Did you have enough time to do them? Are you looking forward to doing any of the other tasks? Why?
6. Has your portfolio work affected how you feel about mathematics? Has it changed how you feel about your ability to do mathematics? Has it changed how you do mathematics, eg. how much you use the textbook?
7. What do your **class** think about portfolios? Is it different to other homework? Did students work together? Has it changed how things happen in class? How? Is it stressful? What is the worst thing about portfolios? How do students feel about the amount of writing involved?
8. What are the things you like and don't like about maths assessment? Reports? Parents Evenings? Homework? Tests? Projects? How does assessment in maths compare with assessment in other subjects?
9. What are the details about how your class does portfolios? Where are they stored? Does the teacher favour portfolios that are computer-printed? Can you use things from Encarta or from other students? What happens to the students who don't do things on time, or who don't do much work on their portfolio?
10. Is there anything else you would like to tell me?

There will be another interview together later in the year.

PORTFOLIO INTERVIEWS - interviewer's guidelines.

Cycle 2, June 98 and August 98

1. How do you get ideas/plan/write up...
2. Questions from Fitzgerald and Vermont studies.
3. Comparison with other subjects.
4. Is there a mathematical way of looking at things? What is it? Give examples?
5. What do you think of this exemplar (frogs exercise from GCSE book)?
6. How much work went into your Cantamath project?

Appendix G

TRANSCRIPT: INTERVIEW WITH 3A Friday 22 May 1998

(Short introduction about the protocol of the interview; that the students have been randomly selected, may leave, etc)

WHAT DO YOU KNOW ABOUT PORTFOLIOS?

They have all sorts of questions to do with Maths that we're doing and every now and then the teacher asks us to do another question and the whole thing is put into a folder and then ... he marks it.

HAVE YOU GOT STUFF IN A FOLDER SOMEWHERE NOW?

Yup

WHAT SORT OF THINGS ARE IN YOUR FOLDER?

We had to write a story about us and things that related to us and about our maths history and stuff like that and

IS EVERYBODY ELSE THINKING "YEAH, ME TOO, I'VE DONE THAT TOO"?

Yeah

YOU ALL ARE. OK. KEEP GOING. IS THAT THE ONLY ONE YOU'VE DONE SO FAR OR HAVE YOU DONE ANYTHING ELSE?

Oh, We've just been given another one to do.

OTHER PEOPLE: ABOUT PORTFOLIOS?

I think we were given another sheet or something ... but I don't know if it's the portfolio or not.

THAT WAS THE SHEET OF THINGS THAT YOU HAVE TO DO ON IT?

No, ... it wasn't a portfolio.

WHEN YOU SAY IT'S IN YOUR PORTFOLIO, WHAT'S YOUR PORTFOLIO?
IS THERE SOME SORT OF BAG THAT YOU KEEP IT ALL IN?

Ah, at the moment ... We're supposed to have a manila folder.

I SEE, SO HE'S ASKED YOU TO GO AND BUY MANILA FOLDERS TO PUT THINGS IN YOUR PORTFOLIOS?

Mmm You've just, like, given us what we've got to do ... sheet ... and the folder is to

... we've got to do I think it was ... Some written work ... but, um, you gave us a sheet we need to do by the end of the year.

AND YOU'VE DONE YOUR WORK UP TO DATE WHICH IS SO FAR THE AUTOBIOGRAPHY ONE?

I didn't do logo design

HAVE ANY OF YOU DONE THE LOGO DESIGN?

Yeah

Yeah, that's what I did.

It wasn't a computer one but ... We did a sort of patterns. ...

WAS IT DONE ON COMPUTER?

No

[Named teacher] said he was going to give us time in the computer room like and books and time but now he's saying that we have to get on and do it by ourselves so I'm not sure what's happening...

THERE IS A PROBLEM GETTING EVERYONE INTO THE COMPUTER ROOM

Yeah, That's what he said.

I was planning to... Logo design on the computers in the computer room...

GOOD, OK, SO, AS FAR AS YOU'VE BEEN TOLD ABOUT PORTFOLIOS THEN A NUMBER OF YOU ARE MENTIONING THE SHEET AND I THINK ITS THE SAME SHEET AND IT SAYS, LIKE, MATHEMATICAL PORTFOLIOS ON THE TOP, SOMETHING LIKE THAT, AND YOU HAVE TO COMPLETE THE SHEET AND IT'S GOT DATES AND ITS GOT ABOUT SEVEN THINGS...

Yeah

Oh, Our dates weren't filled out, Oh they were, but we had to change them because they were set for Saturdays

ALSO THE COMPUTER ONE GOT SET RIGHT BACK

Yeah 'til the 18th or something 18 June.

TELL ME WHAT HELP YOU HAVE WITH PORTFOLIOS NOW AND WHAT SORT OF THINGS YOU WERE GIVEN SO YOU COULD WORK ON THE PORTFOLIOS AND ANYTHING LIKE THAT

You're just given the sheet and just told what to do.....its up to you.

DO YOU GET MUCH HELP AT HOME ON IT? I GET THE IMPRESSION IN OUR CLASS THAT SOME OF THE STUDENTS HAVE BEEN GATHERING INFORMATION AT SCHOOL AND THEY GO HOME AND PROCESS IT AND SHOW THE PARENTS AND ARE HEAVILY INVOLVED AT HOME.

It just really depends, like if I don't understand I tell Mum or my sister to help me yeah. ... I try to work it out for myself.

DO YOU TRY TO BE QUITE INDEPENDENT AND DO IT ON YOUR OWN?

Yeah I do. My sister, she... and then my sister if she thinks she's any better so help me.

DO YOU FIND IT REALLY HARD , PORTFOLIOS?

Yeah um it's not too bad though if you've got the time to do it

DO YOUR PARENTS HELP AS WELL AS YOUR SISTER?

Yeah

WHAT ABOUT OTHER PEOPLE HERE? HELP ON PORTFOLIO THINGS...

All we've done so far is the biography so I didn't need any help with that really. Write what you've done in maths and just talk.

DID ANYONE PROOF-READ THAT? YOU WROTE IT. WAS THE NEXT PERSON TO READ IT THE TEACHER OR DID ANYONE ELSE READ IT BETWEEN?

My Mum and Dad read mine after I'd written it and just told me a few things to fix up

... just asked my parents...

Yeah

Sat down at the table and sort of helped me ...

DID YOU REMEMBER?

Yeah after a while after they'd just like told me what I'd done

HOW'D YOU FIND THAT?

Um, well we had to write quite a lot, something like two pages or something. I was like trying, I couldn't remember much to fill two pages, it was quite hard, I was trying to remember enough to fill two pages.

We weren't set a certain amount but we were just told, just a sensible amount of writing and show some examples of certificates and bits and pieces from different classes.

WAS THAT A GOOD APPROACH FOR THE TEACHER?

I wrote about two pages anyway. Yeah.

DID YOU FIND IT HARD TO FILL OUT TWO PAGES?

No, well Dad's helped me heaps and actually I've been through a tutor when I was at Primary school, it was a thing called Numberworks, and you had to, it was on computers and that really helped me a lot so I wrote heaps about that.

DID ANYONE FIND IT RATHER HARD?

Z did. Yes, I just couldn't get one page: I had no record of what I had done and my parents couldn't think of anything to help me, so I had to do it by myself.

SO FOR YOU IT WAS A FAIRLY FRUSTRATING...

Yes, He said if we couldn't fill up the space we could just write like a card game we'd been told or something because I just couldn't think of anything how I was told or taught or anything....

WHAT HAPPENED? YOU WROTE SOMETHING PRESUMABLY...

I just sort of remembered. I remembered one competition but didn't have much to do with maths but they talked about space ... and a game or something.

I wrote a lot about the past teachers as well, all the different teachers what I liked about them and what I didn't like.

YOU'VE DONE THE SAME THERE P. DID YOU FIND IT INTERESTING TO DO IT?

Oh, yeah, Oh, (laughs).

YES AND NO. DID YOUR PARENTS GET INVOLVED?

Yes. I got work and I was on....I didn't keep any record of my past.

DID IT MAKE YOU THINK?

Yeah it did, I got my parents to tell me a lot because they remember all the things that I've done.

WHEN YOU WERE COUNTING TOES, AND THINGS LIKE THAT

Yeah (laughs)

RIGHT, OK. MOVING ON. THE PORTFOLIOS THAT YOU'RE DOING RIGHT NOW. THESE ARE THE THINGS I WANT TO ASK ABOUT. HOW'S IT GOING TO BE GRADED? I'M INTERESTED TO KNOW.

20% of our maths.....

HAVE YOU GUYS BEEN TOLD THAT?

Yeah, Yeah [named teacher] says quite a big percentage something like 20% of the end mark.

AND HOWS THAT GOING TO WORK EXACTLY?

I think its just 80% for our tests and then add on 5 or 10 whatever we get for portfolios.

DO YOU KNOW WHAT THE 5 OR 10 ARE?

I think he just marks it overall or something because on the back of the sheet it says 5% of average...

I think the sheet. We've got 2 sheets One sheet tells like how much each thing like the portfolio thing I'm not sure we did but I think it said like it would be graded ... how many % of it would be altogether over, um, the portfolio. I think that's what it said but I'm not quite sure.

We never got that sheet, like we just got a sheet saying what we had to do on it. Which ...

We got two sheets. One of them says what we've got to get done and when it's by and the other sheet tells us what we've got to do for each part of our portfolio.

I WROTE THESE. I THINK ONE OF THEM GIVES THE TEST DATES AND HOW MUCH THE TEST CONTRIBUTES TOWARDS FINAL MARK

Yeah, thats what it is.

OK SAY THE AUTOBIOGRAPHY, OR WHATEVER YOU'RE DOING ON THE PORTFOLIO AT THE MOMENT: IS IT REALLY CLEAR HOW ITS GOING TO BE MARKED, OUT OF 40 OR YOU'RE GOING TO GET AN "A" OR A "B" OR WHATEVER ELSE, AND I MEAN WAS YOUR AUTOBIOGRAPHY MARKED, DID YOU GET IT BACK?

Yeah, We just got ours back today.

OH, RIGHT, AND HOW WERE THEY MARKED? HOW DID PEOPLE FEEL ABOUT THE MARKS? DID YOU UNDERSTAND?

Yeah, [named teacher] wrote about a 10 line comment about mine. Told us, told me what I didn't do right...

WHAT GRADE DID YOU GET?

B⁺

WERE YOU PLEASED WITH THAT GRADE?

Ah, yeah, I think I probably could have, like, made it a bit, like, better presented. I just kind of put certificates, I had a clear folder thing I just put my certificates in. I probably could have put some borders round them or something like that.

Well, we didn't get any marks like B, B⁺, ... we got "credit" ...

STAMPED ON

WOULD YOU RATHER HAVE AN A, B⁺ C⁻ WHATEVER THE SYSTEM IS, SO YOU KNOW MORE WHERE YOU ARE?

I don't really mind it doesn't really matter to me. I know that credit is quite good, not bad, so, like if I got, really like low, I'd be quite disappointed and want to re-write it and know that I'd done well.

I would rather have, um, Cs and A because if they just put good or very good it's hard to keep track of what you've actually done, but if they put A or A⁺ then you know you've done great, and if they put D and a bit of a comment afterwards to tell you what you've done wrong that's good.

HOW DO YOU RESPOND TO THAT?

... I'm not sure about different classes. Some of the teachers do that and some don't, it's just....

Our teacher marks. He has an E for excellent as the highest, then A average then ...below that.

DID ANY OF THE TEACHERS SAY "AND IF YOU DON'T LIKE THIS GRADE YOU CAN DO A BIT MORE WORK ON IT AND GIVE IT BACK IN AND GET A BETTER GRADE" OR ANYTHING LIKE THAT?

Most do.

A few of us like don't agree with the mark

SO WHAT DO YOU DO THEN?

I can't believe You know they realise that they've either done not enough or the mark's quite fair...

WHAT ABOUT IF THEY GAVE YOU A PERCENTAGE? WOULD YOU PREFER TO HAVE A PERCENTAGE?

Yeah ... It would be good sometimes so that you know where you were like B⁺ isn't exactly the same ... so you'd sort of know like where you were ... Some people really know that they've done well...

YOU THINK IT WOULD BE A NICE THING TO HAVE A PERCENTAGE BUT YOU REALISE SOME PEOPLE WOULD GET LOW PERCENTAGES AND BE DISAPPOINTED.

...it looks nice if you get an A⁺...

Yeah, you see an A you think "Aw wow, gee I did good" then you see 90% so you can see I could have got higher

OK. RIGHT. WHEN YOU DO PORTFOLIO THINGS ARE YOU SORT OF WARNED ABOUT HOW IT'S GOING TO BE MARKED. LIKE, SAY, YOU GET A B⁺ FOR THE AUTOBIOGRAPHY DID YOU KNOW IN ADVANCE IF I DON'T HAVE A PHOTO OF MYSELF IN THERE I'M NOT GOING TO BE ENTITLED TO HAVE AN A?

Yes.

Yeah. He told us you've got to have at least a page or so and then gave us an idea of what to put in there, ... he didn't really say "if you write 2 pages you will get a full mark".

It's like quality

You told us what you expected but what we could put in there as well ...so we got excellent because we were like the most.....you sort of made that clear, and so everybody worked a bit harder. We knew that you wanted a high mark they knew, 'cause you know that you did well and you don't want to let the teachers down and they don't want to give a bad mark right at the start.

IS IT FAIR THOUGH, BECAUSE IF THE TEACHER SAYS THAT SORT OF THING, LIKE YOU KNOW, LET'S FACE IT, ALL OF YOU ARE "A" STREAM STUDENTS. IF THE TEACHER SAYS LIKE YOU'RE "A" STREAM STUDENTS I EXPECT BRILLIANT STUFF AND THEN YOU GO AWAY AND WORK REALLY REALLY HARD AND MAKE PAGES AND PAGES OF STUFF IS IT SORT OF FAIR. ISN'T IT BETTER GETTING SOME SORT OF LIMIT ON WHAT YOU'RE SUPPOSED TO DO?

Yeah, [named teacher] says he doesn't want pages and pages at all, he just wants something interesting and good quality. He said he liked marking them because they were quite interesting to read.

I was not too sure how much we were supposed to do.

DID YOU NEGOTIATE THAT WITH THE TEACHER?

We weren't too sure just what we needed for a good mark. We just sort of got, if he had said that we write ten pages you'll get A⁺, we just weren't sure what we needed to do but some people had managed only to get theirs done like the day before and didn't have the chance to correct it.

WAS THAT A PROBLEM, NOT BEING ABLE TO CORRECT IT?

Yeah

Yeah. I think we should be told. If we handed it up to him and he'd say 'well, do some more of this you'll get a higher mark'...

WHAT I'M THINKING OF, WITH AN AUTOBIOGRAPHY ITS NOT AS IF YOU CAN IMPROVE YOUR LIFE

Laugh, yeah, if he'd just said well ok you could write better, or make this longer or

JUST THINKING OF SOME OF THE OTHER THINGS IN THE PORTFOLIO, YOU KNOW, SOMETIMES THE TEACHER SHOULD BE SAYING TO YOU SOMETHING, IS THAT WHAT YOU'RE THINKING?

Yeah, he just says the shapes you need, a certain number of shapes or something...

DO YOU RECKON THAT WAS POSSIBLE?

Well I don't know...shapes...

...well you took in some of the papers beforehand and you told us like, what we needed more on and stuff like that so it sort of helped so you'd know oh yeah that's good ...or I shouldn't put that in or something like that...

With [named teacher] I just stayed behind class one day and I just showed him some of my work ... and I said is this allowed or would you like me to write some more, and he just like helped me write to be more descriptive on this part here and stretch it out longer. Like, you can stay behind just for a couple of minutes after the bell goes and he helps you.

IS THIS AN UNUSUAL THING IN MATHS? BECAUSE USUALLY WHEN, IN MATHS ITS NOT LIKE THAT.

...

WHAT'S YOUR RESPONSE? IS IT UNUSUAL IN MATHS TO HAVE THIS SORT OF...

I've never really had to do this, if I know it's for the whole year or something ... I'm just used to saying ok you just have to do this by next Wednesday or something. I'm not used to having something set out that you know is going to count in the end.

HOW DO YOU FEEL ABOUT THE PORTFOLIO WORK? AND HOW DO THE CLASS FEEL ABOUT THE PORTFOLIO WORK? BY THAT, WHAT I MEAN IS, HAS IT CHANGED HOW YOU'RE DOING YOUR MATHS? IS IT CHANGED, YOU KNOW?

...haven't got time to do that as well. Like you've got a certain percent of maths time that you do your homework in and you've also got to have some time to do the portfolios and you know you've got to do it so you know you've sort of got to do that.

WHICH IS YOUR FAVOURITE? DOING ORDINARY MATHS OR NOW DOING PORTFOLIO MATHS

well, I don't know

I think its more interesting

I like ordinary

... extra work.

It would be nice if they set aside some time in class.

Even if it was just a couple of minutes.

HAVE ANY OF YOU HAD TIME IN CLASS ON IT?

No

No

You've given us some time off to study for work on portfolios... an hour, an hour or so, and some of us can just do it, some of us can work really quickly, it's really up to the person though.

OFTEN PORTFOLIOS CAN'T BE DONE IN CLASS REALLY...

We haven't really been told what our next thing for portfolio is yet so we can't really work on it.

WHAT ABOUT THE CLASS ATTITUDE? DO YOU THINK PEOPLE ARE HAPPY DOING PORTFOLIOS OR ARE THEY GENERALLY "IT'S A REAL DRAG"?

I don't think they mind too much, its sort of a change from doing all the number and those things.

It's more homework so it's not going to be too happy about, you know. It's a change, so.

... complain about it ...found it was due in that day

OK. I'VE SORT OF ASKED ALL THE QUESTIONS I WANTED TO ASK. IS THERE ANYTHING ELSE YOU WANT TO TELL ME ABOUT ASSESSMENT IN MATHS OR HOW YOUR CLASS IS GOING OR HOW YOU'RE GOING IN MATHS OR ANYTHING AT ALL ABOUT PORTFOLIOS OR ANYTHING ELSE YOU WANT TO BRING UP?

I WONDER IF ANYONE WOULD LIKE TO CATEGORIZE? YOU KNOW FROM THE FIVE PEOPLE HERE, WHAT DOES IT SOUND LIKE YOUR MATHS IS GOING.

...used to it. Being used to primary school having something different happen each day, but now we know what we've got to do.

...what has to be done, told earlier and have a longer time to do it even though it might take a few weeks, its better than having school stuff where you finish by tomorrow... like, if you've got sport on one night it doesn't matter because you've still a couple of weeks later to do it.

Yeah ...know in advance ... if you don't have to have it done for a few months you can just pick up things that might be useful for it, rather than just finding out a project that's due in next week.

... Yes you ...Oh that would be good for my maths portfolio you know. You can over a period of time you've got these notes ... it's a lot easier

I don't think [named teacher] knows too much about it either. He's going by what it says on the sheet, he doesn't seem to know and he says aw, he actually said I don't know too much about it but just read it I think you do this or I think this should be done.

HOW DID I GO TODAY? NOW I CAME INTO YOUR CLASS ACTUALLY THIS MORNING BECAUSE [NAMED TEACHER] ASKED ME TO COME IN AND HELP.

I don't think he knew much about it, this morning he asked you to come in and explain it.

HOW DID THAT GO? DID THAT ACTUALLY SOLVE THE PROBLEMS THAT PEOPLE WERE HAVING?

It gave us more a wide range of things to think about and to do on it instead of just on the sheet. It said something about like seashells and stuff but I was just going to do it on something like that but when you came in and said you could do something, say the difference between Pepsi and Cocacola, then I thought I could do something on that or something else.

We don't really get a description of what to do. Sometimes he says ... but most of the time he just reads out the question and you know just writes on the board what number to do and its due by, because most of the time all the dates are on the sheet so far he's given us a ...on it.

I think there should be like some one telling us what we can do because they make you think oh I don't know...difference between Pepsi and Coke gives you another idea.

...formal writing

Yeah

Yeah

For the formal writing he just read out the things that said shells etc and I'm thinking "Oh no, where am I going to find..." you know.

You can't think. They ask you is there anything else you want to do it about. The teacher brings up something else you can do and it just gets your mind working. Puts some ideas instead of just sticking to what's on the sheet.

Especially if they can relate it with what's happening or going on nowadays. Like, you know, the difference between Pepsi and Coke one.

I don't have a problem because you're always telling us like what we have to do and stuff so because you wrote it so we know, so I don't really have a problem with creating ideas and stuff because you always help everybody.

THIS IS WHAT I'M THINKING TOO. SEE, OTHER TEACHERS PRESUMABLY ARE LOOKING AT WHAT I WROTE AND THINKING EXACTLY THE SAME AS YOU. JUST BETWEEN US, WHAT I'M THINKING IS I'D REALLY LIKE PEOPLE TO THINK MATHEMATICALLY. YOU GO OUT THERE AND BUY COKE AND DRINK IT, YOU DON'T THINK ABOUT IT BUT IF YOU START THINKING MATHEMATICALLY YOU START THINKING, NOW WHAT PERCENTAGE OF THE POPULATION CAN TELL THE DIFFERENCE, IS THERE A DIFFERENCE....

Yeah

Appendix H

TRANSCRIPT: INTERVIEW WITH 3A Friday 7 August 1998

THIS IS WHAT I WROTE DOWN ABOUT WHAT WE WERE TALKING ABOUT LAST TIME. IT'S THE SAME DEAL TODAY: WHAT YOU SAY IS ALL CONFIDENTIAL AND ALL THAT STUFF. LAST TIME WHAT YOU SAID WAS, WHAT I INTERPRET ANYWAY, YOU ALL SEEMED TO KNOW ABOUT PORTFOLIOS, YOU WERE QUITE WELL BRIEFED AND KNEW WHAT WAS COMING UP. Z SAID HER PARENTS AND SISTER HELPED HER WITH IT AND B SAID HIS DAD HELPED HIM WITH THINGS.

(interruption)

MK, YOU WERE TALKING PARTICULARLY ABOUT HOW YOUR AUTOBIOGRAPHY - YOU WERE TROUBLED ABOUT IDEAS FOR IT AND WHAT TO DO TO GET HELP ON IT, YOUR PARENTS DIDN'T HAVE AN IDEA EITHER ABOUT WHAT TO DO WITH YOUR AUTOBIOGRAPHY, AND P YOU SAID YOUR PARENTS WERE INVOLVED AND MADE YOU THINK, AND THEY COULD REMEMBER THINGS ABOUT YOU DOING MATHS BACK WHEN YOU WERE A YOUNGSTER THAT YOU'D FORGOTTEN ALL ABOUT, LIKE COUNTING YOUR TOES AND THAT SORT OF STUFF. (I'M SORRY, HAVE I GOT YOU GUYS ROUND THE WRONG WAY?)

(interruption)

DO YOU REMEMBER ANY OF THAT BECAUSE IT WAS ABOUT 3 MONTHS AGO NOW THAT WE WERE HERE?

OK, SO QUITE A LOT HAS HAPPENED SINCE THEN. YOU'VE BEEN DOING THIS WEEK ALL YOUR CANTAMATH STUFF HAS BEEN COMING IN. YOU PRESUMABLY HAVE DONE OTHER THINGS WITH YOUR PORTFOLIOS. YOU'VE DONE A COUPLE OF SURVEYS AND I WANT TO TALK ABOUT THOSE AS WELL. WE WERE TALKING ABOUT GRADES. Z HAD SOME STUFF THAT WAS JUST STAMPED "CREDIT" BY HER ROTTEN TEACHER, ME, AND WE WERE TALKING ABOUT HOW YOU PEOPLE PREFERRED REALLY TO HAVE GRADES LIKE A'S AND B'S AND C'S.

Yes.

AND YOU PREFERRED THAT EVEN TO HAVING PERCENTAGE, BECAUSE SOMEONE SAID, AND I DON'T KNOW WHO IT WAS. WAS IT YOU K? I CAN'T REMEMBER. THAT IF YOU'VE GOT AN "A" THAT GIVES A REAL GOOD FEELING, WHEREAS IF YOU GET 90% YOU THINK "OH I WONDER WHY I MISSED OUT THAT LITTLE 10%". SOMEONE SAID THAT AND I THOUGHT THAT'S REALLY INTERESTING. I COULDN'T PICK WHICH VOICE IT WAS, IT WAS FAIRLY QUIET ON THE TAPE.

That was me (laughs)

K WAS SAYING SHE STAYED BEHIND IN CLASS ONE DAY TO ASK IF SHE'D DONE ENOUGH ON ONE PORTFOLIO ITEM. AND I SAID TO HER "IS THAT THE USUAL THING IN MATHS?" SORRY, "IS THAT AN UNUSUAL THING IN MATHS, TO STAY BEHIND?". YOU SAID "YES". SOME PEOPLE SAID THEY PREFERRED ORDINARY MATHS TO PORTFOLIOS AND PARTICULARLY AS THERE WAS A PROBLEM WITH GETTING CLASS TIME TO DO PORTFOLIO WORK AND WE TALKED ABOUT CLASS ATTITUDE A LITTLE BIT. SOME PEOPLE SAID, WE'VE BEEN USED TO PRIMARY SCHOOL THIS IS BETTER HAVING PORTFOLIOS YOU GET LOTS OF TIME, YOU KNOW WHAT'S COMING UP IN ADVANCE, AND THERES A WIDE RANGE OF THINGS TO DO. PEOPLE PUT ABOUT THINGS LIKE, FORM OF WRITING, WHAT'S IT ABOUT, HOW AM I GOING TO WRITE ABOUT SHELLS, THINGS LIKE THAT. SO THATS SORT OF WHAT I WAS MAKING ABOUT THAT INTERVIEW LAST TIME. IS THERE ANYTHING ELSE THAT COMES TO MIND?

THESE ARE THE THINGS I WANT TO TALK ABOUT THIS TIME. FIRSTLY, PEOPLE DID A SURVEY FOR ME RECENTLY, AND THE SURVEY FORM LOOKED LIKE THAT. DID YOU ALL DO THAT?

Yes

Yes

Yes

OK, GREAT. NOW I'M JUST WONDERING WHAT YOU THOUGHT ABOUT THAT SURVEY? I'LL PULL THIS OUT SO YOU CAN ALL SEE IT AND REMEMBER THE QUESTIONS. WERE THERE ANY QUESTIONS THERE THAT YOU THOUGHT WEREN'T VERY GOOD QUESTIONS, OR YOU KNOW IS THERE ANYTHING LIKE YOU COULD SAY LIKE MY CLASS TOOK THE SURVEY VERY, VERY SERIOUSLY OR WHAT? WHAT WAS GOING THROUGH YOUR MIND WHEN YOU WERE DOING THIS SURVEY?

Some of them were pretty similar questions MMm

About the same as everyone.

THAT'S RIGHT, IT'S SUPPOSED TO BE THAT WAY. IF YOU LOOK AT IT YOU CAN SEE. SEE BETWEEN THE BANDS THERE THERE'LL BE LIKE 10 QUESTIONS ABOUT THE SAME TOPIC (yip) AND IT'S REALLY JUST TRYING TO GET A GRADATION ABOUT HOW YOU FEEL ABOUT THIS. THERE'LL BE VERY SIMILAR STATEMENTS BUT MAYBE EXPRESSED A BIT MORE STRONGLY OR SOMETHING LIKE THAT. ANY OTHER THOUGHTS ABOUT THE SURVEY?

WERE SOME OF THESE QUESTIONS JUST NOT APPROPRIATE FOR YOUR CLASS OR ANYTHING LIKE THAT?

Silence

THERE'S ANOTHER PAGE OF THEM ON THE BACK OF THAT.

Silence

NOW ARE WE ALL DEEPLY HONEST. DID IT ALL VERY SERIOUSLY?

Yeah

Mmm

OR MAYBE YOU DIDN'T CARE VERY MUCH AND JUST SPED THROUGH?

Silence

ANY OF YOU SPEED THROUGH AND DIDN'T REALLY READ IT?
BECAUSE I KNOW SOME PEOPLE DID.

Silence

I HAD ONE, SOMEONE JUST WENT THROUGH IT AND CIRCLED ALL THE
3'S. WHAT ARE YOU TRYING TO TELL ME, YOU KNOW.

(Laughter.)

OK. WITH THAT SURVEY, IN THE PAST SOME PEOPLE HAVE LOOKED AT
IT AND SAID WELL, SOME OF THE QUESTIONS ARE A BIT STRANGE.
LIKE "THE TEACHER TAKES A PERSONAL INTEREST IN ME" WHAT DOES
IT MEAN? GO ON SAY WHAT YOU'RE THINKING, P

Well, I thought, I didn't really know what it meant, just well, ...

And also how are we supposed to know if the teacher took a personal interest in us
sort of thing, like you wouldn't know if they did or not, yeah

UNLESS THEY TOOK YOU FISHING AT THE WEEKEND OR SOMETHING?

Yeah. (Laugh)

RIGHT, ALTHOUGH THERE MUST BE WAYS IN CLASS WHEN YOU'D
KNOW. I MEAN DO SOMETIMES YOU FIND YOU'RE IN A SITUATION
THINKING ON THIS TEACHER IS, YOU KNOW

Yeah

COULD YOU GIVE ME AN EXAMPLE?

Oh, once I was getting into quite a bit of trouble and um, she didn't punish me for it
or anything. So I thought Oh, she must have been feeling nice today.

RIGHT, GOOD, OK. ANY OTHER QUESTIONS THERE THAT YOU COULD COMMENT ON. YOU KNOW, "THE TEACHER TAKING A PERSONAL INTEREST IN ME" AND YOU'RE REALLY SAYING THAT'S PRETTY HARD TO KNOW ON THAT ISN'T IT. WHAT ABOUT SOME OF THESE OTHER THINGS ON HERE? TAKE YOUR TIME, READ THEM ALL.

...

What's this question here mean "The teacher moves about the class to talk with me". Is that just like she/he comes over to talk to you sort of thing?

YES, I THINK SO. RATHER THAN THE TEACHER STAYING UP THE FRONT ALL THE TIME.

Oh right.

IS THAT HOW IT GOES IN YOUR CLASSROOM?

Yeah sometimes you can put your hand up and if you point to your work or something he just comes over and asks what you want to talk to him about, what you've written down in your book and stuff.

SO IS THERE A SORT OF A CODE. (Laughter)

SO YOU CAN YOU GO LIKE THIS, JUST PUT YOUR HAND UP A LITTLE BIT SO THE TEACHER CAN SEE IT

Now you just sort of go, now with this question

RATHER THAN SAYING "NOW, EVERYBODY LOOK AT ME, I DON'T KNOW ANYTHING"

Yes, sort of shout over the classroom, "Can you help me with ... Have I done this question right... Look I might need your help. Well, that's what happens with me anyway.

OH, ARE YOU THE FAVOURITE STUDENT IN YOUR CLASS?

I don't know (Laughter)

WERE YOU JUST TREATED THE SAME AS EVERYONE ELSE?

Yeah. Other people just say you know straight away, "Can you come over here and help me with this."

BOSSY. OK, ANYTHING ELSE? Z WHAT'S PASSING THROUGH YOUR MIND AS YOU'VE GONE THROUGH THIS?

Not much.

YOU THOUGHT IT WAS A REASONABLY GOOD SURVEY? WHAT?

(Silence)

OK, FINE, THATS ALL I WANTED TO KNOW BECAUSE IF YOU WERE GOING TO TELL ME ALL THIS, "I DIDN'T UNDERSTAND THESE QUESTIONS SO I JUST GUESSED" OR, "I THOUGHT WHAT YOU WANTED TO ME SAY HERE WAS A 5", IF YOU'D BEEN SAYING THOSE SORTS OF THINGS TO ME THEN THAT WOULD BE A DIFFERENT MESSAGE TO WHAT I'M GETTING RIGHT NOW. WHAT I'M GETTING RIGHT NOW IS "WE UNDERSTOOD THE SURVEY, PEOPLE HAVE DONE IT PROPERLY AND PEOPLE UNDERSTOOD WHAT IT WAS ABOUT". THAT'S THE MESSAGE I'M RECEIVING.

Umm. There's one question on the sheet. The last question says "I get the same opportunity to answer questions as other students" What would that really mean?

MMM. IT'S NOT LIKE HAVING AN EXAM WHERE EVERYONE GETS THE SAME PRINTED OUT THING. I GUESS IT MEANS, YOU KNOW, THE TEACHER SAYS THINGS LIKE "WHO KNOWS THIS, PUT YOUR HAND UP" SOMETHING LIKE THAT (oh) YOU KNOW IF THEY ALWAYS PICKED FRED AND PICKED PHILIP IT WOULDN'T BE FAIR WOULD IT? DO YOU THINK YOUR CLASS IS FAIR IN THAT WAY?

Yeah

HOW FAIR?

Oh,

I BET FOR EXAMPLE THERE ARE SOME STUDENTS WHO HAVE NEVER, NEVER TRIED TO ANSWER A QUESTION.

Yeah, there's some in my class like that. ...

DOES THE TEACHER THEN PICK ON THEM TO TRY AND GET THEM TALKING?

Ignores them.

INGORES THEM? FADE INTO THE WALLPAPER?

Yeah

Our teacher, if someone's talking or something, he'll just suddenly spring a question on them and like and they're like "Oh Oh" and they have to say like "I wasn't listening, you know, please repeat the question"

A QUESTION AS PUNISHMENT.

Yes

OK, RIGHT, NEXT THING I WANTED TO ASK YOU ABOUT, BUT RAISE THAT AGAIN IF YOU WANT TO, WERE THESE THINGS HERE. NOW HERE I'VE GOT SOME SORT OF WORK THAT STUDENTS HAVE DONE, ALL SORTS OF LITTLE QUESTIONS ABOUT THINGS, SO THERE'S ONE HERE ABOUT FROGS FOR EXAMPLE. YOU HAD TO INVESTIGATE FROGS AT THE BEGINNING OF THE GAME, YOU HAD 3 FROGS HERE AND 3 FROGS THAT ARE A DIFFERENT COLOUR HERE, AND THERE'S RULES ABOUT THE GAME AND FROGS WIND UP SOMEWHERE ELSE. HERE'S SOME WORK SOMEONE HAS DONE ON THIS FROGS THING. THE REASON THIS IS PRINTED IN A BOOK IS THAT THIS IS A BOOK THAT TEACHERS CAN READ AND ITS ALL ABOUT HOW WOULD YOU ASSESS THIS. SO YOU CAN SEE HERE'S ONE STUDENT'S WAY OF DOING IT, IN COLOUR, AND HERE'S SOMEONE ELSE WHO DID THE SAME QUESTIONS AND THEY USED CIRCLES AND SHADED IN, NOT SHADED IN, RATHER THAN DIFFERENT COLOURS. AND HERE'S WHAT THEY WROTE AND YOU CAN SEE HOW THEY WENT ON AND ON ABOUT IT AND ITS ALL ABOUT HOW TO MARK IT. WHAT DO YOU THINK ABOUT THIS?

Silence

HAVE ANY OF YOU SEEN THIS PARTICULAR PROBLEM BEFORE, WITH THE FROGS?
FROGS HAVE TO JUMP OVER EACH OTHER, YOU'RE TRYING TO GET THE FROGS FROM THE LEFT SIDE TO GO ACROSS TO WHERE THE RIGHT HAND SIDE FROGS ARE. HOW MANY JUMPS WILL IT TAKE AND WHATS THE FASTEST WAY OF GETTING THEM THERE? IT'S QUITE A NICE PROBLEM ACTUALLY, IT'S QUITE GOOD. THREE FROGS BOTH SIDES SWAPPING, WHAT ABOUT 4 FROGS OR 10 FROGS?

It's just like an investigation

THAT RIGHT. IS IT LIKE ANYTHING YOU'VE EVER DONE IN SCHOOL HERE?

No

No

Oh well, we've done quite a few investigations in the class so yeah, I guess.

BUT THEY'RE NOT LIKE THIS, ARE THEY?

No. Not like this but

WHAT'S THE DIFFERENCE?

We were doing them like, oh, with words and matchsticks and around it and just like games that are played sort of thing

IS IT JUST THAT IT'S A DIFFERENT INVESTIGATION, IT'S ABOUT SOMETHING DIFFERENT, OR DID YOU DO YOUR INVESTIGATIONS IN A DIFFERENT WAY TO THIS?

I think it's just a different topic.

OK, NOW WHAT IF I SAID TO YOU "LET'S CHUCK OUT EXAMS, LET'S HAVE THIS INSTEAD" AND EACH OF YOU HAVE TO DO THIS, AND YOU HAVE PLENTY OF TIME. YOU WRITE THINGS LIKE THIS, THEN I'M GOING TO GATHER THEM ALL IN, AND MARK THEM. AND THAT WOULD BE YOUR MARK. WHAT DO YOU THINK?

It wouldn't be as accurate.

BECAUSE?

There isn't really a straight answer for each one, I suppose. People might write the same answer but in a different way.

Like you could get help, like lots of help on this, but whereas in your exam you have to have learnt the work.

WE COULD DO THIS LIKE AN EXAM, COULDN'T WE? FIRSTLY I'LL SHOW YOU SOME FROGS OR SOMETHING AND THEN SAY, "RIGHT, NO TALKING AND EVERYBODY SIT AT YOUR OWN DESK AND WRITE DOWN AS MUCH AS YOU CAN ABOUT THE MATHS HERE". YOU COULD DO IT LIKE AN EXAM. YOU WERE SAYING IF YOU SET THIS AS LIKE A HOMEWORK EXAM. WOULD THERE ACTUALLY BE PROBLEMS - DO YOU THINK PEOPLE WOULD GET THEIR PARENTS TO HELP THEM? DO YOU THINK IT WOULD HAPPEN?

Yeah

Yeah

For this some people are better at other things than investigations and stuff. So the people that are better at investigations understand it well and stuff, and know how to work it, they would most probably do better, but they might be not as good as, you know, working out some other sort of equations or something and the other people who aren't good at this would be good at working out equations and that could be how they work their points up, their marks.

TRUE, OK. WHICH METHOD IS THE MOST FAIR THEN? THERE ISN'T A MOST FAIR?

I reckon it's quite good when you've done, like, some of the investigations and stuff, that it goes towards your end of year mark and an exam. So you've sort of got a bit of both, and if you're no good at one you've still got that mark to go on the end of year mark.

BUT IF YOU TOOK THE EXAM AWAY AND SAID IT'S ONLY ON THIS OTHER STUFF, YOU WOULD BE VERY NERVOUS?

Yes, well, I know it's just some things like this sort of thing I enjoy doing it but I probably, like exams, they're not, if I do that then its quite easy, but its like you have to investigate more and stuff so I wouldn't really be happy if they only had to do this sort of stuff.

DO THEY TEST DIFFERENT THINGS?

Um

YOU SAID WITH EXAMS YOU LEARN IT, WHEREAS THIS YOU DON'T LEARN SOME. IS THAT THE DIFFERENCE?

No, you do learn. I guess it's learning in a different way. Like this, you just know, you're investigating and you're learning by investigating, but with the other one you've just got a textbook and you'd have to go and like find out what things are from the textbook and stuff.

RIGHT, OK HOW DO YOU FEEL ABOUT THAT? SAY [named student]. DO YOU THINK THIS IS DIFFERENT AND TESTS OTHER SKILLS? OR IS IT STILL MATHS?

I don't really know.

BECAUSE YOU HAVEN'T DONE A LOT OF THESE SORT OF INVESTIGATIONS. YOU DON'T REALLY KNOW WHAT'S GOING ON HERE.

I suppose I've done a couple of investigations but not the ... matchsticks and things.

WHAT'S THE DIFFERENCE BETWEEN YOUR INVESTIGATIONS AND THIS INVESTIGATION?

The ones we've got are just sort of one, if four matchsticks makes a square how many do you need to make (SQUARE GROWS) and the square grows ...

IT'S THAT SORT OF THING ISN'T IT?

I suppose so

BUT YOU'RE FROWNING, SO WHAT'S THE DIFFERENCE. YOU'RE LOOKING AT THIS AND THINKING, NO THIS IS HARDER? BIGGER?

There's lots more we can ... we just

I THINK THAT ONE THERE, FOR EXAMPLE, GOES OVER THE PAGE. I THINK THAT'S THE SAME ONE, IS THAT ALL THE SAME? I THINK IT IS,

(yeah) SO WHAT HAVE WE GOT 6, 8 PAGES WITH GREAT BIG GRAPHS AND ALL SORTS OF STUFF, SOMEONE'S REALLY REALLY SPENT A LONG TIME

I wouldn't know what to do next. I'd maybe do a grid, a diagram, write a paragraph on it but I wouldn't know how to do.

I THINK THIS MAY BE A SLIGHTLY OLDER PUPIL THAN YOU. ALL THE SAME THIS IS OUR TARGET ISN'T IT. I CAN SEE AT THE END OF IT PAGES THEY'VE COME UP WITH WHAT LOOKS LIKE MATHS, YOU KNOW, HERE'S A FORMULA, HERE'S THE GENERAL PICTURE. THIS FORMULA HERE WILL DO IT OVERALL, AND IT STRIKES ME THAT THIS IS THE SORT OF THING WHICH WOULD BE MORE USEFUL IN THE WORLD THAN JUST BEING ABLE TO RECREATE SOMETHING THAT SOMEONE ELSE HAS ALREADY DONE THINKING FOR YOU AND YOU JUST SORT OF REPEAT IT.

That what we're learning about in class at the moment.

ALGEBRA

Yeah.

DO YOU LEARN IT THIS WAY BY COMING TO THE ALGEBRA AT THE END

No

He gives us like an equation with like the letter in it and we have to work out how much the letter is worth and stuff

Yes

YOU CAN'T DO THIS UNTIL YOU CAN ACTUALLY USE THINGS WITH THE LETTERS IN IT AND ALL THE REST OF IT. SO I THINK YOU'VE PROBABLY A WEE WAY TO GO BEFORE YOU COULD ACTUALLY GET UP TO THAT LEVEL

Mmm

WHEN YOU'RE DOING JUST ALGEBRA DON'T YOU FIND, THIS IS FINE, I CAN DO IT, I CAN GET THE RIGHT ANSWERS BUT "WHEN AM I GOING TO USE THIS?" WHAT GOOD IS IT? DOES THAT QUESTIONS NOT ARISE?

(Silence)

WHAT DO YOU SAY IF SOMEONE SAID TO YOU "WELL, WHY ARE YOU DOING ALGEBRA", WHAT WOULD YOU SAY?

I don't know.

(Giggles)

He said it would help us if we wanted to work out the area of what something was ...

Other than being a maths teacher or a school teacher, what other kind of jobs use that?

MMM OK. LOOK I'D LIKE TO MOVE OFF FROM THAT NOW AND ONTO SOME OTHER THINGS. I CAN'T ANSWER YOUR QUESTION. I THINK IT'S A REALLY GOOD QUESTION. ONE YOU'RE REALLY GOING TO HAVE TO WORK ABOUT BECAUSE YOU WILL FIND ALGEBRA TO BE USEFUL AND PARTICULARLY IF YOU'RE THINKING AND INVESTIGATING, OTHERWISE YOU WON'T. IT DEPENDS WHAT YOU DO.

OK. ATTITUDES TOWARD MATHEMATICS. I WAS READING THIS THING HERE AND IT'S SAYING THERE'S A RELATIONSHIP BETWEEN PEOPLE WHO *LIKE MATHS* AND PEOPLE WHO *DO WELL* AT MATHEMATICS. WHAT DO YOU THINK ABOUT THAT?

If you can do it well then you're sort of proud of yourself and you sort of think this isn't too bad. I can do it.

If its too hard you probably wouldn't try too much

(Agreement)

WHAT SORT OF MATHS WOULD THEY BE TALKING ABOUT?

I find the algebra quite easy, you know. Some of it you have to like really think about for a while.

... all different types like they'll put up something then she'll put up something else, and it'll be like there's heaps of types and its probably hard to remember

DO YOU FIND YOU LIKE IT? DO YOU LIKE MATHS?

Algebra, yes.

YOU DO LIKE ALGEBRA? WHAT APPEALS TO YOU ABOUT IT?

I don't really know. It's just really complicated.

After we got it, it was easy. After you've got it.

First one was ... After you've got it, it's fine.

DO YOU FIND ITS SOMETHING YOU CAN TALK TO OTHER PEOPLE ABOUT OR IS IT SOMETHING YOU ONLY DO AT SCHOOL?

School

Yeah

Laughter

...

PORTFOLIOS NOW. YOU'VE DONE SOME OF THE PORTFOLIOS. CAN WE JUST HAVE A QUICK ROUND UP OF HOW FAR PEOPLE HAVE GONE WITH THEIR PORTFOLIO ITEMS. THAT'S MY CHECKLIST AND I THINK EVERYTHING YOU WILL HAVE DONE WILL HAVE BEEN FROM THAT LIST. THIS IS THE LIST WE HAD AT THE BEGINNING OF THE YEAR AND YOU ALL SEEMED TO KNOW ABOUT THESE THINGS. I THINK THAT BY NOW YOU'VE ALL DONE YOUR AUTOBIOGRAPHY.

Yeah

Yeah

EVERYONE'S SAYING YES. NOW LETS GO ROUND, SO K FIRSTLY, THE LOGO DESIGN. HAVE YOU DONE THAT?

Yes

FOUND SHAPES?

yes

FORMAL WRITING?

Yes

LIBRARY RESEARCH? CLASS PRESENTATION? AND INVESTIGATION? OK HOW WERE THEY GRADED? DO YOU KNOW THAT? HAVE YOU GOT GRADES FOR ANY OF THESE THINGS?

He does E for Excellent then it goes down to something else, but I know E's excellent. I went home saying "Mum and Dad I got an E" you know, there're like, "are you sure?" (LAUGH, E'S A FAIL!) They wouldn't believe me that E was the top.

IS IT LIKE EXCELLENT, GOOD BAD, IS THERE JUST 3 CATEGORIES OR 5 OR WHAT?

Yeah, there's 3.

AND THERE'S ALWAYS 3 FOR ALL OF THESE THINGS?

Yeah and most things he does too, like other work that he asks us to do - he uses that same grading too.

OK. Z I KNOW WHAT YOU'VE PUT IN. DO YOU REMEMBER WHAT GRADES YOU GOT?

Well, sometimes you used the ABCD thing and for the um autobiography you used the "credit" and I'm not sure credit/excellent maybe I'm not sure, because I got credit so I'm not sure what the other ones were. And formal writing you gave out credits and stuff as well, yes, and I'm not sure because I printed something out on the computer for Logo design but I'm not sure if I've handed it in.

OH, RIGHT. SO THIS IS A PROBLEM REALLY BECAUSE IN OUR CLASSROOM THE STUFF'S LOCKED IN THE CUPBOARDS SO PEOPLE WON'T INTERFERE WITH IT, BUT AT THE SAME TIME IT MAKES IT HARD FOR YOU TO ACTUALLY CHECK WHAT YOU'VE GOT IN THE PORTFOLIO.

Yeah

AND YOU'RE NOT SURE WHAT CREDIT MEANS. WHETHER THAT MEANS THERE'S A HIGHER GRADE OR NOT.

Yeah, mm I don't know because you haven't really told us. You've just sort of given us the sort of stamps and stuff and we don't really know where it is or what it is.

ACTUALLY, I GAVE UP ON FORMAL WRITING IN THE END AND SAID IF THEY'VE DONE IT SATISFACTORILY THAT'S A PASS AND THATS AS FAR AS I GO OTHERWISE IT'S NOT. SO IF ITS STAMPED WITH A CREDIT OR, I THINK THATS THE ONLY THING I STAMPED, THEN YOU'RE IN, YOU'VE PASSED. (ok) BECAUSE I FOUND IT IMPOSSIBLE TO GRADE IN THE END. I COULD NOT SAY THIS IS AN "A" THIS IS A "B".

ROUND TO P. WHATS THE STORY WITH YOU?

I've done autobiography, Logo design.

DO YOU REMEMBER THE GRADES, AS YOU GO THROUGH?

...

THEY WERE GRADED BUT YOU DON'T REMEMBER THEM? OK.

And half way through, near the end of found shapes.

RIGHT. WHAT ARE YOU DOING WITH FOUND SHAPES? WHAT TOPIC?

Um, I think what it is, you get a piece of paper and you have four boxes down the side and you've got a shape that's part of the box and you do all four boxes and then you draw on all these squares and, yeah, make a pattern...

THIS IS MS B ISN'T IT, YOU'VE GOT?

Yes

RIGHT. SO YOU REFLECT IT AND THINGS LIKE THAT?

Reflection and symmetry.

SOUNDS GOOD. HAS ANY OF THIS GONE IN AS A CANTAMATH PROJECT OR IS THAT A SEPARATE THING?

That is Cantamath

RIGHT OK

...

FORMAL WRITING, LIBRARY RESEARCH, CLASS PRESENTATION - YOU HAVEN'T DONE THOSE YET?

No

OK, M?

I've done the autobiography. We haven't done Logo design yet. Found shapes and formal writing ... that all ... the rest.

WHAT ABOUT YOUR GRADES?

I can't remember how they were graded.

RIGHT. NOW ARE YOU ALL IN THE SAME SITUATION - THAT THIS STUFF GETS LOCKED AWAY SOMEWHERE?

Mmmmm

Yeah

ah ha

SO THE TEACHER GRADES IT, GIVES IT BACK, YOU SEE IT BRIEFLY AND THEN IT DISAPPEARS AND YOU DON'T REMEMBER.

I think he said if we want to we can hold it ourselves but ...

Yeah, safer

Lose it otherwise.

OK. FINALLY, CANTAMATH. IS THAT A SENSIBLE PROJECT AT THE MOMENT? IT WAS ALL DUE YESTERDAY. HOW'S THAT GONE FOR YOU GUYS?

Ok

Fun

Great

WHAT WAS THE FUN YOU WERE HAVING?

He gave out. There was three kinds of sheets that you could have. There was just the cubed dotty paper, and then there was like 12, 24, grid or something that had all these lines all over the place and you got to choose a piece of paper - the grid that you wanted, and each one was like different. It had different lines in different places and you could make a design from that. You could either, like, follow the lines to make different shapes and do curves from that line to that line. And, you know.

OK SO YOU HAD A LOT OF FUN.

Yeah.

YOU SEE A LOT OF THIS WAS DONE IN CLASS TIME WAS IT?

Yes, We had two periods for it and then he gave us the weekend and he expected us to sort of have an idea by the second period that we'd had on it, but he didn't expect us to have it finished in the second period because he said otherwise it wouldn't be that good if you could do it real fast, because he said to put effort and time and watch your colouring in and stuff.

SOUNDS GOOD. AND PEOPLE RESPONDED BY THE SOUND OF IT.

Yip

WHAT WAS YOUR IMPRESSION OF THE CANTAMATH PROJECT IN YOUR CLASS Z? BE HONEST!

Well, I never actually got the sheet, so I never knew what to do and someone told me we could do a poster or anything and like nobody'd done posters and we had to, like, do investigation and, like, I hadn't really even started until the last day because I had never got the sheet because everyone else always got them, and so I actually never knew what to do and so I thought it was quite tough because I hadn't heard about Cantamath until, like, the Tuesday that, like, last Tuesday that you had to have it in by Thursday and so I didn't really heard of anything of it and I was like really busy so I didn't really get anything done.

RIGHT. SOUNDS PRETTY DISORGANISED.

Yeah.

THAT'S NO GOOD. WHAT ABOUT OTHER PEOPLE? WHAT DO YOU THINK?

Lots of people told me that they had started it but they thought that all their projects weren't going anywhere. They thought that (THEY WERE STUCK) yeah they didn't know where to go from there and stuff like that but a few people got it done and, yeah, they looked pretty good so

I didn't get any much done because I was away for a couple of periods, I was away from school. I started one. I got pretty far in that, and then I lost that sheet and then I started another one and I lost that sheet, and had to start another one and I didn't get very far because I was stuck. I looked in my bag and I couldn't find my maths book. I think Mum must have gone through it. I emptied everything out of my bag in maths and couldn't find it.

SO HAVE YOU PUT IN A PROJECT?

No

DID THAT 3RD PROJECT GET DONE AND ENTERED?

I'm not sure. I handed it to him.

WAS IT FUN?

Mmm

WHAT WAS THE FUN PART?

Ah, it was just good to give it a rest, after all that numbers and everything.

THERE WERE NO NUMBERS ON YOURS, IT WAS A SHAPES THING?

Shapes come out ...

OK. M?

So far I've done some. We just had to do a poster. Just "Cantamaths 99" for next year. We had to go to the library 'till it got done.

... Read the Cantamath competiton in the library. I thought that was fun, like. I went in Cantamath last year as well when I was at ... it was really fun it was sort of like the actual thing.

Good to get out of the classroom...

Yeah, just do something

NON-COMPETITIVE ISN'T IT?

Yes. Its quite different to maths class, but like our maths class everybody sort of it better like they always want to achieve higher than everybody else so its really competitive in our class and I sort of don't work like that I just sort of do my own work and just extend it a wee bit but I won't go as far to get highest in the class. So I found that ... be higher.

SO YOU AIM AT BEING NUMBER 2?

No I don't even aim at being high, I just sort of do my personal best and not, you know, try and get to where everyone else is

HELP AT HOME WITH CANTAMATH PROJECT. DID ANYONE HAVE ANY HELP?

Yeah. I didn't have a clue what colours to do it and I'm like keep running backwards and forwards to my room to the lounge, "What colour shall I do"? They were like you know just get two colours you know.

Appendix I

TRANSCRIPT: INTERVIEW WITH 4B 1 May 1998

(Started with assurance that the discussion was in confidence.)

I'VE GOT 10 QUESTIONS WHICH I WANT TO DISCUSS. I DON'T JUST WANT TO HEAR "YES" OR "NO", I WANT TO HEAR, YOU KNOW, MORE ABOUT IT AND IN DEPTH AS MUCH AS YOU CAN TELL ME. MAYBE IF WE SORT OF GO ROUND FROM THE LEFT EACH TIME OR CHIP IN WHEREVER YOU WANT TO GO ON THIS ONE.

THE FIRST THING. I JUST WANT TO KNOW WHAT YOU KNOW ABOUT PORTFOLIOS SO FAR.

G WOULD YOU LIKE TO KICK OFF, ABOUT PORTFOLIOS?

No. I can't remember. Well, I can but he'll start.

GO AHEAD C

A portfolio is where you put together all the stuff that you've done through your work and you might give it to someone and they'll have a look at it might score you or like that.

HAVE YOU USED PORTFOLIOS IN PRIMARY SCHOOL OR IN OTHER SUBJECTS OR ANYTHING LIKE THAT?

Oh, no. I don't think so.

IN THE SCHOOL AT THE MOMENT, AS YOU KNOW WE'RE USING PORTFOLIOS IN THE MATHS CLASSES, TELL ME A BIT ABOUT THAT N.

We haven't done much on the portfolio yet. We just had to do an interview about mainly what sort of sums we use.

Was that the work thing?

Yeah that work.

We did that last year ...

WHERE HAS THE STUFF GONE? YOU WROTE UP SOMETHING ABOUT YOUR INTERVIEW N PRESUMABLY?

Yeah, we just had to write to complete sequence and all that sort of stuff. We just handed it in and he was going to mark it.

I handed it in and it came back after.

WHEN IT CAME BACK WHAT WAS WRITTEN ON YOURS?

Just that it was good, but that's normal.

T HOW'S PORTFOLIOS GONE WITH YOU?

Don't know what they are.

DON'T KNOW WHAT THEY ARE. HAVEN'T HEARD ANYTHING ABOUT THEM, OK.

You can't always get all the information that you need, like its not out fault if we're interviewing say Dad and he can't supply that information then we get lower marks for it and I think that's kind of unfair.

DID SOME PEOPLE HAVE THAT HAPPEN?

Yeah.

RIGHT. WHEN YOU SAY LOWER MARKS, HOW DO YOU KNOW WHAT MARKS YOU GOT? DID THE TEACHER SAY

Like say got 5 out of 10.

DO YOU REMEMBER WHAT YOUR MARK WAS?

No.

OK. HOW DID YOU ACTUALLY FIND OUT? T FOR EXAMPLE HASN'T BEEN TOLD ABOUT PORTFOLIOS YET BUT YOU GUYS DO KNOW A BIT ABOUT IT. HOW WERE YOU TOLD ABOUT IT? YOU SAID YOUR TEACHER JUST SAID "GO AND DO THIS".

Yeah.

Said, this is a task do it. He didn't say this was a portfolio.

RIGHT

So I didn't know.

Our one just told us that it was a project we had to get through the year and just told us to go and do the task.

DO YOU KNOW WHAT THE OTHER TASKS THROUGH THE YEAR ARE?

Yes, I've got a sheet.

Yeah, same.

DID THAT SHEET HAVE A CARTOON, OR SOMETHING LIKE IT?

Yeah.

Yeah.

DID YOU GET THAT GIVEN? DID YOU GET ONE OF THOSE?

Umm Yeah I think I did.

SO YOU'VE SEEN THAT. NOW THIS IS THE ALL THE ASSESSMENT FOR THE YEAR HOW MUCH EACH TEST IS WORTH AND THAT SORT OF THING. THIS IS YOUR PORTFOLIO ITEM TASKS THERE. SO YOU'VE ACTUALLY SEEN THAT PART OF IT ANYWAY T.

Yeah.

DID YOU SEE THE WHOLE SHEET?

I just seen something like this

We got the whole lot and we're up to the second one.

OK

But I haven't handed it in yet.

RIGHT

I've done the first one.

SO YOU'VE ACTUALLY DONE SOME WORK ON THE SECOND ONE ALREADY? DO YOU FIND IT HARD?

It's hard going and getting the information. Sometimes you just don't have time. Like in the weekend I don't do any homework 'cos that's the time I go out with my friends and after school I don't do it, no matter what, I don't do homework on weekends.

RIGHT.

And it's kind of hard where I live, [to] go and see what prices were and all that. For the second one, it's kind of hard, we don't get all [the] junk mail.

RIGHT. SOME OF IT NEEDS YOU TO ACTUALLY COLLECT THINGS.

Yeah, we've got to find out which ones are value for money.

DO OTHER PEOPLE FIND THAT SAME EXPERIENCE?

Yeah.

G, YOU'RE THE SAME. OK.

And you can't always get it finished because

WHAT ABOUT CLASS TIME? ARE YOU ALLOWED ANY TIME IN CLASS AT ALL FOR YOURS?

No. Ours was homework.

Yeah, ours was homework.

STRICTLY HOMEWORK, NO CLASS TIME?

Yeah. What I find about that is, yeah I agree about homework, but you go six hours at school you should go home and do 15 minutes of homework if it's only 15 minutes, but if say if it's a lot you have English, Maths, Science classes and then when you miss out you get home detention and get punished for all that, so it's kinda hard.

It should like be your time instead of doing stuff for school.

RIGHT

But 15 minutes like.

SO YOU'RE ALL FOURTH FORMERS AND YOU'RE TELLING ME THAT YOU'RE FINDING HOMEWORK QUITE HARD TO GET COMPLETED AT ALL.

Yeah.

Yeah.

Some of us have got chores.

They give too much.

You've got some chores, and then do stuff around the home.

My diary doesn't work. It's not big enough to write in everything I need, cause I've got, most of my subjects give me homework so I write in some of it and then when I go to do it then I get home detention for it or something like that. (Laughter.) And then if I've got a home detention then I can't do homework from the other night.

OK. LET'S LOOK AT THE TASKS WHICH WERE ON PORTFOLIOS. WE TALKED ABOUT THE INTERVIEWS AND YOU WERE SAYING C ABOUT THE PROBLEM OF INTERVIEWING PARENTS AND THERE MAY BE SOME PARENTS DON'T HAVE THE FACTS TO GIVE YOU. IF YOU LOOKED AT THOSE TASKS. I'LL JUST SHOW YOU THIS SO YOU REMEMBER WHAT THE TASKS WERE ON THAT SHEET. WHAT DO YOU THINK OF THESE TASKS, ARE THEY "DO-ABLE", ARE THEY INTERESTING, ARE THEY AWFUL?

The first one was quite easy.

Yeah.

RIGHT.

You'll need interview skills when you're older but, yeah, some stuff you don't need when you're older. Like, when I was in Form Two we needed to be told what a triangle was called, and who found them and who named them all. That was pretty boring because like we're not going to go for a job and say like "Well, I learned so many names of a triangle".

You should just like be able to do Maths like have multiplication and all that stuff, then you should do like other stuff for to do a Maths job like algebra and all that.

Yeah like subjects, you could have teachers can really explain it and some can make it really boring.

N WHERE DOES THIS FIT INTO IT THEN, WHEN YOU SAY MULTIPLICATION AND SO ON. DO YOU SEE THIS AS NORMAL MATHS OR WHAT?

Um No, not really.

Its not like plus and this and take away it's (yeah) like go find out some information so its more like English or reporting or media studies which is going out to find information and its not like you don't plus it all together or something like that.

YOU'RE SAYING YOU SEE IT THIS WAY TOO?

Yeah

There's not really much point in learning algebra and all that.

What sort of jobs. You need maths for some jobs like you say like an engineer or.

Just as long as you know how to times, plus and divide and all that.

We've all got calculators now.

FROM WHAT YOU'RE SAYING, YOU'VE ALREADY MADE DECISIONS ABOUT WHERE YOU'RE GOING NEXT YEAR, DO YOU THINK, AND WHAT YOU'RE GOING TO DO?

No. I just think there's [not] much point in doing like algebra and all that.

IT DOESN'T SOUND LIKE YOUR FAVOURITE THING?

No.

The jobs you want to do, they don't need maths skills or anything. Like, the algebra and all that should be optional for the kids that want to do it.

Yeah, if they've already made up the decision what sort of job they want to do they should go and do like that sort of maths. What's required for that job.

DO YOU KNOW WHAT HAPPENS IN FORM 5? NEXT YEAR YOU'VE GOT TO MAKE DECISIONS ABOUT WHICH COURSE YOU GO INTO. HAVE YOU BEEN BRIEFED ABOUT THE COURSES? DO YOU KNOW, BECAUSE YOU DO GET SOME CHOICES.

Yeah I have, because my brother he had to go through it all.

ARE YOU OLDESTS IN YOUR FAMILIES?

Yeah.

T is.

N is.

YOU'RE NOT SO YOU KNOW MORE ABOUT WHAT'S GOING ON WITH THESE I REMEMBER ASKING WHEN WE SURVEYED YOU EARLIER IN THE YEAR AND ASKED HOW MANY SCHOOLS YOU'D BEEN TO AND HOW MANY BROTHERS AND SISTERS YOU HAD.

IT'S INTERESTING TO KNOW, BECAUSE HAVING LOTS OF BROTHERS AND SISTERS MEANS YOU GET MORE INFORMATION AND FIND IT EASIER TO GO THROUGH.

I've got 4

I reckon it does.

My sister comes up with this portfolio.....

CAN WE MOVE ON. "DO YOU THINK THE MARKING WAS FAIR?" IS ONE OF THE QUESTIONS I HAVE HERE. C YOU ALREADY SAID A BIT ABOUT THAT. N DO YOU KNOW MUCH ABOUT THE MARKING OF THE PROJECTS THAT YOU'VE DONE?

Umm, I don't know what I've got yet. I haven't got them back yet.

AND T AND G HAVEN'T GOT ANYTHING IN YET.

No.

RIGHT.

CAN I JUST TALK ABOUT HOW YOU FEEL ABOUT MATHS. I'M INTERESTED IN WHAT ARE THE GOOD THINGS WHAT ARE THE BAD THINGS ABOUT IT? IN PARTICULAR DOING MATHS HOMEWORK IS ONE THING THAT I HEAR A MESSAGE THAT PEOPLE DON'T LIKE DOING IT.

I like doing it if I know how to do it (Yeah, same) and its like pretty quick to go through. ... ask the teacher and sometimes parents might not even know or parents aren't home.

I don't like doing equations that like take 10 minutes each and I've got 12 of them.

Some of my homework my parents couldn't even do.

I like stuff that you know how to do, stuff that you can do, so you don't have to go and ask the teacher all the time.

Sometimes it's a bit hard because in your class the teacher's only got 2 minutes for each student so it's like the classes get a bit big and that in that 2 minutes they're not gonna learn that much so when you're in the class you may not understand.

DO YOU FIND SOME OF MATHEMATICS INTERESTING?

Yeah.

Yeah.

I really don't mind it.

SO YOU FOUR PEOPLE ARE SAYING PRETTY POSITIVE THINGS ABOUT MATHS OVERALL?

It's a good subject compared to some other ones.

Its good compared to like Social Studies.

WHAT'S THE DIFFERENCE? TELL ME THE DIFFERENCE.

Social Studies is a waste of time.

I'd rather do maths than do that.

I don't know, Social Studies is about the past and sometimes it's interesting, but in maths we're just learning the same thing like how we did $2+2$ last week but now we're doing $y+y$ its kinda the same except its like $2y$

RIGHT. WHAT MAKES SOMETHING BORING OR NOT?

The way the teachers explain it. Sometimes teachers don't explain things very good. They give out a hard worksheet and don't explain it very well.

It's boring when you can't do it sort of. When you can do stuff you go through it and the time goes quickly, but when you can't it seems to take ages and you ask the teacher and they explain it but you don't really understand it.

When you can't do it it's like really hard and boring but when you can do it it's boring because you know how so it's just silly doing it. You've got to have something new.

IS THERE ANYTHING ELSE, THOUGH, THAT MAKES A SUBJECT INTERESTING OR MAKES YOUR TIME IN CLASS INTERESTING? YOU SAY TEACHERS BUT WHAT MAKES A TEACHER BE AN INTERESTING TEACHER?

Attitude.

Yeah eh. Attitude.

They're not just giving home detentions out for just no reason.

Yeah, the way they approach it.

If they let you like discuss it between yourselves.

The way you approach maths.

SO YOU LIKE IT WHEN A TEACHER IS ACTUALLY SAYING, "RIGHT NOW OVER TO YOU AND YOU GUYS WORK TOGETHER AND"

Work, but we're still allowed to talk. Like some teachers make us sit there and do it all and you're not allowed to talk to each other or anything.

Yeah and that's when you start to get boring.

Yeah.

If you can talk and write at the same time, but some teachers don't think you can and some teachers make it fun ... She said, OK, I'm going to play a game now and we get a prize if we win this game, you win a lolly and its like BINGO but Y+Y and it would be written on the sheet and like you had to know it to play the game and that's how you'd learn it and by actually having fun so it wasn't boring. But say if she just wrote up on the board Y+Y you know it, but if you make it fun then everyone will get involved.

...

TELL ME NOT ABOUT YOU, PLEASE NOW, TELL ME ABOUT THE CLASS THAT YOU'RE IN MORE. WHAT I'M GOING TO DO IS I'M GOING TO SEE ONE PERSON FROM EVERY CLASS IN THE 3RD AND 4TH FORM MATHS CLASSES AND YOU'RE MY FOUR PEOPLE TO BASICALLY TELL ME ABOUT THE FOUR CLASSES YOU'RE FROM. WHAT DOES YOUR CLASS THINK ABOUT PORTFOLIOS, IN WHAT WAY IS IT DIFFERENT FROM OTHER HOMEWORK? DO THE STUDENTS WORK TOGETHER? YOU'VE ALREADY SAID IN YOUR CLASS, N, THAT THEY SEEM TO.

Yeah.

HAVE PORTFOLIOS CHANGED HOW THINGS HAPPEN IN CLASS OR WHAT?

No, no not really, you just get like through another project we've got to do. Go home and do this.

SO IT WAS DONE AT HOME NOT AS A CLASS THING?

Yeah.

I'd rather do it as a class thing because just like [it's] easier.

Say you could get like two friends to bunch up together and then they could just like, OK, they could solve things ... might add stuff, like what he does for a living, or your Dad or Mum something like that, and then once you'd done that the other one would say "OK, I'll do the writing down of it 'cos you're getting all the information" and they'll be working together and it'll be like more fun than just working through it by yourself and I think the class find it, some of it, quite easy.

WHAT I'M INTERESTED IN TOO, I MEAN THIS MIGHT NOT BE ALL YOU, BUT IF YOU'RE DOING PORTFOLIOS AND WRITING UP REPORTS AND

INTERVIEWS AND ALL THAT, IT'S WRITING ISN'T IT? TELL ME ABOUT THAT.

You could probably give verbal assessment.

YOU WOULD TAPE RECORD THEM?

Yeah.

WOULD YOU PREFER THAT DO YOU THINK, SOMETIMES, TO DOING WRITTEN THINGS?

Sometimes.

Yeah.

...

I think the best writing is usually in groups ... playing games with them in groups

YOU DO THAT AT THE MOMENT?

No.

We do writing in English, it's not maths. And, like, I got marked down for spelling. That's unfair. Because you're actually not meant to be doing spelling. That's for English not for maths. And then we do maths.

WHAT I'M HEARING IS FAIRNESS. PRETTY IMPORTANT TO ALL OF YOU?

Yeah.

... Maths class no one comes right up from the back of say, an English class.

Any class.

TELL ME ABOUT UNFAIRNESS. HAVE YOU SEEN UNFAIRNESS HAPPENING?

Not really.

Some people just pick on students. Make it hard for them for the year. [says T]

Some are quite sexist.

[T continues, about the students] They feel bad about themselves.

IS THAT A BIG PROBLEM IN THIS SCHOOL, T, DO YOU THINK?

Yeah, a lot of kids get put down from the teachers (Yeah) and feel left out eh.

... feel like they've done well.

DO YOU THINK IT COMES THROUGH TO ASSESSMENT? DO YOU THINK, LIKE, THE TEACHERS GIVE YOU A BAD GRADE BECAUSE THEY DON'T LIKE YOU?

mmm

Sometimes.

Yeah.

Yeah ...this kid in my XX class, he called me "gay" in front of everyone so now he's being no good at his work. ... Then everyone starts laughing at the boy and that'll make him feel really bad.

Yeah, but.

N, YOU HAD SOMETHING TO SAY THERE ABOUT REPORTS AND UNFAIRNESS.

No.

Some teachers that put you down they like do it in a funny way, that's not so bad.

But then it's really hard

THAT'S SORT OF ON A DIFFERENT ISSUE AND I WANT TO COME BACK TO MATHS. I'M SORRY TO BE SO BORING ALL THE TIME. SOME PEOPLE'S IDEA OF MATHS IS LIKE YOU GET 10 QUESTIONS AND YOU EITHER GET LIKE SIX RIGHT OR WHATEVER ELSE, BUT IF YOU GO MORE TOWARDS PORTFOLIO STYLE LIKE THAT, INTERVIEW AND ALL THOSE SORT OF THINGS THEN ITS NOT SO RIGHT OR WRONG AND IT'S PRETTY HARD TO GIVE IT A GRADE ANYMORE, AND DO YOU THINK THAT THAT IS GOING TO LEAD TO UNFAIRNESS?

Yeah.

WHAT DO YOU RECKON?

Yeah.

THERE'S A *POSSIBILITY* OF DOING IT. DO YOU THINK THAT IT WOULD ACTUALLY HAPPEN IN THIS SCHOOL? THE TEACHERS WOULD BE UNFAIR?

Oh yeah.

THEY DIDN'T LIKE YOU THEY'D MARK YOUR ONE HARDER.

(Interruption)

If you, like, aren't very good then they look at your work and take like a look back and say like he's done this and this and this so I'll just pick every little thing. Sometimes you might get marked for your working out but the teacher might go, oh I don't want to and just do that just because of like something you might have done. Arguing or something.

Its just like, in our XX class um Mr. XX he um every little thing he makes you, he rubs it out like half a drawing out, and makes you go back and do it again.

BUT HE'D DO THAT THE SAME FOR EVERYONE?

No, he doesn't. He just sort of like picks on the same people.

... Really you've got to have a good first impression on the teachers.

Yeah, they respect you if you work but if you're like naughty...

Sometimes you've got to stand up for yourself, with some teachers. Like when they start being mean to you and stuff like, 'cos we've got rights. Even our Social Studies teacher wanted to walk out of our class because ... no matter who they are always stick up for your rights.

...

LET'S MOVE ON. PORTFOLIOS. DO YOU THINK THAT ANYONE IN YOUR CLASS HAS PRODUCED ANYTHING ON COMPUTER?

Yeah.

Couple of people.

IS THAT SOMETHING THAT IS MORE AVAILABLE THESE DAYS?

Mmm

DO YOU PLAN TO DO IT ON COMPUTER WHEN YOU PLAN TO DO YOURS OR WHAT?

Yeah.

YOU'RE DOING ONE ALREADY ON THE COMPUTER, DID YOU DO YOURS ON THE COMPUTER?

No, I just did mine in writing.

I stuff up things on the computer.

It's not neat and you might get marked down for neatness.

THERE MUST HAVE BEEN STUDENTS, I'M REALLY JUST TALKING TO C & N HERE. THERE MUST HAVE BEEN STUDENTS IN YOUR CLASS WHOSE WORK EITHER NEVER GOT DONE OR CAME IN LATE. ARE YOU AWARE OF THAT AT ALL, AND WHAT HAPPENED TO THOSE GUYS?

Yeah.

Teacher gave them home detentions and they had to stay in at lunchtime but sometimes it was kinda hard for some people to get going because they might write really slow. Because I write really slow that's why I type now, and um other people they might not get a chance, they might leave it at. And that's kind of unfair 'cos they've got it all, at home.

They expect you to find the information that's there.

Yeah, right away.

AND IT'S NOT SO SIMPLE.

Yeah. It's just easy.

Like, some of my friends got just one night to do it. ...

DO YOU GET THAT IN MATHS?

Yeah.

My Maths teacher always gives me homework every single day, but then I've got like English homework and all that and I don't get round to Maths and then I've got to stay in at lunchtime and that's kind of unfair. ... They don't know what you've got.

You probably get homework about three times a week ...

IS THERE ANYTHING ELSE THAT YOU'D LIKE TO TELL ME ABOUT PORTFOLIOS OR MATHS?

Nah.

Appendix J

TRANSCRIPT: INTERVIEW WITH 4B 4 JUNE 1998

FOR THREE OF YOU ANYWAY, WE HAVE TALKED BEFORE ABOUT PORTFOLIOS, ASSESSMENT AND ALL OF THAT. I THINK THAT SHEET THERE, THE 4TH FORM PORTFOLIO SHEET, HAD BEEN SEEN BY MOST PEOPLE AND AT THE MOMENT YOURS IS BEING RE-TYPED P ISN'T IT? YOU'VE SEEN SOMETHING SIMILAR. A HAS SEEN IT ALREADY, EXACTLY THAT. YOU'VE SEEN IT, YOU'VE SEEN IT I CAN'T REMEMBER IF YOU HAVE

Yeah, I have.

SO, EVERYONE'S SEEN IT EXCEPT P MAY HAVE A DIFFERENT VERSION. I'M INTERESTED TO KNOW HOW YOU'RE GOING ON THE PORTFOLIO ITEMS. WHICH ONES YOU'VE DONE AND ALL THAT. A IS TELLING ME SHE'S DONE THE INTERVIEW AND SHE'S WORKING ON THE VALUE FOR MONEY INVESTIGATION AND SHE'S OFF TO AUSTRALIA BEFORE SHE HAS TO DO THE NEXT ITEM. HOW ARE YOU GOING G, WHICH ONES HAVE YOU DONE, WHICH ONES ARE YOU WORKING ON ETC.

I haven't done them.

HAVEN'T DONE ANYTHING AT ALL.

(Laughter.)

OK, IS THAT BECAUSE OF YOU OR HAS THE TEACHER SAID

No, I lost my sheet

RIGHT. SO WHAT'S GOING TO HAPPEN?

I should ask for another one.

YEAH. SO OTHER PEOPLE IN YOUR CLASS HAVE ALREADY DONE THE INTERVIEW FOR EXAMPLE, AND ITS JUST STORED OR SOMETHING. HAVE YOU BEEN CHASED UP ABOUT IT?

No, gives me zero

GIVES YOU A ZERO. WELL DESERVED IF YOU DON'T DO IT. ARE YOU GOING TO CATCH UP? HE MUST BE WRITING YOUR REPORT NOW.

Yeah maybe.

DO YOU WANT ME TO RUN OFF A SHEET FOR YOU?

Yes please

DO YOU WANT MR E TO RUN ONE OFF FOR YOU? OK, I'LL SEE WHAT I CAN DO.

IN YOU WERE SAYING YOU'VE DONE THE INTERVIEW AND YOU'RE WORKING ON VALUE FOR MONEY INVESTIGATION

I've done value, I've done that today.

AND DID YOU HAND IT IN?

Yeah

TELL ME ABOUT GRADES

I don't know.

SO YOU HAVEN'T SEEN THE GRADES. YOU'VE HANDED THEM IN YOU HAVEN'T ACTUALLY BEEN GIVEN THEM BACK.

Yeah

SO YOU'RE NOT SURE HOW YOU WENT AT ALL.

Yeah

AND ARE YOU STARTING WORK ON THE GEOMETRICAL INVESTIGATION?

Yeah

SO WHEN YOU SAY YOU'RE STARTING WORK ON IT DOES THAT MEAN YOU PERSONALLY OR THE WHOLE CLASS?

Whole class.

DO YOU GET CLASS TIME TO WORK ON THIS?

Sometimes, Oh, no we do ...

Because I don't mind, we have to do all ours for homework, but the thing is when you're at high school all general teachers give you homework and they don't know how much you've got from other teachers then they give you home detention if you don't hand it in. It's easier if we do it in class.

HAVE YOU HAD ANY CLASS TIME AT ALL?

No.

Neither have we.

And I handed my value for money one in and I haven't got it back yet but everyone else has.

STRANGE, WELL YOU'D BETTER GO AND ASK, SEE WHAT HAPPENED TO IT. DID THEY GET IT BACK WITH GRADES?

Yeah, I think they got it back with grades.

WHAT SORT OF GRADES: "A'S", "B'S"?

5 being the highest 1 being the lowest.

P WHAT'S UNDERWAY WITH YOUR CLASS AT THE MOMENT? HAVE THEY STARTED ON THIS NOW?

We've just finished.

AND HOW DID THAT GO FOR YOU?

I got 9 out of 10.

SO YOURS IS GRADED OUT OF 10. WELL, 9 OUT OF 10 SOUNDS VERY RESPECTABLE. GOOD ON YOU. WHAT WAS IT LIKE TO DO? DID YOU INTERVIEW PARENTS?

No, we had to do research some of the mathematicians we've done. About how they used maths.

RIGHT. WHO'D YOU DO?

...

WAS IT INTERESTING TO DO?

No it wasn't really.

REALLY BORING?

...

WHICH BOOK?

...

DID YOU GO TO THE LIBRARY YOURSELF AT LUNCHTIME OR WERE YOU GIVEN TIME IN THE LIBRARY?

...

AND A, YOU WERE TELLING ME A BIT ABOUT YOURS AND I'M NOT TOO SURE WHERE YOU WERE. YOU'D DONE THOSE ONES AND YOU'RE NOT GOING TO DO THAT ONE SO IT'S REALLY IN THE FIRST THREE THAT YOU'RE GOING TO DO. GRADES AND GRADING AND MARKING OF IT. WHAT WAS YOUR SITUATION ON THAT?

For the interview I got 7 out of 10.

WHY DID YOU LOSE 3 MARKS, DO YOU KNOW?

Um, No.

IS 7 OUT OF 10 A GOOD MARK? I MEAN 9 OUT OF 10 THAT SOUNDS PRETTY SPECIAL DOESN'T IT. IS 7 OUT OF 10 GOOD?

Sort of in between, it's sort of average for our class.

OK, LET'S JUST LOOK AT THESE ISSUES HERE. I'M INTERESTED. I'VE SEEN MOST OF YOU BEFORE AND WE WENT THROUGH BASICALLY A WHOLE LIST OF QUESTIONS ABOUT THINGS THAT INTERESTED ME ABOUT ASSESSMENT AND ALL THAT SORT OF STUFF. TODAY I WANTED TO KNOW SORT OF HOW YOU'RE GOING TO DO THESE PORTFOLIOS AND FOCUSING MORE ON THE PRACTICAL REALITY OF HOW YOU GET BY. C IS ALREADY SAYING SOMETIMES HE'S GOT JUST HEAPS OF HOMEWORK AND IT'S EASIER TO DO THINGS IN CLASS, AND I MEAN TIME IS ONE PROBLEM ISN'T IT? ARE YOU ALL DOING THINGS TO COPE WITH TIME MANAGEMENT? THE SCHOOL GIVES YOU DIARIES. YOU'RE SUPPOSED TO FILL IN DIARIES. TELL ME ABOUT TECHNIQUES FOR TIME MANAGEMENT.

Well, when you go to do your homework you say, ok, I'll do half an hour of this but then you don't have enough time, sometimes you might have to go out with your parents, or something's happened and then the teacher will just say its an excuse and then you don't have the time and you get less marks.

SO YOU TEND TO HAND THINGS IN LATE. RIGHT. WHAT ABOUT WEEKENDS? IS THAT A GOOD TIME FOR YOU TO DO HOMEWORK OR A BAD TIME?

Weekends, well I reckon it's supposed to be like. ... You go to school majority of time you're in school then weekends its a bit silly if you have to do homework, but if I have to do it, if I have to get it finished I usually do it on Sunday.

WHAT TIME ON SUNDAY?

I start about three, when I get home.

WHERE DO YOU GET HOME FROM?

Friends house. ...

3 AND YOU MIGHT GO TILL DINNER TIME, SOMETHING LIKE THAT?

Yeah.

THAT DOES MEAN YOU'RE STUCK AT HOME, SO LIBRARY WORK LIKE P WAS DOING YOU WOULD HAVE HAD TO GET CLEARED SOMEWHERE ELSE IF YOU NEEDED TO GET A PARTICULAR BOOK OR SOMETHING.

Yeah. But since I was in Hornby if I had to get a book I'd get it from the library.

DO YOU PEOPLE SEE YOURSELVES AS BEING QUITE WELL ORGANISED? IT SOUNDS PRETTY WELL ORGANISED IF YOU KNOW THAT THERE'S GOING TO BE OVERFLOW SO YOU'RE GOING TO HAVE SOME TIME ON SUNDAY. I KNOW YOU DON'T LIKE DOING THAT, YOU'VE SAID THAT, BUT AT LEAST IT SOUNDS LIKE YOU'RE ORGANISED TO KNOW WHAT'S UP. HOW DO YOU FEEL ABOUT BEING WELL ORGANISED? DO YOU COUNT YOURSELF AS A WELL ORGANISED PERSON?

No

OK. AND HOW DOES THAT SHOW? WHAT WOULD YOU HAVE TO CHANGE TO BE WELL ORGANISED?

Aw I'd sort of have to get ...

DO YOU REGULARLY DO HOMEWORK WHEN YOU'RE AT HOME?

No.

SO IT WOULD ONLY BE OCCASIONALLY THAT YOU'D DO HOMEWORK?

Yeah.

AND WHAT ABOUT WEEKENDS? DO YOU SORT OF CLEAR THINGS UP ON WEEKENDS?

No.

SO YOU'RE A "NO". NO HOMEWORK PERSON. WHAT ABOUT IN SCHOOL? IF YOU HAD TO DO THESE THINGS WHICH ARE IN THE PORTFOLIO THING, SAY VALUE FOR MONEY INVESTIGATION WOULD YOU BE INCLINED TO DO THE INVESTIGATION AT SCHOOL?

Yeah.

WHAT IF IT WASN'T IN CLASS TIME? WOULD YOU DO IT AT LUNCH TIME?

No No ...

USING THE LIBRARY. DO YOU USE IT IN YOUR OWN TIME? DOES YOUR ENGLISH CLASS GO IN THERE?

Aw yeah.

WHAT ABOUT OTHER LIBRARIES, PUBLIC LIBRARIES?

No, I don't like them.

INTERNET?

No.

HAVE ANY OF YOU GOT THE INTERNET?

No.

I asked my Dad to get it but then his friend's daughter had it and she spent like \$400...

OK. THE OTHER THING IS LIKE REFERENCE BOOKS AND THAT SORT OF THING. SAY P, YOU HAD TO DO THAT ONE ABOUT A MATHEMATICIAN. IF THAT HAD BEEN SET FOR HOMEWORK WHEN YOU DID IT WOULD YOU HAVE GONE HOME PULLED OUT A BOOK OUT OF THE LIBRARY AND DONE IT FROM THAT BOOK?

...

RIGHT, SO YOU'VE GOT ENCARTA AT HOME?

Yeah.

DO YOU USE IT VERY MUCH?

...

WHICH DO YOU USE THE MOST. ENCARTA OR INTERNET?

...

DO YOU GUYS KNOW WHAT HE'S TALKING ABOUT? ENCARTA.

Yeah. Got it.

Yeah.

SO YOU ALL KNOW WHAT IT IS. SO G'S GOT IT?

I've got it.

We've all got it.

ALL FIVE OF YOU HAVE GOT ENCARTA AT HOME?

We've only got '95 though.

Yeah, we've got '95 no we've got '96, but like when you have to get information its like going to facts..... and you know you shouldn't copy it straight off the computer. Then one day I didn't copy it off the computer and he said you could do that.

IF YOU'RE USING ENCARTA THOUGH WOULD YOU JUST USE THAT? THAT'S ALL THE FACTS IN ONE PLACE ISN'T IT?

Yeah.

Yeah.

WHAT ABOUT INTERNET? HAVE YOU EVER FOUND OUT ANYTHING ON THE INTERNET THAT WAS ACTUALLY ANY USE TO YOU IN SCHOOL EVER?

Not really, it's just too hard to find 'cos there's just so much stuff there.

IF YOU USED IT FOR HOBBIES OR SOMETHING WHERE YOU HAD TO FIND OUT SOMETHING THAT YOU WANTED TO KNOW TO BE ABLE TO MAKE SOMETHING ...

I download games.

YOU DOWNLOAD GAMES AND THINGS OFF IT?

Yeah.

OK, THANKS. COULD WE TALK ABOUT SOMETHING DIFFERENT. I WANT TO TALK ABOUT HOW MATHS AT THE MOMENT IS COMPARING WITH OTHER SUBJECTS FOR YOU. AMOUNT OF WORK, QUALITY OF WORK. I'M PARTICULARLY INTERESTED IN ASSESSED WORK. YOU KNOW, ANY PORTFOLIO STUFF OR ANYTHING ELSE. TESTS AND STUFF LIKE THAT. HOW DO YOU FIND MATHS COMPARING WITH OTHER SUBJECTS?

Yeah, probably about the same, about the same amount of homework about the same amount of work.

HOW MUCH WORK IS IT FOR YOU?

Oh, we don't get that much. We have to do a sheet like...

CAN YOU PUT IT IN HOURS PER WEEK OR DOES IT VARY TOO MUCH?

No it varies ...

WHAT'S THE EASIEST SUBJECT IN SCHOOL TO DO IN TERMS OF HOMEWORK?

Probably maths or English ...

She's going to Australia (laughter).

HOW DO YOU FIND IT P? HOW DO YOU FIND MATHS STACKS UP AGAINST OTHER SUBJECTS? NOT JUST THE HOURS THAT YOU PUT IN BUT ALSO THE QUALITY OF WORK THAT YOU HAVE TO DO, THIS IS ASSESSMENT WORK THAT WE'RE TALKING ABOUT.

We don't get much ... not enough time.

SO DO YOU GET QUITE REGULAR HOMEWORK? EVERY DAY THERE'S GOING TO BE SOME MATHS HOMEWORK?

Not every day just some days we've got to do it ...

HOW DO YOU FIND EVERYTHING? DO YOU GET THROUGH IT?

...

IS IT INTERESTING?

...

HOW DOES IT COMPARE WITH OTHER SUBJECTS?

It's probably about the same.

A, YOU'VE HEARD ALL THE QUESTIONS THERE I'VE SAID THEM TWICE. SO HOW DOES THE MATHS STACK UP?

I don't know. I get homework set for me every night.

HOW DO YOU FIND IT? IS IT A REAL DRAG TO DO THE MATHS HOMEWORK, OR YOU DON'T MIND, OR IS IT ROUTINE?

Aw, well sometimes we just get like a little sheet and its what we've already learned or else we get stuff set in a book about what we've done that day then ... I just don't do it

HOW DO YOU FIND THE BOOK? YOU MENTIONED THE BOOK. THIS IS THE PINK BOOK MATHS WORLD 2?

Well, it's pretty easy.

WHEN HOMEWORK IS SET FROM THAT BOOK WOULD YOU HAVE DONE SOME OF THAT SORT OF WORK ALREADY IN CLASS?

Yeah mmm, we would have done it ...

DO YOU ALWAYS MARK IT?

Mmm

ARE YOU A GOOD STUDENT THEN? IF YOU MARK SOMETHING WRONG WHAT DO YOU DO?

Nothing.

NOTHING, ITS JUST WRONG. DOES THE TEACHER PICK UP ON IT?

No.

WHAT WOULD YOU DO IF HOMEWORK WAS SET AND YOU TRIED IT AND IT WAS ALL WRONG, WHAT WOULD YOU DO? GO BACK TO SCHOOL AND

If it was all wrong I wouldn't care.

DOES THAT HAPPEN?

I don't do maths homework very often but when I do I usually get it right.

DO YOU FEEL YOUR PARENTS ARE VERY HELPFUL WITH YOUR MATHS HOMEWORK?

Yeah, well my maths teacher just had a talk to my Mum because I don't..... myself in class and everything so now I might try harder in maths.

I WONDER WHAT IT WILL BE LIKE IN BRISBANE FOR YOU. HAVE YOU ANY IDEA?

My uncle is over there and I went there on holiday and that sort of stuff.

HAS THE UNCLE GOT CHILDREN WHO ARE ABOUT YOUR AGE?

No they're about 21, 23

SO YOU DON'T ACTUALLY KNOW ANY AUSTRALIAN STUDENTS ABOUT YOUR AGE THEN?

No, none.

SO YOU MIGHT GET A FRIGHT WHEN YOU GO OVER THERE. YOU MIGHT FIND "OH GOD, 4TH FORMERS ARE WAY UP HERE AND WAY BETTER THAN ME"

When I went over there they were not, because they started a year later.

DOES IT WORRY YOU?

Yeah, but I might go back in the 4th Form next year.

IT'LL BE INTERESTING TO SE WHAT HAPPENS.

WHAT THIS WANTS. THIS PORTFOLIO SHEET IS FOR YOU TO APPROACH A WHOLE LOT OF DIFFERENT THINGS AND COME UP WITH A SORT OF A MATHS ANSWER, LOOKING AT IT IN A MATHS WAY. DO YOU FIND YOU ARE ABLE TO DO THAT? IS IT CHANGING HOW YOU GUYS DO MATHS TO ACTUALLY WORK THROUGH THESE THINGS OR IS IT JUST, "THIS IS JUST ANOTHER LITTLE BIT OF HOMEWORK" OR WHAT'S HAPPENING? OR IS IT TOO EARLY TO TELL?

No, I just think of it as like another topic thing, the assignment.

SO THESE ARE QUITE SHORT THINGS REALLY AREN'T THEY? JUST DO IT, YOU CAN DO THAT IN ONE NIGHT THEN FINISHED. IF WE WERE GOING TO COME UP WITH, IF *YOU* WERE GOING TO DESIGN THE PERFECT ASSESSMENT SCHEME FOR *YOU* IN MATHEMATICS - WHAT YOU WERE SAYING BEFORE IS THAT YOU WERE NOT APPLYING YOURSELF VERY

MUCH, I GUESS THAT'S REALLY WHAT THE AIM IS. NOW, IF IT WAS GOING TO SAY THAT, OK, "A IS NOT WORKING AT THE MOMENT" WHAT SORT OF ASSESSMENT WOULD DO THIS? IT'S GOT TO OBEY THESE RULES: IT'S GOT TO BE INTERESTING

Got to be fun.

FUN. BUT NOT TAKE TOO MUCH TIME, IT'S GOT TO ACTUALLY REVEAL IF YOU'RE WORKING OR NOT, AND IT'S GOT TO ACTUALLY MAKE YOU THINK ABOUT THINGS MATHEMATICALLY AND DEVELOP YOURSELF MATHEMATICALLY. WHAT'S THE BEST SYSTEM? TELL ME ABOUT IT. SOME OF YOU DON'T LIKE DOING HOMEWORK AT ALL.

...

Some stuff's boring and when you're bored you just don't want to do it

IS THIS STUFF BORING?

Most of it. But when like you're having fun you keep going.

TELL ME THE FUN STUFF

Games.

And also if you know like what you're doing, like if you know how to do that you can just do it and you won't have to like think much.

Then you're not learning anything because you know it.

DO YOU FIND THAT'S TRUE? IF YOU'RE QUICK AND EASY. BUT AT LEAST YOU'RE DOING IT THEN G AREN'T YOU?

Yeah.

But the thing is, it's like tests, if it's quick and easy like when I'm in a test you say you get hardly any right then that's the end of the subject, well you've got none right then you shouldn't finish the subject they should carry on with it.

HOW DO TESTS RATE COMPARED TO DOING THIS SORT OF STUFF WITH PORTFOLIOS? I MEAN A TEST IS QUITE QUICK AND EASY, REALLY. YOU GO THERE, SIT FOR AN HOUR ITS ALL OVER REALLY. SO DO YOU PREFER DOING A TEST TO ANY OTHER SORT OF ASSESSMENT?

No. Never.

No ... tests are boring

SO WHAT'S THE BEST WAY OUT OF THIS? WHAT'S A GOOD WAY OF ACTUALLY HAVING IT? FOR EXAMPLE AN HOUR LONG TEST, YOU COULD BREAK THAT UP INTO 5 PARTS AND HAVE TESTS 12 MINUTES AT A TIME.

Yeah that'd be way easier, (pause) but then the 12 minute tests would have to be like quite short.

Yeah.

Some stuff on a big test over an hour you'll like do all the easy stuff first then go back and do the hard stuff but if they give you hard stuff if you've got all the easy stuff finished and they've given you hard stuff you won't have enough time. I suppose that's why they do it for an hour.

Yeah.

THIS SITUATION WITH TESTS. AT THE MOMENT YOUR TESTS, YOU'VE NEVER DONE A MATHS TEST, ANY OF YOU, LONGER THAN AN HOUR, HAVE YOU?

Last year

AN HOUR MAXIMUM

Was it last year?

Last year it was an hour and a half or something

I thought it was about two hours.

...

OH, ALL RIGHT, SO IT WAS LONGER. HOW DID YOU FIND IT?

Passed.

Passed.

DO YOU REMEMBER THIS HORRIFIC MATHS TEST? N DOESN'T.

Yes in the hall.

No I don't think it was in the hall.

P DOESN'T. MAYBE NOT EVERY CLASS WAS IN THE HALL.

Some classes in the classrooms.

I didn't pass.

SO YOU REMEMBER THAT YOU DIDN'T PASS?

Aw, was it that big one at the end of the year?

I got 18 or something.

I got 62 (laughs).

YOU SAY THAT AS IF YOU DON'T LIKE 18?

Yeah, I got something like 24 or something like that.

24 PERCENT?

Yeah I think so I don't know.

Because it's different. I reckon the people who did it in the classroom sort of had more of a chance because they were in a nice warm place.

I was in a classroom.

Was it nice and warm?

Yeah and I got 24.

And I got 18.

I reckon it would be easier if you did it in class.

IF THAT TEST HAD BEEN BROKEN INTO, SAY, LETS BE REALISTIC, 4 PARTS, 30 MINUTES EACH. EACH DAY FOR A WEEK WHEN YOU WENT INTO CLASS FOR FIRST HALF OF THE PERIOD WAS THE TEST, THEN THE NORMAL PERIOD AFTER THAT.

Well, yeah, it would have been better.

Would have been better.

Because what would have happened is like you could study for each bit individually but isn't that like unit standards? Because unit standards they do that and I reckon unit standards would be way easier than just sitting all exams at once they do them all right through the year. You forget the stuff you learned at the start of the year. So if they did it unit standards

AND THE OTHER THING ABOUT UNIT STANDARDS IS IF YOU FAIL SOMETHING YOU CAN GO BACK AND HAVE ANOTHER BASH AT IT. NOW THAT SEEMS TO HAVE A LOT OF APPEAL TO PEOPLE.

Yeah.

WHAT HAPPENS THOUGH? IMAGINE IF YOU DID ALL THAT TESTING THEN AT THE END OF THE WEEK YOU'RE THINKING "I WANT TO GO HOME, I'VE HAD ENOUGH OF THIS". YOU'D FEEL PRETTY WRECKED.

No, not if it's only half an hour because at least you get ... stretch in between periods

RIGHT

So 2 hours it's a long time.

SCHOOL CERT'S THREE HOURS. AND SOME STUDENTS DON'T MAKE IT. I MEAN THEY'RE DOING THE SAME THING FOR 3 HOURS, THAT PROBABLY THE LONGEST APART FROM SLEEPING THE LONGEST THING ANYONE'S EVER DONE IN THEIR LIFE. IT'S HARD TO PICK REALLY.

Do you get a break?

Don't you, do you just got to sit there? That's great.

I'd rather just do unit standards. I think it's just like a contest. ...

BUT WHAT ABOUT THIS SORT OF THING WHERE YOU'RE DOING PROJECTS AND STUFF? IS THAT IN THE PICTURE AT ALL OR IS THAT JUST NON ASSESSMENT? YOU REALLY WANT TESTS, TESTS COUNT?

Yeah, because they give you 5 and you had to ... I'd rather just do tests.

Yeah. Tests.

Well you're gonna have tests anyway, we have tests anyway so.

WE COULD DO AWAY WITH TESTS, TOTALLY. JUST DO IT ON PROJECTS. SOME COUNTRIES DO THAT.

Yeah but

They should do that and then just assess you from your projects of what you know.

Yeah.

DO YOU THINK IT COULD BE DONE?

It could be done, but then you forget, like you don't always put your information, all the information you've got down.

BUT G YOU WOULDN'T LIKE THAT. YOU WANT QUICK AND EASY YOU DON'T REALLY LIKE DOING THESE SORT OF THINGS.

No.

YOU MIGHT WIND UP BEING DISADVANTAGED DO YOU THINK? THE DIFFERENCE I SUPPOSE WITH A PROJECT IS THAT YOU TAKE A LOT OF TIME OVER IT.

It should be just like short essays. Find out things.

Portfolios were.

They gave you a choice I'd rather do the test ...

...

GIVE PEOPLE AN OPTION.

I reckon Social Studies is way better, and Science, because we're doing a project at the moment for Science and we're allowed to *choose* it. ...

THIS PORTFOLIO THING IS PRETTY STRAIGHTFORWARD ISN'T IT? THIS PROJECT AND THIS PROJECT AND SO ON. WHAT IF THEY HAD IT ON HERE, FOR EXAMPLE, YOU'VE GOT TO DO SOME RESEARCH, OR SOMETHING LIKE THAT. IT'S WIDE OPEN YOU JUST GET GOING AND MAKE YOUR OWN TOPIC.

You'd be better doing your own research on *something*. There should be like guidelines so instead just get your own research you can do it on any topic, it's got to have like something to do with maths like do research on where something came from, what's pi, something like that

WHAT ABOUT IF IT SAID, JUST "SELECT THE BEST WORK YOU'VE DONE THROUGHOUT THE YEAR ON AN INVESTIGATION, IN ALGEBRA, OR THE BEST HOMEWORK" SOMETHING LIKE THAT, AND YOU CAN PASS ALL THAT UP TO BE ASSESSED, I'M TALKING ABOUT REPLACING TESTS WITH THIS, WOULD IT WORK?

Yeah.

WOULD IT CHANGE HOW YOU WORK?

Because I reckon that would be like unit standards because you do each thing and you just get your best one. In a test you've done it, that's final, no looking back.

Yeah, like if it was marks for each like term or something, there'd be like all that work for that term. It would be like the same as having a test for that term, just hand it in.

WHAT IF I SAID DO IT LIKE, YOU KNOW IN ART IF YOU'RE DOING ART, THOSE KIDS DOING SCHOOL CERT ART FOR EXAMPLE HAVE GOT TO DO SOME WORK WITH OILS, GOT TO DO SOME WORK WITH PASTELS, PHOTOGRAPHY, THINGS LIKE THAT, THEN YOU PUT IT ALL TOGETHER. COULD WE DO THE SAME IN MATHS?

Yeah.

HOW WOULD IT GO? WHAT WOULD IT LOOK LIKE?

Probably.

Yeah.

Do some addition, some geometry, some tessellations. You do sections of each.

Yeah like put it in a manila folder, do it like a project, like a book, open it: have all the information.

And it would show the person what you've learned from each of the things

IF I WANTED THAT TO HAPPEN WHAT WOULD I ACTUALLY HAVE TO TELL THE 4TH FORMERS? "HERE'S WHAT WE'RE GOING TO DO..."

I don't know, tell them to choose say four subjects to do with maths and do a project from each one.

You should tell the subjects so you can mark them all the same because it would be all the same subject.

IT MIGHT BE TESSELATIONS, STATISTICS THAT SORT OF THING?

But what you could ask them to do is like have a list of subjects, like boxes and they just tick four subjects that they want to do, say you could have ten and just take four and then do those four.

BEST WORK FOR THOSE THINGS. OK WELL THAT WOULD BE INTERESTING TO PLAY WITH.

OK, UM, LOOK, I WANT TO GET YOU GUYS BACK TO CLASS, SORRY THIS HAS GONE SO LONG, VERY SLOW GETTING EVERYBODY HERE. ANY

OTHER THOUGHTS ABOUT ASSESSMENT AT THE MOMENT, AND IN PARTICULAR ABOUT YOUR WHOLE CLASS? LIKE, I MEAN IF YOU'RE WORKING REALLY REALLY HARD AND YOU'RE DOING ALL THIS, FINE, BUT EVERYBODY ELSE IS THINKING IT'S PRETTY HO-HUM, THEN TELL ME THAT. HOW ARE PEOPLE REACTING TO THESE PORTFOLIO THINGS? ...

G IS SHAKING IS HEAD, NOT A BIG STIR. IS THAT BECAUSE IT'S EASY OR BECAUSE

I don't think people care.

Yeah.

Oh its just another, just another one of those things, we've got so much

IT'S 20% OF YOUR ASSESSMENT THOUGH

How many?!

PORTFOLIO IS 20% OF YOUR YEAR'S MARK.

Is it?!

THE FINAL EXAM IS ONLY 50%. YEAH. IT'S GONNA ACTUALLY COUNT, IT'S GONNA MAKE A DIFFERENCE.

So these like, is this from our exam?

YEAH, THESE ARE THE MARKS. THERE'S TESTS YOU DO, THERE'S 5% ON 20TH MARCH, 5% ON 1ST OF APRIL AND SO ON, DOWN HERE, THAT ADDS UP TO 30%. YOU DO A FINAL EXAM IN MID NOVEMBER FOR 50% BUT WHAT ACTUALLY YOU PUT INTO YOUR PORTFOLIO IS THE OTHER 20%. SO IF YOU'RE ON, SAY, 45% THE PORTFOLIO CAN BE ALL THE DIFFERENCE COULDN'T IT?

Hmm.

...

IT SOUNDS LIKE YOUR REACTION TO THAT- THAT PEOPLE HAVEN'T TAKEN THAT ON BOARD REALLY.

No.

I just didn't realise.

They don't say that.

They just said Portfolio is but they don't explain

They just explained what we had to do and go to it.

THAT'S WHY I WAS ASKING ABOUT HOW WAS IT GRADED AND ALL THAT. I WAS WONDERING IF PEOPLE FELT IT WAS FAIR. YOU SEEMED HAPPY, YOU GUYS SEEMED TO GET VERY GOOD MARKS. "WELL THEY'RE NOT GOING TO COMPLAIN".

Yeah, well I didn't think it mattered. Because in that one I got all the information down that everyone else did except it was only on one piece of paper and he wanted it on two because I did it on my computer.

Yeah, that's why I lose marks. Mine was like all little writing.

And he said people who do it on computer it would be neater and you might get more marks.

Some people don't have computers.

YOU ALL DO, YOU'VE ALL GOT ENCARTA.

Like with the next one, I've handed mine in. He hasn't given it back to me I don't know about that.

DO YOU THINK, I MEAN IF THIS WAS WORK 50% AND THE FINAL EXAM WAS WORTH 20%, IF WE SWITCHED THOSE AROUND, WOULD THAT BRING THIS TO LIFE, WOULD PEOPLE SAY "WELL, I'D BETTER DO THIS THEN".

No.

No. That wouldn't work.

WHY?

People would just say "Oh well, Nah", they wouldn't bother, because when you've got to do homework it's different than school work.

Yeah.

THIS DOESN'T HAVE TO BE ALL DONE AT HOME, IT CAN BE DONE IN CLASS.

I don't think the teachers

No, teachers don't let you.

ANY OTHER THOUGHTS?

OK. THANKS VERY MUCH.

Appendix K

28 AUGUST 1998 INTERVIEW WITH YEAR 4A

[first named student] IS HERE, [second named student] HAS PREFERRED TO GO TO SOCIAL STUDIES AND THAT'S HIS BUSINESS, IF HE WANTS TO DO THAT, AND [third named student] IS AT MUSIC SHE MIGHT TURN UP HALF WAY THROUGH. I'VE GOT QUITE A FEW THINGS TO DO WITH YOU GUYS TODAY - THE SAME DEAL AS LAST TIME IT'S NOT TOP SECRET. NOW I WANT TO SHOW YOU SOME THINGS HERE AND SEE WHAT YOU THINK ABOUT IT AND TO ASK YOU HOW YOUR PORTFOLIOS ARE GOING AND ALL THAT SORT OF BUSINESS. IN MATHS. WHAT I'D REALLY LIKE TO DO IS GO OVER PORTFOLIOS WITH PEOPLE AT SOME STAGE AND ACTUALLY LOOK AT WHAT YOU'VE PRODUCED AND ASK YOU ALL SORTS OF BEADY QUESTIONS ABOUT IT. HOW DO YOU FEEL ABOUT THAT? IS THAT A BIT TOO INSTRUSIVE? YOU DON'T LIKE THAT IDEA, DO YOU?

I don't care.

YOU DON'T CARE, WELL THAT'S ALL RIGHT THEN. WE MIGHT JUST DO THAT AND WE'LL SEE HOW WE GO. FIRSTLY, YOU'VE BEEN DOING SOME MORE PORTFOLIO ITEMS. WHAT HAVE YOU ACTUALLY DONE? WHAT ARE YOU UP TO?

We did the Cantamath and that's it.

RIGHT, SO YOU'VE BEEN QUITE BUSY DOING THAT. AND WHAT'S YOUR SITUATION?

Yeah we've done the Cantamaths

AND SO

And the technology

AH,

The price or whatever. That was ages ago

GETTING THE BEST PRICES OF SOMETHING

Stereos.

We've done three of them so far I think

RIGHT, OK SO BOTH OF YOU, THAT'S [named student] AND [named student] HAVE DONE THE INTERVIEW THE COMPARATIVE PRICING AND THE CANTAMATH, AND THAT'S ALL?

Yep because our maths teacher said we don't have to do it

AH, YOU MIGHT NOT GET TO DO EVERYTHING THAT'S ON THE LIST. IT DEPENDS ON WHAT HAPPENS. OK, SO THAT'S FINE, WHAT'S THE NEXT THING THAT'S COMING UP FOR YOU GUYS?

Dunno.

We just coloured in a duck.

YOU LUCKY THING, COLOURED IN A DUCK, TELL ME

Oh, that's for the portfolio

But he said it was

Donald Duck?

No. Draw up the lines and stuff.

Yeah, we did that.

Yeah and he said he'd mark us on that because we didn't have time to do the other things.

WHAT IS COLOURING IN A DUCK? WHAT IS IT REALLY?

It's that lines thing.

I DON'T KNOW WHAT IT IS, TELL ME.

And graphs.

You have lines, like, say you have 3,5 and then you go across 3 and up 5 and put a dot then draw lines, I've forgotten what its called.

RIGHT OK SO ITS CO ORDINATES ON A GRID SOMEWHERE AND YOU'VE JUST GOT TO KNOW YOUR CO ORDINATES?

It's something to do with gradient, like you do it when you're doing gradient

OH RIGHT

I just don't know why.

MAYBE THERE'S FORMULAS OR SOMETHING?

No it's just.

BUT ITS LIKE - A WORKSHEET, ITS NOT LIKE SOMETHING YOU INVENTED?

No.

OK, RIGHT.

We drew the picture.

VERY GOOD. TELL ME A BIT ABOUT THE CANTAMATH THING BEFORE WE MOVE ON, DID YOU DO A CANTAMATH ENTRY?

I don't know what that is.

THIS SORT OF THING - SITTING ON THE TABLE HERE.

No.

It's our classes.

OH IT'S YOUR CLASS. RIGHT. SO THEY DID A CLASS ONE, SOME PEOPLE DID INDIVIDUAL ONES, YOU CAN SEE ALL SORTS OF THINGS SITTING ALL OVER THERE [named student]

...

CANTAMATH INVESTIGATIONS, ITS ALL JUST UP THERE, LET'S SEE WHAT HAVE WE GOT, TESSELATIONS, SOMEONE'S DRAWN LITTLE DESIGNS.

We just did ellipses for ours.

OK. IS THAT YOUR CLASS THERE, AN ELLIPSE? WHAT DO THEY CALL IT, AN ELLIPSE IN A RECTANGLE? ELLIPTICAL PATTERNS AND THERE'S PICTURES, THERE'S ACTUAL ICE CREAM CONES CUT UP.

That's to show the ellipses.

YEAH, AND THAT'S YOUR CLASS'S?

Mine's not on there though because the felt, I was doing it and the felt ran out and no one had the same colour so it was sort of went messy,

DIDN'T WORK. OH THAT'S A BIT TRAGIC [named student] BECAUSE IT ACTUALLY WON A PRIZE OR SOMETHING THAT ONE DIDN'T IT?

I don't know.

AND [different named student] WHAT DID YOU DO WITH YOUR CANTAMATH?

We had to do the written one so I just wrote a poem, took me about 10 minutes.

MMM, AND DID IT GO ANYWHERE - GO INTO THE TOWN HALL?

I dunno.

HAS IT BEEN ASSESSED AT ALL?

Dunno.

YOU DON'T KNOW. DID YOU GET IT BACK?

No.

RIGHT, OK, WHAT DO YOU THINK'S GOING TO HAPPEN. DID YOU EXPECT TO GET IT BACK, WITH A MARK ON IT?

I don't know. I don't get everything back except for tests.

RIGHT.

Is [named student] at Jazz Band? Because she should be finished up soon and she will be coming.

YEAH, WE SHOULD KEEP AN EYE OUT HERE I WONDER WHICH WAY SHE'LL GO, CUT HER OFF IF WE SEE HER STROLLING PAST. PULL THE CURTAINS OVER. [named student], IT SOUNDS TO ME THAT YOU DON'T KNOW A WHOLE HEAP ABOUT THE PORTFOLIO THINGS. THEY DISAPPEAR INTO A, INTO A VOID AND YOU'RE NOT TOO SURE WHAT'S BECOME OF THEM?

Oh, He puts them in a folder I think.

MMM.

I think some of the good ones might go in to Cantamath.. We wouldn't get them back anyway.

Teachers collect them in and then they get lost for ever

OH DEAR. OK LET'S MOVE RIGHT ALONG. WHEN IS YOUR NEXT THING DUE - DO YOU KNOW ANYTHING ABOUT THE NEXT ONE?

No.

NOTHING AT ALL? NO ONE KNOW NOTHING. OK RIGHT. FINE. I WANT TO MOVE ON TO OTHER THINGS. HERE'S SOME STUDENT WORK. NOW THIS IS A QUESTION ALL ABOUT FROGS. YOU HAVE SO MANY FROGS AND THEY HOP ABOUT THE PLACE AND THEY'RE HOPPING TO CHANGE SIDES SO THERE'S A QUEUE OF FROGS, THEY JUMP OVER EACH OTHER AND GO TO DIFFERENT SIDES OF THINGS. HAVE YOU EVER SEEN AN ACTIVITY LIKE THAT?

We've used that.

HEARD ABOUT IT?

I saw ... doing something like that

OH RIGHT. HERE YOU SEE SOMEBODY'S WORK, THIS IS A STUDENT'S SHEET

Is this our class?

NO NO

...

YEAH YOU CAN SEE YOU'VE GOT RED FROGS AND BLUE FROGS AND THEY CAN, ONLY ONE FROG JUMPS AT A TIME, AND EVENTUALLY YOU'VE GOT TO HAVE THEM REVERSED, POSITIONS REVERSED.

How do they go, well what if they want to go on the same square?

THEY CAN'T. ONE FROG ...

Is that, can that jump?

FOR THE FIRST MOVE, ONE OF THEM'S GOT TO MOVE INTO THIS EMPTY SPOT IN THE MIDDLE.

So it can jump over other ones into an empty spot?

IT CAN JUMP OVER OTHER FROGS, YEAH.
NOW HERE'S A STUDENT'S WORK ON FIGURING OUT WHAT HAPPENS WITH THE FROGS. WHAT DO YOU THINK OF IT?

[Without hesitation] Beautiful.

MMM

Wonderful.

[Giggling]

BY YOUR TONE CAN IT TAKE IT THAT YOU WOULD TAKE IT THAT THIS WOULD BE A BORING THING TO DO?

Yes.

Yes.

Yeah.

OK. NOW LET'S LOOK AT A DIFFERENT STUDENT'S WORK. HERE'S SOMEONE ELSE, SAME PROBLEM, WHAT DO YOU THINK?

A waste of time.

MMM.

That one looks more interesting because it's got colour.

MMM. NOW WHAT ABOUT THIS, HERE WE'VE GOT SOME "N"S AND "N" SQUARES.

That's boring too.

THAT'S BORING? OK, THIS IS STILL THE FROGS PROBLEM THOUGH

Mmm

They're harder.

MMMM. WE GRAPH THIS IS HOW MANY FROGS TO START WITH AND HOW MANY DIFFERENT MOVES IT TAKES. WHAT ARE YOU THINKING?

Oh!

[giggling.]

YOU'VE CHANGED FROM SAYING "BORING". YOU'RE NOW SAYING WHAT?

Well, that's more boring. At the start of it...

It's just getting harder and more boring.

They're just making it harder for themselves.

FOR THEMSELVES. OK. AND THEN, OVER HERE, YOU CAN SEE THEY'RE STILL DOING THINGS WITH "N"'S AND FORMULAS AND WORKING OUT THINGS LIKE THAT.

They're the same.

There's [named student, coming from Music lesson].

FINE. WHERE'S SHE GONE? RUN OVER THERE AND GRAB HER. GO AND GRAB HER.

BY THE TIME WE GET TO THE END OF IT THERE'S SOME SORT OF FORMULA ABOUT IT. NOW I BET THAT'S DIFFERENT TO HOW YOU WERE DOING FORMULAS IN CLASS.

Mmm.

OK, BUT YOU WERE SAYING THIS IS BORING?

Is it one person that did all that?

ONE PERSON DID ALL THAT. PAGE, SIX PAGES OR SOMETHING.

Waste of time.

Well I saw someone just doing this like just this type of thing.

YEAH,

GIDDAY [named student from Music lesson] HOW ARE YOU?

Hi Ok.

WE'RE JUST DOING THOSE MATHS INTERVIEWS ABOUT PORTFOLIOS. DO YOU REMEMBER DOING ONE *MONTHS* AGO?

Yeah.

I'M REALLY PLEASED WE MANAGED TO GRAB YOU BECAUSE I WANTED TO KNOW HOW YOU WERE ON THIS TOO AND SEE HOW YOU WERE GOING WITH YOUR PORTFOLIOS AND GET YOUR OPINIONS ON THINGS.

Ok

OK. IF YOU DON'T MIND. UM, YOU HAVE, I'M JUST LOOKING YOU UP. YOU MUST HAVE [named teacher], THE FAMOUS [named teacher].

Mmm.

RIGHT, SO WE WANT TO KNOW ALL ABOUT [named teacher]. WE'RE LOOKING AT THE MOMENT AT THIS WORK HERE AND PEOPLE ARE ASSURING ME ABOUT THEIR OPINIONS ON THIS. THIS WAS A SORT OF A BIT OF PROJECT WORK THAT SOMEONE DID AND THERE'S A RULE ABOUT HOW THESE THINGS MOVE AND THEN THEY'VE TRIED TO DO SOME EXAMPLES AND WORK OUT SOME FIGURES ... GRAPH. WHAT DO YOU THINK ABOUT THAT PROJECT?

[Silence]

[giggling]

OK?

Yeah.

HERE'S SOMEONE ELSE'S ATTEMPT OVER HERE, THIS IS A NICE COLOURFUL ONE.

That one looks better.

MMM, RIGHT OH. WHAT ABOUT THAT WHOLE THING? IF YOU HAD TO DO THIS IN SCHOOL WHAT WOULD YOU THINK ABOUT DOING THIS TASK?

[Silence]

Um, I wouldn't really want to do it because it looks like pretty boring.

MMM.

..had to do it last year.

RIGHT. THIS IS THE FROG HOPPING THING.

I remember doing some frog hopping thing last year.

SO YOU KNOW ABOUT THIS? MMM, OK, AND WAS IT ACTUALLY BORING TO DO WHEN YOU DID IT?

No, not really because I didn't finish it so

YOU DIDN'T UNDERSTAND IT? RIGHT. OK. WHAT I WAS SAYING WHEN PEOPLE WERE RUNNING OFF THE GET YOU. [named student] GOT YOU. I WAS SAYING, YOU MUST DO FORMULAS LIKE THIS. DO YOU DO THEM IN A MORE EXCITING WAY?

No we do it.

YEAH.

I just find it boring.

OH, YOU FIND THE WHOLE THING BORING ANYWAY?

But not to do with like, games. We don't do graph games

All Maths is boring.

ALL MATHS IS BORING?

Mmm.

Yeah.

SO ALL OF YOU ARE IN AGREEMENT ABOUT THIS?

Mmmm.

yeah.

yes.

OK, RIGHT , GOT YOU. OK.

OVER HERE I HAVE A STUDY WHICH TELLS ME A BIT ABOUT HOW TO GET STUDENTS TO GO EVER SO GOOD AT MATHS AND, SOMEWHERE IN HERE, "MATHS ACHIEVEMENT: THERE'S A CLEAR RELATIONSHIP BETWEEN LIKING MATHS AND ACHIEVING WELL IN MATHS." OK. PEOPLE WHO LIKE MATHS DO WELL IN MATHS. THIS IS WHAT IT'S SAYING AND THIS IS RIGHT. ALL THESE COUNTRIES, AND THEY GOT ALL SORTS OF PEOPLE. "MORE THAN 40% OF THE STUDENTS REPORTED DISLIKING MATHS. WHAT DO YOU THINK?

Only 40% ?

"ONLY 40% ?". YOU THINK IT SHOULD BE HIGHER?

....

I don't know anyone that likes maths

OK.

...

Maybe it's because of our horrible teachers.

Just because maths so boring and complicated. And they have such gay rules. You can't eat in class here.

...

And he doesn't let you talk.

SO YOU'RE TALKING ABOUT *CLASSROOM* RULES. WHAT YOU CAN AND CAN'T DO IN THE CLASSROOM.

No. No. I'm talking about *maths* rules.

LIKE WHAT?

Just stuff you can and can't do, and why it does that and stuff.

YOU'RE TALKING ABOUT CLASS WORK. WHAT'S THE WORST?

[silence]

WHAT'S THE PITS?

ALL OF IT?

"x"s and "y"s and things like that.

ALGEBRA, YOU HATE IT? WHY DO YOU HATE IT SO MUCH?

Because it's confusing.

CONFUSING. ANYTHING ELSE?

It's *maths*.

[Giggling.]

OK.

[Different speaker] Percentages are the worst.

CAN'T YOU DO THEM?

Er, sometimes.

WHAT I'M TRYING TO GET AT IS THIS. IS IT THAT THE STUFF IS TOO HARD FOR YOU AND YOU DON'T GET IT: IT'S TOO HARD FOR ANYBODY, OR IS IT THAT THE WAY YOU'RE GETTING IT IN SCHOOL IS A BORING WAY? AND THERE'S A BETTER WAY OF DOING IT?

Partly, the teachers don't really explain it all that well, and you just have to do stuff out of the Pink Book [a textbook] all the time.

Yeah we like doing trigonometry and Pythagoras.

We did that.

I don't know.

I like, don't get it.

I get it but it's so boring.

Yeah that's really easy.

THAT'S TOO EASY?

Not too easy but its really easy, like *simple*.

Comparatively.

But it's boring.

I'm trying to be in I'm going to have to do a big test.

[Laughter]

OK. AND ARE THERE PEOPLE IN THE SCHOOL WHO LIKE MATHEMATICS?

No.

No one that I know.

No one in our class.

Teachers.

APART FROM THE ODD TEACHERS? THAT YOU KNOW AT SCHOOL

There could be

Oh Oh Oh

There only person who possibly might...[named student]

He might do.

SO FROM THE 4TH FORM AT LEAST, WE CAN EXPECT *VERY FEW* STUDENTS GOING ON TO DO SENIOR MATHS?

No, I'll probably do senior maths but I don't like it.

WHY ARE YOU GOING TO DO IT IF YOU DON'T LIKE IT?

I'll probably do it because I need it.

Because it's important for jobs

WHAT JOB?

It's just important for jobs.

For jobs you need maths.

I dunno like accounting or something.

YOU SEEM TO REALLY BELIEVE THAT, BUT YOU'RE NOT GIVING ME ANY EXAMPLES.

Well, I want to do something with businesses and stuff so you sort of need maths for

FOR ADDING UP MONEY?

Yeah and even if you don't need all the complicated things you still have to do it to get like....

I like my Dad's job. He gets paid a lot for just working with phonecalls and organising stuff.

What does he do?

He's a Communications Manager at ... these people run round after him, it's cool.

OK, RIGHT. SO IT SEEMS THAT YOU DISLIKE MATHS AT THE MOMENT BUT THE FUNNY THING IS YOU GUYS ARE VERY GOOD AT MATHS.

I'm not very good at maths.

I suck at it.

YOU'RE?

I suck at it.

"YOU SUCK AT MATHS", BUT HANG ON YOU'RE ALL "A" STREAM STUDENTS.

Yes, but that's just because in 3rd form we were good at maths, I mean Form 2 we were good at Maths so we did well in the test and then we just stayed in it.

Yeah and this year we're ...

AND, LET ME SEE

... explained it still a bit confusing

...

[named student]'S IN THE *TOP* CLASS OF ALL 4TH FORM MATHS STUDENTS, SO SHE'S SUPER GOOD AT MATHS, OF TEN CLASSES YOU'RE IN THE TOP CLASS. 90% OF PEOPLE, PLUS, ARE WORSE AT MATHS THAN YOU AND YOU'RE TELLING ME YOU'RE FINDING MATHS BORING AND YOU DON'T GET IT AND THINGS LIKE THAT?

I get most of it but it's just boring.

YEAH. OK. I WANT TO MOVE ON. THIS IS A SURVEY WHICH YOU ALL DID NOT SO LONG AGO I HOPE?

Yeah.

I'M NOT SURE THAT YOUR CLASSES HAD IT?

We got it.

OH YES, YOUR CLASS SHOULD HAVE HAD IT TOO

Mmm.

SO HERE WE ARE

You don't know our numbers, do you?

NO, I DON'T KNOW YOUR NUMBERS, THERE'S NO WAY I CAN FISH OUT YOUR FORM.

Oh, I know my number.

I don't know my number.

I can't remember what mine was, I think it was ...

NOW I'M JUST WONDERING HOW WELL THAT SURVEY WAS DONE AND WHETHER PEOPLE UNDERSTOOD THE SURVEY? SO, FOR EXAMPLE, I CODED IT AND I LOOKED AT IT VERY CLOSELY AND IT STRUCK ME THAT SOME OF THE TIME PEOPLE WERE PUTTING ANSWERS DOWN EVEN THOUGH THEY REALLY DIDN'T KNOW, I THINK, WHAT THE QUESTION WAS ON ABOUT. CAN YOU SPOT ANY PARTICULAR QUESTIONS IN THERE THAT DIDN'T SEEM TO MAKE SENSE TO YOUR CLASS OR DIDN'T MAKE SENSE TO YOU AT ALL FOR WHATEVER REASON?

"The teacher takes a personal interest in me." [Laughter.]

RIGHT. NOW TELL ME ABOUT THAT QUESTION.

Well, most people don't want them to.

DON'T WANT YOU TO.

Especially [named teacher], 'cos he smells.

Augh!

I've got worse in his class. [Coughs.] I got worse at maths since Form 1 because I had a good teacher in Form 1 and then in Form 2 I didn't learn anything new, because I went to a not very good school, and then in Form 3 I didn't learn anything.

RIGHT.

The problem ...

because I had [named teacher] for extension in Form 2.

[Same named teacher] was a really good teacher.

Yeah really nice.

YOU HAD [same named teacher] LAST YEAR?

Were we in the same class?

Yeah...

YOU WERE A 3RD FORMER AND YOU HAD HER WHEN YOU WERE IN FORM 2 DOING EXTENSION?

No, I had her in Form 3. But she was our teacher at the start of the year until [named teacher who smells] came.

Were we in the actual same place?

Yeah.

And she had a....

I like [named teacher, not previously named] he was cool.

BUT, HANG ON NOW, YOU WERE TELLING ME BEFORE THE TEACHERS WERE *AWFUL* BUT NOW THERE'S A COUPLE OF TEACHERS YOU'VE MENTIONED WHO, WHO ARE *GOOD* TEACHERS.

But, like [named teacher who smells] he doesn't "relate to his students".

He does stuff that's too, he does stuff that's more difficult, like but you can get it and stuff, but then when you come to tests it's all easy and you haven't learnt like things for that test. You haven't really learnt what you're supposed to learn.

OH. SO, YOU DIDN'T LIKE THE WAY [named teacher] DIDN'T REALLY PREPARE YOU VERY WELL FOR THE TESTS?

He like, goes too fast.

The common test, like ...

He, like doesn't *redo* anything so you forget it and you remember what you've done just recently.

For the common test we learnt all, um, all the stuff was just like, er, it was like harder than the common test, the common test was like so, 'cos it was easy but we made silly mistakes because it was like so

YOU HADN'T DONE THAT SORT OF THING.

Because it was easy.

[named teacher] came into our class the other day and he said that our class was doing like, harder Pythagoras and that than his 5th Form class which I reckon was pretty dumb so you should be able to get better at like your own level thing than go on to a higher level and not do so well.

RIGHT. IT'S A BIT OF A PUNISHMENT BEING PUT INTO THE TOP CLASS ISN'T IT?

We were doing like, there was this worksheet we did and like then we saw it in one of the maths...some 5th formers had been doing that like they had to do it, but that was an easy worksheet so it didn't matter.

GET USED TO THAT IDEA. I MEAN THERE ARE 6TH FORMERS WHO REPEAT SCHOOL CERTIFICATE SO THEY MIGHT BE DOING THE SAME WORKSHEET AS WELL.

OK. BACK TO THE QUESTIONS HERE. "THE TEACHER TAKES A PERSONAL INTEREST IN ME" AND YOU'RE THINKING "IT'S A STUPID QUESTION BECAUSE" - I'M NOT SURE WHY. YOU DIDN'T LIKE THAT QUESTION AND I'M NOT SURE WHY YOU DON'T LIKE IT.

Because you don't really want the teacher to take a personal interest in you.

YOU'D RATHER MERGE INTO THE CROWD?

Yeah.

OK.

What about that one ...

WHAT DOES IT SAY? "I GET TO USE THE EQUIPMENT AS MUCH AS OTHER STUDENTS" AND YOU SAY "WE DON'T HAVE ANY EQUIPMENT"?

Yeah.

OK, SO, HOW DID YOU ANSWER THAT QUESTION THEN?

"Sometimes".

[Giggling.]

WHICH IS THE MIDDLE OPTION SO IT'S SORT OF NON-COMMITTAL MEANING "I CAN'T ANSWER THIS QUESTION". GOOD, BECAUSE I WAS WONDERING HOW A QUESTION LIKE THAT WENT. THERE SHOULD HAVE

BEEN ANOTHER OPTION SAYING "WHAT EQUIPMENT?!" YOU KNOW, SHOULDN'T THERE, OR SOMETHING LIKE THAT.

Yeah. When we got these well some of the people like read through them and they got up to the teacher part and they like "the teacher always helps you" and they just like started laughing and they just thought the whole thing was a bit of a joke.

RIGHT.

Yeah most of the people in my class put "almost never", "seldom", or "sometimes" as their answers.

RIGHT.

What about [question] 42, "I carry out investigations to test my ideas"?

YES.

I mean, you don't do that unless you're told to.

UH HUH.

I mean, why are you gonna do extra work when its not necessary?

And that one, "I explain my ideas to other students". You're not allowed to talk!

Yeah.

[Giggling]

You get home detentions.

OK.

[named teachers] *shifts* you.

YOU HAVE TO DO AN INVESTIGATION FOR YOUR PORTFOLIO, THOUGH, DON'T YOU? SOMEWHERE ALONG THE LINE YOU'RE SUPPOSED TO DO ONE WHICH GOES IN THERE.

Dunno.

Dunno.

My last one - I just copied an article out of Consumer [magazine].

RIGHT, THAT WAS EASY WORK!

I just typed it out.

ANYTHING ON YOUR MIND THERE, [named student]?

No.

ANY OTHER QUESTIONS?

"I pay attention during this class"

MMM.

Well, I mean, why would you, it's so boring?

RIGHT. HOW DID YOU ANSWER IT?

Um, "Almost never" or "seldom", I think.

RIGHT. WHICH IS A TRUE STATEMENT, THEN, IF YOU ARE NOT PAYING ATTENTION. OK, SO THOSE SORT OF QUESTIONS YOUR ANSWERS WILL GIVE A FAIR INDICATION OF HOW YOU REALLY FEEL. CAN WE LOOK JUST AT THE BACK PAGE OF IT? THERE'S SOME QUESTIONS THERE ABOUT COOPERATIVE WORK, AROUND ABOUT SAY PAGE, QUESTION 67, "I COOPERATE WITH OTHER STUDENTS ON CLASS ACTIVITIES" WHAT DID THAT MEAN?

What activities?

WHAT ACTIVITIES? YEAH OK. SO HOW WOULD YOU HAVE ANSWERED THAT QUESTION? IS THAT A 3,. MIDDLE OF THE ROAD?

Sometimes.

YEAH.

You don't know. Some of the questions you don't know what it is like, you do it or you don't 'cause you don't know.

Yeah, you're not like uncooperative.

I THINK WHAT I HAVE TO DO IS, WHEN I LOOK AT THE ANSWERS PEOPLE GAVE ON THIS SURVEY, IS WHEN THEY HAVE CODED A "3", IT TENDS TO MEAN "I DIDN'T UNDERSTAND THE QUESTION" OR "WHAT THE QUESTION IS TALKING ABOUT DOESN'T HAPPEN IN MY CLASSROOM".

Mmm.

OK. ANY OTHER QUESTIONS IN THERE WHICH YOU THINK ARE SILLY?

THE WHOLE LOT. OK?

They're all asking the same question.

THAT'S RIGHT. THERE'S 10 STATEMENTS OF THE SAME THING WORDED SLIGHTLY DIFFERENTLY SO YOU'D AGREE OR DISAGREE SLIGHTLY STRONGER OR LESS AS YOU GO THROUGH, SO YOUR OVERALL MARK FOR THOSE 10 QUESTIONS GIVES A REASONABLE IDEA FOR HOW YOU FEEL ABOUT THAT KIND OF THING. THAT'S THE IDEA OF THE SURVEY.

OK NOW. CANTAMATH PROJECT. I WANTED TO ASK HOW MUCH WORK WENT INTO IT. YOU ALREADY SAID [named student] THAT IT WAS ABOUT TEN MINUTES WRITING A POEM.

Mmm.

HOW ABOUT EVERYBODY ELSE?

Didn't do one.

"DIDN'T DO A CANTAMATH PROJECT AT ALL" SAYS [named student].

My teacher never told us.

OK. AND DID YOU DO A CANTAMATH PROJECT?

No.

DIDN'T DO ONE. DID THE REST OF THE CLASS DO IT?

Yeah.

YOU JUST DIDN'T DO ONE AND [named student] HOW DID YOU GO WITH THE CANTAMATH PROJECT? HOW MUCH WORK WENT INTO IT?

We had three periods and the first period we practised doing them and the 2nd period we just did it and in the 3rd period just mucked about because we had nothing to do.

RIGHT OH. WHAT ABOUT, YOU KNOW, *REALLY* GOING HARD OUT TO MAKE THE BEST EVER? I MEAN IT'S YOUR CANTAMATH PROJECT.

Yeah. I did that. [Laughs.]

Pardon?

No I didn't, because it's just easy, it's boring as well.

If you try too hard then you don't really get ...

RIGHT.

You couldn't really make it any better apart from my pen run out which I said.

BECAUSE YOUR ONE WAS THE CLASS PROJECT AND THERE WAS SORT OF ONLY ONE THING TO DO?

Yeah.

RIGHT, OK, THAT'S GOOD. UM. NOW YOU'VE GOT TESTS COMING UP, HAVE YOU?

Next period.

NEXT PERIOD, IN MATHS? OH YOU LUCKY, LUCKY THINGS.

It's easy though, it's just that line stuff I think.

..might do I dunno

...

SO YOU'VE GOT ANOTHER WEEK OR SO. OK. NOW HOW DO YOU FEEL ABOUT THESE EXAMS THAT ARE COMING UP, THESE TESTS?

I'll fail mine.

YOU'LL FAIL THEM LIKE EVERY OTHER TIME? [named student]

I dunno.

DO YOU QUITE LIKE DOING TESTS REALLY

Ha ha! [Giggling.] Yeah.

OH, YOU DON'T?

No.

I do.

....IS IT BETTER THAN USUAL CLASS WORK, A TEST?

No.

OK.

I don't understand the questions.

RIGHT.

I mean you can't ask for help.

HMM, OK. WOULD IT BE FAIR TO SAY YOU *HATE* DOING TESTS?

Yes.

HOW MUCH?

Lots.

IS THERE ANYTHING *WORSE* THAT YOU HAVE TO DO AT SCHOOL APART FROM MATHS TEST?

[Silence.]

Maths.

[Giggles.]

DOING MATHS. RIGHTO. HOW DO YOU FEEL ABOUT DOING TESTS?

I think they're better than doing class work. I dunno why, but, I dunno, he doesn't hassle me all the time.

RIGHT.

... he hates me.

YOU POOR THING, YOUR TEACHER HATES YOU AND IS MEAN TO YOU?

He is, and he comes up and *breathes* on me.

He picks on people.

He does.

He picks on you.

He picks on us because the first day we sat in the, we were sitting in the back seat, and he just like stared at us, and he kept staring at us 'cause of, like, where we were sitting.

Look the people who were sitting right at the front can get away with a whole lot more than if you sit at the back.

Yeah. That's true.

HOW DO YOU FEEL ABOUT THE TEST THAT'S COMING UP [named student]?

I'm not really bothered.

I didn't know we had one.

Neither did I.

SORRY. SO, [named student] DIDN'T KNOW SHES' GOT ONE, [named student] DIDN'T KNOW SHE'S GOT ONE, YOU DO KNOW ISN'T IT [named student]?

I know we do have one coming up, but I don't know what date.

BUT YOU WEREN'T SURE OF THE DATE. AND HAVE YOU, HAVE YOU BEEN BRIEFED ON IT? HAVE YOU BEEN TOLD THERE IS ONE AND WHEN IT IS?

Been told there's one next period.

AH, ALL RIGHT. DO YOU KNOW WHAT'S IN IT?

It's that line stuff that you

OH, RIGHT.

Find the gradient and stuff. Its really easy. Sort of.

YEAH. YEAH. OK I'M DONE UNLESS THERE'S ANYTHING ELSE YOU PEOPLE WOULD LIKE TO TELL ME.

Who's going to be the teacher when [named teacher] leaves?

YEAH, THERE'S ANOTHER TEACHER COMING IN AND I'VE FORGOTTEN THE SURNAME.

Student teacher?

NO, NO. AN EXPERIENCED TEACHER, SEEMS NICE ENOUGH IN THE TEN SECONDS THAT I SAW OF HER.

Yeah but then teachers say that [named teacher]'s nice .

[Laughter.]

and they say [named teacher]'s nice but he's evil.

He's the ultimate evil,

Really evil. [Laughter.]

The devil ...

YOU GUYS DON'T SEEM TO, TO LOVE YOUR TEACHERS DEEPLY AND SINCERELY?

... No.

I hate Social Studies. I hate Maths.

I hate English

IT SEEMS TO ME THAT YOU'RE NOT TALKING ABOUT THE SUBJECT LIKE SOCIAL STUDIES, AND THE IDEA OF SOCIAL STUDIES APPEALS TO YOU, AS THEN YOU SAY YOU'VE GOT A PARTICULAR TEACHER, IT SEEMS TO ME YOU GO BY THE TEACHER.

No I go by the subject in Social Studies.

I like [named Social Studies teacher], yeah he's cool.

I think all the Social Studies teachers are evil cause they try and teach you Social Studies.

The only teacher I like is [named teacher].

Yeah, [same named teacher].

[different named teacher] is good too. He never tells you off and he's like, everyone's good because he never tells you off.

I like [named teacher], I think she's a good teacher.

She's going, we'll have [named teacher].

[Laughter.] We're getting rid of the best ones!

OK. UM. I'M GETTING RID OF YOU TOO. THANKS VERY MUCH FOR COMING
I'D REALLY LIKE TO SEE WHAT YOU'VE ACTUALLY DONE IN YOUR
PORTFOLIOS COME THE END OF THE YEAR, SO IF YOU WOULD BE
PREPARED TO SHOW ME I WOULD BE INTERESTED TO KNOW.

[named teacher] has got them.

YEAH, HE'LL PROBABLY HAVE THEM IN A BOX SOMEWHERE, NO DOUBT.

OK, THANK'S VERY MUCH LADIES.

Appendix L

INTERVIEW WITH TEACHER AA

Without any formal instructions they just ploughed into that task and got on with it. The best behaved I've seen that class in the computer room and they did that ... just exploring it. That was good. What else did we do?

Interviewing the parents was good. That was a really good one. A lot of my kids have got zero because they just didn't bother handing it in and after a number of reminders I gave up reminding them. In the 4th Form class I got some good ones. I thought they were good, the only ... is that I needed to time my stats one when we were doing the stats work because they didn't have enough information to go away and do it independently graphing things, comparing and that sort of thing had to be real structured.

DID YOU FIND YOU HAD TO BE FAIRLY FLEXIBLE ABOUT WHAT YOU DID AND WHEN YOU DID IT? YOU HAD TO CHANGE THE PORTFOLIO.

Yeah, yeah I did. I couldn't work to the set timetable that was given but this was the first time we'd introduced it so that's just one of those things.

THE NEW PERSON IN CHARGE OF FORM 3 IS GOING TO SORT OUT ALL THAT SORT OF THING. [Laughter.] YOU'LL FIND IT WILL WORK BRILLIANTLY NEXT YEAR. IT'LL ALL BE TIED TOGETHER SO THAT THEY WILL HAVE DONE STATS BEFORE THEY HAVE TO DO A PORTFOLIO ITEM USING STATS SKILLS.

I think topic-based, something on each topic is a good idea. I think we've already decided to do that for next year, haven't we?

Umm [Agreement.]

WHAT ABOUT DOING THINGS LIKE, KIDS ARE ASKED TO DO SOME SORT OF METACOGNITIVE THING, LIKE SHOW SOME WORK THAT IS EVIDENCE THAT YOU ADVANCED IN MATHEMATICS THIS YEAR. HOW WOULD THAT GO DOWN?

I couldn't try that with my "B" band kids. It's hard enough to get them to do maths without showing them something they've achieved. I could do it with isometric drawing though, because they quite liked that and just knowing.

KEEP AN ORIGINAL ONE, THE FIRST ONE THEY EVER TRIED TO DO AND

And then compare it and that's something they can do quite creatively on their own. I find they're ok if they're allowed to go on free flow, but to get them on a set regimented task, that has to be done in a certain way. It's one of the things these kids don't like. They just like to feel they're playing.

But with the 4th Form class: yeah you could, even just the standard of presentation could be their assessment. How much effort they put into it. How well they presented it and how clear their writing was compared to the ones they did earlier in the year.

THAT GETS THEM ASSESSING THEIR OWN STUFF AND MAKING JUDGEMENTS ABOUT THINGS, WHICH I LIKE THE IDEA OF.

WOULD YOU DO ANY TASKS DIFFERENTLY? DO YOU THINK THE TASKS WERE ADEQUATE AT ALL? WHICH ONES WERE NO GOOD, WHAT NEW ONES WOULD YOU PUT IN? ANY THOUGHTS ON THAT?

I'd put new ones in that were more topic-based, specific within the topics. Um, I'm just trying to think what else we did.

DID YOU DUMP ANY? I THINK THE LIBRARY RESEARCH IN FORM 3, NOT MANY OF US DID THAT ONE.

Yes I did.[dump that task] And there was another sheet that came out. I think I dropped off one part of the fourth form part. ... Oh, the money one I found needed a lot of instruction, because comparing value for money needed a lot of understanding. Taking it down to how many grams, how many cents per gram was the size of the container for that price. It might have seemed ok but they didn't quite understand how they could break it down into comparing, how to compare things, unlike things. That was one I found where there were a lot of explanations.

IF THINK THERE'S NO SUPERMARKET IN CHRISTCHURCH THAT HAS GOT UNIT PRICING DISPLAYED AT THE MOMENT. RATTRAYS USED TO DO IT FOR A WHILE.

The one that used to be down in Riccarton used to. Some of them, just value for money, said 'because it tasted better' and I got some things like that rather than actually looking at the monetary value. That needed a lot of instruction. The interview was good as I said before.

SO DID THAT TAKE OUT QUITE A BIT OF YOUR CLASS TIME THEN?

No, because I made it as a project they could do at home and they could come and ask questions and we didn't set aside class time for it. Just when they all started coming in, it dawned on me that they didn't have an understanding of how to compare value for money.

The geometric one we didn't do, oh wait a minute, we did, we did um, a spiral, Archimedes' spiral. Some kids were really on task with that and they loved it, and some kids just didn't even complete it.

WHAT DID YOU ACTUALLY DO, ARCHIMEDES' SPIRAL?

I got them to draw it using construction. Using circle and 90 degree ..., no 15 degree spokes and then they went around making a perpendicular line and one coming off meeting it at a perpendicular spoke until they actually got around the whole spiral.

SOUNDS LOGARITHMIC TO ME.

I did that with our construction part of the topic, constructions. Cantamath item I didn't get 100% response from that. The ones I did get in were good.

WHILE YOU'RE SAYING THAT I'M LOOKING UP WHICH CLASS IT WAS. YES, YOURS IS THE 3RD CLASS DOWN OUT OF 10 IN 4TH FORM.

Yeah, they're a fairly slack class really. Fairly able but very slack. Their motivation. There's a few in the class that are really on task but the rest are just in cruise mode. This is a class that doesn't seem to be too concerned about where they're going, so, you know.

AND DID THE PORTFOLIO IMPINGE ON THAT AT ALL?

The ones who were motivated, like I've got (named student) and (named student), you set them something and they're so enthusiastic they just come out with it. "Wow this is brilliant". She comes and asks for work when she's going on her cross country orienteering. Can she have some work? Love giving that kid work because she's so enthusiastic about it. Kids like that were brilliant. Some of the slacker ones they just didn't even hand them in. Didn't even bother. It was just a total lack of attitude in the class.

DO YOU THINK IT REINFORCES THE SLACK APPROACH IN THE SLACK ONES? "TODAY I GOT AWAY WITH IT, I DIDN'T HAVE TO DO ANY WORK."

Yeah, even the emphasis on it in a weighting. The percentage weighting on it had no impact on them. They couldn't care. They just seemed to know they were going on to 5th Form next year regardless. There was just sort of this [stops].

(Comment by another teacher who had been overhearing the interview: That may have been the difference between my class, they knew they actually had to work to get into School C [the School Certificate examination stream] I really reinforced that a lot. One of the parents...

FOR YOUR CLASS IT COULD BE QUITE A BIG CONTRIBUTION TO THEIR MARKS.

well I had a boy in tears on Friday because of his exam result ... they were really conscious of it the whole way through and it made them really, those that decided they didn't really care didn't those that really wanted to do it, I think it would be good because I think next year in 5th Form they'll know

they've got to work hard because they know that they're just in there, been very conscious of it.)

Yes, I just found with that 4th form class is was all a bit blasé.

NEXT YEAR WHEN WE DO TWO BITES, WHERE THE MARKS OUT OF 10 FOR THE FIRST HALF YEAR'S WORK ON THE PORTFOLIO, AND MARKS OUT OF 10 FOR THE SECOND HALF YEAR'S, THAT MIGHT WAKE THEM UP A LITTLE.

Yeah.

WHAT WILL THEY BE GETTING IN THE END OF YEAR EXAM?

I'll tell you. I haven't worked that out but the top mark was a 70% and my bottom mark was a 29%.

SO JUST PICKING CASUALLY, MEDIAN IN THERE WOULD BE 40-50.

I don't get many in the 50s. If they were in the 50s they were low 50s.

STILL THE MEDIAN. LETS CALL IT A NICE ROUND FIGURE LIKE 48. THAT'S OUT OF 100. HOWEVER, ITS ONLY 50 MARKS OF THEIR YEAR'S WEIGHTING ON THAT FINAL EXAM SO THATS 24 MARKS WHEREAS THEIR PORTFOLIO WOULD BE 20 MARKS POSSIBLE, AND SOME OF THEM WILL GET 20.

It doesn't ring bells with them.

THEY HAVE DONE THAT CALCULATION HAVEN'T THEY?

Well even if you did it with them they couldn't care two hoots because "I'm going on to 5th Form anyway".

YOU'LL BE DOING SCHOOL CERTIFICATE THIS 4TH FORM IS NO QUALIFICATION, "IT DOESN'T MATTER".

It's just a shunting from 3rd to 4th, 4th to 5th with these guys.

SO THAT FILTERING ASPECT OF WHAT WE DO WITH SCHOOLING ISN'T GOING TO IMPACT ON THEM.

Even my saying "you want to be aiming for a good class in 5th form you really want to get in with some kids that you can really get in and work hard and you can achieve up with that level they are at" didn't have any effect. I emphasised to these kids your placement next year is based on the work this year. If you want to be in a good class next year you put your effort in this year.

SO YOU'VE BASICALLY CONCLUDED THAT WHAT WE'RE DOING WITH ASSESSMENT HERE MEANS THAT IN 5TH FORM STREAMING IS NOT JUST BASED ON ACADEMIC ABILITY AT ALL. IT'S ACADEMIC ABILITY AND A GOOD MIX OF WORK HABITS.

Oh, I think if some kid is not very bright but they work hard they'll get through, and the kids that are bright but don't work. I just think its application to it that gets you through.

UMM

Ok, it's a bit of both but really. If a kid really works hard and isn't the brightest kid in the class they can often get through with good marks. So there's a surprise here: this boy (named student) mucked around all year. He's always underachieved. He's finally reached a mark which I think is where he should be at all year. The only kid in the class that got, well in fact 61% was my next mark.

70% FOR (the named student) ON FIRST IN CLASS AND THEN DOWN TO 61%. THAT'S EXTRAORDINARY, ISN'T IT.

And that's where he should have been all year but he's just cruised around, mucked around, he's failed other tests.

WHAT HAPPENED TO (the named student) THEN, DID HE GET SOME PRIVATE TUTORING?

No. I just think he might have started to work. He might have thought about next year. I've been on his back all year. I'd like to think I had some impact but I don't think it was me. [Laughs.] I don't know whether it was just the type of test it was. It all fell into place for him.

See there's one girl here (named student). She's one of my brightest girls, she only got 31%. And I don't know why. She's normally so dedicated. She normally applies herself well and she's just fallen out in this exam.

SO HER PORTFOLIO IS PROBABLY GOING TO RATE FOR HER MORE THAN HER FINAL EXAM MARK. BECAUSE SHE'LL GET 20/20 FOR THE PORTFOLIO IF SHE'S PROVEN DILIGENT WHEREAS THE FINAL EXAM

She'll get 10. She did about half of them.

RIGHT, SO YOU'VE HAD A DIFFERENT SYSTEM WITH YOURS IS IT? HOW ARE YOU DOING THE MARKS FOR THE PORTFOLIO?

On (the Head of Department)'s system.

ON (the Head of Department)'s SYSTEM, BUT THERE'S NO 10 POSSIBLE FOR THAT IS THERE?

Half the work, yeah. If they did half the assignments and they got, you know, good marks in those, yeah.

SO, CAN I SEE THE RANGE OF MARKS?

(Comment by teacher who had been overhearing the interview: You don't give out a lot of 20s do you?)

Two 20s I've given out, three rather. One guy got zero, he's just about failed everything. Two 20s I've got 1, 2, 3, 4, 5, 6, 7, 15s quite a few 10s couple of 5s and a 0.

HOW DID YOU GET. SO THEY'RE IN MULTIPLES OF 5. HOW DID IT COME ABOUT? SO, IF I HANDED YOU MY PORTFOLIO FOR THIS YEAR WHAT WOULD YOU ACTUALLY DO TO GIVE IT THIS MARK.

If they've done all the assignments and they've done them to a good standard I gave them 20.

If they hadn't done all the assignments, lets say they'd done 4 or 5 out of 6 and they'd done them to a good standard they got 15. If they'd done half the assignments and they'd put in a good effort 10, and if they'd sort of been a bit slack and half hearted and their work was not up to standard they scored lower, and if they didn't do half of them they got a 5 and this chap who didn't do one got a 0.

THE PLAN ORIGINALLY HERE WAS 20,15, 5, 0. SO IT WAS EITHER YOU DID THEM ALL TO GET THE 20 OR 15

I still expected a good standard for that though. They had to have done them all and have a good standard. If you just handed them in and it was a poor standard you didn't earn 20.

SEE THIS ACTUALLY SAYS SOMETHING DIFFERENT TO WHAT PEOPLE WERE TOLD AT THE BEGINNING OF THE YEAR. THIS IS ON THE 4TH FORM BRIEFING NOTE.

Well, not really, "some satisfactory work 5%" but if you did less than half of them, and you did them ok, that comes to some satisfactory work. Poor work 0 is pretty good for poor work isn't it. "Complete and a good standard". OK, if they didn't do all six but they did them to a good standard I gave them that.

YOU'RE GENEROUS. THAT'S GOOD.

THANK YOU VERY MUCH. HOW DID THEY GO ON THE SPREADSHEET, COMPUTER WORK AND ALL THAT?

That was totally slack. They mucked around most of the time. They didn't finish all of the exercises so accordingly they scored pretty low. In fact they were getting 5 out of 15. 4 out of 15, they really only did the first exercise and they just thought it was gossip time. It's not a class that is very motivated and they're not a class that's very proud. With the exception of a few students, they're not a class that's proud of their output.

DO YOU THINK THEY'LL TAKE THAT PORTFOLIO HOME AND SHOW THEIR PARENTS?

I think they'll throw them in the rubbish tin. In fact when I actually handed them back, I did the same mistake with the 4th Form kids for the ones that got really good marks: I gave them back because I thought they'd be pleased to show their parents as they'd talked to their parents, it was that interview one, so I thought it would be nice for the parents to see how well they did. A lot of them were just found in the rubbish tin. They walked out the door and put them in the rubbish tin. They're not a I've got some of their work on my wall. You find, you take it down they don't like to be seen to have stuff on the wall. It's a strange dynamic in that class.

4TH FORM, THEY'RE SORT OF TOO OLD OR TOO ADOLESCENT

They don't care if they have good work. No it's really strange. With the exception of a few in the class who are really good. Like (named student), (named student), (named student). They are really switched on.

DO YOU THINK IS JUST THIS CLASS OR DO YOU THINK ITS THE 4TH FORM?

Well, I've only got one 4th form class. I've got no comparison.

CAN I'VE A LOOK AT THAT CLASS LIST? JUST LOOKING WHICH ONES DID I INTERVIEW.

(Named student) you interviewed. She's normally a good kid. I don't know why she was, well she was absent there, that's not good. I don't know why she fell down on that exam.

YES, YOU'VE GOT AN INTERESTING LOT THERE. YOU HAVE A LOT OF KIDS WHO ARE QUITE BRIGHT AND YET THEY'RE NOT ALWAYS ACHIEVING AT THEIR MAXIMUM ARE THEY?

No, and I don't think it's too much workload with other activities either, because generally you get to know what the kids are involved in, like some of them have been involved in Stage Challenge. There's no great sportmen in that class (named student, the one interviewed)'s probably got Music but I don't think this time of year that's been a big thing for her. It's just funny that class. It'll be interesting to see what they do for 5th Form. (named student) and (named student) they muck around.

WHAT DO YOU THINK ABOUT THE TONE IN THE CLASS? OVERALL.

Oh, they skylark in class. You had them on Friday. Were they ok?

(Teacher who had been overhearing the interview: Oh, they were brilliant. They watched a video, I actually tutored a 7th former...)

They were that good!!! They skylark a lot.

SO BASICALLY I THINK WHAT I'M HEARING IS THAT PORTFOLIOS

(TAPE ENDED HERE!)

Appendix M

TRANSCRIPT 3 DECEMBER WITH TEACHER BB

THESE ARE MY PORTFOLIOS. THAT'S 3A1, AND THAT'S 3B4, LET'S HAVE A LOOK. YOU DON'T HAVE A 4TH FORM YOU'VE ONLY GOT 3RD FORM. SORRY, YOU'VE GOT BOTH. HOW DID IT GO DOWN WITH EACH OF THE TWO GROUPS?

YOU'VE GOT 4E2 (I FORGOT ALL ABOUT THEM) AND THEN YOU'VE GOT 3A5: SHOULD BE AN INTERESTING CLASS, BETWEEN THE TWO BANDS. FAIRLY ABLE.

That's right.

HOW DOES IT GO? THE 3RD FORM ARE ALL STREAMED OFF ON MATHS BUT THE 4TH FORM THEY DO IT DIFFERENTLY.

No they're streamed on maths.

They were quite varied really. What I found with the 4th Form was that once they'd done their first item I could have marked the portfolio from there really. Seemed to like the parable of the talents, that those who had good computers or good access at home to interesting material just produced the goods and those that didn't, didn't really. There was no incentive for them to go to the library or whatever, I mean they just handed in the bare minimum really.

RIGHT. I THINK THERE WAS A BIT OF A FALL OFF FROM WHAT WAS BEING PRODUCED IN THE CLASSES, FROM MY OBSERVATION. FIRST TERM, WE SEEMED TO GET A HIGH STANDARD OF WORK AND THEN IT FELL OFF A BIT DURING THE YEAR.

No, it depended what the topic was. They did all right at the interview with their parents - that was reasonably worthwhile The "value for money" didn't really work very well.

I THOUGHT THAT HAD A FEW PROBLEMS. THEY NEEDED TO HAVE QUITE A SOPHISTICATED MATHS UNDERSTANDING BEFORE THEY COULD DO THAT.

And in some cases value for money didn't come into it, because one kid did an excellent one on tramping boots, and value for money just doesn't come into the equation if you get a boot last that doesn't fit. And you will pay whatever you have to for that, so, I mean that didn't really fit the criterion really.

THESE ARE JUST THE ITEMS WE USED FOR THE 3RD FORM, BUT WE CAN REMEMBER THE 4TH FORM PROBABLY.

Well the geometric one just didn't really go at all. In fact we more or less did our own item for that.

YEAH.

Cantamaths. OK, I gave them plenty of direction for that.

THAT'S WHAT MADE IT ... YOU KNOW WHEN [named teacher] AND I WROTE OUT THESE ITEMS FOR 3RD AND 4TH FORM AT THE BEGINNING OF THIS YEAR. I MEAN THIS IS NEXT YEAR'S YOU'VE GOT IN FRONT OF YOU. YOU KNOW THAT WAS OUR OWN IDEAS. SOME WORKED. SOME DIDN'T WORK BUT I MEAN THE REASON THE PROGRAMME FUNCTIONED I THINK IS THAT PEOPLE ADAPTED THE ASSESSMENT ITEMS TO SUIT THEIR CLASSES AND I DON'T THINK A SINGLE TEACHER DIDN'T CHANGE IT.

You've got to. In fact that's what I didn't like about it, being locked in to it. Having a date.

YEAH AND THE DATES WERE ALL THE SAME. I JUST PICKED A DATE SUFFICIENTLY FAR OFF THE END OF THE TERM SO IT WOULDN'T INTERFERE WITH EXAMS TOO MUCH AND SAID "RIGHT, WELL ALL THREE ITEMS FOR THIS TERM OR WHATEVER DUE ON THIS DATE". THAT WAS A BAD STRATEGY.

I actually found you know that we did other bits and pieces as well, just put that in there, collected it all up, just dished it all out to them at the end of the year. They were quite surprised to find they'd done so much.

YOU'VE GOT TWO "A" STREAMS.

Yeah, but I didn't do any, you know I think investigations are always pretty hopeless really and I'm not really sure what we tried to do with investigations anyway. I think some are a dead loss to tell the truth. But you know the favourite one about maximum area for perimeter, which basically is a hoary old chestnut, a smart kid knows, instinctively knows, that a circle encloses the maximum area for the minimum wall space and so the point of that's lost and the other kids just never get off the ground with it, so, yeah, I'm not in favour of investigations really at all. I think they've proven useless.

IF YOU HAVE SOMETHING LIKE "HERE'S \$500 YOU CAN SPEND ON YOUR BEDROOM: YOU PLAN IT, YOU BUY MATERIALS, YOU'RE ALLOWED STRUCTURAL ALTERNATIONS, DO WHAT YOU LIKE" THEN THAT'S AN INVESTIGATION TOO IN THE VERY WIDEST SENSE OF IT, I MEAN ITS NOT A VERY MATHSY ONE.

Mmm but you see that's the sort of thing that fits really well into other topics like graphics and I just see Maths as sort of scrabbling along trying to catch up and it just doesn't work.

YOU'RE SEEING MATHS AS VERY MUCH A PURE MATHS.

I'm seeing maths as basically a skill-based topic. I think you wouldn't want a workman to turn up to your house and give you a room extension without having the skills, so from that point of view I think the investigations are a forlorn hope. Things in here that I like for instance: I liked formal writing, I liked library research - I think that's quite reasonable really. Found shapes, I thought that [sighed].

THEY NEEDED A LOT OF GUIDANCE. EVEN THE TOP KIDS: SURE THEY COULD FIND SOME SPIDER WEBS OR SOME SHELLS, BUT TO ACTUALLY MATCH SHELLS IN SOME SORT OF LOGARITHMIC PROGRESSION OR SOMETHING, IT'S PRETTY HARD TO DO.

It's growth by oppression ... palentology. There's no way that you could do it here because you need to know graphics as well really and they don't do that.

THEY CAN MEASURE THE ANGLES OF THE ANGLES, LIKE, THE ANGLES ARE THE SAME. THEY CAN DO THAT ONE.

All right yeah, but I mean the real maths is hard ... so I wasn't

WHEN I LOOK AT WHAT THEY'VE PRODUCED HERE WITH FOUND SHAPES I WAS REASONABLY DISMAYED WITH SOME OF IT. FOR QUITE A LOT OF IT FOUND SHAPES IN ART AND NATURE. HERE'S SOME, DIGITAL CLOCK, NO AN INVESTIGATION, I DON'T ...

I think a lot of those things are things that appeal to adults who have been around and have had a look closely and observed and kids really haven't really got that the formal basis behind it yet.

THERE'S A FOUND SHAPE WHICH IS A SPIDERWEB WHICH IS A SERIES OF CONCENTRIC PERFECT POLYGONS, AND SPIDER WEBS DON'T LOOK LIKE THAT

No.

... SORT OF DONE AREAS OF THE AVERAGE AMOUNT OF WEB IT'S NOT, THEN HE TRIED TO DO DIFFERENT SORTS OF WEBS, HE WAS LOOKING AT THE EFFICIENCY AT CATCHING FLIES.

THE LIBRARY RESEARCH I DIDN'T DO IN THE END. THE FORMAL WRITING

Well we kind of got on to doing that library research and I think we probably should have done more of that because that is something that they're quite absolutely hopeless at

YEAH

and they're not good at summarising material.

I ACTUALLY WROTE ANOTHER LITTLE PAPER ON INVESTIGATIONS. WHEN I MARKED THEIR INVESTIGATIONS I WAS SO CROSS ABOUT IT I THOUGHT "WELL I DON'T WANT THAT AGAIN" SO I WROTE THAT. I'LL GIVE THIS TO EVERYBODY. SO NEXT YEAR I WOULD EXPECT FIVE HEADINGS ON EACH INVESTIGATION SO THAT THEY ARE DEFINITELY GOING TO PUT DOWN ACKNOWLEDGEMENTS AND THINGS LIKE THAT, WHICH, A BIT LIKE THE LIBRARY RESEARCH, THEY HAVEN'T GOT A CLUE AS TO WHAT THAT STRUCTURE IS.

No.

OK. WELL THAT'S WHAT WE'VE DONE FOR THE NEXT YEAR, AS YOU'VE SEEN ALREADY. ... THE TEACHER GIVING OTHER OPTIONS, I THINK IS QUITE IMPORTANT. WE DIDN'T DO THAT THIS YEAR I THINK IT WAS ... I WOULD EXPECT THEM TO AND THEY WOULD HAVE EXPECTED TO HAVE THE FREEDOM TO DO IT ...

I'm not sure about it being worth 20% of their marks for the year to be honest either. ...social studies really. To me it's sort of taking away from maths, you know. The plodders, the kids who enjoy doing it get a lot of satisfaction out of presenting it full stop really and I'm not sure that it rewards innovative thought at all, or creative mathematical thought, I'm not sure it does that at all.

IF THEY'RE DOING *INVESTIGATIONS*, ISN'T THAT CREATIVE MATHEMATICAL THOUGHT?

Well I don't think that it is creative because a kid that instinctively knows, he's made that abstract jump, is forced to go through all the plodderly you know of finding it, and they can't see the point. Like I say, a kid that knows that maximum area is a circle, you know, for the [given] perimeter.

NO. THERE ARE SOME THINGS IN THERE. HAVE A LOOK THROUGH.

Different ways of getting from A to B. Well I have to say "what use or what interest is that to most kids?"

YEAH.

For a lot of investigations the thought at the end of it is "Who cares?", you know,

I'M THINKING "LET'S DRAG OUT AN INVESTIGATION, THEN SEE IF IT ACTUALLY SHOWS ANYTHING".

I suspect a lot of them don't.

HERE'S A RELATIVELY BRIGHT GIRL, I KNOW HER ENGLISH ISN'T UP TO MUCH BUT ... SORRY, I CAN'T FIND THE INVESTIGATION IN THAT ONE. SHE DID DO AN INVESTIGATION, IT'LL BE SOMEWHERE ELSE. HERE'S AN INVESTIGATION. ...

WELL IT WAS HER IDEA. DID WE SAY "MATCH PATTERNS" OR ANYTHING LIKE THAT?

No.

THERE'S ANOTHER ONE. WHAT ARE WE LOOKING FOR AGAIN, WE'RE TRYING TO LOOK FOR CREATIVE THOUGHT OR SOMETHING?

Mmm.

LET'S DO THE MATCHES ONE FIRST. USING EIGHT MATCHES MAKE SHAPES OF 4 TRIANGLES INCLUDING A TRIANGLE HAS TO HAVE THREE MATCHED SIDES. IT'S ALL HER OWN IDEA. I DIDN'T GIVE HER ANY OF THIS. ... SHE'S GLUED MATCHES TO A PIECE OF PAPER, ALL SORTS OF INTERESTING PATTERNS ONE THING THERE USING 8 MATCHES I CAN ONLY MAKE SHAPES OF 4 TRIANGLES USING 6 MATCHES, THAT'S THE LOWEST AMOUNT OF MATCHES. SHE HASN'T TRIED TO MAKE THEM IN 3D. ... [Reads project.] ... MY COMMENT'S "IMAGINATIVE AND WELL PRESENTED". I DON'T THINK IT'S TERRIBLY DEEP. WHAT DO YOU THINK?

I more or less think "who cares really?". It's one of those investigations I just don't think really, might as well go and watch the grass grow. I mean, it's sort of trite really, it doesn't

BECAUSE SHE DIDN'T DEVELOP THE FORMULA

Well, she didn't go on about maximum things you know, can you actually, can you consider this is a triangle, I mean they're all at different levels on there really. It's that sort of thing. You've actually got 3 dimensions of there but you haven't acknowledged it so I sort of see problems in it from a graphics point of view.

AND IN MATHS, SHE NEVER GENERALISED.

Right, I wonder "What's the extension?"

IT'D BE NICE TO SEE "AND TWO MAKES SQUARES",

But what relevance is it being able to do that? It's like the Guinness Book of Records, there's a lot of absolutely very useless and totally pointless things in there. I mean I've got, you see what I mean.

BUT *SHE* DID SOMETHING. I THINK IT'S MAKING THEM THINK. I MEAN "M MINUS TWO MAKES T" THAT'S TEXTBOOK. THIS IS PHYSICAL OBJECTS SHE'S HANDLED AND RE-ARRANGED, DONE THINGS TO. FOR HER IT MAY WELL HAVE BEEN AN IMPORTANT STEP.

Mmm.

THIS IS AN INVESTIGATION ON FOUR GIRLS WHO ARE RUNNING AND GETTING DIFFERENT RANKINGS DIFFERENT WEEKS WHICH WE GAVE TO THE CLASS IN TERM ONE

Yeah that's right.

AND WE COLLECTED IT BACK IN. H DIDN'T GET TO KEEP IT BUT HE CAME BACK TO ME IN TERM 4 AND SAID "CAN I HAVE A COPY OF THAT INVESTIGATION QUESTION I WANT TO DO SOME MORE WORK ON IT". ... SO HE'D GONE AWAY AND HE'D TRIED DIFFERENT ARRANGEMENTS OF WHERE THE PEOPLE HAD COME AND HE'D PLAYED WITH IT.

Seeing if he can get the other one to come first.

HE SORT OF WANTED THAT. WHEN HE'D DID THIS AS A TIMED TEST HE MUST HAVE WANTED THAT TO HAPPEN. HE COULDN'T SEE THAT IT WAS IMPOSSIBLE, SO HE'S HAD ANOTHER EIGHT GOES AT IT AND EACH OF THESE ARE GRIDS ... DID HE MAKE A CONCLUSION? HE HASN'T EXTENDED HAS HE? [Reads project.] "IN THE ONES THAT HAVE BEEN DONE SO FAR, SYLVIE CAN'T LOSE, BUT SHE CAN." AND THERE'S, OH, HERE'S HER FINAL RUN AND SHE CAN LOSE. ... SO, HE'S FINALLY FOUND ONE WHERE SHE MANAGES TO LOSE AND HE'S THOUGHT "RIGHT GOT WHAT I WANTED" ...

These are kids in the top class, so what else is there really?

I KNOW

I think its a level of thinking that they're not there at. I think they need to have a lot more skills behind them before they'll

THEY'RE ASSESSED FORMALLY ON IT IN FORM 5 WHICH IS ONLY TWO YEARS FROM NOW FOR THESE GUYS ... I KEEP THINKING THERE'S EASIER INVESTIGATIONS, LETS DO SOME OF THOSE REALLY, REALLY EASY THINGS LIKE "2 CIRCLES NOW MANY DIFFERENT POINTS OF INTERSECTION WOULD THERE BE, 3 CIRCLES", YOU KNOW...

Mmm.

IF PEOPLE DON'T WANT TO DO INVESTIGATIONS

I just find the whole concepts actually very flawed I think.

WHAT, DOING INVESTIGATION?

Kids that age.

YOU CAN ALWAYS DO IT WITH THE "A" STREAM

yes you can almost but "B" stream

I GOT NO RESULTS. THERE'S MY "B" STREAM BOX OVER THERE YOU WILL NOT FIND AN INVESTIGATION.

[class] A5 was just hopeless for investigations, you know. They want to learn yet they want to learn some skills and I think that's fair enough really.

LIKE ALGEBRA, FORMALISM?

Mmm. They want to know some ways of doing things. They need some formal skills because that's what they don't have and that's what they need really. ...

I THINK PARTICULARLY WITH THE "B" STREAM SOME PEOPLE HAVE BEEN SAYING TO ME THAT YOUR IDEA OF ACTUALLY COLLECTING UP ALL THOSE WORKSHEETS AND MATHS SHEETS THROUGHOUT THE YEAR AND COLLECTING THAT INTO A PORTFOLIO SEEMED APPROPRIATE. ...

I just collect everything in and near the end of the year we just have this big hand out. What I've done in the past is I've said "you've got to select six items that show a range of topics and a range of assessments and you'll have to pick them out so that they best describe the year's work".

SO, AT THE END OF THE YEAR, THEN, THEY HAD THIS MASSIVE THING FROM WHICH TO CHOOSE. AT THE END OF THE YEAR THEY PICK OUT THE SIX

Six of the best.

SIX OF THE BEST [laughs]. SO, WHAT HAPPENS TO THOSE SIX: DO YOU ASSESS THEM?

Yes, I just give them a mark. Well, I actually graded them “A” to “E” really, as to how well they represented their year's work, how well they think they summed it up. And they had to write a covering page which was quite revealing.

THAT’S GOOD. THAT’S A TOTALLY DIFFERENT TECHNIQUE TO THIS PRESCRIPTIVE

that’s right, that’s why I found I didn't really like the prescriptive one. I didn't really like “such and such a day we've got to do this”.

YEAH.

Yeah.

I'VE WRITTEN SOME SORT OF SELF-ASSESSMENT SHEET BUT I HAVEN'T DONE IT. SIMPLY I DIDN'T THINK IT WAS APPROPRIATE BECAUSE PEOPLE HAVE DONE QUITE DIFFERENT THINGS.

Yeah, for instance for them they wouldn't have enjoyed collecting it because it would all be collected in for them but they would have had to select their best work and they would have had to think about why they'd selected it and justify their selection and

THAT’S QUITE A MAJOR THEME ACTUALLY AND PEOPLE WHO HAVE DONE PORTFOLIOS IN OTHER PLACES, THEY DON'T JUST WANT CREATIVITY

No.

THEY WANT JUDGEMENT.

Yeah. Well that's what they're do, well I just based it on what they do in Art, really. But they do their work all year and then they select, to make those you know stands, and that’s it, you know. For only 2 sides of A1, whatever it is [metric paper size that governs size of the Art portfolio], doing a year’s work.

ANY OTHER THOUGHTS ABOUT IT?

Like I say, I am a bit wary about 20% of their year’s work. I think it’s the wrong basis for maths.

ACTUALLY, WHEN YOU DO IT, WHEN YOU DO THE CALCULATIONS AS WELL, FOR SOME OF THESE GUYS: IN AN EXAM THEY'RE GOING TO GET, WELL HERE'S SOME MARKS, IN THE FINAL EXAM THESE GUYS WERE GETTING, TYPICALLY 20% IN THAT FINAL EXAM AND THE FINAL EXAM IS WORTH 50 MARKS. SO THEY WERE GETING, TYPICALLY, TEN MARKS FROM THEIR FINAL EXAM. HOWEVER FROM THEIR PORTFOLIO IT’S ENTIRELY POSSIBLE FOR THEM TO GET 20 MARKS OUT OF 20. IN OTHER

WORDS THE PORTFOLIO IS WEIGHTED TWICE AS HEAVILY AS THE FINAL EXAM. IT DOESN'T LOOK THAT WAY WHEN YOU SEE THE ASSESSMENT SCHEDULE WHERE IT'S 50 MARKS FOR THE FINAL EXAM, 20 MARKS FOR THE PORTFOLIO BUT BECAUSE THE PORTFOLIO CAN BE ACHIEVED IT'S BETTER FOR THEM TO DO THAT. HOWEVER THESE GUYS WHO GET VERY LOW MARKS IN THE EXAM TYPICALLY DON'T COMPLETE ALL THE ITEMS IN THE PORTFOLIO.

That's true too, but yeah, I'm not sure it should count as part of their year's work really.

DO YOU THINK THAT'S BECAUSE ITS NOT ALWAYS THE KIDS' OWN WORK?

Yes. I think it reflects the resources that they've got at home. In fact I think that's the single most contributing factor really.

RIGHT. WHAT ABOUT HAVING THIS STYLE OF ASSESSMENT - DOES THAT ADDRESS ANY OF IT? WHERE WE HAVE TWO DIFFERENT BITES AT IT. THIS WAS TO ADDRESS A DIFFERENT PROBLEM. THIS WAS TO ADDRESS THAT INCOMPLETENESS PROBLEM, GIVE THEM TWO CHANCES, BREAKING IT DOWN SO IT'S SORT OF OUT OF 10 MARKS FOR THE FIRST HALF YEAR. I DON'T THINK THIS ADDRESSES YOUR DIFFICULTY AT ALL

No.

ABOUT BEING A VALID ASSESSMENT.

I think it should be assessed. A mark on the report for it but not included in the exam mark. It's a sample of how much they value their *written* work, really. How much they value what they've put down on paper. So those bright smart alecs who get everything straight away but can't be bothered writing everything down, it shows them up fairly clearly but it also doesn't penalise them because they think with their head.

BECAUSE THEY'RE SMART ALECS WHO WANT TO GO THROUGH.

That's right.

THEY'RE IN THE TOP CLASS, THEY'LL GET MORE FORMALISATION AS THEY GO THROUGH.

Mmm. That's right.

Appendix N

Transcript - Teacher CC

Part One - 29 Oct 98

I WANT TO HEAR “STUDENTS SHOULD KNOW AND CAN DO AND HOW THEY THINK ABOUT MATHS, BROAD RANGE OF TASKS, INCLUDE THE ABILITY TO COMMUNICATE FINDINGS, PRESENT AN ARGUMENT, TO EXPLOIT AN INTUITIVE APPROACH TO A PROBLEM. MULTIPLE TECHNIQUES INCLUDING WRITTEN OR DEMONSTRATION OF FORMATS. TEAM ACTIVITIES SHOULD BE ASSESSED. BEYOND A STANDARD ALGORITHM”. AND I WANT TO LOOK THROUGH THESE AND SEE IF THERE’S ANY EVIDENCE OF ANY OF THAT HAPPENING. WHAT DO YOU THINK?

We can try.

I DIDN’T READ THE ONES. THERE WERE A WHOLE LOT OF HAND-WRITTEN ONES THAT WERE REALLY, REALLY DIFFICULT TO READ AT ALL AND SOME, I MEAN YOU DON’T HAVE THE BRIGHTEST BUNCH HERE, AND YOU TO GET THIS LEVEL OF STUFF OUT OF THEM, I THOUGHT WAS QUITE AN ACHIEVEMENT. WHEN YOU READ WHAT THEY’RE DOING YOU REALISE THAT THEIR SKILLS IN ENGLISH ARE ACTUALLY QUITE LOW.

Well that’s actually one of the problems. I think their Maths, several of them in this class, their Maths is above their English quite considerably. It’s a problem.

OK. SO WHAT’S THIS? THIS IS SOME SORT OF FANTASY INTERVIEW? MATHS MAGOO.

Yes, ah this was, ah yes, they were doing the interview ...

[Reads from project] “DO YOU THINK MATHS IS WORTH IT?” “Definitely, child. Like you’ve just asked me, is maths in every job. People have to learn to count don’t they?” “YES.”

NOT EXACTLY GOING INTO DEPTH. I MEAN “MATHS IS COUNTING” WE’RE NOT GOING PAST THAT.

A lot of this seemed to be giving us what she thought we wanted, really.

IT WAS INTERESTING IN THE OTHER INTERVIEWS WHERE THEY INTERVIEWED MUM AND MUM WOULD SAY “YES I HAVE TO USE MATHS. I DO A JOB WHERE I HAVE TO CUT THINGS TO A SPECIAL SIZE OR HOLD IT TO A PARTICULAR TEMPERATURE” AND ALL THAT, THEY THOUGHT “RIGHT WELL THAT WAS MATHS, MATHS IS MEASUREMENT” THE END. WHEREAS WE WOULD THEN ASK A FEW MORE IMPERTINENT

QUESTIONS LIKE “HOW MUCH TOLERANCE IS THERE?” AND “WHAT HAPPENS IF IT DOESN’T WORK?”.

WHAT HAVE WE GOT IN HERE THAT ACTUALLY DOES SHOW ANY OF THE CURRICULUM WANTED?

This is going to be quite a challenge.

HERE’S THE LEAVES ONE. THIS WAS A TASK WE’D GAVE AND THEY’D SORT OF DONE IT IN A ROUTINE MANNER. I AGREED WITH YOUR MARKING BY THE WAY. I LOOKED THROUGH AND I THOUGHT “YES, THAT WAS CONSISTENT ALL THE WAY THROUGH: “G” FOR GOOD, “E” FOR EXCELLENT, “F” FOR FAIL”. WAS THERE ANY OTHER GRADE? ANY “VG”S OR ANYTHING? I DIDN’T NOTICE.

Excellent, good, fair, and poor.

IS “POOR” THE LOWEST?

Yes.

I DIDN’T SEE ANY OF THEM. THERE MUST BE SOME. I SEE SOME IN YOUR COLUMN THERE. [Referring to the open Teachers’ Markbook.] WHAT’S THE DISTRIBUTION? THIS IS PORTFOLIO THINGS HERE, SO HANG ON. THE AUTOBIOGRAPHY IS OUT OF 15 AND THEY EITHER SCORED 15 OR 5?

Yes it could have been 20 but there were no 20.

WHAT HAPPENS THERE IS WE WERE LOOKING AT PASS/FAIL IN THE QUALITY DEPARTMENT. THE QUALITY DEPARTMENT IS A REQUIREMENT ISN’T IT?

Mmm.

SOME SCORED A ZERO BECAUSE NOTHING WAS PASSED IN

It was but it was totally ...

OH RIGHT OK. LOGO TASK IS SCORED OUT OF 10. THAT WAS AS IT WAS BUILT IN. YOU JUST ...

Yes.

SHAPES: IT WAS EXCELLENT/GOOD/FAIL. A FEW BLANKS, WHICH MEANS NOTHING SUBMITTED I GUESS.

Yes.

FORMAL WRITING. LETS HAVE A LOOK. WE'VE GOT 1, 2, 3, 4 FORMAL WRITING "EXCELLENTS", MOST OF THEM "GOOD" A FEW "POOR"S AND "FAIL"S. A FEW "NO SUBMISSION"S. HOW MANY "GOOD": 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 IN A CLASS OF ABOUT 30. HOW MANY "NOTHING"S"? 1, 2, 3, 4, 5, 6, BLANKS, SO 20% ACTUALLY PUT NOTHING IN. WHAT WOULD YOU PUT IT DOWN TO?

Cantamaths item

NO, NO, I MEANT THE FORMAL WRITING.

Partly English skills, and, if I'd given complete time in class I may have got something, and picked it up at the end, but because I gave them just a little bit to get them started and then said "hand it in, just get it finished in your own time" these ones just can't handle it, either don't want to, or choose not to, or whatever. I don't know.

AND THE ONES THAT CAME IN AS FORMAL WRITING - OFTEN FAIRLY MINIMUM EFFORT?

Yes just a start.

I'M LOOKING AT THIS ONE, THIS STADIUM ONE, WHERE HE'S WRITTEN TO THE COUNCIL SUGGESTING THEY PUT CAR PARKS ON THE ROOF OF THE STADIUM. I MEAN THE ONLY MATHS THAT'S THERE IS THE ADDING UP THESE TWO NUMBERS TO GET THIS NUMBER, ISN'T IT?

Yeah.

BUT MULTIPLYING PER CAR HOW MUCH MONEY YOU'D MAKE.

In that whole formal writing I got very little of actual maths. But I sort of tried to encourage them to make an attempt to link the two because I think that for some it was quite foreign to even try so I mean I think it was pretty generous marking.

WHAT WE WERE INTERESTED IN FROM THE CURRICULUM FORMAL WRITING WAS THAT WORD "COMMUNICATION" AND I THINK IT WAS, I'M SURE THE CURRICULUM MEANT COMMUNICATION IN INFORMAL WAYS AS WELL AS FORMAL WAYS. IT'S INTERESTING, THAT THE CURRICULUM, I THINK, HAS A BIG EMPHASIS ON COMMUNICATING MATHEMATICS INFORMALLY, BUT IN FACT THE FORMAL COMMUNICATION OF MATHEMATICS IS MY OWN PERCEPTION OF WHAT WAS FALLING DOWN WHEN I LOOKED THROUGH THESE.

Yes.

[named teacher] - SHE HAD THIS 6TH FORM OR SOMETHING?

It looks like her notes ... misfiled.

AH GOOD, SOMETHING GOOD HAS COME OF THIS 5 MINUTES.

YES, THIS LOOKS BEAUTIFUL DOESN'T IT? SHAPES, COLOUR PRINTER, BUT ALL OF THE SHAPES ON THE FRONT COVER ARE JUST THINGS WHICH ARE SNIPPED FROM VARIOUS PROGRAMMES, SO SHE'S GONE THROUGH WHAT LOOKS LIKE A REALTOR MAGAZINE AND SNIPPED OUT PHOTOS OF HOUSES AND THEN SHE'S, WHAT SHE SAYS ABOUT THE SHAPES IS WHETHER THEY'RE RECTANGLES OR TRIANGLES.

Shape identification.

YEAH. HANG ON, [reads from project] "THIS IS A VERY UNUSUAL SHAPED ROOF, PART OF THE ROOF IS CONCAVE". WHERE? SHE MEANS "CON-", NO SHE MEANS "CURVED". [READS FROM PROJECT] "IT'S A CONVEX CURVE. THIS MEANS CURVED LIKE THE INSIDE OF A WALL CIRCLE." IT'S NOT CIRCULAR IS IT? DO YOU THINK THAT'S A CIRCLE? IT MIGHT BE.

It's still concave.

IT DEPENDS HOW YOU WANT IT.

Mmm.

SHE'S NOTICED SOMETHING INTERESTING. SHE HASN'T GONE INTO ANY DEPTH ABOUT FINDING OUT WHETHER THAT CURVE IS A CIRCLE, WHICH COULD HAVE BEEN ACHIEVED WITH A BIT OF MEASUREMENT, I SUPPOSE.

BECAUSE IT'S PHOTOGRAPHED FROM AN ANGLE IT'S DIFFICULT. HOW WOULD YOU DO IT? YOU CAN'T EVEN RULE IN TANGENTS ON THERE PROBABLY IN PHOTOS, TOO SMALL. PERHAPS THAT'S THE LIMIT OF WHAT SHE CAN DO GIVEN WHAT SHE'S GOT HERE. I MEAN THESE ARE 3RD FORMERS ISN'T IT? THEY HAVEN'T GOT THE ABILITY TO ACTUALLY CALCULATE THE ROOF AREA AND COMPARE IT TO THE FLOOR AREA OR ANYTHING LIKE THAT.

They were happy if they saw some mathematical shapes in their life. That's what we wanted.

I MEAN SHE'S DONE A LOT OF WORK. IT'S *BEAUTIFULLY* PRESENTED. I MEAN THE TROUBLE TO LEAVE THESE GAPS. PROBABLY MORE MATHS WAS DONE IN FIGURING OUT HOW TO GET THE COMPUTER TO DO THIS.

Yes.

MORE ESTIMATION SKILLS THAN ANYTHING ELSE. I WONDER HOW INTERESTED SHE WAS IN IT. YOU KNOW, I GOT THE IMPRESSION FROM THAT, THAT HERE'S SOMEONE WHO LIKES DOING THIS PROJECT WORK AND REALLY WANTS

She likes doing written. She's one of about three who takes a lot of pride in written work. And obviously from the primary school they've done it very well. A lot of displays, they've been taught how to. She still wants to do that. She doesn't find maths that easy, this girl. She's in the top bracket but

YOU KNOW IF SHE DIDN'T HAVE THIS AVAILABLE TO DO IN THE MATHS CLASS THEN ALL OF THAT TALENT AND SKILL AND BACKGROUND IN WORK WOULDN'T HAVE BEEN EMPLOYED.

No, she would be marked on her tests only which she doesn't score quite as well on as she does this, she gets a lot of pride from this.

I BET WHEN SHE LOOKS BACK ON FORM 3, MATHS WILL BE A THING THAT SHE THINKS "YES, THAT WAS MY TOP WORK".

Yeah.

I WANT TO SEE SOME OF THE STUDENTS WHEN THEY'VE GOT THEIR PORTFOLIOS AT THE END OF THIS. I WAS ACTUALLY THINKING "MAYBE I SHOULD BE A COVER SHEET WITH PORTFOLIOS AND HAVE THEM COMMENT ON WHAT IS THE BEST THINGS IN THE PORTFOLIO AND WHY. AND MAYBE THE WORST THING AND WHY AS WELL" AND HAVE THEM THINK "WHERE DID I PUT THE MOST THOUGHT INTO THIS?" AND CREATE A PRESENTATION.

I WANT TO LOOK THROUGH HERE. JUST LETS FLICK THROUGH UNTIL WE CAN SPOT SOMETHING WHICH SEEMS TO INDICATE THIS "THINKING BEYOND WHAT THE TEACHER SET DOWN".

I didn't get a lot of that.

RIGHT.

LOGOS: HE SCANNED THINGS INTO THE COMPUTER. HE DID A LOT OF WORK.

[reads from project] "SOME PEOPLE WALK AROUND THE SUPERMARKET WITH A CALCULATOR AND ADD EVERYTHING UP" ... THE SHAPES WAS VERY HARD FOR THEM WASN'T IT?

Yeah.

THEY DIDN'T HAVE THE SOPHISTICATION TO DO IT. WE SPECIFIED SHELLS, AND SPIDER WEBS DIDN'T WE?

Mentioned them as a possibility.

QUITE A FEW HAVE ACTUALLY SKETCHED SPIDER WEBS IN HERE AND THEIR SKETCHES LOOK *NOTHING* LIKE SPIDER WEBS AT ALL. IT WAS NOT DONE FROM A REAL SPIDER WEB WHICH WAS REALISTIC.

It was just roughly done the night before I reckon.

YEAH.

It doesn't achieve a thing. That's how I approached it.

HERE'S SOMEONE WHO IS TRYING TO WORK OUT HOW MANY TOILETS YOU NEED WHEN YOU'VE GOT THIS MANY PEOPLE COMING TO A STADIUM.

That was creative.

I'M NOT SURE IT WAS DONE RIGHT. THERE'S THE FIGURES BUT IT'S AS IF "IT'S THE TOP FIGURE IN MY MIND". CAN'T JUSTIFY THOSE FIGURES. I MEAN IF YOU'D TOLD HIM: "NOW WHAT NUMBER HAVE YOU WRITTEN HERE?" THEY'D NEVER BE ABLE TO REPLY.

THAT'S INTERESTING SO HE'S TAKEN THE CIVIL DEFENCE LOGO AND TRIED TO DESCRIBE IT USING ... CIRCUMFERENCE IS 9.4 CM AND RADIUS IS 1.5 CM. DID HE MEASURE THE CIRCUMFERENCE?

Yeah he put a calculation ... He hadn't explained it very clearly.

NOW HANG ON, THAT IS ALL ONE TYPE OF THING ISN'T IT? I'M SORRY I'VE, THESE ARE NOW OUT OF ORDER BECAUSE TRYING TO GET THEM OUT OF BLOCKS, THEY DIDN'T WANT TO DO IT. LETS JUST FLICK ON AND SEE WHAT WE'VE GOT HERE. HERE WE'VE GOT CHINA'S POPULATION FROM 1993 TO 1996. THIS IS VERY INTERESTING.

That's a bit of research. They had to get those numbers themselves and prove them and we hadn't done any sort of graphing at that stage.

SHE'S GOT THE RIGHT SORT OF GRAPH.

Yeah, so. No suggestions from me that that's what she should do. It was just all her own work.

HAS CHINA'S POPULATION REALLY DOUBLED IN ONE YEAR? WHAT IS CHINA'S POPULATION. I MEAN THE EARTH IS 'ROUND ABOUT 4 BILLION PEOPLE, OF WHICH CHINA ACCOUNTED FOR ABOUT A QUARTER OF IT, SO WHEN WE SAY A POPULATION OF MILLIONS IS ABOUT 8 MILLION PEOPLE IN CHINA. I'M THINKING "THIS ISN'T RIGHT".

WHAT DID YOU SAY TO HER? "CREATIVELY PRESENTED, GOOD MATHS PART". YOU DIDN'T ACTUALLY TEAR IT APART. YOU'VE BEEN NICE ABOUT IT. WHY DID SHE DO IT? [reads project] "TALK ABOUT THE

CURRENT GROWTH". I SEE, SO IT'S AN INTERVIEW AND SHE'S DONE AN INTERVIEW BETWEEN SARAH AND JOHN "WELCOME TO TONIGHTS SHOW. CHINA'S POPULATION HAS RISEN VERY WORRYINGLY. THIS IS GOING TO BECOME A PROBLEM IN THE NEAR FUTURE". CHINA PHOBIA HERE. "AS YOU CAN TELL FROM THE BAR GRAPH CHINA HAS HAD A MAJOR JUMP IN ITS POPULATION. X-AXIS SHOWS US HOW MANY PEOPLE AND Y-AXIS SHOWS US THE YEARS. IF CHINA CONTROLS ITS POPULATION IT SHOULD NOT BE A PROBLEM. HOW CAN THEY CONTROL THEIR POPULATION? WHAT IF THEY.....KEEPING EVERY COUPLE'S CHILD DOWN TO ONE". WELL THIS IS TRUE ISN'T IT? DOES THIS GIRL DO CHINESE? I BET THAT THE CHINESE TEACHER HAS MENTIONED THIS SORT OF THING. "COULD THIS AFFECT CHINA'S ECONOMY? WE'VE LOOKED INTO IT AND WE SHOULDN'T THINK IT WOULD. THANK YOU JOHN. TONIGHT'S QUICK QUESTIONS. WE'LL SEE YOU BACK HERE IN 4 MORE YEARS". I SEE, NOW WE SWITCH TO 1996.

It's creative!

[reads from project] "JOHN LEE TALKING ABOUT HOW CHINA'S. HI AGAIN! READY FOR YOUR QUESTIONS? HAS THE POPULATION STAYED AS MINIMAL AS POSSIBLE. IT HAS. THE POPULATION HAS HARDLY RISEN. FROM 8.5 TO 8.6 MILLION. THE WHOLE SITUATION IS UNDER CONTROL". SO, SHE'S EXPLAINING HOW TO DO A GRAPH IN HERE ... THAT'S QUITE GOOD ISN'T IT.

I was impressed with that.

YEAH.

I thought she's done well. She's not a top student but she's worked hard at it. Her heart is in it and she's communicating maths.

WELL, THAT'S RIGHT. YOU LOOK AT THAT AND YOU KNOW IT'S NOT JUST THAT SHE'S WRITTEN DOWN YOUR NOTES. SHES ACTUALLY

Especially as we hadn't even done them at that stage.

TRUE.

She's made a pretty good effort I think: presenting an argument, communicating, communicating findings, using maths to back it up.

WHAT WE'RE DOING, WE'RE QUIETLY SAYING TO OURSELVES "THIS IS WRONG, THIS IS WRONG, HERE ARE YOUR MISTAKES" INSTEAD OF THE BIG PICTURE

She's made a damn good try.

YOU'VE ASSESSED IT ON THE BIG PICTURE. SHES GOT AN "EXCELLENT" AND YOU'VE ACTUALLY AVOIDED GOING THROUGH AND PUTTING "WRONG"

And she's backed up an intuitive approach: "China's got a problem, my graph will show it."

THAT'S TRUE. SHE DIDN'T ACTUALLY LOOK AT WHETHER, I MEAN IF YOU'D BROUGHT IN A CONTRACEPTION POLICY IT'S NOT GOING TO MAKE A BIG DIFFERENCE TO THE CHINESE POPULATION WITHIN TWO YEARS OR FOUR YEARS, SO YOU KNOW THERE'S A FEW PROBLEMS THERE, BUT SHES GOT SOMETHING.

[reads from another project] "THERE WAS A BLOCK OF CHOCOLATE SITTING IN THE SHADE". THIS IS POEMS, FIFTH FORMER. THAT'S SOME OTHER STUFF. THAT WOULD BE YOUR FILING. THAT'S YOUR BOOKMARKS OR SOMETHING.

I don't know.

THIS PORTFOLIO'S ALL OVER THE PLACE. THERES ONLY A FEW OF THEM PUT IN FOLDERS. SHE'S ACTUALLY, LOOKS LIKE A SHE, HAS PUT IN A COVER SHEET WITH THE NAMES OF WHAT'S IN IT AND HERE'S THE, YES ITS A GIRL, AND SHE'S ALSO PUT IN THE INFORMATION WE GAVE AT THE BEGINNING SO IT'S ALL IN ONE PLACE. ...

I CAN'T BELIEVE THESE KIDS HAVE DONE ALL THESE YEARS OF WRITING WHEN YOU SEE, YOU KNOW. FOR EXAMPLE I'VE GOT STUDENTS WHO DO NOT KNOW THAT THE FIRST LETTER OF A PROPER NAME IS A CAPITAL. THEN SHE'S DONE A NICE COPY.

OK. DOES THIS SHOW PROGRESSION OF MATHEMATICAL THOUGHT: IN THAT THE ROUGH COPY HAS GOT SOME THINGS THAT SHE'S THOUGHT ABOUT AND THEN ALTERED IN THE NICE COPY? SO LET'S DO THAT. LET'S IGNORE THE FACT THAT IT'S MORE BEAUTIFUL, LET'S SEE IF THE CONTENT CHANGED. SO IT'S SHAPES. SHE'S GOT THE MITSUBISHI MOTORS SYMBOL IN THE ROUGH. SHES THEN TRIED TO RE-DRAW IT AND ACTUALLY MADE A WORSE JOB. "MY REASONS FOR HAVING MITSUBISHI'S LOGO IS BECAUSE IT'S SHAPES WHICH ARE DIAMONDS. AS YOU CAN CLEARLY SEE THE DIAMONDS" THEN WE'VE GOT IT CROSSED OUT. "IT IS LIKE IT IS MAKING UP ITS OWN PATTERN". DOESN'T SAY "DIAMONDS ARE A GIRL'S BEST FRIEND" IN THE FIRST ONE. IT LOOKS LIKE IT HAS COME OFF A PLAYING CARD, "THE ACE OF CARS, THE ACE OF DIAMONDS. ITS A GOOD SHAPE TO DRAW, NEARLY ANYONE CAN DRAW IT, YOU CAN TURN IT ON AN ANGLE, IT LOOKS LIKE" ...

HERE SHE'S SAID "MY REASON FOR HAVING MITSUBISHI'S LOGO IS BECAUSE" FINAL COPY "A THE LOGO HAS SHAPES, B YOU CAN CLEARLY SEE THE DIAMONDS, C THERE IS A SAYING DIAMONDS ARE A

GIRLS BEST FRIEND D ITS LOOKS LIKE ITS COME OFF A PLAYING CARD
ACE OF DIAMOND E IT IS A GOOD SHAPE TO DRAW BECAUSE NEARLY
ANYONE COULD DRAW IT F YOU COULD TURN IT ON AN ANGLE, IT
LOOKS LIKE A COLLAR AND TIE G IT COMPARES WITH THE DIAMOND
AND THEN CARS E.G. A DIAMOND IS RARE AND STRONG WHICH MAKES
THEM SAY THEIR CARS ARE STRONG AND RARE". I DON'T THINK
ANYTHING CHANGED IN THE CONTENT BETWEEN THE ROUGH AND
THE FINAL.

Just the pictures. ... It's supposed to compare with diamonds but she doesn't ...

YES, THESE COULD BE PRECIOUS STONES IN DIFFERENT COLOURS.
THEY ARE ALL DIFFERENT POLYGONS REALLY. IT'S A COLLECTION OF
POLYGON SHAPES.

With the diamond in the middle. There's some thought there which she's not
expressed very well.

WE'VE GOT TO RUSH OFF TO OUR NEXT THINGY. THANKS FOR
TALKING WITH ME. I'D LIKE TO TALK SOME MORE, AND GO THROUGH
IT A BIT MORE AND ACTUALLY SEE IF WE CAN FIND SOME EVIDENCE.

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I'VE GOT MY LOAD [of student portfolios] AS WELL. GUESS WHICH ONE IS
3A AND 3B? [Laughter.] DEFINATELY THE QUANTITY SHOWS [IT].
ACTUALLY, WITH 3B I'VE HAD TO DUMP SOME OF THE ITEMS. IT WAS
JUST SILLY. THEY GOT UP TO THE CLASS SPEECHES - WITHOUT NOTES -
AND OF COURSE IT WAS JUST SORT OF LIKE A ... IN THERE, AND WITH
THAT LEVEL IT WAS JUST STUPID. AND THE BRIEF WAS TO HAVE A
SPEECH THAT WAS PREPARED AND HAVE THE NOTES GO INTO THE
THING AND I SAID ... SO REALLY THEY SHOULD HAVE SHOWN ME THE
NOTES FIRST. I JUST CUT IT IN THE END I SAID. "RIGHT, WE'VE GOT TO
GET THEM ALL DONE BY FRIDAY". FRIDAY PASSED AND QUITE A FEW
OF THEM HAD NOT HAD THEIR MOMENT OF GLORY AND IT WAS JUST
TOUGH.

I'm half way through that with mine. They're actually quite good.

DID YOU USE THE SCORE SHEET THAT I GAVE YOU? DO YOU
REMEMBER THAT?

I don't.

IT'S NOT BAD BECAUSE IT MEANS THEY'VE GOT SOMETHING TO DO WHILE THE SPEECH IS GOING ON

That's right.

OTHERWISE THEY'RE TWIDDLING THEIR THUMBS. I'VE GOT ONE OVER THERE IF YOU WANT IT.

Yeah, I can't remember where I put it now. I remember thinking when I saw it, "it will work" and then forgot all about it.

MY SCRAP PAPER BOX. I FOUND THAT WAS QUITE NATURAL AND IT SEEMED TO WORK. SO YOU'VE DONE A FEW SPEECHES. ...

LET'S HAVE ANOTHER LOOK AT THIS. IT'S VERY INTERESTING MR CREECH'S LATEST THING [pronouncement by the Minister of Education] CHANGES THE STRUCTURE OF THE EXAMINATIONS AND THINGS BUT IT DOESN'T CHANGE THE CURRICULUM AT ALL. YOU KNOW IF YOU'RE REALLY GOING TO HAVE ALL THESE EXAM CHANGES THE TEXTBOOKS HAVE GOT TO GO, ALL SORTS OF THINGS WOULD HAVE TO CHANGE WOULDN'T THEY?

Is he still just releasing it or is he actually

OH, IT'S ALL THERE BUT THERE'S A VERY LONG TIME LINE. SO WE'RE STILL GOING TO HAVE SCHOOL CERTIFICATE AND BURSARY BY THOSE NAMES BUT THEY WILL SIMPLY BECOME LEVELS ONE AND LEVELS 3 OF THE WONDERFUL NEW COMPREHENSIVE ASSESSMENT THING, AND ITS ONLY WHEN WE GET THE FINE PRINT WILL WE KNOW HOW MUCH OF IT IS INTERNALLY ASSESSED AND HOW MUCH WORK, UNPAID WORK WE GET TO DO.

OK WHAT ARE WE TRYING TO DO HERE? WE SHOULD "AVOID CARRYING OUT ONLY TESTS WHICH FOCUS ON A NARROW RANGE OF SKILLS". THAT'S WHAT WILL HAPPEN IN THE NEW SYSTEM, I BET.

We're going back.

SO. "HOW WELL THEY HAVE ACHIEVED IT?" SO, "IN SUMMARISING THE RESULTS OF EVALUATIONS AND STUDENTS ACHIEVEMENT TEACHERS SHOULD REPORT WHAT THE STUDENTS HAVE BEEN WORKING ON, WHAT THEY HAVE ACHIEVED AND HOW WELL THEY HAVE ACHIEVED IT". IT'S SO DIFFICULT.

Yes! [Laughs.] I just ignored that paragraph.

WHAT DID WE DO? WE WERE SORT OF GOING FROM THE TOP WEREN'T WE?

...

RIGHT, WHAT IS ALL THIS? A MATHEMATICAL DESIGN. SO, IT'S A SORT OF A LOGO. WE LOOKED AT THIS BEFORE. WHAT ABOUT USING THE LOGO COMPUTER LANGUAGE, DID THEY DO THAT?

Yes they did. I unfortunately just went round and marked them. Didn't print it off.

THAT'S FINE. A PERFECTLY GOOD WAY OF DOING IT IF YOU'RE HAPPY WITH THAT FORM OF ASSESSMENT.

It means they haven't got it in their portfolio.

THEY CAN SAVE IT ON THE COMPUTER AND IT WILL SIT THERE UNTIL THE END OF THE YEAR.

It gets wiped then.

MINE HAVE HAD TO PRINT IT OFF AND SO, HERE THERE ARE SOME. I LIKE THAT ONE, SEE HE'S TRYING TO DO A SPIRAL. HE DID HIS SPIRAL. IT'S A TRICK. IT'S JUST CIRCLES. WHAT HE MUST HAVE DONE IS THE CIRCLE AND THEN TURN A DEGREE OR TWO AND THEN A CIRCLE OF THE NEXT SIZE. THAT'S ALL HE'S DONE. SO HE'S ACTUALLY DRAWN A SPIRAL.

It's pretty clever.

WITHOUT DOING RECURSION. IT'S QUITE GOOD.

That's the top.

Mmm.

SEE YOU CAN DO ALL THAT USING REPEAT. I THINK.

Mine didn't really get into repeat much. They got as far as turning and drawing straight lines and a few circles but not too much repeat stuff.

DID ANY OF THEM WANT TO PRINT IT OFF?

Some of them wanted to print earlier but a lot didn't have money in their accounts. Some wanted to print their stuff off.

STILL CAN OF COURSE

Mmm.

IT DEPENDS HOW MUCH CONTROL THEY FEEL THEY HAVE OF THE COMPUTER RESOURCES. SOUNDS LIKE THEY DON'T FEEL THEY HAVE MUCH CONTROL AT ALL. SOME OF MINE ACTUALLY WANTED THE SOFTWARE AND THE SOFTWARE THAT WE HAVE THERE IS

SHAREWARE AND SO THEY COULD DOWNLOAD IT THEMSELVES AND IN FACT I GAVE IT TO THEM ON THE DISKS AND SO I HAD A BUSY TRADE OF DISKS OF THIS GOING HOME ... AND THEY'E NOW GOT IT AT HOME AND THEY WERE MUCH HAPPIER WITH THAT.

Yes.

IT'S THE DIFFERENCE BETWEEN HAVING YOUR OWN CALCULATOR IN YOUR BAG AND BORROWING ONE OF A CLASS SET. ...

WHAT IS THIS? WE LOOKED AT THESE DIDN'T WE?

Mmm.

HOW DO YOU FEEL ABOUT FORMAL WRITING?

Um. They need training in it, my class anyway.

IT'S 3B1 ISN'T IT?

A *few* were confident and quite happy to do a sort of project thing with nice formal writing and all done on the computer and so on, but a lot of them don't have English skills, and to try and combine English with Maths. I think some of them were quite threatened by it. I'm not sure. I mean, it's *important*. It gets them thinking beyond just "Exercise Thirteen". I wouldn't want to give up on it.

I'M NOT HERE NEXT YEAR. I DON'T HAVE TO WORRY. BUT IF YOU'RE DOING THIS SAME SORT OF PORTFOLIO THING SOMEONE IS GOING TO HAVE TO PRESUMABLY COME UP WITH SOME SORT OF BRIEF FOR THE CHILDREN NEXT YEAR. WOULD YOU PUT THIS IN? AND IF SO WHAT, WOULD YOU RESTRUCTURE IT?

I think perhaps that needs a bit of talking about. Where this side of things belongs in the curriculum rather than just in the portfolio as a one-off thing. I think its something we do need to do work more on. Perhaps we've got more activities that they write up and and maybe they choose one to put in their portfolio or something like that. I don't know. I think the idea of writing up their maths as well as understanding it is really important. But I'm not sure how well this achieved it.

THEY LEARN BY DOING THIS. IT WOULD BE INTERESTING AT THE END OF YEAR WHEN THEY GET THIS BACK TO SEE HOW THEY RESPOND TO THEIR OWN WORK. WHETHER THEY SAY "OH, THAT'S SILLY. I COULD DO THAT DIFFERENTLY NOW" OR WILL IT TAKE A YEAR OR TWO BEFORE THEY LOOK BACK AT THIS AND SAY "I'M MUCH MORE SKILLED NOW".

...

IS IT SOMETHING WE HAVE TO DO? I LIKE YOUR IDEA OF *CHOICE*, QUITE FRANKLY, BECAUSE CREATIVITY IS ALL VERY FINE BUT

THEY'VE GOT TO HAVE DISCERNMENT AS WELL. IF THERE'S THAT ELEMENT OF JUDGMENT IN THE PORTFOLIO THAT MAKES IT A DIFFERENT DEAL.

Yeah, the striving for excellence. "Put your best" or whatever.

SO, HOW ARE YOU GOING TO DO IT NEXT YEAR? I THINK THERE WERE TOO MANY ITEMS THIS YEAR.

Possibly, maybe we need to start smaller. It would be good to try them though, and now we've got an idea of which we'd like to build on and which we wouldn't.

WHICH ARE THE ONES YOU WOULDN'T?

... Have any absolutely failed? Oh I would say the shapes didn't work.

YEAH, THE FOUND SHAPES. THEY DIDN'T HAVE ANY BACKGROUND. DIDN'T KNOW WHAT TO DO WITH IT. DIDN'T LEARN ANYTHING.

They just did it to get it ticked off. My class didn't want to do anything, and I don't think I gave them the help they needed.

WE COULD HAVE MADE IT QUITE, I MEAN THAT WAS THE MOST UNDIRECTED OF THEM

Yes.

I MEAN IF WE'D SAID "YOU'VE GOT TO FIND A SHAPE ON THE SEASHORE THAT HAS THREE LINES OF SYMMETRY" OR WHATEVER, THEN YOU MIGHT HAVE HAD A CHANCE. WITH MY GUYS, WITH THESE ONES IN HERE: THE FOUND SHAPES DEVELOPED INTO CANTAMATH PROJECTS. CLASSIFYING OF TREE ROOTS INTO DIFFERENT TYPES OF TREE ROOTS ...

Fair enough.

WHAT WAS THE BEST ONE? I THINK THE 4TH FORM HAVE GOT A REAL BIG HIT ON THEIR HANDS ... IN THAT INTERVIEW. THEY HAD TO INTERVIEW SOMEONE ABOUT THE MATHS THEY USED AT WORK.

Ah, yes.

AND I GUESS IT WAS *RIGHT* AT 4TH FORM LEVEL. HERE, THIS ONE IS INTERVIEWING A BUILDER. IT'S SAYING "PAINTERS HAVE A LOT OF MATHS IN THEIR WORK, BUT BUILDING IS ONE OF THE MOST MATHEMATICAL JOBS AROUND". WELL, WHAT?

Yeah.

I MEAN, NO JUSTIFICATION. IF THEY'D SPOKEN WITH A REAL PAINTER OR BUILDER THEY MIGHT GET THE TRUTH, WHICH IS "NOT MUCH MATHS INVOLVED", OR "DOING QUOTATIONS ...". OFTEN IT WOULDN'T BE THE CASE. I THINK *REAL* INTERVIEWS ARE QUITE DIFFERENT.

IT'S INTERESTING NOW THE PARENT FEEDBACK I'M GETTING NOW. THEY LIKED BEING INTERVIEWED. THERE WAS A LARGE INVOLVEMENT IN MATHS ... MOST OF THE KIDS DID IT.

BIOGRAPHY IN THE 3RD FORM ...

I would say so.

...

I learnt a lot from that. ... and they take it seriously. ... I did ask them for an extra project too for their portfolio on famous mathematicians. I've included library research into that and some of those went well. Not all.

ARE THERE ANY OF THOSE IN HERE?

No. A couple of groups. ... To try and get a historical perspective on maths. Some achieved it to a degree. Not all.

WHAT IS A HISTORICAL PERSPECTIVE? WHAT DID YOU COME UP WITH?

Just that maths as we've got it today hasn't always been around. This person developed something, whether it was symbols or a new idea or something like that. It was probably new to a lot of them. ...

YES THE IDEA OF THE NUMBER ZERO, IT HAD TO BE INTRODUCED TO THEM AS A CONCEPT GENTLY. ... THAT'S GOOD. AND WHICH ONES DID THEY DO? ANY PARTICULAR HITS THEY LIKED?

Einstein, even though he wasn't a mathematician! [Laughs.] ... was popular. They didn't recognise the names. I gave them heaps to choose from and a one paragraph summary of each one and there's a whole heap here ...

Archimedes.

RIGHT.

Florence Nightingale.

NIGHTINGALE DID A LOT OF WORK. WHERE DID THEY GET THE INFO? WAS THERE A PARTICULAR BOOK IN THE LIBRARY WHICH THEY

Mainly internet. I got a lot of sites downloaded.

WELL, THAT'S GOOD. DID THEY DO THAT THROUGH SCHOOL OR DID THEY GO HOME AND DO IT?

I gave them a few periods here and there to finish it.

...

I went searching, famous mathematicians ... and women in maths. One of those searches brought up a lot. ...

I COULD GO AND USE IT. WE SHOULD SOMEHOW CATALOGUE THAT. IT WOULD BE GOOD IF THE INTRANET STUFF WAS IN THE LIBRARY CATALOGUE,

Yes, and you'd know what's there.

AND SO WHEN THE KIDS WERE DOING THE SEARCH FOR EINSTEIN ... I PUT ALL THOSE MATHS DIGESTS IN THE CATALOGUE AND THEY WORKED REALLY WELL. ...

SO IT GAVE FLEXIBILITY, THAT YOU COULD ACTUALLY DO THAT AT LEAST.

Yeah. ...

I DIDN'T DO LIBRARY RESEARCH. I RAN OUT OF TIME AND CANNED THAT.

The Logo. That was quite good. They didn't get very sophisticated. Most managed to get around that maze and that was all. Doing their own shapes and stuff, they didn't get very far.

THEY DON'T USE THE COMPUTER DO THEY? LIKE, YOUR 7TH FORM GROUP WHO WERE DOING THAT CONVERSION SEQUENCE OF TERMS AND SERIES ... CUMULATIVE SUM OF THAT, I MEAN THEY WOULD KNOW IF THEIR "ONE OVER ROOT N" FUNCTION CONVERGED OR DIVERGED QUITE QUICKLY BY PUTTING IT INTO A SPREAD SHEET.

I wanted to get mine to use spreadsheets, exactly. ... it was such a curse.

HALF OF THEM HAVE COMPUTERS SITTING 'ROUND AT HOME. ...

I told them what spreadsheets are, ...

I ACTUALLY FIRED UP THAT ONE AND SHOWED ... COULD SEE WHAT THE RESULTS WERE. BUT AT LEAST THEY'D KNOW I'D DONE IT, BECAUSE I HAD THE PRINTOUT ON MY DESK. ... THEY WORRIED ABOUT THAT. ... UNFORTUNATELY IT WAS NOT A WINDOWS COMPUTER SO THERE WAS NO POINT IN SHOWING THEM HOW I DID IT.

OK, ANYTHING ELSE? OH MY GOD, HERE'S SOMEONE WHO KNOWS ALL THEIR TEACHERS OVER THE YEARS. "MISS X WAS NOT A VERY NICE TEACHER BECAUSE SHE HAD A BAD TEMPER AND PEOPLE WERE TOO SCARED TO ASK HER THINGS. I DON'T THINK I LEARNED MUCH WITH MR Y AND HIS WORK WAS PRETTY BORING BUT MR Z WAS ... BUT I LEARNT A LOT FROM HIM". WHAT WILL THEY SAY OF US, [named teacher]?

Exactly.

MAYBE WE SHOULD HAVE THE AUTOBIOGRAPHY UPDATE AT THE END OF THE YEAR FOR THEIR NEXT TEACHER AS WELL. I WANTED THE END OF THIS TO HAVE SELF-ASSESSMENT OF THEIR PORTFOLIO. I WANT TO HAVE A SHEET AND I'D QUITE LIKE TO HAVE THE SHEET INVOLVING THAT BIT OF DISCERNMENT AS WELL. YOU KNOW: "MY BEST THINGS: ONE THING YOU CAN SEE FROM MY AUTOBIOGRAPHY IS THIS", AND PERHAPS ON THAT SHEET YOU COULD HAVE AUTOBIOGRAPHY UPDATE: "ME THIS YEAR". NOT ON THE TEACHER BUT FOCUSED ON THEM.

It wouldn't hurt..

AND MAYBE GIVE THEM OWNERSHIP TO SUCH AN EXTENT THAT THAT'S A PART OF IT THAT WE DON'T SEE. I DON'T KNOW.

Yes. Then they're not writing for us all the time. It's the end of the year. We won't be having them next year. What's the price on reading it. There's no point is there? There's a point on them actually thinking it through and getting it on paper. Yeah.

MIGHT BE FUN TO DO. I WANT TO DO SOME SORT OF SELF-ASSESSMENT. SOME SORT OF WRAP UP OTHERWISE WE'VE GOT A FAIRLY SHAMBOLIC COLLECTION OF THINGS IN THERE, SOME OF WHICH WEREN'T VERY WELL DONE. YOU KNOW. CONTENTS PAGE, FOR EXAMPLE, WITH SOME SORT OF TITLE OR COMMENTARY OR SOMETHING ABOUT IT. MAYBE THEY SHOULD SCORE IT.

Hmm.

I MEAN I'M TALKING 20 MINUTES' WORK. SOME PEOPLE DO QUITE GOOD THINGS WITH THEIR PORTFOLIOS. I MEAN YOU'VE GOT TO YOU SELECT YOUR BEST WORK AND YOU SELECT WHAT GOES IN THEIR TOTAL SO THERE'S SOMETHING IN YOUR PORTFOLIO WHICH SHOWS THAT YOU'RE ABLE TO DO RESEARCH E.G. OR IT COULD BE GEOMETRY OR IT COULD BE ANYTHING. ... IT'S VERY. HOW DO YOU DO IT. WHAT'S THE TIME LINE YOU KNOW. ... WHEREAS WITH THIS EVERYBODY HAS TO COME UP WITH THIS HAS TO BE COMPLETED BY THIS DATE. ...

HOW DID YOU FIND THE GRADING? YOU'VE GRADED. YOU'VE LOOKED AT THEM ALL. THAT ONE JUST SAYS COMMENTS DOESN'T IT?

I don't think I graded that one..

WHEREAS THE OTHER YOU'VE GOT A MIXTURE OF GRADES AND THINGS. LET'S GET TO THE BOTTOM OF THAT. THE KIDS HAVE SAID INTERESTING THINGS ABOUT GRADING.

Have they?

YEAH, I THOUGHT THEY MIGHT LIKE THE MORE EXACT PERCENTAGE TYPE MARKS AND IN FACT THEY SAID NO THEY WOULD PREFER GRADES. IF IT WAS SUPER-GOOD GIVE THEM "A" AND THEN THEY KNOW ITS AN "A" WHILE IF ITS 97 % THEY DON'T KNOW.

Broad band.

DID YOU GIVE ANYTHING A GRADE?

Yeah, these ones.

SORRY. YEAH, RIGHT. THERE WAS AN "F" AS WELL WASN'T THERE?

HOW COME THIS IS A MATHS INTERVIEW?

That would be formal writing.

I SEE. ... "USE ALGEBRA IN A JOB". NOW SHE KNOWS KNOWING ALGEBRA AND ET CETERA HAS MADE PROBLEMS A LOT EASIER TO SOLVE. MATHS IN EVERY SITUATION. "MY HOURS, MY PAY, MY DELEGATE'S PAY, HOW LONG UNTIL I TRAVEL AGAIN". EVEN "WHEN I GET HOME COUNT HOW MANY PIECES OF CHICKEN TO COOK". I GUESS IT'S THE DAUGHTER OF [named parent]. IS IT THE SAME AS THIS WRITING HERE? FOUND SHAPES - A HAND. QUITE GOOD.

...

WEREN'T THE SPIDER WEBS STRANGE?

Yes.

THEY ALL HAD AN IDEA THAT SPIDER WEBS WERE MADE OF EITHER SQUARES OR HEXAGONS, ON A SORT OF A LINEAR FRAMEWORK AND SPIDER WEBS DON'T LOOK ANYTHING LIKE THAT. AND THE ALTERNATIVE OF COURSE WERE PEOPLE WHO TRIED TO TRACE PICTURES OF SPIDER WEBS FROM BOOKS. I WAS ENCOURAGING MINE TO GO OUT ON A DEWY MORNING AND TAKE PHOTOGRAPHS, AND THEN TRY AND TRANSCRIBE PHOTOGRAPHS, REDUCE ENLARGE AND TRY TO ANALYSE IT IN SOME WAY. NO SUCCESS. TOTAL FLOP. THEY JUST DIDN'T RUN. SO, IT WAS QUITE INTRIGUING. MAYBE A SPIDER WEB WAS THE WRONG THING TO DO BECAUSE THE MATHS OF IT. THE ACTUAL CATENARY CURVES OF THE ... AND ALL OF THAT IS QUITE

HARD AND I PRESSED SOME OF THEM. I SAID “AND HOW WOULD THE SPIDER HAVE CONSTRUCTED THIS? WHICH LINES COME UP FIRST?” I WAS THINKING THAT THE SPIDER MUST MAKE THE BIG DIAGONALS AND THINGS LIKE THAT FIRST, AND THEN IT MUST WORK AROUND SOMEHOW BUT IT MUST DANGLE FROM HERE AND SWING ACROSS HERE.

Physics.

I’M READY TO SEE A VIDEO OF ACTUAL SPIDERS DOING IT. AND THEN YOU’VE GOT SOME SPIDERS WHO DO NOT MAKE SYMMETRICAL SPIDERS WEBS AT ALL. IN FACT ITS ONLY A COUPLE OF VARIETIES THAT MAKE VERY SYMMETRICAL ONES AND SOME KID SUSSED THIS. SOME SPIDER WEBS ARE JUST LIKE FLUFF, OR EVEN, YOU KNOW, IF YOU FIND THEM IN NATURE OFTEN THEY’RE JUST ...

This represents their thinking though, doesn’t it? Euclidean model of a non Euclidean world. [Laughter.]

...

IF YOU WANT THEM TO LEARN FROM THAT

Yes ...

MAYBE THEY SHOULD HAVE HAD TO PRESENT THE SPIDERS WEBS TO A SMALL GROUP AND CONVINCED OTHER PEOPLE THAT “THIS IS WHAT I DISCOVERED ABOUT SPIDER WEBS”. I MEAN IF YOU GAVE THEM THIS PIECE OF PAPER HERE. ... A SPIDER WEB STARTS OFF AS A CROSS, AND THE FIRST SOMETHINGS ARE SMALL TRIANGLES AND THE REST OF THEM SPREAD OUT TO LOOK LIKE OBLONGS. IT’S NOT A SPIRAL. IT’S A WHOLE LOT OF CONCENTRIC SQUARES THAT THIS BOY HAS DRAWN.

I THINK THAT IN A SMALL GROUP SITUATION THERE WOULD BE CRITICISM.

Mmm.

THEY’D HAVE TO THEN GO AWAY AND REDO THIS PROJECT.

Have to think it out.

MAYBE WE NEED TO DO THAT. WE’RE THINKING GROUP WORK IS WHERE YOU GIVE THEM A FAIRLY UNIQUE PROBLEM WHERE THERE IS ONE SOLUTION AND THE GROUP GETS TOGETHER AND THE BRIGHTEST ONE DOES IT WHILE THE OTHER ONES LOOK AROUND. [Laughter.] WHEREAS GROUP WORK ON SOMETHING LIKE THAT COULD ACTUALLY CONTRIBUTE TO THIS BOY’S PORTFOLIO. MAY HAVE ACTUALLY BEEN

May have been a better way of doing it.

I DON'T KNOW.

I DON'T IMAGINE THE DEBRIEFING WILL SORT ... POSSIBLY COVER ALL THE ... IT WOULD BE REALLY GOOD TO HAVE IT SOMEHOW SEEN BY SOMEONE ELSE. "YES, THE SPIDER WEB REALLY IS WORTH 3 OUT OF 10 BECAUSE YOU DIDN'T PUT ..."

Peer assessment could be built into portfolios much more. Peer assessment. Not just self assessment. That's important but then others discuss each others, evaluate, mark each others to some degree. They are harder on each other than we are and they'll take it from each other won't they? They talk the same language. They make allowances that they don't think we make, and so they'll listen more.

HOW WOULD YOU ACTUALLY DO IT? PREPARE A SPECIMEN. ITEM BY ITEM SO THEY ACTUALLY GET A CHANCE TO ACTUALLY FIX THEM UP?

Yeah.

YOU COULD DO IT AT THE END OF THE YEAR, BUT IT BECOMES A POPULARITY CONTEST: "YOU GIVE ME 10 OUT OF 10 AND I'LL DO THE SAME FOR YOU".

Nothing's going to change. It would have to be done very early in the year so you get the message across that we're striving for quality. Now what's "quality" mean and they get to talk about it and they set their standards.

"QUALITY CIRCLES" SO WE'RE NOT GETTING TO DEAL WITH RUBBISH SPELLING ANY MORE AND SOME OF THE MATHS IDEAS WHICH REALLY HAVE NOT BEEN REFLECTED ON.

DO YOU THINK THAT WHEN THE PARENTS WERE INVOLVED WE WERE GETTING BETTER QUALITY? FOR EXAMPLE, WHEN THEY INTERVIEWED THE PARENTS I BET THE PARENTS WANTED TO SEE THE REPORT. I WOULD. AND THAT'S WHY. YOU SEE SOME OF THOSE AUTOBIOGRAPHIES WERE *BEAUTIFULLY* PRESENTED WHEREAS SOME OF THE OTHER STUFF WAS FAR MORE KIND OF RUSHED OFF, BECAUSE "WHO CARES, ITS ONLY THE MATHS TEACHER WHO IS EVER GOING TO SEE THIS".

Perhaps on a parents night. Kids know about it well in advance. They choose what gets displayed.

IT WAS ORIGINALLY CONTEMPLATED, BUT I DON'T THINK IT WAS USED AT ALL. I THINK THESE HAVE NOT BEEN DISPLAYED.

Hard to display.

WELL. TELL YOU WHAT, WHEN REPORTS GO HOME THESE COULD GO IN THE SAME PARCEL. WE KNOW THAT THE REPORT PARCEL IS OPENED AND SEEN BY THE KIDS. ...

THAT WAS THE AIM. THAT PORTFOLIOS WERE THEIR OWN REPORT.

Perhaps just a special junior maths parent evening at the end of the year. Pretty short. Let them talk ... than us doing all the talking. And then hand out all the portfolios. People don't have a lot of time.

...

I WOULD LIKE IT ASSOCIATED SOMEHOW WITH FORMAL SCHOOL REPORTING, IF WE COULD GET AWAY WITH THAT. ALTHOUGH WE'RE INCORPORATING MARKBOOK PORTFOLIOS IN THE STUDENTS' REPORTS, 20%, HAVING THE DOCUMENT IS WHAT WE'RE AIMING FOR. THE DOCUMENT IS SUPPOSED TO BE A SUMMARY.

The parents will see that and most won't have a clue what it means, whatsoever.

PRIMARY SCHOOLS, WE'RE GETTING INCREASINGLY THIS SORT OF THING, WHERE YOU GO TO THE PARENT INTERVIEW AND YOU ARE SHOWN SAMPLES OF WORK. YOU KNOW, MAYBE OUR PRIMARY COLLEAGUES ARE SETTING THE PACE FOR US HERE. IT'S FUNNY, I THINK THERE'S A NUMBER OF THINGS WHICH SUDDENLY STOP WHEN THE STUDENTS LEAVE PRIMARY SCHOOL AND GO INTO SECONDARY SCHOOL AT THE MOMENT. PRIMARY TEACHERS ARE WELL AWARE THAT YOU CAN SET PROJECT TYPE WORK WHICH IS WHAT THIS, IS IN ALL SORTS OF TOPIC SUBJECTS. THEN THEY HIT MATHS IN SECONDARY SCHOOL AND SUDDENLY THERE'S NO PROJECTS ANY MORE UNTIL WE'VE GOT THINGS LIKE PORTFOLIOS OR THE ODD AD HOC PROJECT WHICH PEOPLE HAVE. VAST IMPORTANCE ON INDIVIDUAL TESTING. UNDER OUR NEW QUALIFICATIONS STRUCTURE IF WE'RE ALLOWED INTERNAL ASSESSMENT THEN THESE SORT OF DOCUMENTS CAN BECOME PART OF WHAT WE USE, AND THEN WE'D NEED A DIFFERENT SORT OF ASSESSMENT PROCEDURE WHERE YOU AND I WOULD LOOK AT ONE OF THESE THINGS HERE AND WE'D SAY "YES THIS REALLY IS A 70%" OR WHATEVER, AGAINST SOME CRITERIA SOMEWHERE, AND BE ABLE TO JUSTIFY IT. AND PERHAPS MODERATE OUR MARKS AGAINST OTHER SCHOOLS' MARKS AND ALL THE REST OF IT. I'D BE HORRIFIED IF THEY WERE THEN MODERATED AGAINST AN EXAM WHICH SORT OF DEFEATS THE WHOLE OBJECT, DOESN'T IT? THAT'S WHAT HAPPENS WITH INTERNAL ASSESSMENT. ...

WE'VE PROBABLY GONE AS FAR AS WE CAN.

IF THERE'S MORE STUFF TO GO IN THERE I'D BE VERY INTERESTED TO SEE

Yeah. These speeches, written speeches.

OH, RIGHT. MINE WERE VERY BAD AT ACTUALLY HANDING IN SPEECH NOTES AND I GOT A WHOLE LOT OF RATHER SCRAPPY PIECES OF PAPER.

And then I hope to do an investigation.

I'M DOING THE HAPPY NUMBERS WITH MY SLOWISH CLASS. I DON'T KNOW HOW THAT WILL GO. I JUST THOUGHT, WELL WHAT I THOUGHT - IT WAS QUITE COMPLICATED. IF YOU'RE GOING TO GET TO THE NUMBERS YOU'VE GOT QUITE A BIT OF WORK TO DO, BUT THESE GUYS WON'T. THEY'LL FIND SOME NUMBERS WHICH ARE HAPPY AND SOME WHICH AREN'T. LOTS OF PRACTICE AT SQUARING AND LOTS OF MATHS, AND HOPEFULLY THEY GET BORED WITH THE SQUARING OF 3 ON THEIR CALCULATOR AND WILL EVENTUALLY FIGURE OUT WHAT IT IS AUTOMATICALLY. THAT SORT OF THING IS WHAT I WAS TRYING. WE'LL JUST SEE. I DON'T THINK I'LL BE ABLE TO PUT THE WHOLE THING TOGETHER.

WITH HAPPY NUMBERS YOU GET A SEQUENCE AND THE SEQUENCE EVENTUALLY GOES TO 1 OR IT DOESN'T. NOW THEN YOU GIVE THEM A NUMBER WHICH IS IN THE SEQUENCE. THEY'VE ALREADY DONE THE SEQUENCE AND THEY KNOW THAT SEQUENCE CONVERGES TO 1 AND YOU GIVE THEM ONE OF THE NUMBERS WHICH IS IN THE MIDDLE OF THAT SEQUENCE AND SAY "NOW WHAT ABOUT THIS ONE? DO YOU THINK THIS ONE WOULD CONVERGE TO 1?" "OH, I DON'T KNOW". AND THEY START DOING THE SAME WORK IN DUPLICATE. IT'S REMARKABLE. THEY'RE VERY, VERY SLOW, POOR DEARS.

I'LL GIVE THEM THAT. I'LL GIVE THEM A CHOICE. THERE'S ANOTHER ONE WHICH IS A CLOSED INVESTIGATION. 17 POLYGONS WHICH CAN BE FORMED ... STRAIGHT LINES. WE'LL JUST SEE WHICH ONE THEY RUN WITH. THEN THAT WILL BE THE END OF MY PORTFOLIOS. BECAUSE I MEAN THE EXAM IS TWO WEEKS AFTER.

That's right.

THANK'S VERY MUCH FOR YOUR TIME.

Appendix O

Interview with Teacher DD 7 December 98

YOU'VE HAD A CLASS OF 4TH FORMERS ISN'T IT? WHICH CLASS IS IT AND HOW LONG DID YOU HAVE IT?

It's right in the middle, it's the very middle class, it's A4. It is actually the class that hits the median every time and the class really is very close to the median - most of them are [within] 5 marks either side.

RIGHT, SO THE SPREAD ISN'T VERY HIGH IN TESTS EITHER?

No.

HAVE YOU HAD THESE GUYS ALL YEAR? I DON'T EVEN KNOW

After 6 weeks.

OH FROM [named teacher].

Yes.

WELL THAT'S QUITE A LONG STRETCH FOR YOU ISN'T IT?

It is a long stretch, and they've been tough. [named student] particularly has been very difficult and he has disrupted the class considerably and made it, I've had to transfer him several times because he has caused too much disruption. But other than that, the class is, relatively very, you know, quite able to work quite well. And they maintained their "middle of 4th Form" status all the way through.

WHO ARE THE STARS IN THERE? WHO ARE THE BEST ONES?

[named student] would be the best, he's intuitive on investigations and that sort of thing. He has the best brain. [named student] was up and down, sometimes she did extremely well sometimes she did good, very quiet and [named student] has come on, during the year she didn't do too well at the beginning but, had a few problems, but she really has come a long way she's now doing pretty well.

THAT'S GOOD. WHAT I'M REALLY INTERESTED IN IS THE WHOLE ASSESSMENT REGIME. IN A WAY I'VE HERE TO SERVE YOU AS [named teacher] HAS WITH THE 4TH FORM. WE'RE INTERESTED IN HOW WE'VE DONE. THIS YEAR WE HAD A COUPLE OF NEW THINGS, PORTFOLIOS IS THE INNOVATION. HOWEVER THERE'S MORE TO IT THAN THAT: WE ALSO HAD AN ASSESSMENT SCHEME, AS YOU KNOW THAT'S A NOVELTY IN FORM FOUR. HOW DID IT GO?

Overall I think the assessment was a good idea because we knew where to work to. I didn't do, I found it difficult to get the spreadsheet one through, to book the times, because we clashed with a 6th Form computer studies class and it was very difficult. But [named teacher] and I managed to fit our classes in, later than most of the others did the spreadsheet. So I didn't realise, I thought it was counted to support the portfolio, I didn't realise it was meant to be a separate item as well. That was something that wasn't clear, so I didn't give the marks to [the Head of Department] when I should have. We did it eventually!

I THINK WE WERE LATE GETTING THE MARKS IN FROM EVERYONE AND MAYBE WE SHOULD HAVE BEEN MORE ON THE BALL.

Yes, I think perhaps closeness for me to the 6th Form marks was difficult. I didn't realise they had to be in quite so quickly afterwards. ...

WE'LL SORT THAT OUT BETTER THIS YEAR, NEXT YEAR RATHER. I'VE ALREADY TURNED THE CALENDAR PAGE! YEAH. THE COMPUTER ROOM BOOKING SHOULD BE LOOKING UP TOO.

Yes, that's something that must be planned early on so that each class gets a suitable time I think, because it's important that they get a run at it.

THERE WAS ALSO A COMPUTER THING FOR THE PORTFOLIO WASN'T THERE?

Well I did it as a combined thing, so I didn't do it separately.

SO DO THEY HAVE A PRINTOUT OR SOMETHING IN THEIR PORTFOLIO? A RECORD?

Nothing. Some of them did do it and I can't find them so I was sorting through things getting all the marks together, my boys lost the disk with all the results of all the marks on. I had to go back and do them from what originals I could find. I haven't given the students back their portfolios. Although many of them did a lot including the Cantamaths for it, it isn't in their portfolios because I didn't get it back off the walls, not being in our own classroom. But most of them did do that and did well.

THE COMPUTER ONE YOU COULD ACTUALLY HAVE IT COMING IN ELECTRONICALLY, TAKE IT HOME ON A DISKETTE.

I think that would have been better because some of them didn't print, but a lot of them did a lot of work. They actually enjoyed the computer room component of it and I could see some very good work being produced but I didn't actually get printouts of it.

IT WAS ALL [named teacher]'S WORK. I WAS IMPRESSED BY IT ACTUALLY.

It was really well done.

TELL ME A BIT ABOUT THEIR PORTFOLIOS.

In the early part of the year, the tasks that were done, the investigation at the start: that was excellent, that was good introduction to a portfolio, and the Cantamaths project going into that too - knowing that that was part of it, that was good. The value for money one was excellent and the interview, those were both done very well by my class.

YEAH, I THINK A BRIGHT CLASS CAN DO THAT, I'M NOT SO SURE THE "B" STREAM REALLY ...

Mine wasn't a bright class, in the middle, and most of them interviewed their parents pretty well and got good results on the value for money one. I gave a lot of direction on the portfolio myself. I made it quite specific as to what they had to do, and they did that well as well.

WHAT DID THEY DO?

We, a lot of them, assessed fish and chip shops and they had to buy three different items from the fish and chip shop, then rate it on whether it was nice to eat, how dear it was, and if it was good value. Some did supermarkets but it was pretty specific, I gave them several examples of what to do and they chose one of them basically, and then they were all right, they knew what to do, once I directed them. The same with the Cantamaths one, I did a particular project rather than just a general thing, they're not good at choosing something.

WAS THAT A CLASS PROJECT?

No, they did it separately, they did the posters and we did an enlargement, or a distortion cartoon character.

IF YOU'D DONE, SAY WITH THE VALUE FOR MONEY ONE, AND YOU ACTUALLY PREPARED A HANDOUT OR OHP-TYPE MYLAR [transparency for overhead projector] ON IT, THEN LET'S HAVE IT, LET'S SHARE ALL THOSE THINGS AND START HAVING A BANK OF THINGS THAT WE KNOW WORK. I'VE DONE SOMETHING OUT ON THE INVESTIGATION SIDE OF IT BECAUSE I THINK THAT WAS ANOTHER AREA A LOT OF PEOPLE FOUND KIDS WERE FLOUNDERING, THEY DON'T KNOW HOW TO SET OUT INVESTIGATIONS WITH SOME SORT OF SUBTITLES,

No,

FORMAL REPORT, REFERENCES ...

I actually think there's an investigation assessment one ...

IT WAS DONE, IT WAS A TIME-CONSTRAINED ASSESSMENT IN THE CLASSROOM.

AND, THE KIDS THEN - [HAVE THEY] *COMPLETED* THE PORTFOLIOS?

No.

WHY?

Because we didn't do the other topics at the end of it and I didn't push it. Um, because we got a little bit behind. I was trying to keep them up and finish the work for the exam and so concentrated on that, rather than the portfolio. I found I ran out of time, and part of that was because we were so late doing the spreadsheet, so that was where, and I didn't do any more and they didn't do the geometrical design

I DON'T THINK ANYONE DID

Oh ok,

ONE CLASS MIGHT HAVE, DON'T WORRY

We didn't do that and I didn't in the finish give them the folders back to choose which were the best ones either.

HAVE THEY GOT SEVERAL INVESTIGATIONS?

No they haven't.

DOES OTHER STUFF GO IN THERE? DO YOU PUT HOMEWORK AND WORKSHEETS AND THINGS IN?

I have been putting their tests and so on just in the folder with their portfolio, it was a way of collecting their things together.

SEEMS TO HAVE WORKED. A NUMBER OF TEACHER DID THAT, THAT'S GOOD. ANY IDEAS FOR THE FUTURE WITH PORTFOLIO THINGS? ARE YOU HAPPY WITH IT? DO YOU THINK IT'S WORTH CONTINUING?

I think the first two maybe three terms yes, but not in continuing into the last term, definitely not.

I PLANNED TO FINISH IN TERM 3 OF COURSE.

Yes, well, as I say I ran out of time so, yeah, but I think the introduction and the idea of it is a good idea but not [in] the latter part of the year.

WHAT ABOUT THE WORK ASPECT OF IT? TEACHING CONTINUOUSLY FULL TIME LIKE THIS IS AS YOU'VE REALISED, IS THAT YOU END UP DOING A HELL OF A LOT OF MARKING AND PREP. WITH THE PORTFOLIO, DID YOU FIND IT TOOK VAST QUANTITIES OF YOUR TIME?

I didn't mark it particularly. All I did - the marking schedule that I was told basically was completion and completion really well, and that was basically the grades I gave: "not done", "completed", or "completed very well".

SO DID YOU STICK WITH THE MARKS THAT WERE ON THE INITIAL THING ABOUT - THE KIDS EITHER GOT 15, OR 20 IF EVERYTHING WENT IN?

20, 15 or 5

WE'VE CHANGED THAT FOR NEXT YEAR. WE'VE HAD A MEETING AND SOME PEOPLE, PARTICULARLY [named teacher], WERE VERY ANXIOUS ABOUT GOOD KIDS WHO DO EXCELLENT WORK BUT MISS ONE ITEM, WHEREAS A NOT SO GOOD KID MIGHT DO AWFUL WORK AND HAVE EVERY ITEM IN.

Yes.

NOW THE MARKS - THE AWFUL KID GETS 15 THE GOOD KID GETS 5 - IT SEEMS TO BE A BIT TOPSY TURVY, SO WE'VE CHANGED IT FOR NEXT YEAR AND BROKEN THE MARKS INTO TWO LOTS OF 10 MARKS AGAIN ON THAT SYSTEM OF COMPLETION OR NOT. ...

Yes, I think that's a better idea, actually. I found some of the kids had done work which wasn't that wonderful and they got 15, 20 and kids who did some excellent work but missed one ...

THAT'S NOT FAIR IS IT?

ANY OTHER THOUGHTS?

No at the moment. I thought that, I think it's a valuable part.

THERE'S ONE QUESTION I'VE BEEN TRYING TO ASK PEOPLE, THAT'S DO THE PORTFOLIOS ACHIEVE THINGS THAT WE OTHERWISE WOULDN'T HAVE ACHIEVED?

Yes, I think so. It made them involve their parents, for a start,

TRUE

so there was some feedback from that. For the, which one, I had to send a letter home, the computing one that's right, send a letter home and that was quite an interesting exercise as well to make sure that they got their money in to get printing

TO GET PRINTING MONEY TO PRINT OFF THE THINGS

Yes. That was good, but they asked for that ... So that was something that I learned that it was essential to send a note for something like that. But feedback I got from parents when I talked at interviews was they liked being involved.

HAVE THE KIDS BEEN ASKING FOR THEIR PORTFOLIOS BACK, NOW THAT IT'S THE END OF THE YEAR?

Not really, no.

I WONDER HOW MUCH INTEREST THEY'LL TAKE IN THEM. WE SEE IF SOME OF THEM THROW THEM IN THE BIN ON THE WAY OUT THE DOOR.

Yeah.

THANKS FOR TALKING WITH ME. IF ANYTHING ELSE COMES TO MIND WOULD YOU LET ME KNOW?

I will, thank you. And thank you for your effort.

I THINK EVERYBODY WAS SORT OF READY FOR THIS ONE.

Yeah. Just something a bit different from straight classroom work all the time, because I find it difficult to get homework out of the kids, I didn't find it so difficult to get this.

AND IT'S ONE THING, I MEAN PEOPLE HAVE MADE THE POINT TO ME, THAT IT'S ONE THING THAT WHAT COMES IN IS OF A STANDARD OF EXCELLENCE WHEREAS OFTEN KIDS LET BOOKWORK KIND OF GO AND ITS NOT, I DON'T THINK, ANYTHING TO BE PROUD OF.

THANKS.

Appendix P

Transcript of interview with Head of Mathematics Department on 3 December 1998

WHAT I WANTED TO ASK IS WHAT YOU'VE DONE WITH THE MARKS AND WHAT YOU THINK ABOUT IT ALL. BUT BEFORE WE MOVE ON TO THAT LETS TALK GENERALLY ABOUT PORTFOLIOS. SO FAR, AS I CAN MAKE OUT YOU THINK IN GENERAL THEY'VE BEEN A SUCCESS.

I think in general it's been a good idea. It's been a different aspect of their work that's been assessed and its counted as something, and um, because my class is the top Fourth Form like everything else they take it reasonably seriously.

RIGHT. WHAT SORT OF PERCENTAGE OF THEM ACTUALLY DID IT ALL?

Did it all? And got 20 out of 20? Well I think they all except one, got 15 or 20. There was one boy who was away a lot ... trouble ... completed ...

THAT'S INTERESTING, NOT A TOP THIRD FORMER?

There could have been one other student, I can't remember, who wasn't there in the last week and therefore wasn't able to hand in the last investigation ... It was either one or two who didn't get it all finished.

THAT'S GOOD. SO IT WAS SUCCESSFUL FOR THEM AT LEAST. YOU DIDN'T HAVE A "B" STREAM CLASS?

No.

WHAT DID YOU SEE IN YOUR PILE OF PORTFOLIOS THAT OTHERWISE YOU WOULDN'T HAVE SEEN FROM THESE STUDENTS?

It's hard to say really because I've always had them to do a whole lot of different investigations and so on at that level anyway.

YOU WOULD HAVE HAD CREATIVE WORK.

Yeah, I think actually to be honest, what I have done in the past is slightly fewer investigations, but in more depth. So some of them have done in the past we've entered the Caxton Investigations competition and those investigations have been much more prolonged sort of things and in more depth than the ones that they've done for their portfolio.

THAT'S GROUP WORK.

Yeah it is but then I've also required, you know I've had other investigations so yeah probably thinking back to the equivalent class in the past, there are more items that

probably the emphasis on presentation and so on is more in portfolio but the depth I think has been less. I guess probably because we've been trying to do a lot more things this year on the assessment regime overall, not just portfolios all the other things, whereas in the past there've been slightly fewer things and I've given them more detailed assessment statements I think in the past for each item so that ... investigations I've done with them in the past.

SO A MORE DETAILED GUIDE TO IT TENDED TO PRODUCE DEEPER WORK?

Yes I think so.

WHEREAS REALLY WE JUST GAVE THEM A FEW LINES - FOUND SHAPES EXPLORE ... DIDN'T GIVE THEM MUCH HELP ...

I think part of it was actually a teacher learning thing. I think that we were all just adjusting to the new level of all these specific assessment requirements, more than we've had in the past. My view is that we'll do a lot better next year because there's no reason why within the top class, particularly now I think if we're looking at having more flexibility next year, there's no reason why we can't go off into a tangent a bit more about what portfolio items are made more specific to a class.

THAT'S RIGHT, BECAUSE THIS YEAR WE DELINEATED THE ITEMS. ALL THE ITEMS FOR ALL THE CLASSES. EVERYONE WAS SUPPOSED TO DO THE SAME WHEREAS

I think that might be what I'm coming to seeing really, what I said before about the more depth in the past was because it wasn't trying to tie in with the system, it was specifically what was happening within that unit in the top class and so I would have set the requirements at that level.

TELL ME ABOUT THE OTHER ASSESSMENT THINGS THAT ARE GOING ON.

Well levels tests and there was an investigation and whatever, but there weren't a lot of other things, there were the spreadsheets and so on - I think they were excellent. Good.

SPREADSHEETS WAS WRITTEN TO BE A PORTFOLIO ITEM. EACH TERM YOU'VE GOT AN INVESTIGATION OR SOME OTHER SORT OF PROJECT.

I think that's good because it means there are things that are counting which are actually not just conventional pieces of paper test where it gives them ... it also relates to what they are doing in class ... to motivate the kids to succeed it also makes what they're doing in class more important then they regard the things ... most successful ... the top class ... the spreadsheet worked really very well. It was excellent because they had to work together and they had to figure out, I gave them very large ... just threw the thing at them.

IT WOULD HAVE WORKED WITHOUT PRINTOUT GOING IN THE PORTFOLIOS AT ALL. ...

The 4th Form wasn't a printout going into the portfolio it was an assessment.

I SEE, WHICH IS NOT A PORTFOLIO ITEM.

Well no, there were some other thing which was related, part of the statistics but in fact I didn't do that as a portfolio item. There were two aspects to it but the task that they had to was an assessment item.

ONE OF THE THINGS YOU MENTIONED TO ME AS BEING A STEP FORWARD FOR US THIS YEAR WAS TO ACTUALLY HAVE FULL ASSESSMENT STATEMENTS FOR THE 3RD AND 4TH FORM.

Yeah, that was excellent.

AND I THINK THE PARENTS ACTUALLY COMMENTED ON IT AND ONE OR TWO PARENTS WHO ALSO SAID IT WAS A GOOD IDEA, IT'S OBVIOUSLY BEEN ON THE FRIDGE DOOR OR ABOVE KIDS DESKS, THAT WAS OBVIOUSLY A GOOD THING TO DO.

IT SEEMS TO HAVE KEPT THE TEACHERS ALIVE.

[Laughs.] I think that's part of the main point of it, it's meant that there's been movement for some teachers who in the past have been reluctant to move into things beyond the conventional to actually have to do it, and it was interesting processing marks, that almost everything that was required, was done. I think that there was one 3rd Form class that didn't do the statistics, or they were still working on it ... there was one 3rd Form class who didn't do the Logo work, they did some of it but they didn't all actually finish it and have it as a mark, and in the 4th Form it was obvious that some teachers hadn't taken things like Cantamath terribly seriously when half the class had zeros for their item.

RIGHT.

They'd either made it very optional or something. By and large overall there was a huge support.

EVEN GOT PEOPLE OVER TO THE COMPUTER ROOM. WE HAD TROUBLE WITH BOOKINGS IN THE END.

Mmm.

AND I MEAN THAT'S QUITE A DRAMATIC CHANGE, ISN'T IT, WE'VE HAD EVERY 3RD AND 4TH FORMER SPENT BASICALLY A MINIMUM OF FIVE PERIODS IN THE COMPUTER ROOM THIS YEAR.

No, it was good. It needed a bit more time and I suspect, I mean there are lots of things that need to be fixed up and changed. I mean the spreadsheet task was perfect, was a wonderful thing for the top 4th Form class but other people were struggling, other kids struggled. It was excellent, I've never seen so much mathematical process going on, looking round the room and all the problem-solving, communication and group work investigations: it was all happening, all at the same time and I wasn't doing anything. It was wonderful. I hope that we can actually get the 5th Form involved in that, something along that line as well. I'll need to write a statement like this for the 5th Form for next year and also include something in the computer line, it would probably be a graph, which is a ... different area, more or less the whole thing will run very ... 3 or 4, 6 and 7 will do something in a different area ...

...

THAT'S GOOD, WELL YOU SOUND QUITE HAPPY WITH THE IDEA

Yeah, I mean.

PORTFOLIOS: IT'S NOT JUST PROFESSIONAL DEVELOPMENT, IT'S ALSO PART OF THE ASSESSMENT CHANGE WHICH WAS MORE WHAT THE ... STUDENT PORTFOLIO WAS LINKED TO ... QUITE A LOT OF DIFFERENT ASSESSMENT ACTIVITIES ALSO HAVING A, USING COMPUTERS,

[continues the sentence] libraries, interviews of people, processing information off the internet.

I have to say that I'm happy with it now at this time of the year but for most of the year I wasn't happy with it, just personally I think I was behind with everything. I got behind with it all when I went away to Europe that first term and I never really caught up until Term 4. So I was always on the back foot and partly that was just because it was something new. And, I don't know, it was just something that ...

IT PUT YOU OFF BALANCE.

Well, it didn't put me off balance, it was just that it was, um, something that I kept putting off I suppose. [Laughs.] It wasn't the kids' fault, they did whatever was asked. They were fine. It was me procrastinating and then and then and not catching up.

OF COURSE THIS IS THE FIRST TIME THAT IT ACTUALLY COUNTED FOR THE STUDENTS' MARKS. THAT WAS THE DIFFERENCE WASN'T IT? WE DIDN'T JUST INTRODUCE THIS, SORT OF GIVE THEM A FANCY FOLDER, WE ACTUALLY SAID "AND IT WILL BE 20 MARKS".

And that, in retrospect, I'm not very happy about the marks, the marking arrangement in a way because I think that, well I know we introduced that for next year, but it was a bit unfair if the student had had for example five really excellent pieces of work which were

of portfolio quality and would have got 20 if they'd completed the sixth one, and if they were away for a period of time or something like that, there was no way I could give them ... full marks.

WE COULD HAVE WEIGHTED IT ON A SORT OF AGEGROTAT BASIS

Sure, but I mean sometimes things so wrong, particularly if there are computers problems or things like that or things get late or lost or whatever, there can be things that go wrong. I just think, I know that the intention of the marking schedule was to make sure that they do [all the tasks] and it certainly worked, to that extent, because they all, well at least all of mine, ... completed everything and get 15 marks ... I achieved what it was meant to achieve but I'm not entirely convinced about it.

WHAT ABOUT THE WEIGHTING OF THE MARKS? I MEAN PEOPLE COULD HAVE GOT 20 OUT OF 20 FOR THEIR PORTFOLIO AND WHEN WE LOOK AT THE AVERAGE MARKS, THIS IS THE LIST FOR THE 3RD FORM CLASS THIS IS THE END OF YEAR EXAM WHICH IS WEIGHTED 50 MARKS VERSUS THE PORTFOLIO OF 20 MARKS. BUT OF THE 50 MARKS WE CAN SEE AN AWFUL LOT OF STUDENTS GETTING 40% OR LESS. LET'S SEE:

Well, it's half of them, because the median's about 50.

I THINK ABOUT 50 OR 60 STUDENTS WHO GET 40 OR LESS, NOW THAT MEANS EXACTLY 20 MARKS ARE ... [examination] MARKS. NOW THOSE 60 STUDENTS COULD HAVE GOT EXACTLY THE SAME WEIGHTING OF MARKS GETTING 20 OUT OF 20 FOR THEIR PORTFOLIO WHICH WOULDN'T HAVE BEEN TERRIBLY HARD. AND SO IN FACT THE PORFOLIO CAN CONTRIBUTE MORE MARKS THAN THE FINAL EXAM FOR SIGNIFICANT NUMBERS OF STUDENTS.

Well, yes and no, because of the way I standardise them. Because there were so many different sort of levels tests and so on, the only way to cope with the marks and to come up with a fair sort of ranking in the end was to standardise all of the marks to the two common assessments, which were the common test in Term 1 and the exam,

RIGHT.

weighted on 20/80 weighting so, what it meant was that in a class with very low overall marks in those items they would have got, even with students that have got 20, they would be scaled down to something less.

PORTFOLIO MARK AS WELL AS THE INVESTIGATION MARKS, PROJECTS ALL MIXED UP?

Well there was no other way to deal with it sensibly, apart from some other huge kind of moderation process which would have taken hours. And I don't think it's ...

NEXT YEAR COULDN'T WE KEEP THE PORTFOLIO MARK AS A RAW SCORE WHICH WE ADDED ON?

It depends what you want to do that for the mark. I mean there are two things for which that final mark is useful. One is to put on their report which for that purpose that would be fair enough, but the other thing that it gets used for is to look at their placement in the classes next year. Now if you do that you'll end up with students who for example, in the lowest class getting a rather distorted mark: the odd kid, on the basis of that, being placed in the B1 class instead of B4 simply because they've got a high portfolio mark. On your raw score of 20 it's going to shuffle the bases around and make it inappropriate, so it's not a

IT MEANS YOU'D BE GRADING MORE ON WORK HABITS THAN ON, NECESSARILY, ACADEMIC ABILITY.

Yes.

I'D WIND UP WITH THE BOTTOM CLASS BEING

lazy people rather than those that are struggling.

YEAH.

SO REALLY IT'S A BIT OF A FRAUD WHAT YOU'RE SAYING THAT THE PORTFOLIO IS 20% OF THE MARK WHEN ITS A POTENTIAL 20% ... BUT BECAUSE IT'S STANDARDISED TO THE EXAMS.

Its still 20%. It's still relative weighting to the exam within that class. It's just that the potential number of marks is not 20 but the weighting's still correct. Raw marks after they've been standardised are divided again according to the weightings which are what we stated right at the beginning of the year. And in Form 3 we've done that exactly, because there are enough classes that have done all of the items for that to be done. So the combining all the marks by weighting is exactly as the original statement for Form 3. For Form 4 it was different because there was one item that nobody did - the geometry task. I simply took that out and doubled the weight of the common test. So there was one adjustment for the 4th Form in the processing, for the 3rd Form there was none.

THAT'S NOT BAD, IF WE ACTUALLY STUCK TO THE ASSESSMENT SCHEDULE IN YEAR ONE.

That's not bad - I thought it was really excellent. There were a lot of things that, um, that we had set out to do, and I was really pleased. And I don't think we got it right and I think it was because teachers don't get it right, and I'm including myself in there, simply because we were coming to accept that we're in a different situation.

IT WAS INTERESTING TO SEE THE TEACHERS DEPARTING FROM THE MARKING SCHEME FOR THE PORTFOLIOS WHEN THEY WERE ACTUALLY GIVING MARKS WHICH WEREN'T 0, 5, 15 OR 20.

Oh yes. I realised that, but it was too, when I was processing, it was too late to do anything about that and I didn't have time to argue with them or go back and get them to change them or whatever. And I just thought that Ok, just simply accept what people had given me.

DID YOU FIND THROUGH THE YEAR THAT YOU HAD VARIOUS MEMBERS OF THE MATHS STAFF WHO WERE COMPLAINING ABOUT ASSESSMENT ...

Um, no I don't think so. I think at the beginning of the year some non-specialist maths teachers were rather horrified by what they saw as a huge amount of work but in the end there was no complaining to me. Um, one or two people who always complain about everything continued to always complain about everything, but I didn't take any notice of that, so that wasn't a measure of the assessment schedule - it was a measure of the complainant.

BUT PEOPLE SEEM TO HAVE AGREED TO DO IT AGAIN NEXT YEAR

Yeah.

NOT A SINGLE WORD WAS SAID AGAINST CONTINUING WITH PORTFOLIOS ... WITH THE ITEMS ...

DO YOU THINK IT'S DONE THE CURRICULUM AIMS? I MEAN HERE'S PORTFOLIOS: THATS 3B4 AND THAT'S 3A1, DO WE SEE IN THERE WHAT WE WANTED TO SEE?

I suppose so. I mean, yeah, I guess so. Well I can't really do it in a superficial look through this but I can certainly say that it, well what my class did, they were, it was in that assessment schedule there were lots more aspects of, for example the processes strand of the curriculum, being acknowledged, they'd been acknowledged in what's been taught in which they've been doing in the past but now its actually been acknowledged what's counting in their mark. So I think it's probably good. I wouldn't necessarily say that all of the things are. I mean for example, this maths autobiography, while that's interesting and its interesting to get students to reflect on that, I mean I wouldn't know if you could find anything in the Maths curriculum which said that this was part of it. It's not really. It's not *really*.

WELL, IT'S THEIR "OWN EXPERIENCES".

I know but I mean well, maybe that's mentioned I'm not sure. I think it's valid.

FASCINATING THINGS IN THERE. I THINK IT'S NOT SO NEW FOR THE STUDENTS. THIS IS LIKE PROJECTS THEY'VE DONE IN PRIMARY SCHOOL.

WHO TOLD THEM TO PUT LITTLE FRAMES ROUND THE PAGE, THINGS LIKE THAT?

Well, it's their Social Studies teachers. Yes, that one of the comments the complaining people have said, that it's too much like Social Studies and um yeah.

THEY HAD FUN DOING IT.

I think so. I think that different classes obviously enjoyed different things.

... IS QUITE NARROW REALLY WASN'T IT, WHEN YOU LOOK AT THAT STATS PROJECT. THAT WAS AN ACROSS THE BOARD THING, IT WASN'T NECESSARILY PORTFOLIO. ...

Some of these I think probably, this top class have made a real success, they've been really creative.

YES THERE'S NO PROBLEM. THEY HAD A FEW PROBLEMS WITH SOME OF THE THINGS, FOUND SHAPES FOR EXAMPLE IT WAS JUST TOO "OFF THE WALL" I THINK.

THANKS VERY MUCH.

Appendix Q

Interview with teacher FF, 7 December 1998

SO YOU'VE DONE PORTFOLIOS ALL YEAR. WHICH CLASS DID YOU HAVE NOW? YOU'VE GOT

I'm number 5 out of the 3rd form.

NUMBER 5 IN THE 3RD FORM, BOTTOM OF THE "A" STREAM. A CURIOUS LITTLE CLASS WHICH IS THE CROSSOVER BETWEEN "A" STREAM STUDENTS WHO SHOULD BE IN THE "B" STREAM AND "B" STREAM STUDENTS WHO SHOULD BE IN THE "A" STREAM - THE BOUNDARY OF STUDENTS, WITH A HUGE SPREAD.

Well, there's not a huge spread really if you look at the exam results. The standard deviation is 5.

GOOD

for the class, if you looked at the range it varied from 70 to 33, but if you knocked off the top guy, the next one I don't think anyone else got over 60, so actually they've been very narrow all year in any of those across the board assessments. Always sitting very - my median was almost exactly the same as the other median. ..

HAS IT BEEN A GOOD CLASS TO TEACH SINCE ITS SUCH A DEFINITE SLICE OF ABILITY?

Um, well in terms of ability there's still actually quite a range but yeah, I've enjoyed them, they're a very pleasant group of students, there's only really 3 or 4 who are slightly indifferent when it comes to behaviour.

HOW DID YOU GO WITH THE PORTFOLIOS, DID YOU GET A GOOD COMPLETION RATE?

The completion rates would be about, total completion about 80%, down to one or two students who I got very little from on time, or very little at all.

WHAT DO YOU PUT THAT DOWN TO?

The particular student, they're the kids having I'm having constant problems with in terms of behaviour, work in class and not doing their homework.

WAS PORTFOLIO A HOMEWORK THING THEN?

Um, much of it was, for some of the things we'd spend a couple of periods in class and then they had to complete it for homework.

AND WHAT ABOUT THE QUALITY OF PORTFOLIOS THAT WERE COMING IN? DID YOU FIND THAT WAS UP TO YOUR EXPECTATIONS?

Um, well, again it varied fairly significantly. There are some outstanding students in that class in terms of their work habits and the time and effort they put into it. The last item which I assessed had half a dozen students that scored close to 100% in my assessment scale.

SOUNDS GOOD.

Well I was ...

HOW DID YOU DEAL WITH THE MARKS, ON YOUR ASSESSMENT SCALE, YOU WERE SAYING THAT WAS FOR AN ITEM

Well, I ...

AND THEN DID YOU DO THE OVERALL MARK FOR THE PORTFOLIOS?

I did. Some of them I used the [name of the high school] maths A-E-R system, or E-A-R: Excellence, Acceptable, Requires attention, or maybe that's the [named Head of Department] system, I heard about that a few years ago. For others, that might have been where this paper [looking for papers]

CAN I LOOK, YOU DON'T MIND?

Not at all, ...

[named student], ok, she generally did better, she had everything handed in. [reading papers] I assessed them in different ways, I used that EAR scale twice and other times I gave marks so the one on shapes I just had 3 categories which I marked them all on, presentation, features of the various shapes which they chose, and then they had to say about them, so those are the sorts of things I tended to do. I just made up my own.

THE TROUBLE WITH USING "E" FOR EXCELLENT IS IT LOOKS BAD!
[laughter] I JUST READ AN INTERESTING AUTOBIOGRAPHY THERE, BUT IT GOT AN "E" AT THE END, AND I THOUGHT...

CAN I HAVE A QUICK LOOK AT THE MARKS THING YOU WERE LOOKING AT THERE?

... there's that.

SO THIS IS E-A-R, FIRST COLUMN, WHICH IS AUTOBIOGRAPHY, THEN LOGO DESIGN IS OUT OF 10, THEN SHAPES OUT OF 13, FORMAL WRITING OUT OF 12 AND CANTAMATH E-A-R

... and you were supposed to put in marks there which was a problem, so I had to make ... and there's a couple more things which are not on that sheet.

LOGO DESIGN, CREATIVITY AND COMPLEXITY 5 MARKS EACH,
SHAPES, 3 FOR FEATURE, 3 FOR COMMENTARY, 5 FOR PRESENTATION,
FORMAL WRITING 5 FOR MATHS CONTENT, 5 FOR PRESENTATION, 2
FOR BONUS

People who do that little bit extra.

THEY'VE HAD A GO. I THOUGHT THE FORMAL WRITING WAS QUITE
HARD TO DO.

I think one thing which I would definitely do differently next year — I'd probably give more class time, but I would think at 3rd Form level for some of these things, because they're not used to writing in maths for example, I would give them some more guidance, basically. A little bit more teacher input. There's got to be some sort of balance there, or alternatively do a practice one on something beforehand which is fairly well guided where its needed to be, and then they do their portfolio which they do more or less on their own.

THE INVESTIGATION: I WAS DISAPPOINTED WHEN I WAS MARKING
THAT WITH MY GANG, SO I WROTE A LITTLE PAPER ABOUT THE FIVE
THINGS AN INVESTIGATION MUST HAVE: AN INTRODUCATION, ...
REFERENCES, AND I'LL GIVE THAT TO EVERYBODY THIS WEEK
SOMETIME.

Yes, I think, probably general investigations as well, not just the one going into the portfolio. Students just need a little bit more guidance than I've been giving them. I have done practice ones at times where I have basically said, these are the steps we're going to work through, let's go to it, but students at that level find investigations hard, totally independent things where they're not given any clues as to where to go. Mind you, it's the same in all aspects of maths, we tend to give a little bit more guidance, why shouldn't we when we're doing investigations and some of the things that are in the portfolio. There's no reason why I should be assuming they will be able to do those with less guidance than they might get when doing other aspects of maths.

THESE PORTFOLIOS IN THE ENVELOPES ON YOUR DESK NOW, HAVE
THEY TURNED UP WORK WHICH WOULDN'T OTHERWISE HAVE
ARRIVED?

Yes, they have. Well, they have in cases. If I look at the Statistics: I would have done statistical investigations with them anyway, it just so happened that I could take the ones which had been put there. I don't think I would have done formal writing, not quite like that. I try to encourage students to write more in terms of explain things, that's not quite the same as the formal writing,

THE FORMAL WRITING WAS WRITING SOMETHING IN A FORM WHERE
IT COUD BE LIKE LETTERS TO THE EDITOR OR SOMETHING.

That's right. Yes, yes.

IT WAS A DIFFERENT IDEA FOR MATHS TEACHERS WASN'T IT?

Um.

WOULD YOU USE THAT PARTICULAR ITEM AGAIN?

Yeah, I'd be quite happy to, except that um I think they required a little bit more guidance. This was the one where they had to interview someone about the maths they used in their jobs. It was a big variety of what was handed in so I think they need a bit more guidance about how to get information out of those people.

ARE YOU GOING TO KEEP SOME COPIES OF THESE WHICH ARE EXEMPLARS? HOW ARE YOU GOING TO GUIDE THEM - YOU TELL THEM, OR WOULD YOU SHOW THEM MATERIALS?

Well, I actually hadn't thought about keeping some of these as exemplars, but that would be a good idea.

How am I going to guide them? Well, as I said, one possibility is to do some sort of practice one similar to what's going to go into the portfolio. I could, we could do role plays in class, we could get someone to do an interview, we could talk about the sorts of questions you can ask: how can you [ask] open-ended questions, that sort of thing, write down some ideas on the sorts of things they could ask, do a brainstorm of the class on the sorts of questions they could ask, those sorts of things.

THIS IS SORT OF QUITE INTERESTING, I MEAN YOU'VE BEEN A HEAD OF MATHS AND YOU'VE TAUGHT MATHS I DON'T KNOW FOR HOW MANY YEARS

Seventeen.

SEVENTEEN, AND IT'S MEANT REALLY THAT WHAT YOU'RE DOING IN CLASS IS BEING CHANGED BY THIS, IN A WAY. YOUR TEACHING PRACTICE HAS BEEN CHANGED BY THIS DEVELOPMENT.

It has, it's partly been changed by the different school, and it's partly been changed by portfolios. So, yes, I'd be happy to think about, you know, going back to the formal writing thing - now that I've seen the way that I did it this year didn't work out as well as I'd wanted it to - I know I have to sit down and think and say 'OK, what can I do that's going to be different?'. The sort of things which I haven't done in the past because I haven't had formal writing as part of what I have been doing with my students. So yes, it's been really good, it's been challenging to me, which is good, and it's been new.

I THINK, IF, GIVEN THE CHOICE, POSSIBLY NONE OF THIS WOULD HAVE HAPPENED. I MEAN, IT DEPENDS HOW MUCH FLEXIBILITY YOU GIVE PEOPLE. WHEREAS YOU'RE KIND OF PRESCRIBED BY THIS FORMAT OF MATHS ASSESSMENT WE'VE GONE WITH.

Well, it is relatively prescribed. Although, there would be absolutely nothing to stop me from doing those sorts of things. I know I need to report on the mathematical processes and there's all sorts of ways in which it could be done. I've had no problem with the items in the portfolio being prescribed, in the sense that there should be a statistical investigation done at some stage, some formal writing, I have no problems with that at all. It may be that the suggestion which is made for the formal writing I don't take up, and I want to take up one of my own, but I think that saying "there should be something particular called formal writing" included: I'm very happy to live with that.

I'M NOT SURE THAT "FORMAL WRITING" IS ACTUALLY MENTIONED AS SUCH IN THE CURRICULUM, JUST ONE OF THE METHODS OF EXPRESSION WHICH WE DON'T DELVE IN VERY MUCH.

I think if you looked at some of the objectives in the maths processes that we could find some things, ... under the communication thing and so, yes.

ANY CRITICISMS OF PORTFOLIOS?

Um, no, no. I mean I've spoken to you in the past positively about the idea and how I've changed my views.

YES, YOU THOUGHT IT WAS, IN THE PAST YOU'VE LOOKED AT IT, I DON'T KNOW THE RIGHT WORD.

I thought it was a bit of a trendy idea, but um yeah I'm very happy to continue running with them, and for me personally to do it differently and better next year, given what I've learnt myself.

I THINK IT WILL BE INTERESTING WHEN THESE PORTFOLIOS ARE GIVEN BACK TO THE STUDENTS - PRESUMABLY THIS WEEK, AND WE SEE HOW MUCH INTEREST THEY ACTUALLY HAVE IN THEM.

THANKS VERY MUCH FOR YOUR TIME

Appendix R

Interview with teacher GG, 7 December 1998

YOU HAVE A 4TH FORM CLASS WHICH YOU RELINQUISHED IN TERM 3
SOMETIME, IS THAT THE ONLY JUNIOR CLASS YOU HAD THIS YEAR?

Yes.

RIGHT, AND YOU HAD SOME PORTFOLIO WORK WHICH THEY DID. THEY
MUST HAVE INTERVIEWED THEIR PARENTS FOR THAT?

Yes.

I DON'T KNOW IF YOU DID ANY OTHER ITEMS.

I did. We did the interview. We did a geometrical design so that was, that was their
geometrical investigation.

RIGHT.

and they did a few things that we incorporated. That's right we did a Cantamath item
which would, I didn't put anything through, that was a geometrical one as well involving
symmetry. Effectively there were three things, no oh we did value for money as well.
We did four things. So I actually did four.

RIGHT.

DO YOU THINK IT COUNTED FOR THE KIDS VERY MUCH - WAS IT
ASSESSED WORK? DO YOU THINK THAT WAS SORT OF IN THEIR MINDS?

For those kids, no.

THAT'S WHAT I THOUGHT.

For those kids, no, I don't think it would have made any difference. I don't think it will
make any difference to them unfortunately, but I still think it was worthwhile doing it.

WHY IS THAT?

Well, because what I was aiming to do, like I had bought, I bought it out of my own
money. I bought some nice folders, coloured folders, and so I took the stuff that they did
and punched it I wouldn't let them take the folders away. They were allowed to look at it
and then give it back.

YOU KEPT IT.

and so because I had hoped was what I would do is that we would have a few nice bits of work they had actually done so that for them it was like - their exercise books are often very scruffy and they produce worksheets and they're pretty scruffy - whereas if I can collect something that they have done, which was reasonably attractive even if I had to direct them because that's what happened with the geometrical ones, some of them were really good. Then we could have a look at that folder part way through the course and say "Well, there's the nice stuff that's been done". So for me it was less to do with assessment, but more to do with motivation. With actually handing [in] something that at the end of it the kids could look at the folder and say "well, I actually achieved a few nice things throughout the year".

RIGHT. AND IT WORKED?

Yes and no. I mean I was happy with it and they were, when I'd marked something or when they'd done something like that and I'd put it in the folder they were keen to look in their folders. As ongoing motivation, I don't know whether it made a great deal of difference. I certainly felt happy that there was at least one thing that they had which was not crappy, you know - which was not scruffy, but as for - I'm thinking of one of the exercises that they did with a geometrical investigation, it was an investigation actually it was a design - and they got started and they were supposed to finish parts of it for homework but unless we did it in class I had great trouble ... interpreting value for money well, some of them did that and one or two of them did it ok, even though we'd done it in class they didn't do a particularly great job. I thought it worthwhile and it was just a flavour with that bottom class.

TELL ME A BIT ABOUT OTHER PEOPLE, BECAUSE, I MEAN, YOU'RE AN ASSISTANT H.O.D. AND HAD OPPORTUNITY TO TALK TO MEMBERS OF THE STAFF AS WE'VE GONE THROUGH THE YEAR. WHAT'S THE FEEDBACK YOU RECEIVED FROM OTHER MATHS TEACHERS?

I have to say I have not had that much touch in the second half of the year with people. I mean, in fact probably no more than you've seen in departmental meetings with portfolio work where I believe that most people were doing some of the portfolio. I think [named teacher]'s an example when he might have left it to quite late but then he'll take the flavour and extend out in whatever way he can with his higher class.

IT MOTIVATED [named teacher] AND [named teacher] THINKS IT MOTIVATED EVERYBODY TO HAVE AN ASSESSMENT SCHEDULE THIS YEAR WITH THE JUNIOR CLASSES. AND I MEAN, I WAS JUST SAYING TO HIM NOW, IF PORTFOLIOS WEREN'T PART OF IT, IT WOULDN'T MAKE ANY DIFFERENCE. IT'S THE ASSESSMENT SCHEDULE WHICH ACTUALLY MADE THE TEACHERS, UM, CHANGE GEAR AND SAY "RIGHT I'VE GOT TO DO SOMETHING HERE".

Yeah. I think it needs to be it needs to be that way. That there has to be something. I've said this a number of times. I need marker points. Say, right by the time you get there you should have done X,Y and Z because if it's not set up that you have to do it or that

it's easily accessible then I think it doesn't get done. So I'm looking forward to a scheme at the moment to try and add some marker points and a few other things.

SO THIS IS IN THE 4TH FORM'S SCHEME, YOU'RE GOING TO ACTUALLY HAVE ACTUAL DATES?

Oh well what I want to look at

RIGHT "WEEK 7 THEY'VE DONE SOMETHING OR OTHER"

Yeah, I've only just started looking at this. These next two days are to be devoted, nothing to do with IT apart from Telecom but actually the 4th Form scheme. What I'm looking at is a number of ... say, this is possibly off the track of portfolios, but I would like in each one of these to have some sort of processes task which may or may not be a portfolio task, but also be able to say, you know in here "by such and such a time you should have got your first portfolio item finished about here", so that people know if they get to there and think "Oh I haven't even thought about it" but then there's going to be another one coming up, so that throughout, this will be expanded out, so its Topic, Topic, Topic, common test is going to be here, the portfolio item the first one should be done in about here and the next one should be finished here, so that people can actually look down, say "well that's where I am in the scheme and that's what I should have got done by then".

SO LINK THE ASSESSMENT SCHEDULE UP WITH THE SCHEME THE WHOLE TIME THEN?

WE HAD OUR PROBLEMS OF COURSE GETTING INTO THE COMPUTER ROOM WHEN WE FOUND IT. PEOPLE HAD TO GO IN THERE ONE CLASS AFTER ANOTHER AND NEVER GOT

Yeah.

COMPLETED. FOR 3RD FORM AT QUITE DIFFERENT TIMES WHEREAS ITS JUST AN ONGOING TASK ... WENT THROUGH ALL OF TERM ONE AND TERM TWO

Yeah.

WAS THERE ANYTHING ELSE?

Well there was. I think the spreadsheet one, which was to be a statistics project that was part of the portfolio, didn't happen.

RIGHT.

Partly because of timing.

IT WAS A BIT HARD FOR SOME CLASSES WITH THE WHOLE SPREADSHEET THING. SOME PEOPLE WHO WERE ABLE SEEMED TO HAVE COPEd AND WATERED IT DOWN.

Yeah. I think the spreadsheet task that was done in class, most people got through and did that ok and I got very positive feedback about that, that it worked. I mean, like I'm [indistinct "not"?] even happy with it with my class because I put it on overhead and then told them do X, Y and Z and so they got some graphs out and we left it at that.

THAT'S THE LOWEST ABILITY [streamed class].

That's the lowest ability

CONGRATULATIONS.

and I suppose. I wouldn't necessarily re-write what was there to go further down because I think there's enough pictures - that I think they could follow some of the pictures - because that's what I tried to do when I wrote the thing, was follow the words, but then there's enough pictures to say "well you've got to do this".

RIGHT.

So I think that worked ok.

IT SEEMED LIKE A REALLY GOOD PIECE OF WORK TO ME. I WAS IMPRESSED WITH IT.

Thank you. So what I want to have for myself before the start of next year is a very clear picture of what's going to happen at approximately what time and these are my possibilities for a portfolio item. Whether it be related to a topic or not related to a topic.

YES. I WAS JUST LOOKING AT THAT. THAT'S ACTUALLY WHAT WAS MISSING FROM THE 3RD FORM SCHEME THIS YEAR. WE SHOULD DO SOMETHING THE SAME FOR THE 3RD FORM, I THINK. [named teacher] AND I GETTING THE DATES OF THE VARIOUS TOPICS. I THINK IT'S A GOOD IDEA. I TRIED TO DO IT. REMEMBER I GOT YOUR FILE AND JUST TOOK OUT ALL OF THE BLANK BITS AND CRUNCHED IT UP TO A FEW PAGES.

Yeah.

Well, ... what I can do is reduce these pages onto two separately because what I'm toying with.

I THINK I QUITE LIKE THE INDIVIDUAL SHEETS.

Well what I'm toying with as well, and this is off the track of portfolios, but as some pre-topic testing so as soon as you study a topic you do a short test based on skills only at the relevant remedial and core work for 3rd Form, not anything extension, not anything hard, so that we at least can say at the beginning of the topic well, this is what was taught last year, this is where, somewhere around where we're assuming you're at and then there has to be some follow on to that which might be a revision session to get up to there. The hope there is that by doing that instead of what we do at the moment, we go back and reteach it all. Some of which we don't need to, and some of which we do, and then we don't actually have enough time to actually do the new stuff because we're still doing all the 3rd Form stuff.

YOU CAN GET AN IDEA OF WHERE THEY'RE AT BY INVESTIGATIONS APPROACH RATHER THAN A CLOSED TIME TESTING SESSION BUT ... THEY DO SOME SORT OF SHORT PROJECT, SAY IN STUDYING STATISTICS YOU CAN SAY "RIGHT, FIND OUT ALL ABOUT PEOPLE'S ATTITUDES TO SOMETHING OR OTHER" NOW AND IN A COUPLE OF DAYS YOU'VE GOT ALL THE PROJECTS AND YOU CAN LEAF THROUGH AND SEE WHAT SORT OF GRAPHS THEY REALLY DO KNOW.

Mmm.

THAT'S NOT SPECIFIC IS IT

Yeah.

AS A DIAGNOSTIC PRETEST.

I suppose while it is very skills based and only skills based not any applications I suppose what I would hope to be able to do is, say on day one, which is areas and volumes is give them some questions on perimeters, areas, measuring something, and if we were able to mark it in the period, great, and if we were able to actually then do some revision type exercises or follow it up by a homework sheet or something like that which we said "you've got to finish this by the end of this week" and that's going to hopefully get to get you up to speed with where you're supposed to be, because unless you can do that we're not, you can kiss any possibility of succeeding goodbye. I don't know. I suppose I like that idea because it can put it back on the student because it's saying "this is the beginning of the topic, this is where you're at, if you want to succeed at the end of the topic then you'd better do something about it now".

YES, PRETESTS MATCH IN WELL WITH THE SELF RESPONSIBILITY THEME FOR THE YEAR

Yeah

WHAT YOU NEED IS A WAY OF PUTTING MARKS TOGETHER SO YOU CAN SEE, "OH, THEY'RE ALL GREAT AT THIS SORT OF ALGEBRA BUT THIS SORT OF ALGEBRA THEY FALL DOWN ON"

Mmm.

YOU REALLY WANT THAT CROSSANALYSIS OF THE CHILDREN.

Maybe it would be possible with a pre-test to have it such that they can actually record which sections they're weak on, so that you can get them to summarise the information because the thing is it can't take a long, long time or else we spend all their time testing and not time actually learning.

YOU COULD GIVE FIVE DIGITS INSTEAD OF A PERCENTAGE SCORE, AND THOSE FIVE DIGITS WERE FIVE SECTIONS.

Yeah.

THANK FOR YOUR TIME, ANY OTHER THOUGHTS ON PORTFOLIOS AT ALL, THEY'RE CONTINUING NEXT YEAR - AS FAR AS I'M AWARE EVERYONE'S HAPPY WITH IT.

No, as far as we're concerned, no, I think they're a great idea.

Appendix S

INTERVIEW WITH TEACHER HH, 30 Nov 1998.

WE'RE LOOKING AT PORTFOLIOS IN YOUR LOVELY CLASS. WHAT ARE YOU ACTUALLY DOING?

I'm basically I've just put together their work because some students still didn't have a folder by the end of the year, so I used to store it all in a plastic bag and I've now gone through and stapled all their items to their ... grouped together. OK and now I'm going to go through, look at them, grade them on the 0, 5, 10, 20 thing.

THIS IS A 3RD FORM CLASS?

4th Form

4TH FORM: WHICH? HOW FAR DOWN IN THE PILE?

B4

4B4 SO IT'S THIRD TO BOTTOM

Second.

SECOND TO BOTTOM 4TH FORM CLASS OUT OF 10 AND YOU HAVE A STACK OF STUFF WHICH IS APPROXIMATELY EIGHT CENTIMETRES HIGH ON THE DESK IN FRONT OF YOU.

Right.

NOW LET'S SEE WHETHER YOU HAVE ACTUALLY DONE WHAT IT SAYS TO DO IN THE CURRICULUM. SO WHAT WE'RE LOOKING FOR IS ANY EVIDENCE WHICH IS "A WIDER RANGE OF SKILLS BEYOND THE APPLICATION OF STANDARD ALGORITHMS" WE'RE LOOKING FOR "A BROAD RANGE OF MATHEMATICAL TASKS AND PROBLEMS REQUIRING THE APPLICATION OF A NUMBER OF MATHEMATICAL IDEAS, SKILLS ASSESSED SHOULD INCLUDE THE ABILITY TO COMMUNICATE FINDINGS TO PRESENT AN ARGUMENT AND TO EXPLOIT AN INTUITIVE APPROACH TO A PROBLEM". THAT'S WHAT WE WANT TO SEE. DO YOU HAVE ANY EVIDENCE OF ANY OF THAT?

Yes, I think I do. I'll go to my best portfolio. One that I'm giving 20 out of 20.

RIGHT.

This student has not only presented it in a very readable format but has always gone further with what he chose. For example, his value for money investigation. He went through all the contents of a MacDonalds burger, prices from the local supermarket and compared it against the price you would pay for each individual part of it, at MacDonalds.

WAS THIS ALL HIS IDEA?

Yes.

“HOME MADE IS BETTER VALUE”. SO HE’S MADE A CONCLUSION

Mmm. Now I daresay he had some help at home on it, but we’re not ruling that out as a, maybe it is something that they’re doing in Home Ec [Home Economics class] anyway, so I guess its expected that would happen .

THAT WAS PART OF OUR IDEA, WASN’T IT, THAT WE ACTUALLY WANTED TO HAVE MORE INVOLVEMENT WITH THE PARENTS IF WE COULD.

The geometrical investigation that I set them up was to “do a snowflake” and he chose to do his on the computer.

FANTASTIC. HOW’D HE DO IT?

Paintshop, I imagine. He’s painted the little colours in.

SO HE’S GOT TWO AXES OF SYMMETRY, GOOD FUN. HE’S THOUGHT ABOUT IT AND HE’S HAD A GO.

And then they also had their news research article. A lot of them in my class either did rugby statistics or the share market graph.

WAS THIS WHERE THERE WAS A PARTICULAR DAY OF THE YEAR AND THEY HAD TO GIVE SOMETHING FROM THAT NEWSPAPER?

No. Well yes, that was the one, but I modified that, just took any part of the paper that interested them.

DID YOU FIND YOU HAD TO HAVE A BIG INPUT INTO THIS?

I had to really state outright what it was that I was expecting to have handed in, and if I didn’t do that then I didn’t get them handed in, so I had to say it a lot, and I had to extend dates, I mean things never came in on their due date. They came in over a series of weeks. We gave ourselves a two week period when things had to be in.

YOU’RE OBVIOUSLY PLEASED WITH THIS ONE.

I am very pleased with this one. That’s from a ... They also had a statistics assignment. I don’t have any of their statistics assignments with me because they’re on my wall in the room and a lot of them are on the computer, and I also returned them to the students not realising they were part of their portfolios.

RIGHT.

They took them home and they're probably lost. That's another student who, not in the same league, but also has completed everything to the standard that I was marking on. Found an article, went through, found some things that she thought were related to maths. Found some days in there, found some minutes and so on

RIGHT.

There's a snowflake, very basic but still completes the... Value for money she looked at stereos and the price of buying stereos.

THIS HAS THE LOOK OF BEING SOMETHING SHE TOOK A PERSONAL INTEREST IN.

Mmm. They found something they liked. And

DID SHE BUY A STEREO?

No just got the thing, saw it in the paper.

OK, INTERVIEWED MUM AND DAD WHAT WAS ALL THIS? YOUR OCCUPATION IS A BUILDER YOU USE MATHS EVERY DAY YES. WHAT DO YOU USE FOR MEASUREMENT. METRIC SYSTEM, TAPE, RULERS ...WHAT WAY DO YOU USE MATHS? BUILDING HOUSES SETTING UP FOUNDATION PRICING AND TENDERING JOBS ALSO VEHICLES, SET UP PROFILES BEFORE THEY START FOUNDATIONS THEY SET UP HYPOTHESIS SQUARES AND SQUARES OF THE PROFILES TO ESTABLISH THE PARALLEL LINES TO THE SQUARE ... OH, AND HERE'S THE 3.4.5. TRIANGLE SQUARE BUILDING IS THAT ACTUALLY USED OUT THERE?

Mmm

REMARKABLE. DO BUILDERS ACTUALLY DO THAT?

They must do. So I had to

I'D LOVE TO SEE A PHOTO OF THEM DOING IT

Measuring it out.

If I had a higher ability class I'd expect a lot further, these things a lot more expanded on. This is the basic that I would accept sort of thing, but I mean you lower your expectations depending on what sort of class you have and then you get a student like (named student) who really exceeds what you would ever have imagined they could have produced for you.

WHAT MARK DOES THIS GET?

Let have a look at the statistics, yes completed statistics, completed everything and it was to the standard I set. Um, most likely 15 or a 20. I'm really going to have to

THEY EITHER GET 0, 5, 15, OR 20?

Yes.

SO YOU'RE GOING TO HAVE TO WORK OUT WHICH ONES,

which one's I'm really going to give a 20 for

DO YOU USE ANY SELF-APPRAISAL OR PEER APPRAISAL WHEN YOU'RE DOING THIS?

No. I mean here it says "complete and excellent". Well, I don't know that it's really excellent but I'm going to have to compare that with the other things I get in my class. Like this student here, very low ability student, had no idea, this was their, for their geometric thing they could do an enlargement or something like that. They had to go from an original picture and enlarge it. Well, there's nothing else, and that did not reach the standard, and I don't believe the student ever repeated that for me as I asked. Um you know this is just, so that is not, the work she's handed in, while she's completed every task it is definitely not to a quality standard and I'd probably be looking at giving her five for that.

RIGHT.

It's complete.

THIS IS (named student). (named student) I SAW FOR A NUMBER OF LUNCHTIMES AND THEN SHE DROPPED OFF WITH ME.

Oh, did she.

I MEAN SHE COULD HAVE BEEN DOING THAT WITH ME, BECAUSE SHE WAS SO KEEN AND DOING SO MUCH STUFF

She was keen but always a shortcutter. This is her friend (named student). Very poor English. Went right off and just did a whole lot of things right at the start of the year and saw that sheet and went through and did everything

DOES IT MAKE SENSE?

A lot of it was hard to get through.

I SEE ABOUT 3 OR 4 TICKS PER PAGE SO YOU'VE READ EVERY WORD.

Oh yeah.

HAS IT BEEN QUITE TIME CONSUMING?

I add my comments. No it wasn't time consuming at all. Did not take long at all. You take that see ... and some things take longer to read than others and you've got more comments to make on it.

YOU DO CORRECT EVERY WORD IN THE SPELLING.

Same here, statistics assignment was out of 30 and they had to do it on the computer.

RIGHT.

That fast food assignment

I KNOW

And I mean, she just did not use the spell check and nothing that she typed was even legible even though it was typed on the computer which should allow something to be done, but their situation where she had no idea of what..

IT LOOKS LIKE A ...

That's what I thought as well so I didn't even mark it. She did a lot of geometrical investigations so I found the one that would best suit what I was interested in.

ISN'T IT INTERESTING, YOU GET TO WELL I MEAN THAT A MAP OF A PARK OR SOMETHING YOU'D THINK THERE WOULD BE ANY AMOUNT OF THINGS YOU COULD DO. AND OVER HERE THEY'VE GOT SOMETHING WHERE ONE OF THEM COSTS THIS AND TWO OF THEM COSTS THIS AND THREE OF THEM, SHE DOES THAT UP TO 10 OF THEM. WELL PERHAPS THAT'S A PROCESS THEY HAVE TO WORK THROUGH, "OH YES, IT REALLY DOES INCREMENT BY WHATEVER THE MULTIPLYER IS".

But this doesn't make any sense to me whatsoever this one.

NO, IT DOESN'T DOES IT

I don't have a clue what she was talking about so I just wrote that, and she had these three geometrical investigations and I chose one

YOU JUST KNOW THAT YOU'RE THE FIRST PERSON APART FROM THE AUTHOR TO SEE ONE OF THESE THINGS DON'T YOU.

So that was a good one, looked at MacDonalds, Pizza Hut, fish and chips and Valentines meals.

HOW DID SHE GET THE INFORMATION? DID SHE GO THERE?

I imagine she's been to Valentines, they've got a set thing and MacDonalds has a thing. She would have had these at some stage and then she completed her last one for me, the sharemarket, which a lot of them did.

I DON'T THINK I'VE READ THE WORDS. THEY'VE PICKED THAT THAT'S A GRAPH AND IT'S TO DO WITH MATHS.

It's to do with maths but in (named student)'s case I don't actually think she would be able to read the words her English is just so, so low.

WELL, JUST AT A GLANCE, THATS 16 [years] PLUS READING LEVEL

Mmm

SHE'S WORKING ROUND, JUDGING BY THE WRITING, SHE'S MORE LIKE A 10 OR 11 YEAR OLD ISN'T SHE? YOU CERTAINLY HAD THEM GO AND LOOK THROUGH THE PAPER AND FIND SOME INTERESTING

They did. They did everything I asked, they would go and do, and here's another.

DID YOU GIVE CLASS TIME TO THIS THEN?

No, the only thing we did in class was the statistics thing we did on the computer and the Cantamath, those two things we done in class, the rest of them we did at home. Our best investigation is what we're doing now, which is our stained glass windows. They will leave them with me so I can have them on my window.

STAINED GLASS WINDOWS. YOU'VE GIVEN THEM LIMITS ON HOW MUCH SHOULD BE COLOURED GLASS AND HOW LONG THEY CAN HAVE BETWEEN

and they've got to have certain shapes and at least three different colours, and each colour costs a different amount so they're going to have to do a bit of working out.

IF THEY'RE SMART EVERYTHING WILL BE TRIANGLES.

It will be a bit tricky for them, but I've got one already saying I want to do a dolphin and I want to do this and that. I mean this was quite original

IT GIVES THEM A CHANCE TO DO A NICE PRESENTATION. OUT OF THE PAPER, THEY'VE GLUED SOMETHING ON TO CARDBOARD AND PUT OTHER THINGS OVER THE TOP OF THAT. YOU KNOW, YOU'VE GOT THE BEGINNINGS OF SOMEONE DOING MAGAZINE LAYOUT AND THINGS LIKE THAT THERE.

It's simple but it's what I asked. To me that was pretty good. I liked that. I liked the way it came in and then when he did his value for money he chose different boats, and here's a snowflake.

GOOD. DID EVERYBODY ACTUALLY DO A PORTFOLIO?

No, sorry, you can see here on my mark sheet I've got a zero there and a zero there. Two students did not complete any of it, any work whatsoever.

OUT OF HOW MANY?

Out of a class of 23 at the moment, and this one here would also have a zero. There's several students who didn't do a lot. These two here for example did not complete at all, and you get to the point when you get tired of handing out Home Detentions and me I don't think its the sort of situation where I should have to hand a Home Detention. If they don't want their marks they can have zero.

DO YOU THINK THEY WERE VERY AWARE OF THE MARKS?

Mmm. I bugged them enough and I told them enough, and they could see what everybody else was doing, and they had this and I photocopied it off three times for some people.

THIS IS THE SUMMARY OF ALL OF THEIR ASSESSMENTS FOR THE YEAR INCLUDING THE PORTFOLIO WITH DATES ON AND STUFF. AND YOU HANDED THAT OUT AT THE BEGINNING OF THE YEAR.

Yeah, we went right through that at the start of the year and then I would remind them. I had one on the wall in my classroom. We'd go to it and check things, sometimes they were the ones that reminded me: "When's our next portfolio due?" and I'd say "right, let's have a look at our list" and I'd go through and explain what was expected. See, this geometric investigation I had to change for my class because, you know, you can see that (named student) tried to do the park but you know I would rather have a nice snowflake that's perfect symmetry and or an enlarged picture, a lot of them did both for me and have that handed in than have them do something like this, not to quality standard.

"DESIGN A PARK, DESIGN PACKAGING, RULE WRITE A COMPUTER PROGRAMME VISUALISING 4 DIMENSIONAL SPACE" DID ANYONE TRY ANYTHING LIKE THAT? "MAKE STICK MODELS OF REGULAR 4 DIMENSIONAL SOLIDS". WOULD HAVE BEEN ALRIGHT FOR CANTAMATH, DID ANYONE DO THAT?

No

THIS ONE'S SEWING. "SEWING TOPOLOGICAL SURFACES ON MAPS", DID ANYONE DO THAT?

Nah.

"MAKE A SUNDIAL AND DESIGN CALENDARS"

I had one do a calendar.

SO THEY WENT FOR THE PARK AND THE PACKAGING?

Mmm. I had one do a calendar, this is a perfect example, they saw the word calendar, they really didn't know, they didn't read any further, and so what I got was a calendar for next year.

ILLUSTRATED. IS IT CORRECT?

Yeah it's all there.

GOOD. IT DOESN'T SHOW THE HOLIDAYS OR ANYTHING LIKE THAT.

It isn't this year 'cos Christmas this year's on a Friday. So, you know, I mean in my case it was much better for me to say I want a snowflake this is going to be part of your geometrical because it actually fitted in with exactly what I was doing ...

THEY COULD DO A NICE SNOWFLAKE IN LOGO. PRESUMABLY THESE GUYS DID LOGO ON THE COMPUTER LAST YEAR AND MUST HAVE KNOWN YOU COULD USE THE REPEAT.....

Where's a really lovely, snowflake, this one here and this is the one that I was able to show around the class and I was very impressed by that one. They all got a little sheet with snowflake pictures on they could have used this and this girl took one original snowflake for that picture and then you can see here. I don't think she handed everything in, no sorry she did. She's taken stuff home. She's got ticks for everything, so that's OK. But this, this was quite good, this was a bit of a different article that she chose.

I LIKE LAMBING PERCENTAGES, THAT'S GOOD. THEY CAN BE RELIED ON TO GET MORE THAN 100%

Mmm.

LOT OF CHANGE, 110, 115, 125 % IN 1995/97/98. PERCENTAGES HAVE GONE UP 15% SINCE 95/96, OH SHE'S CONVERTED OTHER PERCENTAGES WITH THESE FIGURES. THAT'S INTERESTING.

That was quite a good one for her.

QUITE A LOT OF INTERESTING STATS THERE. MEAT PRODUCTION PER HECTARE

Mmm, and she's come to a conclusion. It shows that the lambs are getting more expensive the more lambs are getting killed every year, and lambs' weight is increasing. She's read the article and seen what it is going on about.

LAMB KILL WEIGHTS IS JUST A FACTOR OF THE WEATHER ISN'T IT?

Yeah, but still she's seen the lambing percentage increase. Number of lambs killed.

GROSS INCOME DOLLARS PER HECTARE. WE DON'T ACTUALLY KNOW THAT LAMB IS GETTING MORE EXPENSIVE OUT OF THAT. MAKING MORE MONEY FOR THE FARMERS PRESUMABLY IN 95/96 THAT MUST HAVE BEEN A REAL BAD YEAR FOR THEM NOW WE'VE GOT HEAVIER LAMB WEIGHTS AND MORE LAMBS. THAT'S A GOOD ONE TO HAVE IN YOUR MATHS TEXTBOOK.

Good choice that, isn't it.

Mmm, and what else have I got? Basically the rest of them, well. This is a boy whose parents got him his folder and it always came to school, whenever there was something to hand in and that was something that the parents obviously took a watchful eye in. And this wee boy who hasn't done well this year. With my kids the parent involvement was very strong, they knew about this at parent interviews. I took this to parent interviews with me and ran through it with them and if they had done a piece of work I took it along and showed it to them and said this is what we're doing and have these things to do. Some parents said to me "Oh yes I've got this up on the fridge."

RIGHT

We had this tacked to our fridge so some would know when each thing is.

AND EACH THING WAS ABOUT A MONTH APART

Mmm.

SO IT WAS SENSIBLE.

So they kept a good eye on it as they went. So this wee boy hasn't performed well, probably won't go into School C classes next year because really finds a lot of maths really difficult, but this was something he could do. He could find an article and talk about it. He could go home and talk to Mum and Dad about maths and he's taken for his geometrical investigation he chose to enlarge my symbols. That was OK we did that in class on the wall, we put those on the wall, and he put those in his portfolio.

LOOKS GOOD.

Looked at videos, and by the time we get to the stained glass windows he takes them home he's got some nice bits of work to show.

WHAT'S HE GOING TO SCORE?

Probably 15.

HAVE YOU DONE ALL YOUR FINAL EXAM YET?

Yes.

THE FINAL EXAM WAS OUT OF ABOUT 50%

The final exam was 50% yes.

IN THAT EXAM WHAT SORT OF MARKS ARE THEY GETTING?

OK. In the exam, I've got a low of 11, and a high of 39, and that 39 I presume that went to (named student).

BUT A TYPICAL MARK IN THAT EXAM WOULD BE AROUND

Our median was 23.

RIGHT, 23. THAT'S PERCENT.

Uh huh.

OUT OF 50 MARKS WE'RE TALKING ABOUT 12 MARKS. BUT IF THEY'RE GETTING 20 MARKS FOR THEIR PORTFOLIO, THEIR PORTFOLIO IS WORTH TWICE AS MUCH AS THE FINAL EXAM IN TERMS OF THE MARKS IT GENERATED.

I see.

I WONDER IF THEY'LL FIGURE THAT SORT OF THING OUT EVENTUALLY.

Exactly. That's going to really... This really helps them.

DO YOU THINK IT WILL DISTORT? AT THE END OF THIS WE'RE GOING TO HAVE MARKS OUT OF 100. 20 MARKS FOR PORTFOLIO THE REST OF IT FOR MORE ROUTINE THINGS. BECAUSE SOME OF THEM WILL GET 20 OUT OF 20 FOR THE PORTFOLIO BECAUSE THEY ARE WELL ORGANISED: DO YOU THINK THAT'S GOING TO DISTORT THE SELECTION PROCESS FOR WHICH CLASS THEY'RE GOING INTO NEXT YEAR?

No, because I think the ones that are getting 20 out of 20 in the portfolio and have achieved high in the exam are the ones that are going to go into School C classes anyway.

YEAH.

[Interruption.]

I mean we always said these portfolio grades were going to be based on their class so I don't feel that just because they're the lowest class I shouldn't give them a 20. If they've done the work to what I expected, that [indicating the work of the top student] basically does exceed my expectations, in (named student)'s case it did, then he deserves the 20.

I THINK ANYONE WOULD LOOK AT WHAT YOU GOT OUT OF THE CLASS THERE AND SAY "THIS IS GOOD WORK" AND ONLY AFTER READING IT CAREFULLY WHEN YOU REALISE THEIR ENGLISH ISN'T MUCH GOOD WOULD YOU FIGURE OUT THAT THESE ARE IN FACT VERY, VERY SLOW CHILDREN. I THINK ANYWAY.

Yeah, I've been quite proud of them. For them it's, for them I think they really will enjoy taking home their folder and stuff they've got.

THAT'S GOOD. SO YOU'RE QUITE HAPPY WITH THE WHOLE PORTFOLIO IDEA, IS IT?

I am. If I had a high ability class I'd probably be doing more things but then you see my problem is that I always like putting my things on the wall, which means that they don't even get to take them home until the end of the year, but they can do that for the end of the year I'll take down. For each of their portfolios as well they've all done an enlargement picture, some on the walls, so they'll get to take them down and take that away as well. And some of them have their, as I said, their statistics assignment that they had to present to me on cardboard, so they're glued all over the wall. Take those away and do that as well. So that's one thing, I imagine with a higher ability class I'd probably have more things on the wall.

WOULD YOU DO DIFFERENT TYPES OF TOPICS?

I would. I mean, I'd do, you know, with the packaging thing we'd probably do something in class and last year I did with my 4th Form we actually designed a new packaging, for something, we did a whole study on packages, how much space was wasted in a packet and I would definitely do that again if I had a higher ability class. Yeah, there's plenty of things out there that you can do and it depends. It just comes down to how much time you've got and how it's going to fit in with what you're doing in that class anyway.

A LITTLE OFF THE TOPIC, BUT YOU WERE DOING THIS SORT OF THING WITH A SENIOR CLASS AS WELL AT THE BEGINNING OF THE YEAR. A LITTLE BIT WITH THE 6TH FORM WASN'T IT, ALONG THE LINES OF A PORTFOLIO?

My MAP class. [Mathematics Applied, an alternative course not leading to university]

IS THAT RIGHT?

No, what my maths class did was basic things like this. They had assignments on every unit of work. So, for example, our last unit of work was the food unit and they did stuff all about good nutrition and food and bad nutrition and just a whole statistics unit about graphing, reading tables reading articles and so on. They also had a unit that they completed on water conservation. They called it the water unit where they learned all about the amounts of water you get when you flush, and how you can save water and how much water consumption in different countries, and looking at differences in that and that was another unit, so they had units, and they had their tax unit. They had to complete a tax IR5 form for me and so they would go through and they would get graded on each of the housing one, they a liqueur bottle they had to design, travel assignment, water assignment ... geometry, statistics.

SO YOU WORK ON PRETTY MUCH AN ASSIGNMENT BASIS. THAT'S YOUR TEACHING STYLE.

And you can see, you know, this one that scored zero did not basically, did not hand in. Whereas you come to these students here who've done and (named student) also a top student. It worked well for them because they worked at their own pace. They did things as they wanted.

(Interruption.)

And for Maths Applied if I was teaching it again, I would do exactly the same thing again, because it worked really well. They're not a testing class. We had the test which was the moderated test, the written one they were scoring the middle of the ones whereas I've got them achieving and they're doing assignments out of, let's look at the water ones for example and I've got them achieving 9 out of 10, 9 out of 10, 7 out of 10, 6 out of 10, 8 and a half. They're doing really good quality work at that level and they're getting good grades and that makes them do more.

THAT'S GOOD.

And that was their bridge assignment. See the tax, some of them didn't complete that little part of the thing, they never completed the IR5 so I wrote that on their report. Did not complete such and such unit.

IF YOU COULD CHANGE THE REPORT, ESPECIALLY FOR SAY THE 6TH FORM MAP CLASS, WOULD YOU ACTUALLY LIST DOWN ALL THESE VARIOUS ITEMS AND GIVE ALL THESE GRADES ON THEIR REPORT AT THE END OF THE YEAR, OR YOU DON'T THINK THAT'S APPROPRIATE?

I don't know. I think in a way it's enough if you state it in your written comment as to what they did really well. So for (named student) I would say "An excellent bridge assignment and water assignment, however..." whereas with (named student)'s one I said "Did not complete his tax assignment or geometry assignment". So it gets stated, and they know that you noticed that. No, I don't think there's any need to have all the little names of everything

OK. PRESUMABLY, THEY HAVE THESE ASSIGNMENTS AND THINGS THEY MADE, THE CONSTRUCTED LIQUEUR BOTTLES OF PARTICULAR VOLUME

Usually they leave them with me because once again they go along the wall and get displayed. That in itself when I asked for it, if I can have it for my wall that gives them a lot of whatever, and a lot of the things they made, the landmarks that they made they all sit on the shelf. They did some origamis on Tuesday afternoon for a couple of weeks and those are on the shelf, and it all gets displayed, and I think that's one thing that they like. They can walk round the room and see all their work. And, you know, for example, [named teacher] was in my room for an exam the other day and he came up to me and said "Oh, you've done some really interesting work: I've been looking around your walls". I like that. You know that means people see what's going on.

YOU SEE IT AND IT INSPIRES THE STUDENTS DOESN'T IT. SOME OF THE PORTFOLIO ITEMS THAT YOU'VE HAD FOR THE JUNIORS, SOME OF THESE AREN'T SO FLASHY ARE THEY? IF THEY DO AN INTERVIEW YOUR WRITE UP OF THE INTERVIEW YOU CAN'T STICK THAT ON THE WALL.

Yeah that's right, so that goes in their little folder.

WELL THAT'S GOOD, THANK YOU VERY MUCH FOR YOUR TIME.

ANY OTHER THOUGHTS ABOUT PORTFLIOS?

No that's about it.

YOU SEEM FAIRLY HAPPY WITH THEM

Yeah. It's all come together quite nicely really and it hasn't been a big headache at all.

THANK YOU

Appendix T

DECEMBER 2, 1998 Interview with teacher II

YOU DID TWO THINGS WITH YOUR KIDS?

Three things with my kids, and um, they did a famous mathematician, they all did do a research on a famous mathematician.

OH, THAT'S RIGHT, THEY ALL WENT TO THE LIBRARY FOR THIS DIDN'T THEY?

Yeah. And the second thing they did was a spreadsheet. A spreadsheet, over [at] the library, worked through the spreadsheet what's-a-name, and do the, do the exercise on that and

SO THAT WAS, THAT WAS BASICALLY [named teacher]'s SPREADSHEET WORK THAT YOU ...

Yeah.

OK.

The third thing they had to do was survey. Now I've got a, from the first one -famous mathematician - I've probably got a return, I've probably got a return of about 65 -70%, on the spreadsheet I would of had a return of about 40%, and on the survey a return of about 30%.

RIGHT. WHICH STREAM IS IT, WHICH CLASS IS IT?

Second to bottom 4th form.

THAT WOULD BE B3, ER, B4

Something like that.

SO YOU'VE GOT A PRETTY TOUGH TIME. I HAD THE SAME. I HAD 3B3, 3B4 RATHER, WHICH IS THE BOTTOM 3RD FORM AND, UM, QUITE POOR IN TERMS OF. THEY DID THE AUTOBIOGRAPHY, SOME OF THEM QUITE WELL, THAT WAS DONE, AND THEN THE REST OF IT DIDN'T HAPPEN. [Named teacher]'s APPROACH HAS BEEN TO PUT IN A PORTFOLIO BOX, WORKSHEETS ... THAT THEY HAVE TO DO AS WELL, SO THAT COME THE END OF THE YEAR THEY ACTUALLY HAVE A RESOURCE.

You know I think that's a good idea for these lower ability kids because I could not see any point in standing over some of these kids, um, making it a hassle for me, um when, in something that they, they were basically not involved in. They had to type on a piece

of paper and hand it in. I can't see the point in that. And, to be fair on them, ... to all the other classes, if the kids did all three of them, and made a good job of it, I gave them an 8 out of 20, if they did two of them and made a very good job they got a 5 and if they only did one then I give them 3.

EVERYBODY'S HAD TO MODIFY THE MARKING SCHEME A BIT.

Yes. I didn't want anybody, I didn't want anybody getting above 50%. They would had to be ...

NO ...

... Yeah, in comparison with the other people, to be fair so that the kids that I would have marked ...one of my kids said "I got 18 out of 20" "Oh, what'd you do?", "A couple of things" and this other kid's saying "We did seven things and I only got 14" or 12 or something like that, so to be fair it would have had to be done like that.

FAIRNESS IS A PRETTY BIG PRIORITY WITH YOU AS WITH ALL OF US, GOOD. LET'S JUST CUT TO THE ESSENTIAL THING HERE. BY DOING PORTFOLIOS DID ANYTHING GOOD HAPPEN? DID ANYTHING HAPPEN THAT WOULDN'T HAVE HAPPENED OTHERWISE? DO YOU THINK IT'S WORTH CONTINUING WITH IT? WHAT'S YOUR OPINION?

Yeah, I do. I'm a bit of a fan of [named teacher]'s approach. Putting everything, collecting everything they do and then at the end of the year saying to a kid "Ok, you've got to have" some set things for the kids to do I think that's a good idea, autobiography you know some kids found out about a person they would never have found something out about.

YEAH I SEE THIS [named student]'s ONE

And the spreadsheet idea, the spreadsheet idea I thought was quite good because they enjoyed being in the computer room.

YEAH, THAT SPREADSHEET WAS PRETTY HARD FOR THE SLOWER CLASSES

Yeah,

I PERSONALLY THOUGHT IT WAS A RATHER GOOD PIECE OF WORK, BUT IT'S VERY HARD TO WRITE SOMETHING THAT WORKS AT EVERY LEVEL.

Oh, that's right and there were probably two or three other things in there that I could have got around to having a go at. I mean even doing work in class for some of these kids is pretty hard yakka.

DID THEY GET, I MEAN THE SPREADSHEETS: CLASS TIME?

Yes.

MATHEMATICIANS IN THE LIBRARY IS CLASS TIME?

Yes.

DID THEY GET CLASS TIME ON THE SURVEY, DID THEY GET CLASS TIME TO DO THE SURVEYS?

No, that was one they had themselves to do.

TO GET THOSE MARKS THEY HAD TO DO SOMETHING AT HOME?

Yes, that's right.

LISTEN, I'VE JUST GOT THIS BECAUSE I DON'T KNOW IF YOU'VE SEEN IT OR NOT. THAT WAS, THAT WAS WHAT WE GOT WITH FOR NEXT YEAR

Last week at maths department meeting?

YEAH, YEAH. I THINK IT GOT SHOWN AROUND. BUT WE WERE TINKERING WITH THAT MARK THERE.

Right.

AND AGAIN I THINK ITS FAIRNESS. I MEAN [named teacher] RAISED THE POINT, YOU KNOW, THE GOOD KID MIGHT MISS JUST ONE ITEM

Mmm.

AND A NOT VERY GOOD KID MIGHT ONLY DO ONE ITEM.

Mmm.

AND THE MARKS, THE DIFFERENCE BETWEEN MARKS FOR THEM IS QUITE DRAMATIC. THE GOOD KID'S GOING TO GET 5, YOUR NOT VERY GOOD KID'S GOING TO GET 15, AND THAT'S NOT FAIR.

It's wrong, no.

AND SO, THIS IS PARTLY TO ADDRESS THAT IN THAT YOU TAKE THE FIRST HALF YEAR AND THE SECOND HALF YEAR SO YOU ONLY GET A FEW THINGS. I WOULD, I'VE BEEN THROUGH MINE TOO AND IF THEY DID JUST ONE ITEM...I ONLY GAVE THEM ZERO BECAUSE... TWO ITEMS AND I GAVE THEM 25 OUT OF 100, I DIDN'T GO DOWN TO 20 UM BECAUSE THEY'D DONE SOME WORK..

Mmm, Mmmm

WHAT DO YOU THINK OF THAT? WHAT WE'RE TRYING TO DO IS TO BRING ALL THE TEACHERS A BIT CLOSER TOGETHER AND IT MAY BE AN IMPOSSIBLE DREAM BECAUSE OBVIOUSLY YOUR SYSTEM, OF 8 OUT OF 20 AND SO ON, WORKS.

I was trying to give my kids some marks where I felt they deserved them but I also wanted that mark to be related to kids in other classes so they weren't scored, I mean a problem: quite a lot of my kids got zero because they didn't do anything. Now I'm quite happy to put that down and when I write their report the comment will be "um has done no work in this area". End of story. I can justify the mark of zero because they haven't done anything, whereas if they have done something I didn't want to put a zero, because they have done something.

THAT'S RIGHT.

I can put "has done very little in this area", consequently, 3 out of 20.

OUR SCHEME WAS FAIRLY CRUDE, WASN'T IT? YOU WERE EITHER GOING TO GET 0, 5, 15, OR 20. I THINK THAT WAS TOO HARSH. THIS MAY NOT WORK EITHER, BUT AT LEAST WE'RE TRYING.

WHAT ABOUT THE ACTUAL AMOUNT OF TIME TO MARK THESE? SAY "THE FAMOUS MATHEMATICIAN", YOU HAD THE MAJORITY OF THE CLASS DOING IT. OBVIOUSLY A LOT OF WRITTEN WORK. DID THIS TAKE YOU OUT OF COMMISSION FOR SEVERAL HOURS TO MARK?

No, because they didn't all produce it at the same time so I didn't sit down with um, there's 25 in the class, I didn't sit down with 25 and have to mark 25 in one night in one go. I actually marked it probably over the space I'd say, of a week, because again with their writing skills and that sort of thing I had to give them a reasonable sort of, if you haven't done it today ...

DID YOU CORRECT THEIR SPELLING YOU KNOW AND THAT SORT OF ENGLISH TEACHER STUFF?

No, no, no. I felt that would of been unfair because they, they weren't doing it from that point of view um, some of them would have been quite a lot of crosses, and "sp."s and things like that which would have been unfair.

YOU KNOW, EVEN WITH THIS SCHEME HERE, IF YOU'RE GETTING 8 OUT OF 20 FOR YOUR PORTFOLIO, YOUR KIDS IN THEIR FINAL EXAM IF IT WAS OUT OF 50, WOULD HAVE BEEN GETTING MARKS LIKE, SAY, 20 OUT OF 50 WOULDN'T HAVE BEEN VERY ABNORMAL, I EXPECT. I DON'T KNOW THAT PARTICULAR EXAM.

No.

IT ACTUALLY MAKES GOOD SENSE FOR THEM TO GET THEIR PORTFOLIO RIGHT BECAUSE COMPARED WITH THE FINAL EXAMS IT ACTUALLY WORKS OUT TO BE QUITE HEAVILY WEIGHTED. MORE HEAVILY WEIGHTED THAN WHAT THIS ASSESSMENT SCHEDULE SUGGESTS, BECAUSE THE 20 MARKS FOR THE PORTFOLIO CAN BE DONE.

Yeah, yes that's right.

...WHEREAS IN THE EXAMINATION ONLY 50 MARKS. FOR A CHILD IN ONE OF OUR CLASSES THEY'RE UNLIKELY TO EXCEED SAY 20 MARKS OUT OF 50 MARKS, SO THE PORTFOLIO COULD ACTUALLY BE MORE VALUABLE TO THEM THAN THE FINAL EXAM

Yes, than the final exam.

AND MAYBE THAT'S NOT BEEN MADE CLEAR ENOUGH TO THE GUYS. WHAT DO YOU THINK OF THE RELATIVE WEIGHTING OF THE PORTFOLIO?

Well, it's an ongoing thing, something they're doing throughout the year. I think that it has to have a reasonable weighting. I don't think it was weighted too heavily as against the exam really, and especially for those lower ability kids it does give them a chance to get some marks.

YEAH, GOING BACK TO THAT OTHER QUESTION. DID THEY DO ANYTHING BECAUSE IT WAS A PORTFOLIO THAT WE WOULDN'T HAVE HAD THEM DOING OTHERWISE?

People wouldn't have done a famous mathematician, that was in the portfolio. I think we would've still done the spreadsheets. Um, survey we

WE WOULD HAVE DONE A SURVEY BUT IT MIGHT NOT HAVE BEEN ASSESSED.

Yeah that's right. Survey tied in with statistics, that sort of thing. I think I've got a 3rd form class next year, and I've now got a 3A class so you know, obviously I'm going to be working through, working through all of it. I'll still do, I'll still partly do [named teacher]'s idea as well and collect in the stuff. I may sort of say "ok, you can have a couple of tests but if there are 7 or 8 or whatever pieces of work maximum 2 of them tests or whatever, the rest of them have got to be..."

SO YOU COULD ACTUALLY SHAPE THAT, SO THEY ARE GOING TO BE PICKING THE TWO VOLUNTARY HOMEWORK ITEMS THAT THEY HAVE CHOSEN VOLUNTARILY, SO THAT, SO THERE'S THAT SELECTION IDEA.

Yes. That's sort of what I'm thinking but it will depend on the standard of the class and all that sort of thing.

WE'VE CHANGED ALL THAT. YOU SAW THIS, DIDN'T YOU?

Yeah.

WE'VE CUT DOWN THE NUMBER OF CORE ITEMS TO 4, PUT THESE AS OPTIONALS. I DIDN'T ACTUALLY CHANGE THE ITEMS

Right.

AND I'M NOT CONVINCED, FOR EXAMPLE THE LIBRARY TASK, I'M NOT SURE THAT THAT WORKS AT ALL. WE THOUGHT THAT THESE WORKED QUITE WELL - THE AUTOBIOGRAPHY, LOGO DESIGN AND INVESTIGATION SEEMED SATISFACTORY.

Mmm.

AND WE NEED TO DEVELOP A BANK OF THOSE.

Mmm, yes.

IS THERE ANYTHING YOU'D DO DIFFERENT?

Not with the not with the class I had, not with the ability level class I had. If they were, well if they had done a good job and most of them had done say the first one, they'd all say done the first one, then the spreadsheet one I may have got interested in doing a few more, but as I say with the ability of the kids and not doing a lot at home you can't put a lot on to them.

THOSE RATES 70% 40% 30% ARE DECLINING AS YOU GO THROUGH THE YEAR. NOW IS THAT BECAUSE THEY GOT LESS INTERESTED IN PORTFOLIOS OR LESS INTERESTED IN MATHEMATICS AND LESS INTERESTED IN ASSESSMENT?

I think just less interested in doing anything.

YEAH, SO THE ACADEMIC WORK WOULD BE SIMILAR?

Yeah, I mean first term not a problem, you can get them wound up and that sort of thing and get a fair bit done, um, but its only the better kids who keep going through the year only half a dozen of them and that's basically where I've taught to. I've just tried to gee the other ones along so that they're doing a bit of work during the period type thing. But its only the half a dozen the good half a dozen or so, perhaps ten at the outside who probably completed all three of them.

SOME OF THE GOOD KIDS GET QUITE A GOOD MARK.

Well, I don't know. That's why I felt a bit sorry for some of those kids that I didn't do a bit more, but I actually ended up concentrating with them on the sort of work they're going to have to do for School Cert for next year because I think half a dozen of them need to have a go at the School Cert maths. Although in yesterday's exam I just wonder about the reading content of it and that sort of thing.

THERE'S SOME VERY PORTFOLIO TYPE QUESTIONS THERE.

Mmm.

I MEAN ONE OF THE QUESTIONS WAS A STRAIGHT COPY OF ONE OF THE PUZZLES WE'VE GOT DOWN THERE AND IT WAS A BLOCK

Mmm

AND A PUZZLE

Mmm yes

THEY'RE REALLY...

Yes. Straight lines and that sort of thing, they don't actually have a straight line question as such, it's hidden in something else. Kids don't always recognise it: you know, "draw the line on this straight line graph" or something like that, better ability kids will, but the average to below average kids won't.

MM. YOU SEE PORTFOLIOS AS BEING BETTER FOR THE BETTER ABILITY KIDS.

Yeah, well, yes. Although the lower ability kids, it does give them an area where they can achieve something. They can do a piece of writing even if they copy, not quite verbatim but just about, out of a book At least they can, you know, and then I asked a few questions about the piece they wrote about and they seemed to when I collected it in - it would have been no good down the track - but when I collected it in they seemed to have some idea of who they'd written about, that sort of thing, which I thought was quite good. But, they were pretty keen on the spreadsheets one, I think that's because we were in the computer room and we were doing in there. You see some of them didn't get to finish in the time allocated and of course they're not the sort of students to...lunchtimes.

...THERE WAS A PRINTER ...

... But you see a lot of them aren't the students who would go back at lunchtimes if they want to print something out or "I've just got this table to finish" or "this graph to draw". No, they wouldn't go back and do it and I just got to the stage of saying "Well, ... "

Whereas, a good class, the kids would just pop in at lunchtime to print something out if they hadn't had money in their account or something like that.

WELL, THANKS VERY MUCH [name] FOR LETTING ME TAPE IT

.....

Not really, I think it's useful for them to have something different to do but long as people can appreciate that there are going to be some classes who are going to be able to do it all and as you go down the levels the kids are going to have less chance of doing it all, or cutting down on it, a good idea.

YOU SEE, WHAT YOU'VE DONE IS, IF YOU DON'T MIND ME SAYING IT, YOU'VE SEEN THIS AS A RESOURCE, YOU'VE APPLIED YOUR PROFESSIONALISM, AS AN EXPERIENCED TEACHER TO SAY "I CAN'T USE THAT ASSESSMENT SCHEDULE

Mmm

THIS IS WHAT I WILL DO. HERE'S AN ITEM WHICH I THINK WILL WORK WELL" AND IT DID.

Mmmm

TO ME, THAT'S WHAT MADE THIS WORK AND THAT'S QUITE GOOD.

Appendix U

To: Maths staff
From: Paul
25 May 98

Summary of responses to the May 98 Teacher Survey

Thanks for doing this survey! 75% teacher response rate, which is 15 of the 19 classes. Here is a summary of responses:

On the whole, have your students done the items due to date?

Yes 13, No 2

“There are a couple of useless ones that haven’t/will not ever hand work in.”

Roughly, how many of your students have items overdue from last term?

Mean 5.53, standard deviation 5.52, mainly Form 4

Are you satisfied with the standard of your students’ portfolio work?

Yes 12, No 3

“Varied quite a bit but students generally put a lot of thought into the autobiographies.”

“Some have really put a lot of effort in - others have produced a ‘rush job’.”

Would you like more direction about how to mark the items?

Yes 13, No 2

“Perhaps you could develop a standardized marking sheet which could be used across all portfolio topics, ie. a criteria-based scheme. 0 for ‘nothing handed in’, 1 for ‘shows little effort/detail’, etc, 5 for ‘marvellous, superb, please teach the class for me oh wondrous one!’.”

“I have used Good, Very Good, and Excellent. (Two of mine were exceptional.)”

“Some guidelines/suggestions would be helpful but still need to leave flexibility.”

“I think this is dependent on the level of class/teacher’s expectations.”

Feedback from parents, eg. Parents’ Evening:

“None” for 10 classes. Positive otherwise.

“Enjoyed the F4 interview, able to monitor what is due and when.”

“Did not ask, so did not get an answer.”

“Excellent feedback from the parents - involvement in the ‘Interview’.”

“A number of parents were aware that their students had done them.”

Feedback from students:

“More work - not another assignment.”

“Most seemed willing and keen to do a good job.”

“Reasonably keen to get them in and know their mark.”

“They have been quite happy.”

“Most seem keen and enjoy the challenges.”

“Most have difficulty getting organized.”

“Not so positive.”

“Many of them appeared to enjoy doing it.”

“Seem to enjoy the structure ie. folders, due dates, continuing work.”

Your own concerns and comments. These headings are just to prompt some ideas.

About the Form 3 autobiographies:

“A ‘pain’ having to chase people who haven’t handed in this work.”

“I learned some interesting information.”

“A good idea.”

“I found the autobiographies were very helpful. Most of the kids were honest about where they were at with maths and that opened up some useful disclosure that is not normally possible in the classroom format.”

“None. I learned some interesting information. Card games seemed to feature. (Mostly played with Gran.)”

About the Form 4 interviews:

“A good idea - some were really negative beforehand but much more positive after doing it.”

“I found them interesting to read and they had impact on the students’ awareness of maths in use everyday.”

“Some were well thought out.”

“Surprising range of responses. Parents volunteered plenty of info. Many seemed to enjoy the participation.”

About the Form 4 value for money investigation:

“???”

“Not all in for marking yet.”

“Most students had no idea what to do and assignments reflected this.”

“Not clear enough.”

“Needed a lot of direction to the students. Would be better timed with the statistics topic. Most had no idea what to do - often said an item was value for money because they could afford it and some compared apples with pears. To have been an exercise of benefit, learning tool, for them more understanding of comparisons was needed.”

The big picture:

“Logo activity: wasn’t sure what the learning outcomes were. Students had a ball on the computers but few actually on task. Maybe the (task) path was too long and errors frustrating to correct. No-one in my group got past the first activity.”

“Adds up to lots of extra work marking and keeping track of it all. The autobiographies and interviews are good - did not enjoy the value for money investigation. It appears that those who like social studies and writing a lot about very little enjoy it - other students moan and groan.”

“Just a wee problem about the administration role of things and what’s the best way of keeping all these portfolios?”

“Getting Year 10 to take responsibility is a slow process.”

“Think it’s worth persevering worth.”

“Portfolios have never appealed to me in the past but I’m fast changing my opinion.”

“Perhaps they need to have a more set out criteria.”

I have begun interviewing students drawn randomly from every junior class. It seems interesting and worthwhile! The feedback about maths in general has surprised me: they enjoy maths and like doing it and express this more strongly than I ever expected. They seem quite happy about the portfolios and see them in a context of similar “project” work in primary school and in other subjects. They like showing parents/working with them.

I hope to see all the students again later this term to see how it is going as they get a little more involved in the portfolios. (Some classes are only just starting.)

Thanks for your feedback. Keep talking to me and don't hold back about negative experiences and difficulties!

Appendix V

Summary of responses to the May 99 Teacher Survey

100% response rate: 12 teachers of junior classes.

On the whole, have your students done the items due to date?

Yes 7, No 5

Three of the four teachers new to [the school] in 1999 indicated No.

“Had to push a great deal.”

“And several more.”

“The 3rd form class (average to above in ability) aren’t too bad. The 4th form (low A-band) are not the slightest bit interested. Most have not completed even one item. Most of these are struggling with classwork and it is an onerous task trying to chase them up for portfolio items. I have reinforced the fact that portfolios are worth 20% of year’s work - they appear unfazed. (Most cannot afford to give away 1/5 of year’s work).”

“Too much work to cover at this stage of the year, it may be easier later.”

“No - however, getting better.”

Are you satisfied with the standard of your students’ portfolio work?

Yes 8, No 4

“Despite leading them through, many students still satisfied with minimum.”

“Yes, but not all students are meeting the standards.”

“Will improve as the year goes on.”

“Just.”

“Again, 3rd form class have produced work of a high standard. 4th form work (ie. the work handed in) is very mediocre and totally unacceptable.”

“Of those that have completed work, results have been average.”

“I’m a bit unsure if I’m marking too easily though. Will get confirmation from [another teacher, named].”

“Standard of ones handed in is fine.”

Would you like more direction about how to mark the items?

Yes 2, No 10

Both of the Yes teachers were new to [the school] in 1999.

“Although I mark according to: Completion 3, Depth 3, Presentation 3.”

“I think this should be teachers choice. An overall mark for reports of 20, 15, 10, 5 is fine but different items should be marked according to assignment criteria.”

Feedback from parents, eg. Parents’ Evening:

7 teachers indicated “None”.

“Some have commented, especially on the interview.”

“Little to none. (Although at that time of the year, there wasn’t much work completed for portfolios.”

“A few comments about the interview. One very positive.”

Feedback from students:

“They like the folders they go in.”

“Students who do a good job show pride in work. Some do very well and are enthusiastic.”

“Some are inspired, most are indifferent.”

“None yet, though some have wondered about low marks.”

“The Fourths seem very settled about portfolios.”

“They don’t seem too interested nor do they show any great enthusiasm. (It sort of gets lumped alongside ‘homework’). I really haven’t got much time to cover this work in classtime.”

“Mostly my students seem to find it all takes too much effort. That’s a comment on their work in general too. They find it difficult to read a lot of instructions.’

“Seem to enjoy doing things which require colourful presentation. (Lower ability classes very poor response & are a waste of paper.)”

Your own concerns and comments. These headings are just to prompt some ideas.

Workload

“Much better with only one class on them.”

“No real extra workload although have spent some time developing appropriate activities.”

“Not too much time spent.”

“Extra marking takes time that seems to be less and less available.”

“I think assignments etc should be part of every maths classroom whether they are contributing to a portfolio or not.”

“I haven’t spent too much time on portfolios yet. I am concentrating on understanding test contents. I find it difficult to complete (thoroughly) course content before common tests. (I am scared of my class not showing up well compared to the others!).”

“The marking of items is no problem - however chasing up portfolio work is a nuisance.”

“A bit high for the kids. Substantial marking load for the teacher!”

Interesting aspects

“Gives a real project feel even if for a short time. I like that as it takes away notes/exercise delivery for a while.”

“Feedback from interviews.”

“How much effort some of the better students put into their investigations. Not marked on ‘prettiness’.”

“Good quality work is always pleasing.”

“Not a bad idea for ‘higher ability’ students. I don’t see lower ability students making many gains.”

“Good to do non-textbook work.”

Administration

“No real increase.’

“Another ‘must be done’.”

“Not difficult.’

“A databank of ideas is useful for teachers to pick and choose from.”

“Marking scheme makes no sense. Why only 0, 3, 7, 10?”

The big picture:

“I think it will take me a bit longer - time/workload to build up a bank of usable resources. BUT WORTH IT.”

“As a teacher I think there is some value in collecting work the students have done to make a portfolio but I would like to aim to have say six pieces of work which I have set which relates to their classroom work rather than set items. For a low level class the task of doing a mathematics autobiography for most of them highlights the negative experiences they have had. The tasks involve writing and reading which many of them find difficult.”

“Fills a gap in the scheme.”

“Will benefit the students in the long run.”

“I think I would rather set portfolio items that relate specifically to what we are doing in class. (In fact I have done this for optional items.) I find the ‘set items’ more of a problem - they often don’t relate to the classroom teaching at the time.”

“I think it’s a neat idea.”

“I’m not sure about the value of these portfolios, whether they enhance the kids’ maths skills/attitudes or whether its just a dressing up exercise.”

“Portfolios are good for getting them to think about how maths can be used in a variety of ways in the real world.”

Appendix W

Responses to Oct 99 Teacher Survey

92% response rate: 11 out of 12 teachers who had junior classes.

To: Teachers of junior classes [teacher codes given]
From: Paul Brown
October 99

Re: Portfolios - a last chance to air your views

[Contact and questionnaire return details given.]

Thank you all for completing the last survey, sent in May. Attached is a sheet about what I made of your comments.

[Personal message here.]

I have been reading extensively about education, assessment, and changes in professional practice. Basically, I've been trying to see what the two years of mathematics portfolios at [the school] say in regard to current educational research. That's why I have some new questions for you. They are numbered so that you can use extra paper if there is not enough room here.

1. What, if anything, did you discuss with other [this school] teachers about portfolios this year?

"I looked at some of the work students from other classes produced, and discussed it with the teachers concerned. I was very impressed with some of the work I saw."

"Aspects of assessment, marking."

"Potential extra activities."

"Just general stuff, eg. 'How are you going with your class?'"

"Only the requirements/marking schedules."

"What was done in other people's classes."

"Giving resources and ideas to others and collecting marks. Trying to keep people on track! Most don't like being told how to mark it."

"Asking others if they were getting them in."

"How worthwhile are they? Are they beneficial to students across the board?"

2. What are the reasons you would recommend or not recommend portfolios to teachers at other schools?

"Recommend them only as a retrospective collection of work."

"It depends on the ability level and motivation of the students. I have found them hopeless with my 4th Form [middle stream]. It is difficult enough to motivate them to do homework and bring equipment to class! My 3rd Formers were better, yet still rushed their work a bit."

"Recommend as a chance to do Mathematics from a different perspective."

"Builds pride in work."

"Recommend - it is something different from routine number crunching."

“Would not recommend them for use with lower ability classes. At least would recommend different tasks to be done compared with higher stream classes.”

“Cumbersome & time consuming. Still not convinced of their value.”

“Can be an opportunity for students to think beyond notes/exercise skills type activities.”

“Recommend: nice for the students to keep their extra work together. Makes you continually work on assignments, investigations.”

“Positive - good learning activities for able classes/motivated. Not overly useful for lower stream classes.”

“All right for lower ability students, giving them something to achieve (strive for).”

3. Teachers in some schools do not want to use portfolios for mathematics assessment. What do you think could be the possible reasons for this?

“Assesses the parents involvement or willingness to assist.”

“Some students appear to get quite a bit of parental help. Would this be fair for assessment purposes? I think it is great that parents become involved in their son/daughter’s work, but would be uncomfortable if it played a bigger part in overall assessment.”

“The written nature makes them more time consuming to mark unlike standrad setting out assessments.”

“Laziness?”

“Probably see it as different and extra work.”

“The imbalance in number of tasks completed in different classes.”

“Extra workload.”

“Time to complete content of course - which has also been an issue in the Yr 10 course. Value - do teachers see it as valuable?”

“Dependent on class and assignment, it is hard to make marking consistent.”

“?”

“Perhaps they see them as making more work?”

4. For you, what have been the unanticipated spinoffs from using portfolios?”

“Peaceful periods in the afternoon as low ability classes colour in or join the dots.”

“Opening up channels of communication with some parents. Seeing some of the ‘lesser able’ students produce some really neat work.”

“The enthusiasm that has taken students beyond my anticipated level of achievement.”

“None.”

“N/A”

“Excellent Cantamath assignments - had 2 ‘Highly Commended’.”

“Nothing.”

“None noticed!”

5. For you as a teacher, what was the downside of using portfolios?

“Time!”

“Chasing students all the time for their work. I found that I had to set a very short timeframe from the time I handed out the assignment until the time they were due in. (otherwise they lost them, forgot about them, etc, etc). This probably meant that the work was a bit rushed, but otherwise it didn’t work too well.”

“Put pressure on to assess core elements of the Y9/10 curriculum.”

“Displaying work on walls vs. placing in portfolios.”
“Extra work organising, getting items in completed and on time, and marking.”
“Difficult to motivate students & collect work. Tasks too difficult.”
“Chasing up items - marking difficult when this occurs! Finding suitable items.”
“My own management of time and short sharp ideas for portfolios. Both will improve.”
“Would have always used them anyway. Now I just keep it all together in nice folders. Needed to come up with simple ideas for the low levels.”
“Trying to remember to collect back work after they have seen it marked.”

6. I’m interested in whether portfolios have encouraged parents to be more involved in the mathematics learning of their children. Please tell me what you have found out about this.

“Not much - but relieved that I won’t need to suffer as a parent next year.”
“Yes, in many cases. However in many cases the portfolio tasks didn’t really relate specifically to the topic(s) we were covering in class. I would prefer that they did.”
“in some items where interaction with parents has been involved, positive comments have been made at parents evening.”
“Nothing - haven’t heard anything about it.”
“Don’t know.”
“Difficult to motivate students and collect work. Tasks too difficult.”
“No mention made at any stage by parents.”
“Not a lot. Have sought little parent involvement.”
“Mmm, not sure.”
“No feedback.”
“Nothing noticed.”

7. To what extent have you felt “pushed” into using portfolios, using common portfolio tasks, marking the same way as all the other teachers...?

“Somewhat...”
“I guess I have felt pressured a little because the tasks are part of their overall assessment. For the 4th form I have had to readjust the tasks and simplify things a great deal. I have encouraged many small tasks rather than larger research ones - but they have been practically based.”
“Minimal.”
“I haven’t felt pushed at all. Didn’t use the marking scheme because it was too inflexible.”
“I probably wouldn’t have used portfolios unless I had been given the necessary ‘push’!”
“I wasn’t aware there were other options.”
“Because its part of the assessment the class would be disadvantaged if items not done - big pressure. Marking the same as others not an issue.”
“Pushed - yes but I prefer to have it this way. Otherwise it is too easy to allow it to slide. Have not had to mark individual items in the same way.”
“Not at all, I have done the portfolios my way and using the topics/assignments I choose.”
“No pushing.”
“A lot!!”

8. In what ways do you think that the portfolios have advantaged your students?

“The ones who like Social Studies like it.”

“Not a great deal at all.”

“Variety.”

“Pride in work - neatness, clarity. Keeping it means it must be important!”

“The opportunity to do individual research and put extra effort into computer use and presentation. I think that the bulk of students don’t mind doing projects providing it doesn’t require too much thinking or effort.”

“Not at all.”

“Some have produced neater, well presented items than their general work.”

“A few students provided good looking work with real maths.”

“Makes them understand maths in the ‘real’ world.”

“Think outside the square. See practical ways where maths is used.”

“None!”

9. Classroom time can be spent listening to the teacher, doing exercises, groupwork, problem solving, copying notes, and many other things. In what ways did using portfolios change the balance of how time was used by students in your classroom?

“We didn’t work on Portfolios in the classroom - we undertook some group tasks but I didn’t include these as part of the portfolios.”

“Moved me out of the classroom to the Library. Encouraged students to use IT - searching for info, typing it up.”

“None.”

“It didn’t.”

“No real change.”

“Not a lot of difference. Focussed mainly on completing content based work.”

“Most portfolio items were homework assignments or 1/2 periods in library or internet.”

“None - all completed outside class time. Only classtime used = explanation.”

“It gave them ‘assignments’ to do at home, rather than ‘classroom homework’.”

10. Do you think all the [school] teachers implemented portfolios in a similar manner? If not, what are the important differences you are aware of?

“No - different classes, different materials.”

“As mentioned above, I have had to adapt the level of difficulty of the tasks with my 4th Form. The idea of Portfolios is to display individual work (research etc) - yet my 4th Formers appear so disorganized that this expectation is unrealistic. Some teachers have done a lot of Portfolio work, others possibly minimal amounts.”

“Different approaches to marking.”

“I have no evidence, but I feel there is an inconsistent approach. One of my inconsistencies is ignoring the marking scheme!”

“I can’t really comment on what other teachers have done/are doing - I don’t know. I think some have placed more/(less) importance on portfolios than others, and have therefore been more encouraging toward the quality and completion of tasks.”

“No.”

“Basically the same.”

“No. Some did very little to some who did a lot.”

“No, I think many don’t like being pushed to do them.”

“No idea.”

“Some worked at it seriously, others still have not got their act together!”

11. Please tell me about any portfolio work of your students which caused you to change your judgement of their mathematical abilities? (If there are any, I would welcome copies of work which did this.)

“No.”

“Nothing so far.”

“?”

“N/A. From memory they performed to expectations.”

“None.”

“Environmental maths assignment. Showed many students enjoyed taking photos of plants, fences and buildings.”

12. Has the use of portfolios changed the degree of your enthusiasm for teaching mathematics?

“No - if you're not part of the steamroller, you're part of the road.”

“No, not really.”

“No.”

“No.”

“No!”

“Not particularly - But I still believe it is the way to go.”

“I always was!”

“No!”

Thank you for completing this (final!) survey.

Appendix X

Responses to Teacher Survey Oct 2001

7 responses received, including that of the new Head of Department.

Thank you for doing this questionnaire! Feel free to expand on the points that are important to you.

1. What, if anything, did you discuss with other mathematics teachers about portfolios this year?

“Whether we keep them.”

“‘Portfolios’ did not operate at [the school] this year for various reasons. I was not part of the discussion to not run them this year (will presumably run next year).”

“The need to re-instate them!”

“Whether - they should continue,; if students enjoyed them; are they worthwhile; what staff thought about them.”

“Recall a discussion earlier in year to shelve the idea for repackaging later.”

“I started doing Portfolio work with my Year 9 class at the start of the year and only discovered (end of term 2) we had let them go for the year.”

“Very little. Portfolios were not given a high profile this year.”

2. What are the reasons you would recommend or not recommend portfolios to teachers at other schools?

“Only introduce them if you are going to use them properly and have a clear shared purpose. Unless all staff are on board then the purpose gets lost in some classes.”

“Portfolios add variety to ‘normal’ math teaching. Some students really accept + enjoy the challenge of ‘extra’ work - doing research etc (likewise many don’t!). Allows greater flexibility in assessment.”

“A good way to assess more creative work. A chance for the less able to do well.”

“Assess different aspects of maths. Uses different media. Non-threatening assessment.”

“Would only recommend them as a summary of a years work. Very few students could come up with interesting, creative and productive investigations.”

“I would recommend them to other teachers as a good way to encourage work that can be kept & looked at at the end of the year. Quite a few take much pride in presentation.”

“I would recommend portfolios as a way to introduce variety to the scheme.”

3. Teachers in some schools do not want to use portfolios for mathematics assessment. What do you think could be the possible reasons for this?

“Lack of understanding of purpose. Unfamiliarity with marking style.”

“Probably because they are ‘traditionalists’ - don’t like change, are comfortable with what they are already doing. (I can relate to that!)”

“Extra work. Not like traditional tests.”

“Extra work. Consistency. Possibility of several answers - moderation needed.”

“The pendulum is swinging back to the toolbox idea for mathematics, but basically they are resisting attempts to change for change’s sake.”

“Too much extra marking?”

“Time constraints.”

4. For you, what have been the unanticipated spinoffs from using portfolios?

“None - advantages have been as expected.”

“You see aspects of students you weren’t aware of. You can get more ‘personal’ with students - ie. good opportunity to, possibly, talk to kids on a one-to-one basis - perhaps about pet interests of theirs.”

“n/a”

“The way I have done it by collecting work over the year and then returning it at the end for them to select and decide, the interest the kids showed in their own work and a week of focussed peace at the end of the year while they were happy + occupied. We all left happy at the end of the year.”

“The enthusiasm from some of those students who had not previously seemed enthusiastic about Maths.”

“This year none since they haven’t been integral to the Y9 and Y10 schemes. In past years they have given the students some pride in their work.”

5. For you as a teacher, what was the downside of using portfolios?

“Marking, but then I’ve always created portfolio type assessments and had to mark them. Nothing new.”

“I’m a traditionalist (see #3) - I just want to get in front of the class and get on with ‘normal’ maths. Portfolios sometimes mean group work where I have less control over behaviour. I am also reluctant to give up class time when you are behind teaching the normal curriculum (common, the way I teach). I do not like marking of any sort, Portfolios represent more.”

“None.”

“Other peoples different interpretation.”

“The extra marking. The loss of time teaching the curriculum.”

“The time taken to process them.”

6. I’m interested in whether portfolios have encouraged parents to be more involved in the mathematics learning of their children. Please tell me what you have found out about this.

“Some yes, others no.”

“?”

“Nothing.”

“Nothing.”

“Not much - but I would have been driven mad as a parent if my kid had done one.”

“Nothing!”

“In the past the feedback has been positive when the issue has been raised at parents evenings about portfolios and their issue.”

7. To what extent have you felt “pushed” into using portfolios, using common portfolio tasks, marking the same way as all the other teachers...?

“Nothing new to me.”

“I do feel pushed - but only to the extent that I have to do it - set up the tasks, marking, meet deadlines etc.”

“Didn’t like the marking scheme.”

“None as we’ve not used them.”

“Somewhat, but being totally belligerent I resisted.”
“If it is a department decision one has to go along with it.”
“Not at all this year.”

8. In what ways do you think that the portfolios have advantaged your students?

“Allowed different skills to shine.”
“Give them a chance to shine.”
“None this year!”
“?”
“It has advantaged those not before enthusiastic about Maths. Has given those into drawing and colouring in a chance to display these skills.”
“When done they have been an advantage in that they have encouraged the students to go beyond the routines of notes/classwork/homework.”

9. Classroom time can be spent listening to the teacher, doing exercises, groupwork, problem-solving, copying notes, and many other things. In what ways did using portfolios change the balance of how time was used by students in your classroom?

“Didn’t. It’s always been part of my programme.”
“None this year (see #1). Previously, Portfolios didn’t take up too much time - I didn’t allow it (see #5).”
“More ‘creative’ work.”
“None.”
“It reduced the time for most of the things noted above.”
“N/A in 2001.”

10. Do you think all the teachers at your school implemented portfolios in a similar manner? If not, what are the important differences that you are aware of?

“No. Some didn’t do it. Marking styles vary. Tasks vary.”
“Some were more enthusiastic than others, offering more advice and encouragement.”
“No - not all did all the items, not all invented ‘extras’.”
“No - some tried to do interesting + creative things.”
“No! I was the only one (apparently) doing it in Year 9.”
“N/A in 2001.”

11. Would you like more direction about how to mark the items in your students’ portfolios?

“Will be providing exemplars for staff.”
“Yes - only for consistency.”
“No.”
“No.”
“Yes.”
“No.”

12. Please tell me about any portfolio work of your students which caused you to change your judgement of their mathematical abilities? (If there are any, I would welcome copies of work which did this.)

“Don’t necessarily change my judgement, more help me to make one. Particularly useful to help identify or confirm gifted students.”

“?”

“In examples I have seen, it does show parents mathematical abilities or the ability of some students to enthuse on trivialities.”

“I didn’t notice any change in mathematical ability but there were improvements in setting out from the first ones to later ones.”

“N/A in 2001.”

13. Has the use of portfolios changed the degree of your enthusiasm for teaching mathematics?

“No.”

“No.”

“No.”

“They will do hopefully.”

“No.”

“No.”

“To some extent when the topic matches an area in which I am interested.”

14. What do you think should be the future of portfolios in mathematics teaching over the next two years?

“Should continue but with a lot of staff education because when I arrived at [the school] they were not working properly.”

“I am happy to do them or not do them - I don’t feel strongly either way. I will do what I am told (as always).”

“Keep going/reinstate.”

“Used for improving student esteem and for assessing process skills.”

“In the vague hope that the curriculum document will be reviewed, improved and have the flaws removed, I hope that portfolios will come second to this larger issue.”

“I think there is a place for them. Staff need good guidance on their use and worth.”

“They should be reintroduced as part of our Y9 and Y10 scheme but not spoiled by excessive assessment and analysis.”

15. Other issues/the big picture

“NCEA [National Certificate of Educational Attainment] is going to put time demands on staff, I can see many pushing portfolios away using NCEA as an excuse.”

“My views probably do not represent typical views of maths teachers. I am only a part-time maths teacher - happy to teach maths but not interested in ‘re-inventing’ the subject - I’ve got more than enough to do in my own subject. Hence - I don’t think about it - I just do what I have to.”

“Not used this year.”

“Time should be allocated at both Year 9 and Year 10 levels. All teachers in these levels should be encouraged to do the portfolio work where it is indicated in the syllabus for that level.”

“The big picture as I see it is that portfolios can fill in some of the gaps in the vast tapestry of mathematics (or numbers if painting by numbers), and give extra breadth and depth to Mathematics.”

16. About yourself: Name (optional):

How many years of teaching mathematics:
From 3 to 31.

How many years at [the school]:
From 1 to 31.