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MATHEMATICS ASSESSMENT
IN THE PRIMARY SCHOOL

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This research study contains no material which has been accepted for the award of any other degree or diploma in any tertiary institution. To the best of my knowledge and belief, this study contains no material previously published or written by another person, except when due reference is made in the text of the research study.

J. Siemink
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Abstract

As society evolves and changes, so does the education system within it. Educators, and in particular teachers, are constantly looking for more effective ways to develop children's knowledge, understandings, attitudes and skills. The changing needs of society, as well as changes in educational philosophy, have led to the development of "new" curriculums and guidelines in the mathematics area, as well as in other educational areas. One important, and complex, aspect of these documents, and of current teaching and learning practices, is the issue of assessment.

A number of factors relating to the issue of assessment are considered in this study. These factors include the aims of assessment, what to assess and when, the use of the most appropriate and effective methods of assessment, and consideration of the role that assessment plays in the context of the complete mathematics program in view of the current changes in educational philosophy and practice.

The Australian perspective on mathematics assessment is examined and some of the recently occurring changes in assessment and reporting practices are outlined briefly.

In a case study on assessment and reporting practices, a series of questions on assessment are given to eight teachers from one school. These questions aim to determine the essential components of their assessment practices and the role that assessment plays in their classroom mathematics program. Some of the results of the investigation are then compared with associated research on assessment.

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Chapter 1

Introduction

As society evolves and changes, so does the education system within it. Educators, and in particular teachers, are constantly looking for more effective ways to develop children's knowledge, understandings, attitudes and skills. The changing needs of society, as well as changes in educational philosophy, have led to the development of "new" curriculums and guidelines in the mathematics area, as well as in other educational areas. In Tasmania, these documents include The State Mathematics Guidelines K-8, The National Profiles, and Our Children: The Future. One important, and complex, aspect of these documents, and of current teaching and learning practices, is the issue of assessment. Stephens (1992) suggests that "in Australia and in many other countries, the reform of assessment is seen as a necessary condition for any reform of the mathematics curriculum". He adds that "past attempts at the reform of the school mathematics curriculum have foundered because assessment practices were left unchanged"(p.vii).

There are a number of issues in mathematics assessment which are currently being considered by both researchers and educators. One important issue is that of the role assessment plays and its relative importance within the classroom, school and education system. Webb and Briars (1990) suggest that continual assessment is "particularly important in grades K-8, where students form the foundation for further learning in mathematics". They define assessment as the "process of determining what students know" and they suggest that this information can be "used to guide the development of subsequent learning experiences"(p.108).

Other assessment issues include the purposes of assessment, the appropriateness of more traditionally favoured methods of assessment, what should be assessed and for whom, and the recording of assessment. An additional current controversial issue among researchers (Stephens, 1992; Collis, 1992) is that of whether assessment should follow or lead the objectives of the mathematics curriculum.

The aims of this study are to explore these issues and to examine current and possible future educational assessment practices. The study also aims to consider national and state mathematics documents and to look at possible implications for the classroom.

Information for this study will come from a number of sources. The primary source will be from current research literature on assessment. Additional information will also come from national and state curriculum documents, from information provided by mathematics consultants in different Australian states (in the form of documents and verbal information over the phone), and finally from a case study in which eight teachers in one school were interviewed about assessment.

The case study is limited in that it only considers the knowledge and views of eight primary teachers, and it therefore cannot give any generalisations about teacher's views on assessment.

This study will consider assessment from a number of different perspectives. In Chapter 2 there will be a review of the literature on mathematics assessment in general, while in Chapter 3 the Australian perspective on assessment will be examined more closely. Chapter 4 will then outline the methodology of the case study and its results. It will also compare some of these results with associated research on assessment. Finally, Chapter 5 will consider the teaching implications of the literature on assessment and of the case study results.

Chapter 2

Outline of Research on Assessment

This chapter will review the literature on research relating to mathematics assessment in the primary school. It will consider the definition of assessment, the purposes of assessment, what to assess and when, changes in assessment, assessment methods and the recording of assessment.

Defining assessment

The Tasmanian Education Department (1991), in its document Our Children: The Future, defines assessment "as a process which entails acquiring information about children's learning and making judgements on the basis of that information"(p.3). Webb and Briars (1990) suggest that assessment is an interactive process between the teacher and student "with the teacher continually seeking to understand what a student can do and how a student is able to do it and then using this information to guide instruction" (p.108).

The document Our Children: The Future also distinguishes between *formative* and *summative* assessments. It defines formative assessment as "assessment done specifically for the purpose of providing feedback which will help children in their learning", and summative assessment as an "assessment normally done at the end of a major period of learning for some kind of reporting or program evaluation purpose" (p.6).

Purposes of assessment

The purposes of assessments are defined by the context in which they take place. Within the primary mathematics classroom, assessment is mainly used to provide feedback and to inform action, and forms an active

component of teaching practice. Maxwell (1992) suggests that assessment teaches both proactively and enactively:

"Assessment teaches *proactively* through its explicit or implicit defining of expectations, directing and focusing of student learning, indicating of appropriate boundaries on the subject matter, identifying of valued concepts and skills, specifying of the qualities that students should acquire and communicating of the standards they should emulate. Assessment teaches *enactively* through appropriate feedback on the quality of performance on the assessment tasks and on the direction of improvement which can be taken in the individual cases towards enhanced performance future"(p.288).

Similarly, Clarke et al (1990) state that assessment should play an active role in the learning process within the classroom. They outline the following purposes as major uses of assessment information:

- "* To improve instruction by identifying the specific sources of a student's error that requires remediation or the specific learning behaviours that might need to be encouraged and developed or discouraged and replaced.
- * To improve instruction by identifying those instructional strategies that are most successful.
- * To inform the pupil of identified strengths and weaknesses both in knowledge and in learning strategies so that the most effective strategies might be applied where most needed.
- * To inform subsequent teachers of the students' competencies so that they can more readily adapt their instruction to the student's needs.
- * To inform parents of their child's progress so they can give more effective support"(p.119).

As well as informing students, teachers and parents within the school context, some forms of assessment also inform the wider education system. According to Webb (1992), assessment may also be used to "provide information to decision makers, including those within the educational system, governmental policy makers, and others", and may be used to "provide information on the effectiveness of the educational system as a whole" (p.663).

What to assess and when

Traditionally most assessment of progress in mathematics has been directed at the knowledge of facts and definitions, algorithms, heuristics and problem schemas (Lester & Kroll, 1990). However now most research indicates that there are a number of other areas within mathematics education which also need to be assessed.

The National Council of Teachers of Mathematics (1991) in its Standards document outlined seven student assessment standards which focus on students' understanding of, and attitudes towards, mathematics. These seven standards are mathematical power, problem solving, communication, reasoning, mathematical concepts, mathematical procedures (including when, why and how) and mathematical disposition (including confidence, perseverance and interest). Webb and Briars (1990) expand on these assessment standards and suggest that the following should be included when assessing the standards:

"An assessment of students' knowledge of concepts should provide information about whether the student discriminates between relevant and irrelevant attributes of a concept..., is able to represent concepts in various ways, and recognises their various meanings. An assessment of students' knowledge of procedures should... provide information on what a student knows about the

concepts that underlie a procedure, when to apply procedures, why they work, and how to verify that these procedures give correct answers. An assessment of problem solving skills should provide evidence of a student's ability to ask questions, use given information, make conjectures, derive solutions to problems and generalise the solutions. An assessment of students' reasoning skills should provide evidence about different types of reasoning, an analysis of situations, the development of plausible arguments, and the appreciation of the logical nature of mathematics. An assessment of students' ability to communicate mathematics should be directed toward the expression of mathematical ideas, the understanding and interpretation of mathematical ideas, and the use of mathematical vocabulary and notation"(p.11).

Lester and Kroll (1990) have devised a model of assessment which takes into account knowledge acquisition and utilisation, control, beliefs and affects (four of the main factors which influence problem solving). In the model they have 'included an affects and beliefs component, a performance component, and a problem features component. The affects and beliefs component includes interest in mathematics, willingness to take risks, perseverance, motivation, and beliefs about mathematics problem solving and self. The performance component includes "cognitive processes" (understanding, selecting, implementing strategies, stating the answer in terms of data, evaluating the reasonableness of answers, and monitoring progress) and "getting correct answers". The problem features component includes problem type, strategies involved, mathematics content, data sources, and type of information. They suggest that it is important for teachers to include methods for assessing each of these components.

Assessment may be continuous, periodic or incidental, depending on the students, the activity, the objectives of the assessment, what is being assessed and the context of the assessment. Continuous assessment provides on-going information about progress and achievement, periodic assessment usually focuses on specific knowledge, skills or capabilities, and incidental assessment is useful for quick feedback about an activity.

Changes in Assessment

There is a current debate among researchers as to whether changes in assessment should be the result of changes in the curriculum or whether changes in the curriculum should be assessment led. Collis (1992) suggests that

"practitioners, who are now at the forefront of curriculum change are insisting that any reforms must be 'assessment led'. They recognise that evaluation is a necessary and valuable part of the curriculum process, and as such, must be built into all aspects of the process at all levels"(p.37).

However Stephens (1992) puts forward an opposing view, and suggests that

"assessment should follow the objectives of the mathematics curriculum and not lead it. There should be a clear linkage between the expressed learning objectives of the mathematics curriculum, the learning activities which are intended to give expression to those objectives, and how students' learning of mathematics is to be assessed"(p.vi).

As well as the debate on the direction of the connection between assessment and curriculum change, there is also the issue of whether assessment is based on the same educational philosophy as the other aspects of a mathematics program. Current educational practices in the primary mathematics classroom are becoming more child-centred, and more

focused on the child as a learner and as an active participant in the learning process. Researchers (Cobb, 1988; Jaworsky, 1988) have identified these educational practices as being based on a constructivist educational philosophy. According to the constructivist view of learning "the learner is not *given* the knowledge, but actively constructs it herself, and learning, or coming to know, is a process of adapting one's view of the world as a result of this construction"(Jaworski, 1988, p.292). Constructivist activities aim to assist the teacher in thinking about the child as a learner, and to encourage children to communicate mathematically among themselves, develop rational understanding and the ability to think creatively, and to help children to make judgements and to structure meaning (Cobb, 1988).

Several researchers (Niss, 1993; Galbraith, 1993; Wilson, 1992) have suggested that although the current curriculum is based on a constructivist view, assessment practices are still being driven by the traditional paradigm. According to Niss (1993), changes in content and activity in the mathematics curriculum "have not been matched by parallel developments in assessment, where values, notion and theory, practice, modes and procedures are concerned. Consequently, an increasing mismatch and tension between the state of mathematics education and current assessment practices are materialising"(p.4).

Clarke and Reed (1992) suggest that the main purpose of constructive assessment practices is to provide the information needed for action on the students' learning. Clarke et al (1988) state that

"we have a professional obligation to ensure that our assessment contributes constructively to the learning of our pupils and to ensure that all skills and attributes that we most wish to foster receive the recognition of appropriate assessment"(p.129).

According to Wilson (1992) an implication of the constructivist view of learning for the assessment and monitoring of student learning, "is that we must start measuring the understandings and models that individual students construct for themselves during the learning process"(p.78). He adds that levels of achievement should be defined in terms of 'best estimates' of the student's level of understanding of key concepts and principles underlying a learning area.

Constructivist assessment tasks tend to be open-ended allowing students to express and display what they have learned. They are primarily concerned with the exchange of information, with maximising opportunity for students to express the outcomes of their learning, and they should anticipate action (Clarke & Reed, 1992).

The mathematics curriculum is also changing in its content and focus, with problem solving skills now becoming a major focus area of the curriculum. A key objective of a problem solving program is to develop students' creative and divergent thinking skills. Polya (1973) said that teachers should bear in mind that their primary goal is to get students to "use their heads", that is, to think for themselves. According to Mason, Burton and Stacey (1982), thinking mathematically can be improved by practice with reflection, provoked by contradiction and tension, and supported by an atmosphere of questioning, challenging and reflecting.

Clarke (1988) suggests that "in order to effectively assess within a mathematics curriculum which emphasises applications and problem solving, we need assessment tasks which are sensitive to process as well as product". (p.1)

Assessment methods

There are a number of assessment methods which may be used within the primary mathematics classroom. According to Lester and Kroll (1990), a teacher's choice of assessment method depends on a number of factors, such as the concept or skill being assessed, the number of students being assessed, the amount of time available, the teacher's experience, the assessment purpose and the availability of assessment materials. They suggest that teachers choose techniques that both provide information appropriate for the goals of their assessment and that are feasible for use in their classroom situation.

Assessment methods can be divided into *informal* and *formal* type assessments. Clarke (1992) defines formal assessment as involving "the cessation of instruction, typically for the whole class, while an 'assessment event' is held", while informal assessment "involves the collection of information about student learning coincident with instruction, without disrupting the learning process"(p.157).

A traditionally used and well-known formal assessment method is that of written testing. Although in past years testing has probably been the most often used form of assessment, a number of researchers have outlined problems with it as an effective and sometimes appropriate method of assessment. One problem with test results is that they are usually given as a single score or as a profile of scores. Webb (1992) suggests that "it is difficult using only numerical scores, to describe how a student draws relationships between different mathematical concepts... or how a student goes about solving a problem"(p.663).

According to Joffe (1990) there are several other limitations of written tests, including that

"tests which claim to test numeracy (for example) do not directly address skills that are useful in real life, but rather try to infer

something about the ability to apply mathematics in context from the ability to remember decontextualised facts or standard written procedures. The items selected for inclusion often tell us little except that students have good skills for manipulating numbers" (p.141).

Thus the limitations of testing include that many tests do not reliably assess what they appear on the surface to be trying to assess, and that test results are often used to imply more than is valid (Joffe, 1990).

Although primary schools do not use the formal examination system traditionally used by most high schools, many primary schools do use standardised mathematics testing. Formal examinations and tests can have several additional problems. According to Izard (1993), formal testing may lead to teachers teaching to the test and to students believing "that the study of mathematics is the development of skills that are required by their teacher under test conditions"(p.187). Another problem with standardised tests are that they are primarily used as indicators to signal rises or declines in mathematical performance, but don't show what underlying understandings about mathematics students may have. Grouws and Meier (1992) suggest that "narrow forms of assessment, such as standardised achievement tests, tend to stress simple skills, rather than higher order thinking, or other more sophisticated tasks, not because they are more important, but because they are easier to measure"(p.98).

Tests can still be useful as an assessment tool if the limitations are kept in mind. According to Joffe (1990) when using or designing a mathematics test the following things should be considered:

- "* traditional test questions can be used to initiate a valuable diagnostic process, as well as serve as an end product;
- * we need to talk to students about their understanding... to find out what beliefs underlie their responses;

* we must be sensitive to the language in which problems are couched since terminology used can radically influence the outcome"(p.148).

As well as the formal (single-correct-answer) written test, there is also a range of other tests which may be useful for assessment purposes. These include open-ended test items, group tests, student constructed tests, and practical tests. When assessing using group tests Clarke (1988) suggests that the following procedure will ensure accountability within a group, as well as providing individual incentive:

"* Each person in the group must present his/her own written version of the group's solutions.

* Each person must list, on the first page of their test paper, the names of all other students who cooperated in the group.

* The group must submit their solutions together.

* Each person in the group will receive two marks - a mark as an individual and the average of the group's marks. The latter will be the recorded mark"(p.57)

An additional factor which may also be considered when giving students a test, in any of the forms mentioned above, is to remove time restrictions in order to allow students to work on the problems at their own pace.

A number of researchers have been studying the effects of environmental conditions on student performance and assessment results. Fischer, Kenny and Rose (in Fischer & Knight, 1988) conducted a study which demonstrated the effects of environmental conditions on problem solving performance. Fischer et al tested eight students from each of grades three through to sophomore year at college on arithmetic items. They tested each student individually under four assessment conditions. The first condition was the one most like the "normal" classroom assessment in which the student "spontaneously" answered a specific question about

an arithmetic relation. The student was then shown a sample good answer and there was a discussion of the arithmetic relation, before the same student was asked the same question again. The students were then told that they would be tested again on the same item in two weeks time. In the second session (two weeks later), conditions from the first session were repeated. There was initial assessment with no support and then assessment with the support of seeing a good answer. Fischer et al found that with environmental support the students performed at, or near, their "optimal" level, while with no support students performed at their "typical functional" level.

Fischer and Kenny (1986) suggest that the environment "induces the transformation of a skill to a new level" and that it also effects the level of performance of a skill. As a result of their study they recommend that students

"must be tested a) in familiar domains, where they have had the opportunity to construct high-level skills b) under environmental conditions that provide contextual support for high-level performance, and c) with the opportunity to practise the tasks they must perform" (p.63).

De Lange (1987) also outlines a study in which students were assessed under different environmental conditions. The OW and OC publication (de Lange, 1987) set out to evaluate both ikonic (primarily intuitive, visual) and concrete-symbolic (primarily learned, school-based) modes in one question. It described what was called the *two-stage-task*, which consisted of three distinct parts. The first part of the task "set the scene" and gave all of the necessary information, the second part involved answering specific questions mathematically including use of calculations, and the third part consisted of extended responses to explain, advise and discuss limits relating to the original section (part

1) and to the results to questions in part 2. In the first stage the students initially answered only the questions in part 2 under test conditions in a restricted time frame. Their responses were corrected and given back to the students with feedback. In the second stage the students did the whole of the test again at home without any restrictions. De Lange (1987) found that

"student results in the first stage showed the usual spread from poor to excellent; in the second stage all the students performed satisfactorily; girls performed less well than boys in the first stage but the difference disappeared in the second stage; students performing well in stage one performed equally well in stage two; students performing poorly in the first stage had their self-confidence enhanced when they did well in the second stage"(in Collis & Romberg, 1992, p.108).

Collis and Romberg (1992) suggest that the main advantages of this testing format are that it can be used to test students' abilities in both the ikonic and concrete-symbolic modes and that it tests what students know, allowing for optimal performance.

Other alternative assessment methods to traditional testing are also now being suggested and are given credence by a number of researchers. These alternative assessment methods include observation, interviews or conferencing, questioning, journal writing, self-assessment, peer-assessment, work sample folios, outcomes-based assessment, assessment based on SOLO taxonomy, error analysis, and interactive assessment.

Teachers are constantly observing and assessing students during their contact with them in the classroom. However, it is only recently that researchers have begun to recognise that these informal observation,

questioning and conferencing techniques are legitimate forms of assessment. According to Clarke (1988),

" teachers formulate definite and quite accurate opinions concerning the competence of their pupils, and formal assessment using tests commonly does little more than legitimise and quantify the assessment made through extended classroom contact. However, informal assessment generally lacks structure, and the information it provides while influencing teacher decision-making, is not systematically recorded and lacks the status accorded to a test score. Yet the quality of information collected informally is often higher than that obtained by conventional testing"(p.19).

Lester and Kroll (1990) state that observation and questioning can provide valuable information about students' mathematical performance, skills, attitudes and beliefs. They also suggest that "when using observation as an assessment tool, it is important to consider beforehand the purpose of the assessment in order to focus attention on the relevant aspect of students' work"(p.62).

According to Clarke (1988), questioning students about their mathematics

"is useful to gain a quick assessment of a student's understanding... (Teachers) should develop the ability to ask questions with statements or questions which do not influence the line of thought a student is following and the questions should encourage responses that expand or elaborate on a point rather than require a single word response" (p.17).

The questioning may be done informally or in an interview or conferencing type situation. Interviews may be done to diagnose difficulties and assess progress, to determine how students attempt a problem, to increase

student confidence, and to check a student's understanding of a particular mathematical concept or skill.

One classroom questioning technique designed for use with individual students is the Newman Five-Point-Error Analysis procedure (Newman, 1984 in Clarke, 1988). The procedure involves asking the student to find a problem that he/she cannot do and then to work through the following five points:

- "1. 'Read me what the question is asking you to do.'
2. 'Tell me what the question is asking you to do.'
3. 'Tell me how you are going to find the answer.'
4. 'Show me what to do to get the answer. Tell me what you are doing as you work.'
5. 'Now write down the answer to the question'"(Clarke, 1988, p.33).

These instructions are given to the student in order to identify the area in which the error may have occurred, with the points focusing on identifying reading errors, errors in comprehension, transformation errors, errors in the use of process skills, and encoding errors. Clarke (1988) suggests that

"research indicates that at least 40 percent of our children's errors on written mathematical problems occur before they even get to use the process skills... In particular, children and teachers need to focus attention on the transformation of a written task into a mathematical procedure. The five questions can usefully equip teachers (and pupils) to evaluate understanding and identify the point at which difficulties occur"(p.33).

Incidental and unstructured observation, questioning and conferencing based assessments, although stored in the teacher's memory, are often not recorded. However more structured observations may be recorded in

several ways. These include checklists (e.g. Appendix 1), journal format and annotated classlists (e.g. Appendix 2). According to Clarke (1988),

"observation notes by a teacher in the classroom are best restricted to significant events which can be later incorporated into a checklist if appropriate. A significant event is likely to be either atypical student behaviour, or a clear illustration of new understanding or lack of understanding"(p.20).

Another alternative form of mathematics assessment is student self-assessment. Clarke (1988) states that "one of the most constructive and empowering educational goals we might frame would be to equip students to *monitor their own progress*"(p.44). One method of self-assessment is student journal writing. Through regular journal writing students can describe what they have learned, summarise key topics, and reflect on and explore the mathematics that they have been doing. According to Southwell (1992), possible outcomes of writing in mathematics are to help students to clarify their thoughts and understanding, to allow students to express their learning in a way that can be understood by others, and to promote reflection. One limitation of using student journal writing as an assessment tool is that what students write is often very different to what they think.

Teachers' monitoring of the students' journals informs their teaching practice and may form the basis of individual teacher-student discussions (Clarke, 1988). Some teachers may choose to assess and report formally on the student journals, and Lester and Kroll (1990) describe three methods for formally evaluating students' written work on problem solving. These are analytic scoring, focused holistic scoring and general impression scoring. Analytic scoring involves the "use of a scale to assign points to certain phases of the problem solving process". Focused

holistic scoring "produces one single number assigned according to specific criteria related to the thinking process involved in solving the problem". General impression scoring "is an evaluation technique in which an evaluator studies a student's written problem-solving work, then relies on an overall impression to assign it a score on a scale"(p.63-64).

Another method of student self-assessment is to use a student response sheet. Clarke (1988) constructed a response sheet (Appendix 3) and an outline of what he calls the IMPACT procedure which utilises the sheet (Appendix 4). He includes the following questions in the response sheet:

- * What have you learned in mathematics during the past month?
- * Write down one problem which you have continued to find difficult.
- * What would you most like more help with?
- * How do you feel in mathematics classes at the moment?
- * How could we improve mathematics classes?

Clarke (1988) suggests that in order to maximise the value of the IMPACT procedure, the student response sheets should be confidential, regular and valued by the teacher. In addition, he also outlines several potential teacher and students benefits of the procedure:

"Possible teacher benefits include knowledge of students' difficulties with content, heightened awareness of prevailing student concerns, improved student-teacher rapport and the identification of more appropriate, more effective means of instruction. Students may benefit through the recognition accorded to their concerns; the opportunity to reflect on and articulate their experiences of mathematics instruction, and the possibility that their instruction may become both more appropriate and more effective"(Clarke, 1988, p.46).

Another effective way of monitoring students' progress is to keep a folio of specific samples of the student's work in mathematics during the year. The samples should be significant, relevant work samples which demonstrate the students' levels of understanding in different areas of mathematics, and their mathematical development or progress during the year.

Criterion-referenced assessment is an assessment framework which is now being seen as a legitimate alternative to the traditionally favoured test and examination-based form of assessment. The lower secondary Tasmanian Certificate of Education, introduced in 1989, is based on criterion-referenced assessment, and primary schools are now beginning to assess with reference to outcomes in the National Profiles. According to Maxwell (1992), "criteria are the various characteristics or dimensions on which the quality of student performance is to be judged"(p.293). Any number of criteria might be expressed for assessing any particular assessment task.

Maxwell (1992) suggests that some of the benefits of criterion-based assessment are that there is a better representation and communication of goals and capability; that there is improved orientation towards strategy; that the profile provides a detailed record of achievement; and that feedback can contribute to student improvement on the criteria. Some associated issues that he puts forward are the small number of feedback loops (due to the shortness of the terms), common versus tailored criteria and standards, the number and completeness of criteria, synthesising profile information, and staff time and effort.

In the United Kingdom, the Graded Assessment in Mathematics (GAIM) project attempted to implement a criterion-referenced assessment system using a variety of assessment methods. In addition to observation,

discussion and traditional classroom tasks and tests, the project recommended assessment methods which emphasised problem solving and investigative open-ended activities. The assessments integrated the use of criteria. According to Brown (1993), as a result of the project, teacher professionalism increased "with teachers becoming much more aware both of the nature of the mathematics they (were) teaching and of their students' individual achievements and weaknesses"(p.76). However, Brown (1993) says that the UK now seems to be going back to the previous position of traditional written examinations, and that there are disillusioned teachers and educationalists "who put a great deal of now apparently wasted effort into realising the positive effects of the earlier proposals"(p.82).

Another alternative method of assessment is the use of SOLO (Structure of Observed Learning Outcome) taxonomy (Biggs & Collis, 1982). It is a method of classifying student responses according to the structure of the response elements, and it aims to assess the structural level of the students' learning. The five levels of response structure in the taxonomy are prestructural (consisting only of irrelevant information), unistructural (including only one relevant piece of information from the stimulus), multistructural (including several relevant pieces of information from the stimulus), relational (integrating all relevant pieces of information from the stimulus), and extended abstract (extending the response to integrate relevant information not in the stimulus). A SOLO item usually consists of a short piece of stimulus material such as text, table or figures followed by open-ended questions concerning the material. Each question is linked to a successive level of the taxonomy, starting with the unistructural level. The SOLO taxonomy may also be applied to problems where the

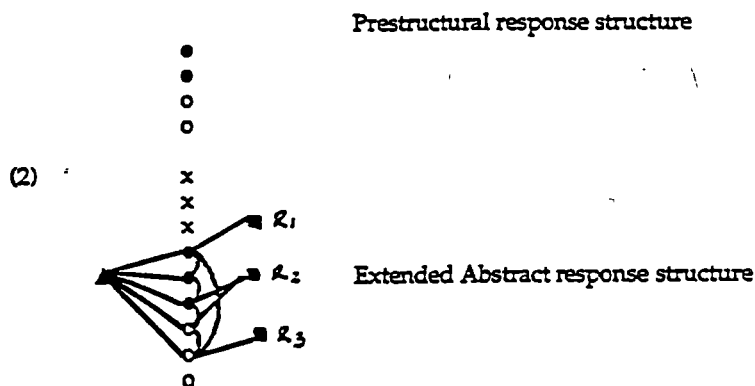
response (usually open-ended) can be assessed according to its complexity. According to Pegg (1992),

"The SOLO taxonomy is a categorisation system that enables student responses to a variety of stimuli to be assessed. It provides teachers, curriculum analysts, and researchers with a useful tool to interpret students' understanding, plan instructional sequences and analyse how students acquire concepts... It provides the teacher with a means of considering the quality of understanding" (p.368).

Chick, Watson and Collis (1988) conducted a study of first year students (at the University of Tasmania enrolled for the Degree of Bachelor of Education) in which task analysis maps or response maps were used to describe the SOLO levels on assignment items done by the students. The mapping procedure focuses on the student's response and on the way in which the student structures the data of the problem. The symbols used in the response structure (Collis & Watson, 1991, p.66-7) are shown in Figure 1.

Figure 1: Response Structure

- x - inappropriate or incorrect data, concepts, processes or strategies
- Δ - data given with the potential to cue a response
- - information from the question (including implicit formula/e if necessary) that is essential to obtain a correct solution
- - information external to the question which could be useful



Collis and Watson (1991) showed that "it is possible to map responses to problem situations in a manner that highlights the way in which the individual has structured the given data and the necessary concepts to arrive at an answer"(p.77). As well as being useful for teachers for task analysis prior to a problem being set, Collis et al also found this mapping procedure to be useful in analysing student errors. Chick, Watson and Collis (1988) found that it was possible to classify errors according to (i) the use of appropriate information; (ii) the omission of information from the response; (iii) a response level conflict among levels; (iv) undirected manipulation of data; and (v) skills hierarchy problems. Collis and Watson (1991) suggest that in the classroom, error analysis using this mapping procedure

"would most often be undertaken with a view to remedial instruction after the student has failed to solve the problem satisfactorily. The mapping procedure highlights the part of the path where the error has occurred and thus enables the remedial work to be designed to resolve that specific error"(p.85)

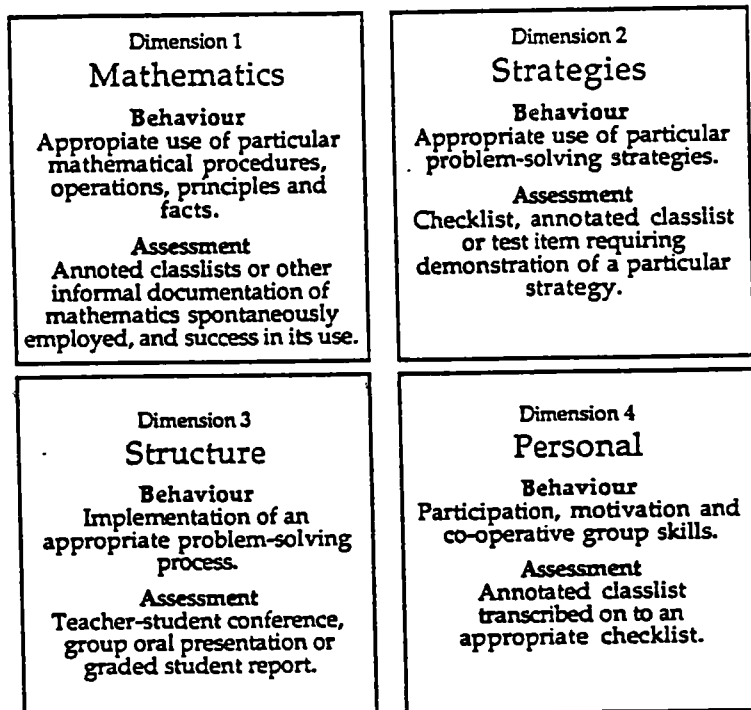
Collis and Romberg (1992) developed an assessment package based on SOLO taxonomy called Mathematical Problem Solving Profiles. The Profiles consist of assessment items, diagnostic forms for recording individual and group information, guidelines for using the Profiles for diagnostic assessment, and suggestions for further teaching based on the students' current level of understanding. The SOLO assessment items are designed to measure a student's performance on problem solving in algebra, chance and data, measurement, number, and space. Collis and Romberg (1992) suggest that by using the Problem Solving Profiles

"with individuals or groups, teachers are able quickly and accurately to determine a student's progress through a range of mathematical problem solving skills. The information provided by the Profiles also

includes advice on further teaching strategies for students based on their performance"(p.4).

Teachers can also assess problem solving skills through classroom problem solving tasks and investigations. According to Clarke (1988), "assessment of problem solving must be multi-dimensional to adequately reflect the different aspects of mathematical behaviour being displayed". Unlike Lester and Kroll (1990) who focus on describing methods of formally "scoring" a problem solving written task (outlined earlier), Clarke also includes a variety of other less formal assessment strategies as well as the more formal testing and "grading of student reports". He provides the following multi-dimensional model (Figure 2) and he suggests that "student performance on a particular problem may be assessed at any or all of these levels"(p.39).

Figure 2: Assessing Problem Solving



Problem solving tasks could include problems where there are several solutions and different possible solution strategies, where there are "real-life" problem situations and where higher-order thinking can be demonstrated. Factors such as the time taken to do the task, the solution strategy and the problem solving process may also be considered when assessing problem solving.

In summary, the review of literature on assessment in this chapter has demonstrated the complexity of the issue of assessment of mathematics in the primary classroom. Within the mathematics assessment issue there are a number of factors which have been considered. These factors include the aims of assessment, what to assess and when, the use of the most appropriate and effective methods of assessment, and consideration of the role that assessment plays in the context of the complete mathematics program in view of the current changes in educational philosophy and practice. The next chapter will examine the Australian perspective on assessment. this will include how the national and state documents deal with assessment issues, as well as the assessment expectations placed on different states.

Chapter 3

The Australian Perspective

This chapter will examine the Australian perspective on mathematics assessment. It will outline information on mathematics assessment in primary schools in Australia, from national and state documents, as well as from comments made by several state mathematics consultants.

Assessment at a National Level

The issue of assessment has been one that has been considered and discussed by various people in Australia (including educational policy makers, educators, and people within the general community), with the development of several new curriculum documents in Australia over the past four years, and in particular with the development of the National Profiles. There has been a recognition stated within these documents that there is a need for change in assessment strategy, with particular reference to changes in what should be assessed and how. A National Statement on Mathematics for Australian Schools states that

"we need to develop strategies for the assessment of some of the newer content of school mathematics. For example, we need to assess students' capacity to judge the reasonableness of results and to choose appropriate levels of accuracy, data collection and analysis techniques, mathematical investigation and modelling. We also need to assess the development of attitudes and appreciations"(p.21)

The AAMT (Australian Association of Mathematics Teachers) Discussion Paper on Assessment and Reporting on School Mathematics, states that assessment should be comprehensive in scope, that it should provide teachers, students and parents with the basis for future action,

and that it should clearly reflect a student's achievement of the learning objectives. It also suggests that changes in teaching and learning methodologies in Australia have been based on a "constructivist" model of learning, and that these changes have "significant implications for the design of adequate assessment programs"(p.2).

According to Clarke and Reed (1992),

"certain statements have emerged as guiding principles in the restructuring of assessment in Australian mathematics education. Assessment in school mathematics at all stages whether through informal classroom assessment or external examination should:

- * relate to and be consistent with the full range of educational objectives;
- * recognise a range of learning styles;
- * be fair to all groups of students and be free from bias;
- * enhance student motivation and commitment to learning;
- * provide starting points for further learning;
- * ensure parity of esteem among the different learning objectives in mathematics learning;
- * be reported in a clear and meaningful way;
- * define and communicate standards to students and parents"(p.231).

The National Statement (1991) was a joint project of the states, territories and the Commonwealth of Australia, and was initiated by the Australian Education Council (AEC). According to Stephens (1992),

"The National Statement is intended to provide a framework around which school systems may build their mathematics curriculum by identifying important components of a mathematics education for the majority of students. Following completion of the Statement, the AEC commissioned the development of mathematics profiles which would

enable teachers to report on students' achievements in mathematics in terms that would be understood nationally.... While not assessment instruments themselves, the profiles include assessment practices that will be new to many teachers, as well as illustrate expected standards of achievement" (p.x).

The Mathematics Profile is divided into six strands, five of which are the content strands: Space, Number, Measurement, Chance and Data, and Algebra. The sixth strand is called Working Mathematically and it deals with the processes used. Each strand is divided into a number of Strand Organisers which organise content, process and/or conceptual understanding within a strand. Listed under each strand organiser are the relevant outcomes which describe the various skills and knowledge that students typically acquire (e.g., Appendix 5). The outcomes then contain pointers which are indicators of the achievement of an outcome. The Profile is organised into eight levels which cover grades 1 to 10.

In a document Introducing Statements and Profiles, McLean (1994) states that one of the reasons that the Profiles were developed was to help improve methods of assessing and reporting. She suggests that the use of the Profiles by Australian teachers could "help teachers focus on students' learning needs by identifying what students can and cannot do at any particular time, help teachers form judgements about students' achievement that are consistent with those of other teachers, and help teachers provide students with a widely recognised and understood record of progress at school"(p.5).

Olssen (1993) refers to the Mathematics Profile as a "standards - referenced reporting framework", and he suggests that it

"establishes what students ought to be expected to know, understand and be able to do at various stages throughout their years of schooling. It sets these standards and trusts teachers to make

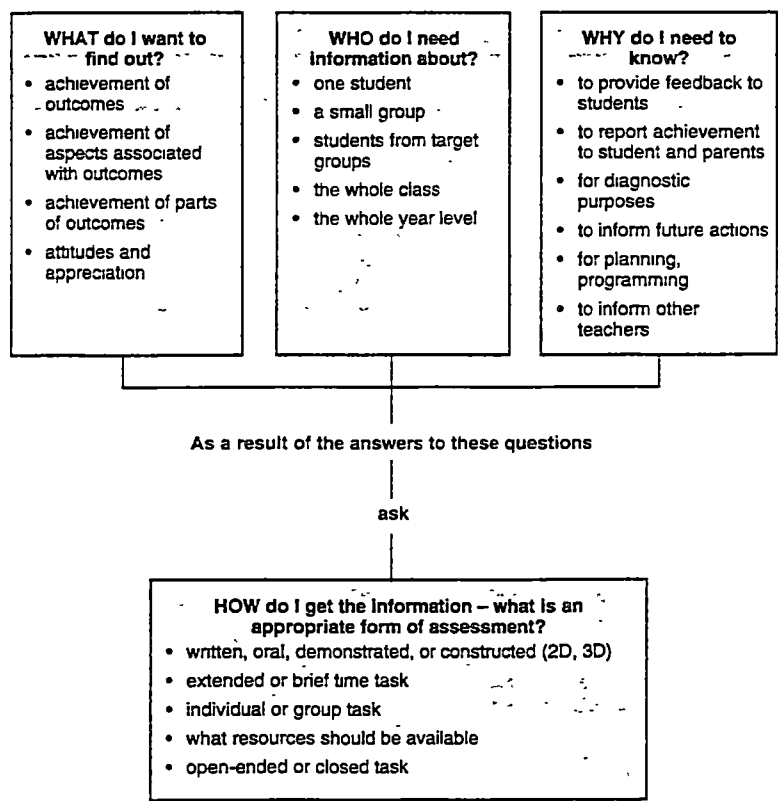
holistic judgements about their students' performance. Information about a students' 'profile' will be developed according to agreed standards and will be available to students, teachers and parents and, potentially for systematic purposes. This style of reporting has significant implications for assessment practices in that a teacher's holistic picture of a student's performance will require access to a rich set of information about the student's capabilities. This picture will need to be constructed from information collected from a wide range of assessment practices"(p.2).

The two main purposes of the Mathematics Profile, with regard to assessment, are to identify achievement and progress in mathematics and to inform teaching planning and the learning process. The Profiling approach "allows teachers to report on significant developments of their students in mathematics using assessment techniques that are appropriate to the elements being assessed with some assistance to ensure that consist judgements are made"(Ferguson, 1992, p.256).

Olssen, Adams, Grace and Anderson (1994, p.51) suggest that when choosing appropriate assessment strategies for a particular situation, four key questions should be asked. The questions and possible answers are contained in Figure 3. Olssen et al (1994) also outline some activities which teachers have used to assess students' understanding of specific mathematics areas or concepts within the National Mathematics Profile. These activities include a list of assessment expectations for that activity. Olssen et al (1994) also describe a number of the alternative methods of assessment which were outlined in chapter 2, including group tests, planned and incidental observation, student self-assessment, student work folios, and reflective journal writing, and they assert that "the quality of the information that can come from an

assessment task is significantly affected by the quality of the task itself"(p.51).

Figure 3: Deciding on an Assessment Strategy



In the *Educational Review* of "The Weekend Australian" (May 29-30, 1993), Hill writes that .

"the National Profiles represent something of a compromise between the competing demands of the various State curriculum guides and are a challenge to the authority and influence of local and subject-based interest groups. In this context, vigorous debate is not only to be expected but is also to be welcomed. The new profiles will need to be subjected to extensive trials in schools"(p.43).

Olssen (1993) conducted an Australian teacher survey in 1991 of 564 teachers in years 2, 5, 9 and 12 in schools across Australia about their assessment and reporting practices. He found that

"Teachers involved in the case studies presented a very encouraging picture of rich and successful practices. The primary teachers described a wide range of informal assessment practices, including those that actively involved their students in the assessment process through various forms of self-assessment. They were clear about the outcomes for their students as a result of their assessment practices and why they valued what they were doing. Assessment was integrated with learning and part of daily classroom procedures"(p.7).

Assessment developments in states other than Tasmania (briefly)

Although the National Profiles are the result of national collaboration, each of the states is making its own decisions about how teachers and schools are expected to utilise them. Several of the states have decided that teachers in their states will use the Mathematics Profile to report back to the system as well as using them to enhance learning in their own classrooms, while other states have not yet decided how to use the Profile. Some of the states have also incorporated a system test for certain grades as part of their assessment approach.

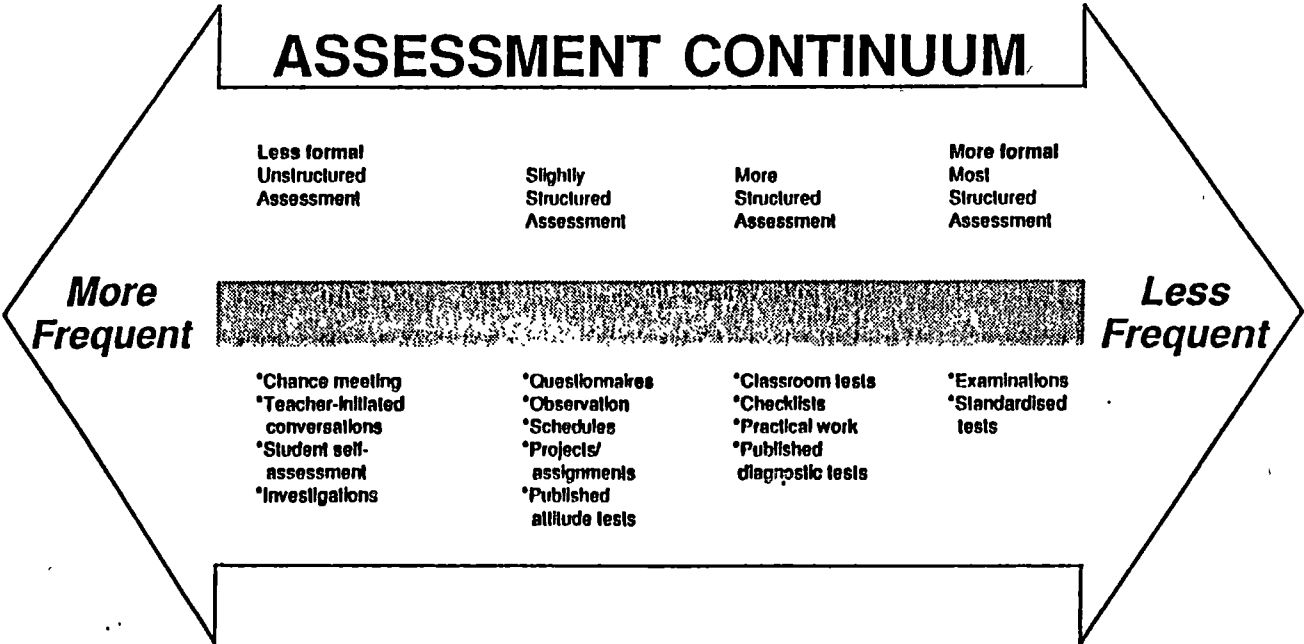
At the time of writing this summary of assessment in the various states, not all of the states had finalised plans for implementing the Mathematics Profile or other system methods of assessment. This is an ongoing process and will continue to change and develop. The following discussion is based on communication with several state mathematics education authorities and is also based on documentation produced by the various states.

Western Australia is currently trialling the National Mathematics Profile in eighty schools around the state. The trials are in both primary and secondary schools and the Profile is being trialled in a

variety of ways in the different schools. The Western Australian Education Department is aiming to develop the Profile as a monitoring tool, and they may become a broad assessment tool which will be adapted in an appropriate form to report to parents. However there has been no final decision yet. All of the schools have received the Profile, but unless they are participating in the trials, it is up to the individual school what they do with them (J. Johnston, personal communication, September, 1994).

In the Western Australian curriculum document "Learning Mathematics", it is suggested that teachers should use a variety of assessment methods and that the assessments are more purposeful when they relate directly to the teaching and learning program. The state has developed an assessment continuum moving from the types of assessments which should be done more frequently to the methods which should be utilised less frequently. This is summarised in Figure 4 (W.A. Ed. Dept., no date, p.79).

Figure 4: Assessment Continuum



As one of its assessment strategies, New South Wales introduced a Basic Skills Testing Program in 1989. The program assesses aspects of children's literacy and numeracy skills in grades 3 and 6. According to Masters and Doig (1992), the problems are set in a context "that makes them as natural as possible to the children being assessed", and they suggest that the children's responses to the tasks "sometimes provide insight into the variety of understandings, strategies and errors common among year 3 and year 6 students". A response map is used to display the variety of responses that students make to an item and to map the prevalence of these responses at different ages or levels of mathematical achievement. Locan and Jones (1991) suggest that this type of program can be used over a period of several years to look at what is happening to statewide standards, as well as providing teachers and parents with confidential information about the student's strengths and weaknesses in numeracy skills.

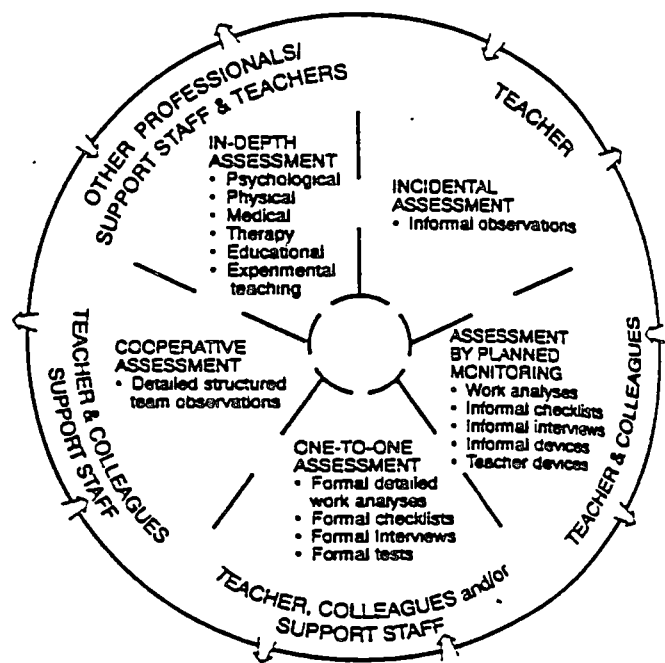
The N.S.W. Basic Numeracy Testing program will also be used by South Australian schools in grades 3 and 5. However Barry Schmidt (personal communication, September, 1994) says that the introduction of this method of assessment is causing concern in South Australia, and that a number of teachers believe that the testing program is not educationally sound. They believe that they can provide richer assessment using other alternative methods of assessment.

In South Australia teachers have initially been told to familiarise themselves with the National Profiles in 1994. In 1995 they will be required to report using the Profiles in three learning areas and then provide the Department with the information. This will also be a requirement in Queensland in 1995 (G. Micklejohn, personal communication, September, 1994). Schmidt (personal communication, September 1994) said that personally he believes that "we have moved to assessment driving the

curriculum with the Profiles" and that "there is an unfortunate focus on assessment". He also says that he believes "that primary teachers use assessment as a natural part of their teaching".

In 1994 the Queensland Department of Education produced a document on assessing for planning, learning and teaching. In this document they constructed a model for organising assessment which is shown in Figure 5 (Queensland Department of Education, 1994, p.46). This model contains five assessment options which they call incidental assessment, assessment by planned monitoring, one-to-one assessment, cooperative assessment, and in-depth assessment. It is stated that these "five assessment options are not fixed or rigid in sequence" and that the options "selected will vary according to individual student needs and aspects of the classroom and school contexts"(p.46).

Figure 5: Assessment Organiser



During 1994 The Queensland Association of Mathematics Teachers (QAMT) and the Queensland Education Department began a project to implement the Student Performance Standards, which are the Queensland

version of the National Profiles. The project is led by a project officer and a liaison officer from the QAMT, and a research person from a university. The project includes all of the schools in Queensland across the systems, including both private and state schools. During 1994 a network of key personnel and facilitators has been established, and several workshops have been conducted, particularly for facilitators. The key personnel work for the Education Department or the private system and they act as a liaison between the teachers and project officers. The facilitators are generally classroom teachers who play a leadership role within a school or a cluster of schools. The facilitators are supplied with workshop materials to provide professional development on the Performance Standards for other teachers. The teachers themselves decide what they want to do in this professional development within the framework of mathematics and the Performance Standards, and they appoint a local person (facilitator) to lead it.

In 1995 teachers in Queensland will be required to report using the Performance Standards on the space, number and measurement strands of number. In 1996 teachers will be required to report on all of the mathematics strands. This information will be collected for the system, but its main purpose is for reporting to parents. The project will act as a major source of support, helping teachers with what they want to do. Support Centres may also be set up in Queensland to give teachers the opportunity to share information on what the individual outcomes within the Performance Standards mean and how samples of work should be interpreted (Neville Grace, personal communication, 8th December 1994).

In Victoria, a Curriculum and Standards Framework has been developed which is based on the National Profiles. During 1994 the Board of Studies, Directorate of School Education and Universities in Victoria have begun a pilot professional development program to develop links

between assessment and instructional decision making in schools. The program is focussing on the Number Strand and Tools and Procedures Strand of the Standards Framework. There are four clusters of schools participating, and each cluster has a different focus within the two strands. The assessment tasks are provided to and by each school in the cluster. The schools are also provided with the possible use of various sample tasks. Each cluster has a person designated to keep a written record of work within the cluster who will document short-term, medium-term and long-term impacts of the assessment tasks on teaching. The key elements which are to be considered in this project are:

- * What changes in instruction took place as a result of teachers using the assessment activities?
- * What information derived from the project was incorporated in students' end-of-year reports? Especially to be highlighted is information about students' mathematical performance which might not have been known before.
- * What changes in teaching are being considered in 1995 as a result of the use of assessment activities in this project in 1994 (M. Stephens, personal communication, September, 1994).

Towards the end of 1994, a document will be produced which will discuss the results of this project and its key elements (M. Stephens, personal communication, November 1994).

Victoria will also introduce a Learning Assessment Program in 1995 which will assess primary school students statewide. According to the Board of Studies Newsletter. The Learning Assessment Project "will provide ways of expanding the assessment methods used in primary schools, and it will assess the progress of students against the standards described in the Curriculum and Standards Framework"(p.1). In grades 3

and 5 the students' progress in the statewide curriculum will be assessed against statewide standards.

In June 1994 the Board was consulting educators to determine what form of assessment will be used, but it is anticipated that children will be assessed in a variety of ways to establish their levels of numeracy (as well as knowledge in other areas). The Minister has guaranteed that the information will be confidential and that assessment data will not be used to make comparisons between individual students, schools or teachers, or in teacher or school appraisal. The Board Newsletter suggests that the project will:

- "* help teachers identify difficulties experienced by students and develop programs to tackle these difficulties
- * give teachers a yardstick for measuring their students' strengths and weaknesses against statewide standards at two crucial points of their primary schooling
- * help teachers prepare teaching programs
- * help teachers prepare students for the transition to secondary school"(p.3)

Assessment in Tasmania

In Tasmania all teachers have been supplied with the National Mathematics Profile. In addition, each school received a support package Working with Statements and Profiles. In this document it points out that

"in Tasmania the extent to which profiles will contribute to reporting on student progress has yet to be determined. Initially though there is an expectation that from 1995 teachers will begin to report on a limited number of outcomes each year. This expectation is likely to cover literacy and numeracy outcomes..."(p.7).

In March 1994 The Tasmanian Education Department provided each school with a draft document on the *Use of Curriculum Profiles in Tasmanian Schools and Colleges*. In the document it stated that schools will be expected to use the curriculum profiles "to assist teachers in planning the learning programs in schools", "to assist teachers to monitor the progress of students", "to inform the reporting process", and "to assist schools in the review of their education program". Graham Harrington (Deputy Secretary, Tasmanian Education) wrote that the Profiles

"can provide a resource for guiding teaching, assessing, reporting and recording that should be more efficient and effective than the myriad of separate processes currently being required of teachers.... For these reasons Tasmania will not be rushing the implementation of the profiles - their potential value is too great to risk in that way. I hope that initially teachers will look at the materials; think how they might be helpful to them; see how they fit with our Curriculum Framework...; (and) experiment with them and share findings with other teachers"(Harrington, April 1994, p.2).

Towards the end of 1994 and in 1995 a Review Unit will be formed which will decide what will happen with the Mathematics Profile in Tasmania, and whether there will be reporting on the outcomes and in what form. The Review Unit will also be reviewing all departmental assessment procedures including the 10N Test (Howard Reeves, personal communication, November 1994).

The 10N Test has been given to schools statewide in a four year cycle since 1975. The primary purpose of the 10N Test is to provide information which indicates trends in the performance of 10-year-olds in mathematics and to therefore "assist in evaluating the effectiveness of the Department's policies and programs in primary mathematics. The test

is also meant to give an indication of the extent to which all 10-year-olds attending Government schools have mastered those basic numeracy skills which they need if they are to participate successfully in everyday life and progress through the education system" (Department of Education and the Arts, 1993a, p.1).

Two Tasmanian curriculum documents which have been published in recent years, and may influence what happens in assessment in Tasmania, are The Framework for Curriculum Provision K - 12 (Tas. Dept. of Ed. & the Arts, 1993b) and the Mathematics Guidelines K - 8 (Tas. Dept. of Ed. & the Arts, 1992). The "About teaching and learning mathematics" section of the State Guidelines contains only a small section on assessment in which it briefly outlines some points which could be focussed on in the assessment of mathematical development and it names some methods of assessment. The Curriculum Framework identifies five sets of capabilities that children should be continually developing and using. These capabilities are personal, linguistic, rational, creative and kinaesthetic. In the Framework it is suggested that "teachers continually need to monitor and assess how children are developing these capabilities" (1993b, p.21). It is also stated that assessment of student learning should be "outcomes-based with clear standards of achievement" and that evidence should be provided on the achievement of the five capabilities and of the outcomes described in the National Profiles.

In summary, as in the research on assessment outlined in Chapter 2, recent Australian curriculum documents have also identified the need for assessment which is comprehensive, informs future actions and demonstrates student achievement. In the documents there is also a recognition of the validity and need for the use of a range of informal and formal assessment methods. These changes in assessment strategy and focus within

the documents are reflected to a degree in the general curriculum and assessment changes occurring in most of the Australian states.

➤ In chapter 4, a case study involving eight Tasmanian teachers will be outlined. Some of the results from this case study will be compared with associated research on assessment.

Chapter 4

The Case Study

This chapter will outline the methodology of the case study and its results. It will also compare some of these results with associated research on assessment.

Case Study: Methodology

The Sample

Eight teachers of grades kindergarten through to grade 6 from an isolated Tasmanian primary school were included in the sample. The teachers ranged in teaching experience from 1 year to 20 years, with three of the teachers being male and five teachers being female. Six of the teachers were interviewed individually on a series of questions about assessment, and the other two teachers were supplied with the question sheets and they wrote down their answers. The teachers involved in the interviews were given the question sheet beforehand to allow them time to think about the questions. They were instructed not to do any reading or research on assessment prior to the interviews. One teacher (#1) did do some background reading and this was noted. The interviews took place on a one-to-one basis and were recorded. Summaries of the transcripts of these interviews are found in Appendix 6.

The Interviews

The teachers were asked to answer the questions found in Table 1 and to fill in two attachment sheets associated with questions 2 (Table 2) and 4 (Table 3).

Table 1: The questions

1. What do you think is meant by assessment?
2. What are the purposes of assessment? (also refer to attachment 1)
3. When and how often do you assess mathematics?
4. What assessment and recording methods do you use? (also refer to attachment 2)
5. Do you assess mathematics differently to literacy? If so, how?
6. How do you record the assessments?
7. a) Who determines what you assess in mathematics?
b) What should be assessed?
c) What do you assess in mathematics?
8. Do we need a school policy for consistency in
a) assessment of students' mathematics?
b) reporting of assessment?
9. What do you think some of the current trends in assessment are?
10. a) Do you think some forms of assessment are more appropriate than others?
b) Should the school or system provide professional development to introduce different forms of assessment?
11. Did you receive any assessment summaries from the previous teacher? If you did, how useful were they? How could they have been more useful?
12. Do you see a need for recorded assessment that follows children's progress from year to year as well as assessment that informs your planning?
13. What do you consider to be the essential components of assessment?
14. How relevant and important is assessment in the context of the classroom and school mathematics program?

Attachment 1 is based on a questionnaire in Assessment and Reporting in Mathematics (Olssen, 1993). Olssen (1993) conducted a study in which 564 teachers in years 2, 5, 9 and 12 in schools across Australia were interviewed about their assessment and reporting practices.

Table 2: Attachment 1 (purposes of assessment)

<p>Number the following from 1 to 5 where 1 is of first importance.</p> <p><u>A</u> The purpose of assessment in mathematics is to inform whom:</p> <p>student(s)</p> <p>parents and care givers</p> <p>teacher</p> <p>other teachers</p> <p>education system</p> <p><u>B</u> The purpose of assessment in mathematics is to inform about:</p> <p>achievement</p> <p>possible actions</p> <p>attitudes</p> <p>behaviour</p> <p><u>C</u> The purpose of assessment in mathematics to manage learning is to:</p> <p>provide feedback</p> <p>plan actions</p> <p>modify program</p>
--

Attachment 2 (Table 3) attempts to determine the methods of assessment and reporting which have been used by the teachers in the case study, and also to find out which methods teachers were unfamiliar with and would like more information on.

Table 3: Attachment 2 (methods of assessment and recording of assessment)

Tick one or more columns					
Methods of assessment and recording in Mathematics					
Assessment method	Using Currently	Used Success.	Used Unsuccess.	Never Used	Like to Know more
Journal writing					
Prob. Sol. Profiles					
National Profiles					
Observation					
Conferencing					
Self-assessment					
SOLO Taxonomy					
With environmental support					
Projects					
Open-ended Questions					
Items which test: critical thinking & problem solving					
Group assessment					
Tests					
Worksheets (other)					
Criterion referenced					
Personal Records					
Work samples, folios					
Checklists					
Annotated Classlists					

Case Study: Results

Question 1 (meaning of assessment)

Assessment was defined by the Tasmanian Education Department (1991) "as a process which entails acquiring information about children's learning and making judgements on the basis of that information"(p.3).

The teachers in this study generally gave definitions of assessment which were similar to the definition stated above. For example,

"It's where you use a variety of means to ascertain what a child knows or what a child can do or what level of development they are at. It's a way of ascertaining a child's ability or attitude or development in some certain area" (#3)

"Assessment is finding out what students can do and what areas need some attention" (#6)

Several of the teachers made mention of the formative aspect of assessment as demonstrated by the following comments.

"It's a process which supports and enhances the learning of individual children and I see it as being an integral part of teaching and learning" (#1)

"Assessment is identifying each child's capabilities with a view to determining courses of action which will form the basis of future learning" (#7)

Teacher #8 was the only teacher who made mention of assessment being done to evaluate a program (summative form).

"I think of assessment as evaluating the work you've done and improving, changing or modifying your program"

Question 2 (assessment purposes)

Most of the teachers in this case study (refer to Table 4) identified the *teacher* as being the main person whom assessment informs. This is consistent with a study of assessment and reporting practices across Australian schools done by Olssen (1993) in which 564 teachers in years 2, 5, 9 and 12 in schools across Australia were interviewed about their assessment and reporting practices. Olssen found that most of the primary teachers identified themselves as the key person being informed as a result of formal assessment. This is in contrast to secondary teachers who identified 'informing students' as being the most important purpose. The teachers in this case study identified informing *students* and *parents* as being of next importance, and saw informing *other teachers* and the *education system* as having a lower priority.

Table 4: Who the assessment informs

	1st	2nd	3rd	4th	5th
student(s)	1	4	3	0	0
parents	0	4	4	0	0
teacher	7	0	1	0	0
other teachers	0	0	0	6	2
education system	0	0	0	2	6

Olssen (1993) found that a high percentage of primary teachers saw *achievement* as being the most important information conveyed by both formal and informal assessment. However, in this case study only two of the eight teachers saw achievement as the primary purpose of assessment (refer to Table 5). Most of the teachers (5/8) indicated that they

believed that informing possible actions was the most important. This is in contrast to Olssen (1993) who found that only 31% of primary teachers mentioned informing possible actions as one purpose of formal assessment (22% for informal assessment), and that of those teachers almost none saw it as being the most important purpose. In this case study one teacher indicated that she saw all four of these purposes as being of equal importance.

Table 5: What the assessment informs about

	1st	2nd	3rd	4th
achievement	2	1	4	0
possible actions	5	2	0	0
attitudes	0	4	3	0
behaviour	0	0	0	7

Four of the eight teachers in this case study indicated that they thought that providing feedback, planning actions and modifying programs were of equal importance when considering how assessment manages learning. Of the remaining four teachers, three identified planning actions to be of primary importance (refer to Table 6).

Table 6: How assessment manages learning

	1st	2nd	3rd	4th
provide feedback	1	1	2	0
plan actions	3	1	0	0
modify program	0	2	2	0

This result is again different to the result obtained by Olssen. He found that most of the primary teachers identified providing feedback as the major purpose, and that a much smaller percentage indicated that planning actions or modifying their programs were the most important uses of assessment in regard to managing learning.

Question 3 (when to assess and how often)

All of the teachers in the case study indicated that they assessed continually, and that assessment was an ongoing process. This is illustrated by the following comments.

"I think that formative assessment is an ongoing part of maths. It's really going on all the time with lots of dialogue between myself and the child - conferencing, giving them feedback about what they're doing" (#1)

"I assess every time that I am involved in a maths activity.... I feel that assessment is an ongoing thing - I'm always assessing.... I do some form of formal assessment every fortnight in the form of a small test - I do that usually whole class in relation to activities that we're doing whole class" (#3)

"I do maths everyday and therefore I am assessing everyday - not necessarily writing everything down. But usually on a day-to-day basis I look at them, I talk to them, I watch them and I also conference with them..." (#5)

"Assessment is ongoing. Almost daily children are assessed through observation and through set tasks with given objectives and outcomes" (#8)

This is consistent with research which indicates that primary teachers in particular use more informal methods of assessment and are constantly assessing children's use of mathematics in the classroom.

According to Joffe (1990), "teachers use ongoing assessment all the time in their classes to make judgements about how students are coping: whether students understand, whether there is a need to recap etc. Teachers identify students with difficulties and those with excellence, often without recourse to a test"(p.149). Olssen (1993) also found that "Assessment was integrated with learning and was part of daily classroom procedures. The teachers conveyed the feeling that they had never known more about what their children know, than they do now"(p.7).

Question 4 (assessment and recording methods)

The teachers in this study indicated that they used a variety of both informal and formal assessment strategies (refer to table 7) in their mathematics program. The most commonly used methods of assessment and recording utilised by the teachers were observation, personal records, checklists, National Profile, work folios and annotated classlists. Several of the teachers who said that they were currently using the National Profile qualified their statement saying that they had only just begun to look at it as an assessment tool.

Other assessment methods which had also been used successfully by most of the teachers were testing and open-ended questions. The most common assessment and recording methods used by the teachers in this study (7/8) were observation and checklists:

"Usually I observe them. I talk with them and question them about what they've been doing" (#5)

"I mainly use observations and checklists..." (#4)

"Mainly informal observations, for example of students' responses during group games. Students' responses are observed and evaluated.... Because of their language and literacy levels (at kindergarten), the

assessment tends to be more subjective and is most useful when resulting from direct interaction with the student" (#6)

Table 7: Methods of assessment and recording in mathematics

Methods of assessment and recording in Mathematics					
Assessment method	Using Currently	Used Success.	Used Unsuccess.	Never Used	Like to Know more
<i>Journal writing</i>		1		2	6
<i>Prob. Sol. Profiles</i>				4	5
<i>National Profiles</i>	5				4
<i>Observation</i>	7	1			
<i>Conferencing</i>	4	3			1
<i>Self-assessment</i>	1	2		1	4
<i>SOLO Taxonomy</i>				3	6
<i>With environmental support</i>				3	7
<i>Projects</i>	2	2			4
<i>Open-ended Questions</i>	2	5			1
<i>Items which test: critical thinking & problem solving</i>	3	4	1		
<i>Group assessment</i>	3	1		5	1
<i>Tests</i>	3	6			
<i>Worksheets (other)</i>	1				
<i>Criterion referenced</i>	3	1	1	1	4
<i>Personal Records</i>	7	2			1
<i>Work samples, folios</i>	5	1			2
<i>Checklists</i>	7	3			
<i>Annotated Classlists</i>	5	3		2	2

This is a similar result to that found by Olssen (1993). The primary teachers in his study said that they used observation (37%), checklist/anecdotal (37%), conferencing (34%), tests (31%), work samples (21%), and student self-assessment (15%).

The teachers in the case study indicated that there were a number of alternative assessment and recording methods which they would like to know more about. These methods include journal writing, problem solving profiles, National Profile, student self-assessment, SOLO taxonomy, assessment with environmental support, projects and criterion referenced assessment. This would seem to indicate that although teachers are already using a range of assessment methods, they may benefit from professional development to introduce additional alternative methods. Olssen (1993) suggests that "there is evidence that teachers need support to develop strategies for student self-assessment"(p.8).

Question 5 (assessment of mathematics versus literacy)

Four of the teachers said that they found assessment in mathematics and literacy different (although for differing reasons), as demonstrated in the following comments.

"In one sense I find it alot easier to assess mathematics - it's easy to have something that's right or wrong. But then that's really the product, and the process also requires assessment... I think historically people would have had far more accurate assessment and records in mathematics... and I just question the 10N and the 10R tests - whether they should be done - you're either right or wrong in the 10N - there are no shades of grey" (#1)

"Yes, because maths is harder... I use more structured assessment in maths. I have more checklists for maths than literacy" (#2)

"I do in some ways because you can test in maths. In maths you can get a definite answer whereas in literacy there are more shades of grey"

(#5)

"Maths tends to be more cut and dried..."(#7)

These comments also indicate that there is still a tendency for some teachers to look more at the product side of mathematics and to see it as being either right or wrong and this may be reflected in the way that they assess mathematics.

Question 6 (recording of assessment)

All of the teachers said that they recorded their assessments through the use of anecdotal records and/or checklists. Several of the teachers also commented that one of the forms in which they recorded their assessment was through their planning. This is consistent with the belief that assessment is an integral part of teaching practice.

Question 7 (what is assessed and who decides)

When discussing what they assess in mathematics the teachers commented on several aspects of mathematics, although none of them mentioned all seven of the standards outlined by the National Council of Teachers of Mathematics (NCTM). The main mathematical assessment areas which the teachers outlined were mathematical concepts, mathematical procedures and mathematical disposition. There was also mention made by a few of the teachers of the need to assess reasoning skills and the transference of knowledge. The following statements include mathematical areas which are assessed by the teachers.

"Whether they're transferring the knowledge that you've taught them into other areas, whether they retaining what you've taught them, and

whether they've got a good understanding of it. Whether they try and their attitude as well" (#2)

"Maths strategies, skills and attitudes..." (#3)

"Attitudes, knowledge and skills appropriate to the child's level of development that are essential for developing learning. In early childhood I assess basic concepts and the transference of these concepts to other situations" (#6)

"I assess processes, calculations and reasoning skills" (#7)

Although one teacher briefly mentioned problem solving (#2), none of the teachers included mathematical power and mathematical communication as areas which they assess.

Most of the teachers (5/7) felt that they themselves determined what was to be assessed in mathematics in their classroom. Several of the teachers also added that they thought that the school and the education system had some input, and one teacher thought that the Education Department determined what was assessed with the teacher having the least say. One teacher suggested that the students determine what is to be assessed "through their level of functioning" (#6).

Question 8 (school assessment and reporting policy)

All of the teachers in the study said that they would like a school policy on assessment and reporting. The following statements are some of the reasons given by the teachers.

"I think that there needs to be a policy on assessment and reporting - not to lock into just a single form - but that there shall be assessment and reporting, and that the school has some formalised reporting, for example records of development... We should make it clear what is meant by assessment because some people get involved in

the collection of huge amounts of information that has no assessment value" (#1)

"It's a way of developing people's understanding - and that's really important - as long as the policy is flexible... It's really important in the recording of assessment. It's important that parents get a united message about what we're doing and what we're believing..." (#3)

"It would be helpful. Especially as a first year teacher I don't know whether I'm doing enough or I'm not sure if what I'm doing is right... Sometimes it would be nice to have something there and know that that's roughly what we're supposed to do and then we can adapt" (#5)

"...because it cannot be assumed that every teacher will have enough motivation and background knowledge to come up with their own comprehensive system. A child's academic future cannot be left to chance" (#6)

Several teachers also added that the assessment policy could take the form of a guideline rather than being prescriptive and allow teachers to choose their assessment and recording methods and strategies for themselves.

Question 9 (current trends in assessment)

Several of the teachers (#s 1, 2 & 5) in the study indicated that they thought that assessment was becoming more outcomes based. For example, teacher #2 suggested that

"assessment is getting better because of the Profiles, so it's being based on the outcomes. So what they should have gained, not only in the concrete stuff, but attitudes and other areas as well are being assessed" (#2)

Teacher #1 expressed concern at the increasing focus on outcomes believing that this may lead to standardisation, and that in the future children from different schools may be compared.

Several of the teachers (#s 2, 3, 6 & 7) also suggested that assessment was changing in that it was focusing more on the individual, and that more areas of mathematics are now being assessed (including the capabilities). For example,

"Through the Profiles and the other new documents that have come in, there is a broader view of mathematics and of learning... Assessment has to change with the changing beliefs" (#3)

"Assessment is becoming more focused on formative rather than summative assessment. Assessment is being used more to address individual needs and to determine remediation needs and to extend more able students" (#7)

Teachers #4 and #8 said that they were unsure of what the current trends in assessment were. Teacher #4 added that she thought that children were no longer tested every week and that although there is more mathematics to cover, numerically it is now easier.

Question 10 (appropriate assessment methods, professional development)

The only method of assessment which was considered to be inappropriate in some situations by any of the teachers, was testing. Two of the teachers (#s 4 & 5) suggested that testing can put too much pressure on the students and that it did not always give you the information you needed. Several teachers said that the method of assessment which could be used depended on the grade, stage of student development and the purpose of the assessment. Teacher #3 suggested that

"any form of assessment that provides information is totally relevant. Assessment becomes inappropriate when it fails to give adequate or appropriate information".

The majority of the teachers (7/8) said that they thought that the school should provide professional development to introduce different forms of assessment, and that thought that they would benefit from seeing a variety of different assessment methods which they could possibly use in their classroom. This is illustrated in the following comments.

"I think we need professional development to state this is what we're talking about. Here's a shopping basket of assessment methods - you can select some of these and we've got our school focus to be at least this, this and this" (#1)

"... because it's always good to be exposed to new and different techniques. It's good to see what other people are doing" (#2)

"It's a necessary thing to be broadening teachers' views, and if we're only relying on what we already know then we're ripping ourselves off as teachers" (#3)

"There are some forms of assessment that I've never heard of and I would like to know more about, and there are some that I am using that I would like to go into in more detail" (#8)

Only one teacher did not see a need for professional development on assessment, unless teachers were not assessing effectively. Teacher #4 stated that

"It depends if they're doing a big push on it, and if we aren't doing the job at the moment. In the primary section there might be more need for assessment - I don't see the need as much in the infant section"

Question 11 (assessment summaries)

The teachers' opinions on the usefulness of assessment summaries passed on from the previous teachers were mainly negative. Most of the teachers who did receive summaries from the previous teacher did not find them useful for a variety of reasons: teacher #1 said that he did not find them useful because he found that the previous teacher's summaries were inaccurate; teacher #3 said that the assessments were recorded in a way that he did not use and that they did not contain appropriate information; and teacher #5 thought that there was too much information and said that she had left it too late to use them. Teacher #3 added that

"A whole-school approach would help because everyone will have had an input into it, and will include things that we believe are relevant... I wonder if teachers will ever feel comfortable about receiving information from other teachers. I think that we're a bit egotistical and we all want to find out for ourselves. Even if we get a wadd of stuff from the teacher beforehand, until we see the children and see how they operate, a wadd of information might never be totally relevant"

This comment seemed to reflect the opinions of most of the teachers in the study, although several teachers did give a few suggestions for ways that assessment summaries might follow a child through a school including personal records.

Question 12 (recorded assessment which follows children's progress)

Despite the negative comments made in question 11 about the usefulness of the teachers' summaries from the previous year, all of the teachers in the study thought that there was a need for recorded assessment which follows the child from year to year. This is demonstrated in the following comments.

"It's got to be a key feature of assessment.... As long as it's an honest assessment there is a need for assessment that progresses with the child, and it needs to be in the form of a personal record... and it needs to be kept manageable" (#1)

"It's valuable in establishing quickly where students are at. The Profiles can help in this area" (#7)

"It means that you are able to see the areas the child is/has been weak/strong in, and that may need more help or development. It may assist the next teacher with developing programs that are continuous" (#8)

Question 13 (essential components of assessment)

The following statements include what the teachers consider to be the essential components of assessment.

"It has to be based on individual children. It has to be related to the areas that you're covering, so you have to have good aims. Children have to understand it" (#2)

"Determining relevant information is important.... Being able to provide assessment that is able to help a child give the most accurate response is essential.... How the information is recorded is important for the teachers themselves and for the students and parents" (#3)

"Looking, listening and learning. Looking at the children, listening to what they have to say, and what they're having trouble with. The learning is writing down what you see and then using it" (#5)

"Knowing the basics of child development in the area, knowing the hierarchy of skills development for each maths area, and knowing the child's learning styles and patterns, and then using all of this information to devise assessment tools" (#6)

"Assessment needs to be continuous and used constructively to establish learning programs. It needs to be formative rather than summative" (#7)

"The essential components are observation, checklists and samples of work" (#8)

Teacher #1 answered this question in the form of a question, asking whether people understand the issue of whether evaluation, monitoring and recording are interchangeable terms of assessment.

These comments would indicate that each of the teachers seem to have a different perspective, and a different level of understanding, of what the essential components of assessment are.

Question 14 (relevance and importance of assessment)

Most of the teachers in the study indicated that they believe that assessment is an essential and integral part of the classroom mathematics program, and that teaching and learning cannot take place effectively without some form of assessment taking place. This is illustrated in the following teachers' comments.

"I think that if we as a teaching group are committed to the teaching pedagogy of the department which is based on the constructivist theory of learning, then I think that assessment really is the tool that allows us to determine whether we intervene in children's learning" (#1)

"Essentially important, because that's how you plan your program and how you cater for the children. You have to have an idea of where they're at, and if you didn't assess them you wouldn't know what you were doing" (#2)

"If I'm not planning with assessment in mind...then I can't be someone who teaches - I am only someone who spouts information. The only way I

can determine whether a child in my care has grasped a concept or increased their understanding is by using assessment. Unless everything I do is directed by assessment and followed up by assessment then it's a waste of time" (#3)

"It's one of the foundation stones, without which an effective program cannot be run. Assessment should have a direct continuous bearing on the teacher's program overall and especially in relation to individual students. Without assessment there is risk of some students getting lost in the system and others getting bored. Even if students are able to learn the rudiments of mathematics appropriate to their grade level, without assessment and using this knowledge for planning, many will not reach their potential or develop higher level thinking skills that they would have been capable of" (#6)

Teacher #7 suggested that although assessment is important "it should not dominate teachers' thinking".

Case study: Conclusion

In general, the teachers in this case study appear to have a good understanding of assessment, its purposes, and how, when and what to assess.

One area of confusion which did emerge, is the distinction between assessment and the recording of assessment. For example, in question 13 teacher #8 suggested that the essential components of assessment are "observation, checklists and samples of work". Similarly in question 14, teacher #5 appeared to equate assessment with the recording of assessment saying that "without assessment you'd have nothing - you do it

subconsciously anyway - but if nothing's written down then little things are forgotten and things aren't followed up on".

Olssen (1993) found a similar result in his study where primary teachers, in particular, were unable to clearly distinguish learning, informal assessment and informal reporting. He suggests that

"The distinctions between these aspects of teaching are in a sense quite arbitrary. The benefit of making distinctions, however is that a framework is established.... The fact that informal assessment and reporting are so integrated with the teaching and learning process in some primary classrooms described in case studies is indicative of the well-developed understandings that those teachers possess"(p.3).

The main areas that teachers commented on when they discussed what they assess in mathematics, were mathematical concepts, mathematical procedures and mathematical disposition. This is illustrated by the following comments.

"To start off with you should see if they have basic number skills, basic knowledge of the operations and place value - because alot of maths is based on them... The children's attitude should also be assessed" (#5)

"In early childhood I assess basic concepts and the transference of these concepts to other situations" (#6)

"Processes need to be assessed and calculation should be assessed.

Reasoning skills should be assessed" (#7)

Only a few of the teachers mentioned the need to assess reasoning skills, one teacher briefly mentioned problem solving, and none of the teachers included mathematical power and mathematical communication as areas which they assess. Although they were not asked which areas of mathematics that they included in their mathematics program, the teachers responses showing that they assess the more traditional aspects of

mathematics may indicate that problem solving and some of the "newer" aspects of mathematics have not yet been incorporated into their classroom mathematics program. At the very least, the teachers' responses indicate that they are not assessing mathematics in these areas.

The definitions of assessment which some of the teachers gave in question 1 seem to indicate that a number of the teachers base their assessment and teaching practices, at least partly, on a constructivist educational philosophy. Also, in question 2 most of the teachers answered that they thought that assessment's main purpose is to inform them about possible actions. This would also seem to indicate that their assessment practices are based on a constructivist pedagogy. This constructivist view of assessment is in contrast to findings by researchers (Niss, 1993; Galbraith, 1993; Wilson, 1992) who suggest that although the current curriculum is based on a constructivist view, assessment practices are still being driven by the traditional paradigm.

All of the teachers in the study commented that they assessed continually and that they believed that assessment was an ongoing process. This is consistent with Webb and Briars (1990), who state that assessment is an interactive process between the teacher and student "with the teacher continually seeking to understand what a student can do and how a student is able to do it"(p.108).

The teachers in the study indicated that they utilised a wide variety of both informal and formal assessment methods and strategies, although a number of the teachers also said that they would still like to find out more about some of the different assessment and recording methods. According to Olssen et al (1994) " using a variety of assessment techniques increases the opportunity for achievement to be observed and to gain high quality information to support student learning"(p.50). The majority of teachers said that they thought that the school should

provide professional development to introduce different forms of assessment, and that they would benefit from seeing a variety of different assessment methods which they could possibly use in their classroom.

Most of the teachers in the study suggested that they saw assessment as an essential and integral part of the classroom mathematics program, and that teaching and learning cannot take place effectively without some form of assessment taking place.

The following chapter will discuss the teaching implications of the findings on assessment discussed in chapters 2, 3 and 4.

Chapter 5

Teaching Implications

Implications from current literature on assessment

The assessment of mathematics in classrooms no longer simply involves just the testing of curriculum content - correcting written answers as either right or wrong. It has become more complex, involving the use of a variety of methods as well as being used for a number of different purposes. Assessment has begun to play an integral role within the mathematics classroom. It being is used by teachers and students to inform action within the classroom, as well as the more traditional role of providing information on student achievement for reporting more formally to parents and to the system.

One important component of the changes within assessment practices are the changes in the assessment methods being used by teachers, and the greater recognition of the effectiveness of the informal methods of assessment which are often used by primary teachers. There is still a continuing need for people in the wider community, as well as for teachers, to recognise the validity of some of these less formal assessment strategies, such as observation, and to realise that although testing is one valid form of assessment, it is not always the most appropriate or effective method.

As well as the use of written tests, some other methods of assessment which teachers may use include mathematics journal writing, observation, conferencing, student self-assessment, SOLO taxonomy, Problem Solving Profiles (Collis & Romberg, 1992), projects, open-ended questions, and assessment with environmental support. A teacher's choice of assessment method will depend on a number of factors within the classroom context. These factors may include what is being assessed, the

purpose/s of the assessment, when and how often the assessment occurs, the number of students being assessed, the teacher's experience, the availability of assessment materials, and any system requirements. Lester and Kroll (1990) suggest that teachers should choose techniques that both provide information appropriate for the goals of their assessment and are feasible for use in their classroom situation.

Current educational practices are being based on a more constructivist view of teaching and learning, and according to Wilson (1992), an implication of this "is that we must start measuring the understandings and models that individual students construct for themselves during the learning process"(p.78). Thus there is a need to assess process as well as product when assessing a student's understanding of mathematics.

In line with the constructivist philosophy there is also a need for more problem solving and open-ended assessment items. One of the difficulties with this type of assessment is the construction of these items, and then how to assess using these items. Although some assessment tasks like this are already available, such as the Problem Solving Profiles (Collis & Romberg, 1992), there is also a need to help teachers acquire the skills to create and develop more open-ended assessment items which allow students to express and show what they understand and have learned. According to Izard (1993) the assessment tasks should also "include problems in appropriate contexts where there are several solutions and different solution strategies, where there are 'real' problem situations, and where higher-order thinking can be demonstrated"(p.188).

According to Clarke and Reed (1992), the adoption of new goals by mathematics teachers and school systems "demands the use of new assessment strategies", and they suggest that this assessment should:

- "* relate to and be consistent with the full range of educational objectives;
- * recognise a range of learning styles;
- * be fair to all groups of students and be free from bias;
- * enhance student motivation and commitment to learning;
- * provide starting points for further learning;
- * ensure parity of esteem among the different learning objectives in mathematics learning
- * be reported in a clear and meaningful way;
- * define and communicate standards to students and parents"(p.231).

Implications of Australian curriculum documentation

The recent development of a number of education documents in Australia, and in particular the development of the National Profiles, has a number of assessment and reporting implications for teachers. McLean (1994) suggests that the National Profiles "were developed to help improve methods of assessing and reporting" and that "they will allow for more positive reporting, recognising students' achievements as they progress from level to level"(p.5).

Documents associated with the Mathematics Profile, such as Working With Statements and Profiles, Introducing Statements and Profiles and Using the Mathematics Profile, provide additional information for teachers on how to use the Profile and they encourage the use of a variety of assessment and reporting strategies. McLean (1994) states that "the profiles emphasise the importance of assessing a wide range of skills and knowledge over a period.... Planning their assessment means teachers can cover all the strands and substrands in the profile. This calls for a variety of teaching and learning activities and different kinds of assessment techniques, both formal and informal"(p.15). In Using

the Mathematics Profile, Olssen et al (1994) describe a number of alternative methods of assessment of mathematics including group tests, planned and incidental observation, student self-assessment, student work folios and reflective journal writing.

In order for Australian teachers to use the Mathematics Profile effectively, in addition to these documents, there is also a need for teacher development. Several of the states' mathematics consultants (for example B. Schmidt, personal communication, September, 1994; N. Grace, personal communication, November, 1994) indicated that there were teachers who had shown concern about reporting on students' progress, particularly to the system, using the Mathematics Profile. Any professional development done with teachers will need to make clear exactly what the purposes of assessing and reporting using the Profile are. The professional development will also need to involve teachers in developing ways of incorporating the Profile into their classroom programs both as an assessment and recording tool and as a planning tool. Olssen (1993) suggests that

"when assessment and reporting changes are introduced at a system level it is important that teachers have opportunities to value those changes and are supported to do the necessary personal learning to enable sensible implementation. Even with the best of intentions, procedural and structural changes can easily take over at the expense of teacher development"(p.96).

Most of the Australian states, to varying degrees, have already identified the need for teacher development, and have begun professional development programs to help teachers with the implementation of the Mathematics Profile, and in particular to help teachers to use the Profile to report on students' progress in mathematics.

Implications of the Case Study

The teachers in this study indicated that they used a variety of both formal and informal assessment strategies within their mathematics program. The most commonly used methods of assessment and recording utilised by the teachers were observation, testing, open-ended questions, sample work folios, personal records, checklists, the National Profile and annotated classlists. Several of the teachers who said that they were currently using the National Profile qualified their statement saying that they had only just begun to look at it as an assessment tool.

The teachers also indicated however, that there were a number of alternative assessment and recording methods which they would like to know more about. These methods include journal writing, Problem Solving Profiles, the National Profile, student self-assessment, SOLO Taxonomy, assessment with environmental support, projects and criterion-referenced assessment. This would seem to indicate that although the teachers are already using a range of assessment methods, they would be interested in, and benefit from, professional development to introduce additional alternative methods of assessment and reporting. The majority of the teachers (seven out of eight) said that they thought that the school should provide professional development to introduce different forms of assessment, and that they thought that they would benefit from seeing a variety of different assessment methods which they could possibly use in their classroom.

All of the teachers in the study said that they would like a school policy on assessment and reporting. Several of the teachers added that the assessment policy could take the form of a guideline rather than being prescriptive and could allow teachers to choose their assessment and recording methods for themselves. This may indicate that some of the teachers do not value their own assessment strategies enough and that

they feel that they need some authorised form to legitimise strategies which they may already have been using. For example Teacher #5 said that

"especially as a first year teacher I don't know whether I'm doing enough or I'm not sure if what I'm doing is right... Sometimes it would be nice to have something there and know that's roughly what we're supposed to do and then adapt".

One role of teacher development may be to let teachers know that what they are currently doing in the classroom, for example observation and questioning, are legitimate and effective assessment strategies and should be valued as such.

When discussing what they assess in mathematics, the teachers in the study mainly commented on the more traditional areas of mathematics, such as mathematical concepts, procedures and disposition. Only a few teachers mentioned the need to assess reasoning skills and the transference of knowledge, one teacher briefly mentioned problem solving and none of the teachers included mathematical power and mathematical communication as areas which they assess. This ties in with the curriculum aspect of teaching and learning mathematics, and the need for a "broader" mathematics to be included in the classroom. Teachers need to include reasoning skills, problem solving, mathematical power and mathematical communication as part of their classroom mathematics program, and once that has been done they need to ensure that all of the areas of mathematics are assessed.

General Implications

There are several important teaching implications resulting from the information on assessment obtained from the review of the literature and Australian curriculum documents, and from this case study. The first of these is that for mathematics assessment to be comprehensive there

needs to be an extensive mathematics program within the classroom, and that teachers and schools need to ensure that they are incorporating the "broader" mathematics curriculum.

The second important teaching implication is that a range of assessment and recording strategies should be used within the classroom, school and education system. According to the study completed by Olssen (1993), and from the results of this case study, many primary teachers are already utilising a range of assessment methods, both formal and informal, although only a few teachers in this study had used student-self assessment.

A final implication is the need for teacher development. With the continuing changes occurring in mathematics education, including changes in curriculum and in assessment, teachers need to be made aware of the implications of these changes for their classroom mathematics program. Similarly teachers also need professional development if they are required to use documents, such as the Mathematics Profile, as a framework or basis for assessing and reporting on students' progress in mathematics.

Conclusion

Within the next few years the National Mathematics Profile will continue to be implemented in states around Australia, and may form the basis for assessing and reporting on students' progress. There may also be more development of strategies for assessing the "newer" content of mathematics such as problem solving, reasoning skills and attitude.

One of the problems which still needs to be overcome includes a broadening of teachers' views of mathematics, and the need for teachers to assess both process and product. Several of the teachers in the case

study indicated that they saw mathematics as being either right or wrong, and this may be indicative of the views of some teachers in the wider community.

Another problem which may occur, in reference to the Mathematics Profile, is that some teachers may fear standardisation (for example Teacher #1 in the case study) and demonstrate a negative attitude towards using the outcomes in the Profile as a framework for assessing and reporting on students' progress in mathematics. The assessment and the reporting of assessment should be seen as an integral part of teaching and learning mathematics, and should be a part of the classroom mathematics program rather than something which is additional.

In conclusion, when assessing mathematics teachers need to consider the purpose/s of the assessment, the most effective method of assessment, how to record the assessment, when and how often to assess, and what should be assessed. However, teachers also need to remember that the primary goal of mathematics education is for the student to learn, and that assessment is only one aspect of the teaching and learning process.

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Appendix 6

Interviews

Teacher #1 (Did some background research on assessment)

1. Assessment is the process by which information is acquired about children's learning and making judgements on the basis of that information.... It's a process which supports and enhances the learning of individual children and I see it as being an integral part of teaching and learning....

3. I think that formative assessment is an ongoing part of maths. It's really going all the time with lots of dialogue between myself and the child - conferencing, giving them feedback about what they're doing. On the summative side of assessing mathematics I make my own anecdotal records and then I feed those back into the records of development.... The only other longitudinal type testing is things like the state 10N testing.

5. In one sense I find it alot easier to assess mathematics - it's easy to have something that's right or wrong. But then that's really the product, and the process also requires assessment. In my past teaching practice I've found it easier to assess the product part of maths, whereas in literacy we've never really got a product - it's always being refined. I think it's changing with the Intended Literacy Outcomes and that there's really no difference and it'll be outcome driven. I think historically people would have had far more accurate assessment and records in mathematics... And I just question the 10N and 10R tests - whether they should be done - you're either right or wrong in the 10N - there are no shades of grey.

6. I have a formal assessment document which is done on individual observations - the anecdotal records of what the children are doing. Out

of that it allows me to form my teaching groups. Also the informal assessment is done really through the dialogue between myself and the child. I keep very clear notes on what the children are doing and where they are going. I also keep samples of children's work.

7. I think that the system is dictated to us. To a large extent the department determines it.... The staff has a large stake in it. I'd like to think that the school community, and in particular the school staff determine the direction of mathematics... I'm concerned about standardisation in mathematics . I believe that the school community should determine both the product and the process... I assess basically both process and product.

8. We definitely do. I think we do need one given that assessment means something different to each of us. We get these words - assessment, evaluation and monitoring - so that people are very clear as to what we're looking for, the aspects of assessment both summative and formative... I think that there needs to be a policy on assessment and reporting - not to lock into just a single form - but that there shall be assessment and reporting and that the school has some formalised reporting, for example, records of development. That also includes the collection of student work. We should make it clear what is meant by assessment because some people get involved in the collection of huge amounts of information that has no assessment value.

9. I think that the current trend will be that it will become outcome driven system. This is a concern because it focuses on endpoints. The issue is that, for example, at this school we started out focussing on what we thought that the children in this community could do, and now we are being dictated to by the system and there will be a standardisation. ...Children in this school could be in the future compared to children in another school - which may not be totally appropriate.

10. I think need professional development to state this is what we're talking about. Here's a shopping basket of assessment methods - you can select some of these and we've got our school focus to be at least this, this and this.

11. I think that because some people are not skilled in a system, some of the information that was passed onto me was inaccurate. I think it would have been more productive by having greater professional development so that they were clear on what they were expected to assess.

12. It's got to be a key feature of assessment. Records of development are still a concern - the system says that this, this and this shall be so that children be transferred across the system not just moving from class to class within our school. As long as it's an honest assessment there is a need for assessment that progresses with the child, and it needs to be in the form of a personal record... and it needs to be kept manageable.

13. Are evaluation, monitoring and recording interchangeable terms of assessment? I see people not understanding that issue of assessment.

14. I think that assessment is an essential element of teaching and learning, and I think that if we as a teaching group are committed to the teaching pedagogy of the department which is based on the constructivist theory of learning, then I think that assessment really is the tool that allows us to determine whether we intervene in children's learning.... An aspect of assessment is to observe, and then planning should be based on our observations.

Teacher #2

1. I think it means evaluating children's progress and working out where they're up to with what you're doing. So that you're evaluating concepts,

you evaluate the children and you evaluate yourself... You assess the children and that helps you with your programming.

3. You assess all the time when you're walking around - I suppose like individual assessing when you're doing observations, and then you assess in your planning, and you assess when you're planning.

5. Yes, because maths is harder. Literacy is more open so they tackle it, whereas maths is more concrete so they have to know more about it and the kids are at different levels more so in maths.... I use more structured assessment in maths. I have more checklists for maths than literacy.

6. Mentally, anecdotal and in my planning. So you plan from what you find out.

7. The program determines what you should assess, and what you're doing. Your assessment comes from yourself and from the guidelines that you have to follow and from the children themselves. It depends on what you're looking for when you're doing a topic - so if you're looking for creative thinking in problem solving or persistence or whether they're using different strategies that's what you assess.

Whether they're transferring the knowledge that you've taught them into other areas, whether they retain what you've taught them, and whether they've got a good understanding of it. Whether they try and their attitude as well.

The way that they approach problems and whether they understand what I've done. I assess everything - from what they've done, to what they understand and where they're at because they're in so many different groups because they're all at so many different levels.

8. Yes, there should be a policy on assessment - to say whether we should use checklists or whatever.

Yes. There needs to be information on what the children have gained and their previous knowledge before they go into the next class and what

concepts they've got. We need a developmental thing and on attitude as well.

9. Basing assessment on individual needs and then planning for individual needs.

Assessment is getting better because of the Profiles, so its being based on the outcomes. So what they should have gained, not only in the concrete stuff, but attitudes and other areas as well are being assessed.

10. Yes, in different situations - it depends on what you're doing. Sometimes its just good to observe and take a mental note and then jot it down later, and sometimes it's good to test.

Yes, because it's always good to be exposed to new and different techniques. It's good to see what other people are doing.

11. No. They could have been useful if I'd have got them - a checklist of concepts that the children know would be useful.

12. Yes. It would be good to have a checklist and you could quickly go down it to know where you're at. But then again a lot of info also comes from your initial test.

13. It has to be based on individual children. It has to be related to the areas that you're covering, so you have to have good aims. Children have to understand it.

14. Essentially important, because that's how you plan your program and how you cater for the children. You have to have an idea of where they're at, and if you didn't assess them you wouldn't know what you were doing.

Teacher #3

1. It's where you use a variety of means to ascertain what a child knows or what a child can do or what level of development they are at. It's a way of ascertaining a child's ability or attitude or development in some certain area.

3. I assess every time that I am involved in a maths activity. It may be on a whole class scale on the mat doing something using questioning to try to find out what they know. That could be covering stuff we already know - reviewing - but also extension - finding out what they know that we haven't covered. I also assess in small groups. I feel that assessment is an ongoing thing - I'm always assessing.... I do some form of formal assessment every fortnight in the form of a small test - I do that usually whole class in relation to activities that we're doing whole class. I have kids running individually in the number area - working at different levels. But with concepts like time I run that whole class and that's what I usually assess with tests.

4. I'm using the national Profiles but not for assessment.... I sometimes have difficulty separating planning and assessment because whenever I plan a unit I also say how do I assess this unit - how do I get feedback from children about what they know and about what I've done. So I'm using the National Profiles in my planning but I'd like to know more about how to use them for assessment. The other thing I use a lot of are personal records and checklists.

5. No, I don't. I do a lot of conferencing with literacy, I review kid's working.... Most of my most efficient assessment comes when I am working with small groups and I get them talking a lot about maths - about what they're doing, and about why they think that they need to do that. I find that it's the talking that will give me clues and pointers much more than a sheet of paper. I also find that in my literacy area. I find that talking about the use of language effective. I don't tend to use formal testing in literacy like I do in maths.

6. I use checklists made up of things that I feel are important - that I want to know, and they often will break down dramatically even from one point.... For example, place value - I have to break that down into many

components for my sake because I need to know exactly where they are going.... I make notes about observations I make - I record in an exercise book.

7. I do, and the Profiles. But I make the choice about what I assess and how.

Maths strategies and skills and attitudes, but I find it hard - and I always find my checklists insufficient. I find it difficult to get specific from broader statements... You always think I've got this definitive checklist and then it's blown out the window as soon as you start using it.

Strategies that children use, attitude, ways that they manipulate numbers, what they understand.

8. Yeah. I think that individual teachers have got individual assessment procedures which are good, and I don't think that should be wiped out. But - it makes a teacher's job easier if they're recording and collecting and collating information that is similar to another person's, because when the information is shared it becomes more common. It helps people like me who don't have a good understanding of maths to get a better understanding of it. It's a way of developing people's understanding - and that's really important - as long as the policy is flexible.... It's really important in the recording of assessment. It's important that parents get a united message about what we're doing and what we're believing....

9. I think there's a push towards the capabilities and assessment in that area.... We're suddenly going from content and outcomes towards capabilities. Assessment is changing as our concept of maths is changing. Through the Profiles and the other new documents that have come in, there is a broader view of mathematics and of learning... Assessment has to change with the changing beliefs....

10. Any form of assessment that provides information is totally relevant. Assessment becomes inappropriate when it fails to give adequate or appropriate information.

Definitely. It's a necessary thing to be broadening teacher's views, and if we're only relying on what we already know how to do then we're ripping ourselves off as teachers.

11. I did receive some. I didn't find them useful because they were presented in a way that I personally don't record information and I didn't believe that it gave me appropriate information. It included a peripheral activities type base rather than a knowledge base or basis of understanding about maths.

A whole school approach would help because everyone will have had an input into it, and will include things that we believe are relevant... I wonder if teachers will ever feel comfortable about receiving information from other teachers. I think that we're a bit egotistical and we all want to find out for ourselves. Even if we get a wadd of stuff from the teacher beforehand, until we see the children and see how they operate, a wadd of information might never be totally relevant to any teacher....

12. It's necessary if the assessment is for parents and students as well as the teacher. It's an ongoing thing and we need something that follows the child through

13. Determining relevant information is important... Being able to provide assessment that is able to help a child give the most accurate response is essential. If a child has difficulty writing then written tests mightn't determine the child's full maths knowledge or understanding... How the information is recorded is important for the teachers themselves and for the students and parents...

14. It's essential. If I'm not planning with assessment in mind...then I can't be someone who teaches - I am only someone who spouts information.

The only way that I can determine whether a child in my care has grasped a concept or increased their understanding is by using assessment. Unless everything I do is directed by assessment and followed up by assessment then it's a waste of time.

Teacher #4

1. I think of assessment as evaluating the work you've done and improving, changing or modifying your program... I think that assessment is looking at the children's work - seeing whether they are reaching the outcomes, for example in literacy, and how they're going about the processes, and seeing how their little minds work.

3. I probably assess maths every time I do it. I'm always assessing whether they are learning anything from the activity... It's an interaction between you and the child - you work out if the child knows what you're doing.... I also assess once a week in my planning - I decide what needs more work and what we haven't done.

4. I mainly use observation and checklists. The checklists are mainly to check if they can do time, days of the week and so on. Occasionally I give them a sheet to do, but I check all the time when they're doing their work - if they get their sums right or if they're cottoning on to a particular activity.

5. I don't think I do.... I focus on what the children are producing. If they're doing the work then you assume that something positive is happening in their minds. If they're floundering then they either need more work or there's a step that's been missed out. You assess different things in maths and literacy, but it's the same process.

6. I record with anecdotal evidence in the child studies and I record on the checklists and I also record in my planning and from there I'll do individual planning if they need extra work.

7. I do at the moment.

I think that what they're doing should be assessed - any new skills or concepts that they're learning.

8. We'll sort of have one with the outcomes National Profiles although it's not actually assessing... It would go through in their records of development.

9. No idea.

It's not as rigid. The teacher's ability to internalise whether children are progressing hasn't changed. We don't do weekly tests like we used to. The thing that has changed is not so much the assessment but what we expect of the children. It's now alot easier - there's more things to do but they're not as complicated in a numerical sense.

10. Yes. I think that the sitting down and testing puts too much pressure on children and they don't perform properly. Other forms you can get a better idea - just working one-to-one with the child, talking to them and seeing how they're trying to work things out.

It depends if they're doing a big push on it, and if we aren't doing the job at the moment. In the primary section there might be more need for assessment - I don't see the need as much in the infant section.

11. They were fairly useful - they give you a bench mark for how much they improve. But I find it more useful to just work with the child on a one-to-one and I tend to understand the child more that way... If the child is having a problem you need to have some form of assessment sent up so that you can follow it through with the child.

12. Yes

13. One of the most important things is the teacher knowing the work - knowing what she should be teaching the child, knowing what the child can do....

14. If you weren't assessing you could just flow along and do a bit of maths here and there and there wouldn't be a lot of progression, and with some people who aren't maths oriented maths could fade away and become just a small part of your program. It's important to keep the teacher on task, and to know where the children are going.

Teacher #5

1. Assessment is looking at the children, what they're doing in class, what they understand in the maths they're doing. Assessment can also be what they think of maths, and the way that they work through maths questions.

3. I do maths everyday and therefore I am assessing everyday - not necessarily writing everything down. But usually on a day to day basis I look at them, I talk to them, I watch them and I also conference with them...

4. Usually I observe them. I talk with them and question them about what they've been doing. I give them set tasks based on an end of unit work and I mark their work... Sometimes I ask them what they think of what they're doing in maths and that's a real eye opener. I have used tests such as mental maths or times table tests which are basically if the answer is right or wrong.

5. I do some ways because you can test in maths. In maths you can get a definite answer whereas in literacy there are more shades of grey.... Most of the time observing, questioning, talking to children and conferencing them is exactly the same....

6. I've got a book with their names in it and I make anecdotal notes about them. So I look through their books and I comment on what they've done and then any area that I need to follow up on. I also use checklists where I write down what they've been doing, whether they've achieved the

goal and have actually finished the task or whether they haven't understood what we've been doing. Other times I just jot down things during class.

7. I'd say the Education Department and then the district and then the principal and then the teacher.

To start off with you should see if they have basic number skills, basic knowledge of the operations and place value - because a lot of maths is based on those.... The children's attitude should also be assessed because sometimes if children have a negative attitude towards maths and you get rid of that then you've got rid of most of their problems....

I basically assess whatever I'm teaching at the time. I do number and place value on a day to day basis and then at the end of the time that I'm doing measurement, shape or whatever I give them an activity which is based on that unit. Plus I also assess while they're doing that unit.

8. It would be helpful. Especially as a first year teacher I don't know whether I'm doing enough or I'm not sure if what I'm doing is right.... Sometimes it would be nice to have something there and know that that's roughly what we're supposed to do and then we can adapt. It would be good to have a policy which gives you some guidelines but doesn't tell you exactly what you have to do.

9. The current trends are personal records and the objectives or outcomes that the children should be, but not necessarily are, doing.... It's moving away from testing as such.

10. I used to think that testing was the be-all and end-all and now I realise that it's not. That half of what you learn is what you see in the classroom, what you hear the children talk about and looking in their books to see what they're doing. I gave the children a test at the beginning of the year which told me absolutely nothing except what they

didn't know.... There's always room for testing, but I think that observation and conferencing are better methods of assessment.

Yes.

11. Yes, and they were good. But it was all too much and I left it too late for them to be really useful... It would have been helpful if the school had said that this is the most useful thing that you can read.... I wasn't sure of how to use them.

I think that work samples are alright for the earlier grades but too much isn't useful. You need to select just a few over the year.... A self assessment would be really helpful. The personal records would be helpful if people were told how to use them.

12. It's important to keep assessment from year to year because it's important to see where the children are coming from. But too much is overwhelming and too little is no use so there needs to be a balance.... Old reports are really good to read to - especially their comments.

13. Looking, listening and learning. Looking at the children, listening to what they have to say, and what they're having trouble with. The learning is writing down what you see and using it.

14. Without assessment you'd have nothing - you do it subconsciously anyway - but if nothing's written down then little things are forgotten and things aren't followed up on. Assessment makes sure that you keep on track and that you're catering for every child. Because sometimes there are quiet children who can slip through....

Teacher #6 (written answers)

1. Assessment is finding out what students can do and what areas need some attention. This includes attitudes, knowledge and skills.

3. I assess continually mainly using observation.

4. Mainly informal observations, for example, of students' responses during group games. Students' responses are observed and then evaluated. At kinder level, students' performance tends to be inconsistent, depending on their familiarity with "test" items and also on other environmental factors. Also, because of their language and literacy levels, the assessment tends to be more subjective and is most useful when resulting from direct interaction with the student.

5. Both are assessed similarly by student responses, work and attitudes.

6. Anecdotal notes and rated checklists.

7. The students, through their level of functioning, determine what is assessed.

Attitudes, knowledge and skills appropriate to the child's level of development that are essential for developing learning.

In early childhood I assess basic concepts and the transference of these concepts to other situations.

8. Yes. Because it cannot be assumed that every teacher will have enough motivation and background knowledge to come up with their own comprehensive system. A child's academic future cannot be left to chance.

9. There is becoming more balance in terms of capabilities or content and attitudes skills and knowledge. the pendulum swinging between various aspects of maths is levelling out.

10. Some are more appropriate at various ages and stages of student development and for different purposes.

Yes, because teachers have different areas of strengths and assessment may not be one of them.

11. Not applicable at kinder level. But in previous years the most useful assessment material was student work samples because they gave me some idea of error processes as well as whether a student could or could not do something.

12. Yes, because earlier level "gaps" need to be addressed and because it can indicate learning styles and patterns that can help subsequent teachers to program for maximum learning.

13. Knowing the basics of child development in the area, knowing the hierarchy of skills development for each maths area, and knowing the child's learning styles and patterns, and then using all of this information to devise assessment tools.

14. It's one of the foundation stones, without which an effective program cannot be run. Assessment should have a direct continuous bearing on the teacher's program overall and especially in relation to individual students. Without assessment there is risk of some students getting lost in the system and others getting bored. Even if students are able to learn the rudiments of mathematics appropriate to their grade level, without assessment and using this knowledge for planning, many will not reach their potential or develop higher level thinking skills that they would have been capable of.

Teacher #7 (Written comments)

1. Assessment is identifying each child's capabilities with a view to determining courses of action which will form the basis of future learning.

3. I use ongoing assessment procedures. I attempt to evaluate individual work on a daily basis.

5. I have a folder of sheets containing classlists - with an individual class list sheet for each strand. I record whether children have a problem with process (p) or calculation (c).

6. Maths tends to be more cut and dried particularly if you assess using the procedure above. In literacy I tend to use annotated notes more heavily with specific criteria being addressed.

7. I determine according to need - balance between strands.

Processes need to be assessed and calculation should be assessed.

Reasoning skills should be assessed.

I assess processes, calculations and reasoning skills.

8. Yes

Yes

9. Assessment is becoming more focussed on formative rather than summative assessment.

Assessment is being used more to address individual needs and to determine remediation needs and to extend more able students.

10. Yes. Some teachers have the 'mistaken notion that record keeping amounts to assessment. Assessment does more than record marks - it requires a judgement to determine the education needs of individual students within your class.

Yes.

11. No

12. Yes. It's valuable in establishing quickly where students are at. The Profiles can help in this area.

13. Assessment needs to be continuous and used constructively to establish learning programs. It needs to be formative rather than summative.

14. Assessment is important but it should not dominate teachers' thinking - it should be used as a tool to determine future learning programs.

Teacher #8

1. Assessment is to evaluate or plot what the child knows against certain outcomes, objectives and skills.

2. To see what knowledge or skills the child has attained, and to ascertain certain weaknesses or areas that need to be further developed.

3. Assessment is an ongoing. Almost daily children are assessed through observation and through set tasks with given objectives and outcomes. At times certain activities are specifically designed to assess areas so as to effectively plan a programme to assist development.

4. I assess basically through observation, personal checklists of skills and outcomes, and samples of work where applicable.

5. Yes, but I am beginning to change. In both areas I assess through observations and checklists. In literacy I rely heavily on assessment based on the KILOS. I make a checklist of specific outcomes and have made up a code to show levels of achievement.

6. I have made (through reading various maths guidelines) checklists of skills and outcomes that would be desirable to be attained by the end of the year. As the children attain these I use a highlighter pen. I am beginning to use a code to state the level of achievement/attainment as in literacy. This is still experimental.

7.a) Basically the teacher determines what is to be assessed, according to their own program. However the school also determines it through school/personal profiles, and the department (and government) determines it through the implementation of the National Profiles.

b) All aspects and strands of maths should be assessed and records of performance, attitude and skills should be kept.

c) I assess the knowledge that the children have (e.g. what a triangle is etc.), how they work and how they come to certain conclusions. I also assess their cooperation and attitude.

8.a) Yes

b) Yes

9. I am unsure of what the current trends actually are except for the National Profiles and State Maths Guidelines.

10.a) Some forms of assessment are more appropriate. It depends on grade level as to what you are assessing and when you are assessing.

b) Yes. There are some forms of assessment that I've never heard of and I would like to know more about, and there are some that I am using that I would like to go into in more detail to see if there is a more effective way of using these to assess.

11. Not applicable.

12. Yes. It means that you are able to see the areas the child is/has been weak/strong in, and that may need help or more development. It may assist the next teacher with developing programs that are continuous.

13. The essential components are observation, checklists and samples of work.

14. Assessment is very important in the classroom so that you can see which areas are strong are weak, and where further planning needs to be focussed. It also pinpoints at times weaknesses of teaching that needs to be developed for an effective all round program.