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**Investigating assessment strategies in mathematics classrooms :
a CD-ROM resource enabling teachers to explore assessment
strategies in mathematics education**

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Investigating assessment strategies in mathematics classrooms

Tony Herrington, Len Sparrow,
Jan Herrington, Ron Oliver



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Investigating Assessment Strategies *in Mathematics Classrooms*

A CD-ROM resource
enabling teachers to explore
assessment strategies in mathematics education

Investigating Assessment Strategies in Mathematics Classrooms

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Investigating assessment strategies *in mathematics classrooms*

A new vision

Assessment is a critical issue in the teaching and learning of mathematics and one that requires careful consideration by teachers and preservice teachers alike. The assessment experiences for many students in the classroom is still one that is based on a behaviourist approach where discrete facts and skills are tested, where grading and ranking are the primary goals (Niss, 1993). Kilpatrick argues that an alternative vision is necessary for today's classrooms:

The challenge for the 21st century, as far as mathematics educators are concerned, is to produce an assessment practice that does more than measures a person's mind and then assign a mind treatment. We need to understand how people, not apart from but embedded in their cultures, come to use mathematics in different social settings and how we can create a mathematics instruction that helps them use it better, more rewardingly, and more responsibly. To do that will require us to transcend the crippling visions of mind as a hierarchy, school as a machine, and assessment as engineering. (Kilpatrick, 1993, p. 44)

This view changes the focus of assessment from summative assessment where students are assessed principally to determine an overall measure of achievement, to the more supportive role of formative assessment where students' achievements result in action plans, for both teacher and student, in the pursuit of further learning.

The need for change

The need to change assessment practices must be seen in the wider context of changes to society, and changes to the way we view mathematics, teaching mathematics and learning mathematics. Today's society has moved from an industrial to an information-based society that relies on a far greater use and application of technological understanding and has goals that promote equal opportunity for mathematics learning for all its citizens (NCTM, 1989). Mathematics itself is no longer seen as hierarchical and discrete with the consequent belief that this is the way it is learnt (Stephens, 1992). Instead, influential reports on the mathematics education show a vision of mathematical knowledge that is different to many preconceived beliefs about the subject. The accepted view of mathematics as basic arithmetic skills has given way to a broader view that emphasises mathematics as general processes, or ways of thinking and reasoning (NCTM, 1989), as an important form of communication (DES, 1982), and as a science of patterns (AEC, 1991).

Current theories of learning mathematics suggest that students are not passive receivers of knowledge but actively construct knowledge consensual with social and cultural settings (von Glasersfeld, 1991). These changing views of mathematics and the way students learn have broadened the ways in which mathematics is taught. Instead of a view of teaching that relies on teacher exposition followed by student practice, modern teaching practices involve strategies such as problem solving, investigations, practical activity, (DES, 1982); group work, projects (NCTM, 1989); and applications of relevant technologies (AEC, 1991).

What is needed

Rather than relying on approaches that provide assessment solely for the purposes of grading, ranking and credentialling, assessment practices are needed that integrate with learning activities, that support students' construction of knowledge and that reflect the diversity found in the curriculum and in the learners themselves.

As well as the variety of mathematical topics found in any mathematics curriculum, the expected learning outcomes for each topic vary from routine mathematical facts and skills, to conceptual understanding, strategic knowledge, appreciations and awareness, personal attitudes and qualities (Swan 1993a). The learners themselves bring rich experiences that reflect different social, cultural and gender groupings in society as well as varying ages, developmental levels and maturity (NCTM, 1989). The recognition of such diversity has necessitated 'a shift in the vision of evaluation toward a system based on evidence from multiple sources and away from relying on evidence from a single test as well as a shift toward relying on the professional judgements of teachers and away from using only externally derived evidence' (NCTM, 1995, p. 2).

Assessment approaches

Multiple sources of assessment will involve different ways of presenting tasks to students as well as different ways of probing assessment information so that valid inferences about students' progress can be made. Tasks can include a variety of formats: written, oral, practical; can be closed or open-ended; real life or abstract; completed individually or as a group (Swan, 1993b). Teachers and students alike will make inferences about learning based on information gained through broad approaches like observing, questioning and testing. More fine-grained strategies can also be employed. Observational strategies include such techniques as anecdotal record keeping, annotated class lists and checklists. Questioning approaches may involve structured or open-ended interviews, self questioning, using higher-order questions or fact recall. Reporting may take the form of oral reports given to the class, written reports on a project or investigation, portfolios, journals and diaries. Testing procedures may be formative in nature such as diagnostic tests or have a more summative purpose as in examinations (Clarke, 1988; Mitchell & Koshy, 1993; NCSM, 1996; Stenmark, 1991).

The CD-ROM program

Assessment in the mathematics classroom is a complex issue that requires teachers to plan tasks and procedures that reflect the diverse nature of mathematics, its teaching and its learning. The program will enable you to explore the variety of tasks and strategies that are commonly advocated across the K-12 mathematics curriculum. As you interact with the program you will face many of the issues identified in the introduction. The program does not attempt to provide answers for your students' assessment needs. What it does do is enable you to develop an awareness of the breadth of tasks and strategies available and a consideration of how and when these strategies may be implemented in particular circumstances so that you will be able to use this knowledge in your school, with your students, and for your particular needs.

The program

The interface of the program has been designed to simulate the front part of a classroom so as to allow teachers to access resources intuitively, almost in the same way they would if they were physically present in the room. Seven types of resource are available to users and these are described below.

Video scenes and interviews

By clicking on the video cassettes pictured under the television screen, teachers can view short video sequences of:

- The scenario:** A scene of the strategy being used in the classroom.
- Teacher:** A short interview with the teacher on his or her use of the strategy.
- Student:** A short interview with a student from the class on the strategy.

Filing cabinet resources

Each filing cabinet drawer contains a written resource which students can examine:

- Descriptions:** A description of the assessment strategy.
- Samples:** Samples of students' work or teachers' records, or other documents.
- Reflections:** Advice given by a preservice teacher on his or her experience of using the strategy on professional practice in schools.
- Interviews:** Expert commentary on the use of the assessment strategy.

The following page gives a map of the interface, together with a short list of instructions on how to get started using the program. The page is a useful guide for new users of the program and can be photocopied for distribution to teachers. For details of setting up the software and troubleshooting, see pages 43-44.

The elements in the program and how to access them

Quick guide to getting started

1. Wait till the EXIT sign turns green.
2. Click to select a strategy from the whiteboard to investigate.
3. Click on any element on the screen to watch a video or read some text. For example, click on a video cassette or one of the filing cabinet drawers.
4. Copy items or write your own reflections in the notebook.
5. When you have finished, choose another strategy from the whiteboard to investigate.

Click here to read a description and discussion of the strategy

Click here to see scanned images of samples of students' work and other material

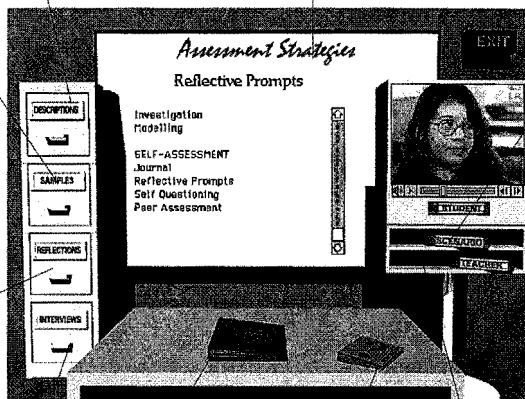
Click here to read a preservice teacher's comments and advice on the strategy

Click here to read an interview with a mathematics education expert on the strategy

Click here to use the electronic notebook, which includes space for reflections and pastes from other documents. It also includes investigations and problems

Choose an assessment strategy to investigate by clicking on one of the categories shown in black on the whiteboard

Click here to play a video clip of the assessment strategy being used in the classroom



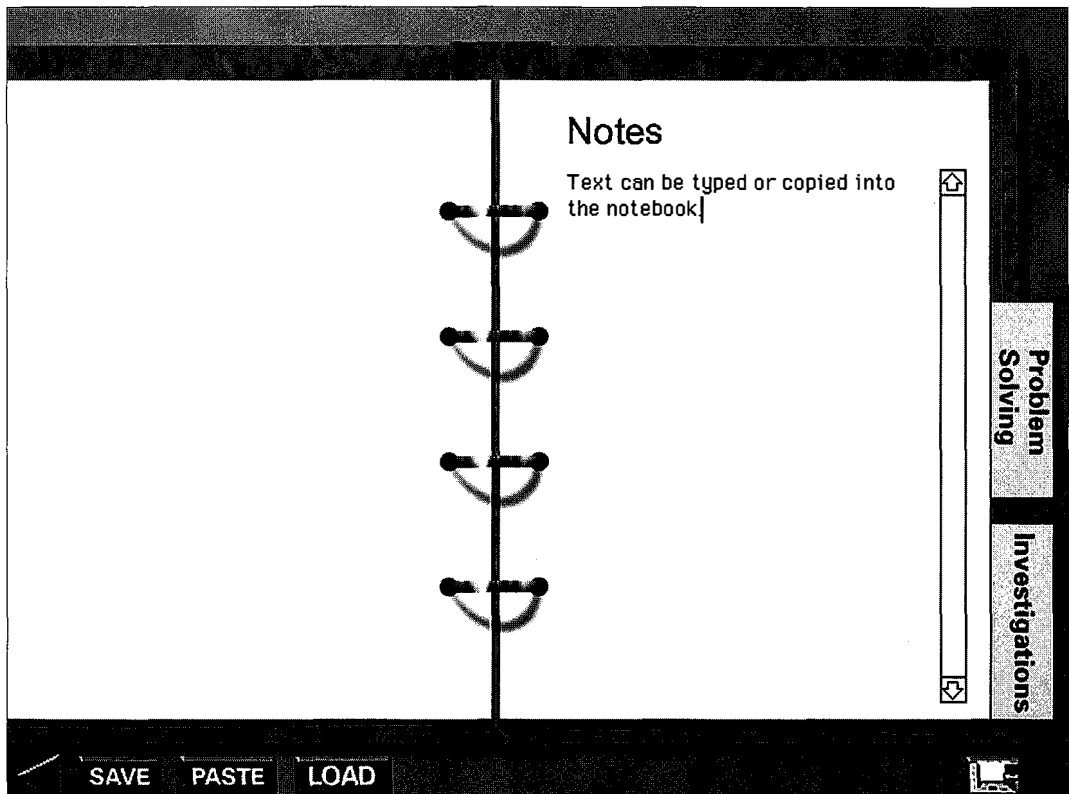
Click here for help

Click here to play a video clip of a student's comments on the assessment strategy

Click here to play a video clip of a teacher's comments on the assessment strategy

Electronic notebook

In addition to providing documents and videos for users to examine, the resource also provides an electronic notebook to enable users to write their own reflections and ideas as they explore the various elements provided. They can also select text from the documents in the filing cabinet drawers (all documents except the scanned items in the samples drawer) and cut and paste text into their notebook.



At the end of a work session, users can save copies of their notes to their own disks, then format them using their regular word-processing program. If required, the notebook file can be saved and reloaded in plain text form at a later work session by clicking on the Load button, and nominating the saved file. Note that you cannot reload the document once it has been saved as a word processor file, unless it is returned to Text Only form.

Using the program

The program is designed to be used with preservice and practising teachers of mathematics. It has been designed according to principles of situated learning to create a learning environment which provides for the following conditions:

- Authentic context that allows for the natural complexity of the real world
- Authentic activities
- Access to expert performances and the modelling of processes
- Multiple roles and perspectives
- Collaboration to support the cooperative construction of knowledge
- Coaching and scaffolding which provide the skills, strategies and links to complete the task
- Reflection to enable abstractions to be formed
- Articulation to enable tacit knowledge to be made explicit
- Integrated assessment of learning within the tasks.

Note that not all these elements can be incorporated into the program itself. Many, such as collaboration and articulation, need to be provided at the time of the implementation of the program and they have also been allowed for in the investigations provided with the program. One such investigation places teachers in a situation where they are required to investigate alternative assessment strategies. Critical features are highlighted in the diagram opposite.

Critical features of the investigations

Collaborative learning

All activities are addressed to a group rather than an individual to allow for collaborative learning

Multiple perspectives

A problem situation is described which requires investigation of the resource from a variety of perspectives

Authentic task

A realistic task is set, requiring a written response

Articulation

An opportunity to articulate and defend findings is given, together with a recommended time limit

Memo to: New teachers

From: Rebecca Edwards, Mathematics Coordinator

Reference: Mathematics assessment

As discussed at our last staff meeting, there is considerable concern that mathematics teachers in our school are not using an appropriate range of assessment strategies in their day to day assessment of students. There have been several complaints from parents about the over reliance on pencil and paper mathematics tests, and the amount of anxiety this produces in their children.

As you are the most recent teachers to join our staff, and you have recently graduated from teacher training, it is felt that you are the most appropriate staff members to provide some guidelines on how we might proceed. I am writing to formally request that you prepare a report on alternative approaches to assessment in mathematics to be presented to staff.

I have allowed for your classes to be covered for a total of six hours over a period of two weeks. In that time, I would like you to observe other types of assessment being used in classrooms, and to talk to teachers, students, preservice teachers and experts about the techniques. Prepare a suggested plan on how our school might proceed, including benefits and problems for parents, students, and teachers.

I would be grateful if you could present your report at the next staff meeting, scheduled in three weeks. I will allow approximately 15-20 minutes for your report.

Thank you for your assistance in this matter.
Rebecca Edwards
Mathematics Coordinator

To the Principal

I am writing to express my concern at the number of maths tests Lauren is required to take. She gets extremely anxious before each of these tests, almost to the point of making herself sick. Is there any other way she could be assessed, as the constant tension is making our home life very difficult?

Yours Sincerely,

Authentic context

A supplementary document is provided, often the source of the problem that requires action

Problems and investigations

There are two types of activities provided in the program: *Problems* and *Investigations*. *Problems* are questions which allow the user to explore the resource with a single issue in mind and are more limited than *Investigations* which require a more open-ended and sustained examination of the resource.

Users will gain the most from the resource if it is used with the *Investigations*, under the following conditions:

- Focus of investigation:** The resource is best examined in depth, from a number of different perspectives; for example, completing two or more investigations
- Length of time:** Best used over a sustained period of 2-3 weeks rather than for a single session
- No. of teachers:** Teachers or preservice teachers working in pairs or small groups around each computer, rather than individually
- Facilitator support:** Facilitator present during use to provide 'scaffolding' and support, rather than it being an independent study activity
- Setting the task:** Facilitator demonstrates the resource by thinking-aloud as an investigation is modelled. Students then choose an investigation from those provided, or one of their own choice.

Using the investigations

Five investigations have been included in the *Investigations* section of the electronic notebook. The investigations are all in the form of two related documents which set the task in a realistic and authentic manner.

The five investigations have been reproduced on the following pages.

Investigation 1: Alternatives to tests

The first investigation addresses the concerns of a child's parent who has written to the principal of the school to complain about the number of formal tests the child is required to take. The mathematics coordinator of the school asks the new teachers (the users of the multimedia package) to investigate the assessment strategies being used by teachers and to prepare a suggested plan to encourage teachers to use an appropriate range of assessment techniques.

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Yours Sincerely,

Investigation 2: The case for multiple choice tests

The second investigation is prompted by a short article in the newspaper, where a visiting professor claims that streaming students into ability groupings is a waste of time. The principal of the school is concerned. Having seen the article and read other reports, he asks the Mathematics Coordinating Committee to suggest an alternative to the current school practice of using multiple choice tests to stream (track) students.

Memo to: The Mathematics Coordinating Committee

From: Leslie Moore, Principal

Reference: Mathematics assessment

In the light of recent journal articles and media reports throwing some doubt on the effectiveness of multiple choice tests, I am seeking your advice on our present streaming policy. As you are aware, our present practice is to give all students from the feeder primary schools a multiple choice test prior to admission to the school. We then stream students on the basis of these results.

I am interested in your thoughts on this procedure from a mathematics perspective. Can you please provide me with a 1-2 page report on the current thinking on assessment in mathematics and multiple choice tests in particular. Please consult with teachers, students and experts in the field, and if your considered opinion is to adopt an alternative procedure, please outline that approach with your reasons.

Could you also prepare a short presentation on your ideas to present to all teaching staff at our next staff meeting.

Leslie Moore, Principal

Streaming a waste of time: Expert

A Mathematics Education Professor at the Annual Meeting of the Mathematics Teachers said today that the common practice of streaming students into similar ability groupings for instruction based on multiple choice testing was a waste of time. Professor Kibbi Yankelovich said that research has indicated that the multiple choice test, frequently used as the basis of streaming, was incapable of determining, with any validity, how well students understood significant mathematical ideas.

Investigation 3: A new report form

The third investigation looks at how mathematics achievement is reported on the report form which goes home to parents. There is a suggestion from the School Council that the form is inadequate and the principal asks the Mathematics Coordinating Committee to suggest an alternative manner of reporting.

Memo to: The Mathematics Coordinating Committee

From: Chris Miles, Principal

Reference: New report forms

In the past, the report forms used by the school simply gave a letter grade and a brief description of the student's progress. As you are aware, the School Council has requested that the school consider revising our reporting procedure. I would like the Mathematics Coordinating Committee's submission to the Council on:

1. The different ways that students are assessed in mathematics, and
2. How you would like to report these assessments to parents. Attached is a copy of our current report form.

A Council meeting is scheduled in two weeks to discuss the issue further and I would like your input at this meeting.

Thank you
Chris Miles

Subject	Name	Grade	Comments
Mathematics	Sally Evans	B+	Sally has worked to the best of her ability this term

Investigation 4: Ten terrific tests

The fourth investigation is an approach to the Mathematics Coordinating Committee to write an outline for a book on assessment entitled *Ten Terrific Tests*. Ace Academic Press publishes a series of books called *Maths is Marvellous*, and they have already published five titles in the series. They want an outline on the best approach for a book on assessment, together with an alternative title, if appropriate.

Ace Academic Press

Dear Mathematics Sub-Committee,

I am writing to inquire whether you are interested in compiling a volume for our very successful, bestselling series of booklets: *Maths is Marvellous*. The series aims to present serious educational issues in an easy to read and accessible format.

The work of your committee was brought to my attention recently, and I was impressed with your discussion in the assessment area of mathematics. I have enclosed a brochure listing our existing titles in the series. As you can see there is a need to address the issue of assessment, with particular reference to expert opinion and practical classroom application. I had in mind something along the lines of 'Ten Terrific Tests'.

If you are interested, I need to know firstly, whether you think the idea is a good one, and if not, an alternative approach you might suggest. I also need a title for the book and an outline in 1-2 pages of the overall philosophy and contents you would include, together with justification. Can we meet within the next two weeks with the directors of my company to discuss your ideas?

I look forward to hearing from you.

Bernie Brown

Publisher

Maths is Marvellous

Booklets in the series:

- Twenty top tips to trouble-free teaching
- A gallery of great games
- Countless clues for classy calculating
- Thirty themes for thinkers
- Hundreds of homework hints

Investigation 5: Professional development presentation

The fifth investigation asks for a presentation to be prepared on *Assessment in Mathematics Classrooms* to be presented to the Professional Development Question Forum. Teachers are asked to consult with experts and observe others teaching, and present an overview of the situation and guidance on the use of assessment strategies in the mathematics classroom.

Professional Development Centre
 Central Office
 Education Department
 Dear Colleague,

Thank you once again for volunteering to conduct a session at the Professional Development Question Forum which is to be held at your school in two weeks' time. There has been an excellent response from the teachers in the region and well over a hundred will be attending. I will discuss with you at a later date such things as car parking and refreshments.

As is our usual practice, I have selected a major area of concern in mathematics teaching for you to address. This year it is 'Assessment in mathematics classrooms'.

Can you please consult with experts and observe some exemplary teaching in order to plan your presentation. You will be allowed 15 minutes for your presentation and in that time I hope you will be able to suggest an overall framework and a number of specific strategies to assist in this area.

I look forward to meeting you again and to a successful Forum.

Yours sincerely,

Professional Development Officer

**Come to the
 Professional Development Question Forum**

**The highly successful
 Professional Development Question Forum is
 again to be held in this region.**

WHY? To enhance your teaching ability

**To answer your questions on subject specific assessment
 strategies**

**To provide you with access to some of the best teachers and
 to observe their techniques**

To help you keep up with recent research

WHERE?

WHEN?

Using the problems

Ten problems have also been listed in the *Problems* section of the electronic notebook. These are less comprehensive than the investigations and may require the exploration of only part of the resource. They could also be completed in a much shorter time than the investigations.

The problems listed in the Problem section of the notebook

1. Make a list of different items that could be included in a student's mathematics portfolio. Explain how and why you would use a portfolio for assessment purposes.
2. In what ways can interviews be used to assess students' mathematical abilities?
3. Solve this problem:
A square has 2 diagonals. How many diagonals does an octagon have?
Indicate what you might assess from a student's written response to the problem.
4. List 10 questions that students may pose related to this statement:
The diagonals of a square are perpendicular.
5. Change these closed questions to open-ended questions:
 $17 + 25 = \dots$
Find the perimeter of a rectangle length 24 cm and width 15 cm.
Factorise $x^2 + 2x - 3$
6. Design a checklist that a teacher may use for this performance-based test question:
Using the newspaper make some shapes that have an area of $1m^2$.
7. Complete this modelling problem then develop a marking scheme:
How much paper will I use in school this year?
8. Indicate how you might implement journal writing in a mathematics classroom and how this may assist you in assessing students.
9. Outline methods that students could use to assess their own learning of mathematics and indicate how the activities may also provide assessment information for the teacher.
10. As part of your assessment you will be using a pencil and paper test. Choose a topic and develop a 40-minute test. Provide a marking key and a brief written justification for your method of allocating marks where necessary.

The assessment strategies

A review of the literature on assessment, and extensive reading of current issues in the field, enabled the identification of 23 assessment strategies which were relevant to K-12 mathematics classrooms. These categories formed the basis of the assessment strategies which are featured on the CD-ROM.

The strategies have been grouped into several sections:

Observing	Checklists Anecdotal
Questioning	Higher order Factual Open-ended
Interviewing	Structured Open Parent
Testing	Diagnosis Performance-based Pencil and paper Multiple choice Problem solving Attitude
Reporting	Oral Written Portfolio Investigation Modelling
Self - Assessment	Journals Reflective prompts Self-questioning Peer assessment

EDITH COWAN UNIVERSITY
GERALDTON REGIONAL CENTRE
PMB 10000
GERALDTON WA 6531

Each strategy is described in detail in the following pages.

STRATEGY: Checklists

Description:

Checklists provide an efficient way of recording student outcomes as they occur. They also highlight behaviours and attributes that teachers need to monitor. These outcomes might include cognitive abilities such as a student's understanding of a particular concept, or demonstration of a particular skill. They can also include attitudinal outcomes such as a student's willingness to cooperate in group activities, their use of equipment, and their level of interest in the activity. Checklists can be completed as students are undertaking the activities or as a summary of other assessment tasks. The checklists can be developed to cover content across a term's or year's curriculum, or to identify, for example, mathematical processes and attitudes displayed in a problem solving activity.

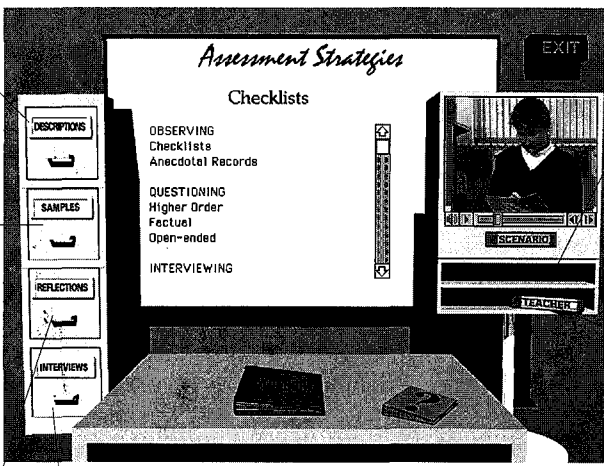
Checklists can be used to record information as students work individually or in groups. Particular lessons or activities can be planned where observations are formally recorded through the use of checklists. Teachers can observe and assess students working with their peers in group situations which may allow for a more confident use of the mathematics.

Examples:

An example of a teacher's completed checklist

Reflections:

Example: A pre-service teacher's reflections on using the strategy



Scenario:

Video clip of a teacher completing a checklist in the classroom

Teacher:

The teacher's comment on checklists

Interviews:

An interview with David Clarke

STRATEGY: Anecdotal records

Description:

Observation of students working individually or in groups provides a major part of student assessment. The teacher is continually in a position to observe students' mathematical outcomes and act on them immediately. This type of assessment is often described as informal, however, its significance should not be underestimated in forming a complete assessment of a student's capabilities.

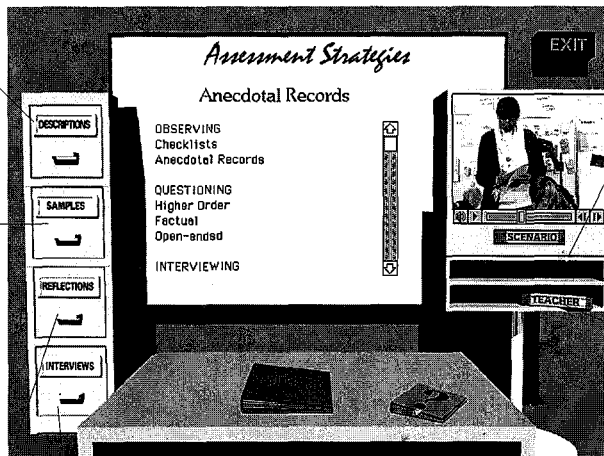
Anecdotal records are informal, and often infrequent, assessments of students' achievements, beliefs and attitudes that are observed as they are engaged in some mathematics. These records may relate events that the teacher judges to be surprising or out of the ordinary; for example, situations in which a student displays a misconception. On the other hand records can also indicate events in which the student displays a high standard of work or effort, such as a creative method of solving a problem. Anecdotal records provide a valuable form of information when discussing student progress with parents. One way to structure anecdotal records is to simply add comments to the class list. This annotated class list can be used to record significant events on the occasions when they arise and need not be an everyday task.

Samples:

An example of a teacher's anecdotal records

Reflections:

Matthew: A pre-service teacher's reflections on using the strategy



Scenario:

Video clip of a teacher making anecdotal records of students

Teacher:

The teacher's comment on the value of anecdotal records

Interviews:

An interview with David Clarke

STRATEGY: Higher order questioning

Description:

Questioning can be either written or oral, can be asked by others or by oneself, and may be used for many different purposes. Higher order questioning attempts to find out not simply whether a student has memorised a particular fact or procedure but whether he or she has made important connections that underpin such knowledge. A question that asks: 'What is the sum of the internal angles of a triangle?' is a factual question. Higher order questions related to angles might be: Does this work for every type of triangle? What if the shape changed to a square? Why does this work? How can I prove this?' These types of questions require time for thought (wait time) and cannot be answered in an automatic way as may be expected with factual type questioning. The following are examples of stems of higher order questions:

- | | |
|-----------------|----------------|
| What if ...? | How does ...? |
| Why does ...? | How could ...? |
| What about ...? | |

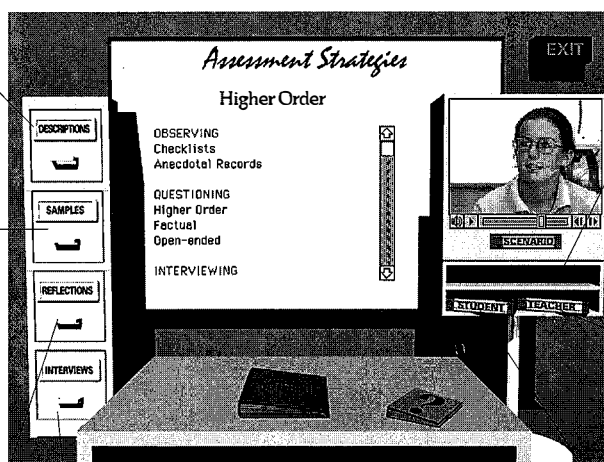
Teachers can model these higher order questions, display them on classroom posters, and support students in self questioning using higher order questions.

Examples:

An example of a higher order question poster

Reflections:

Examples: A pre-service teacher's reflections on using the strategy



Interviews:

An interview with Gilah Leder

Scenario:

Video clip of a teacher using higher order questioning in class.

Teacher:

The teacher's comment on using higher order questions

Student:

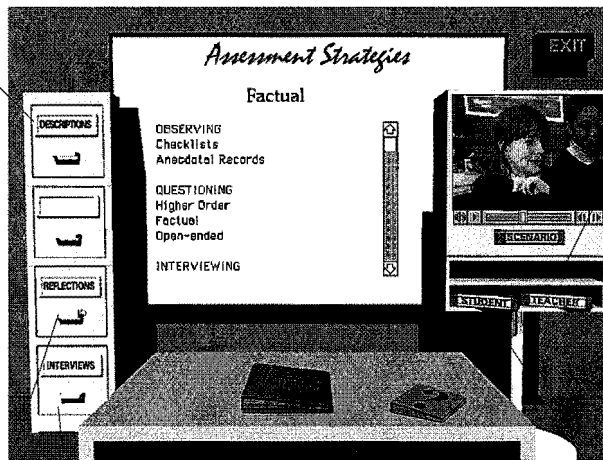
A student's comment on higher order questions

STRATEGY: **Factual questioning**

Description:

Factual recall is a traditional requirement of mathematics classrooms especially in relation to learning basic number facts. Fact recall usually requires students to respond automatically with the answer to the question. This does not mean, however, that students learn the knowledge in a rote or meaningless fashion. On the contrary, it is important that students meaningfully learn the concepts that underpin the factual knowledge to be learnt. In the case of number facts, students should have meaningful experiences with concrete materials and thinking strategies for gaining answers, before they attempt to memorise. Providing students with time to think about answers (wait time) allows for students to employ thinking strategies.

When assessing students' factual knowledge the teacher may wish to have students explain their right (or wrong) answers so that others can benefit from the varied thinking that inevitably occurs. This is one way in which students learn important mathematical processes. The benefits that accrue from simply recording the number of correct and incorrect answers from factual quizzes has limited educational value and may in fact cause students to become more anxious about the subject and more inclined to avoid it in the future.



Scenario:

Video clip of a teacher asking a number of short answer fact recall questions

Teacher:

The teacher's comment on factual questions

Student:

A student's opinion of short answer fact recall questions

Reflections:

Simone: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Gilah Leder

STRATEGY: **Open-ended questioning**

Description:

Open-ended questions are questions that allow for more than one answer. They involve mathematical thinking that goes beyond recalling facts or demonstrating skills. Examples of open-ended questions are:

The average of three numbers is 8. If one number is 3.5, what are the other two?
Find the perimeter of a rectangle with an area of 24 square centimetres.

Open-ended questions are good starting points for investigations. They enable teachers to identify understanding, or lack of understanding, and have the added benefit of enabling students to extend their learning and discover relationships and patterns.

Many textbooks rely on closed questions and so it becomes important for teachers to change at least some of these to open questions.

Samples:

An example of a student's notes on an open-ended task

Reflections:

Cameron: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with David Clarke

Scenario:

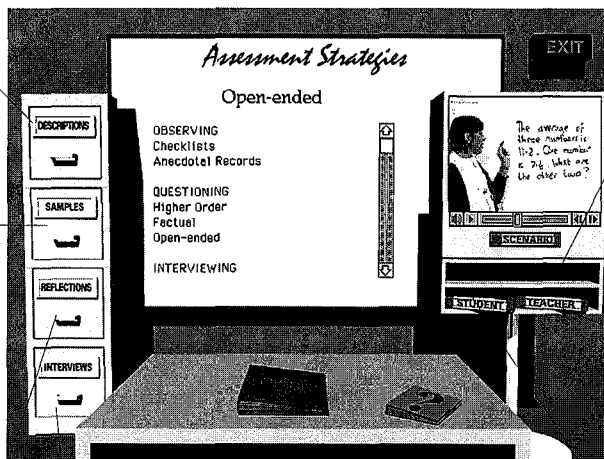
Video clip of a teacher giving the class an open-ended question

Teacher:

The teacher's comment on the use of open-ended questions

Student:

A student's opinion of good questions



STRATEGY: **Structured interviews**

Description:

Structured interviews contain the same set of questions given in the same sequence. For example, a teacher may wish to find out the mental computation strategies that her students use for a particular set of number facts, such as $3 + 8$. In this way the teacher is able to determine those students who effectively use particular strategies for certain types of number facts.

Another reason for using structured interviews is to diagnose difficulties that students may be encountering. For example, the Newman error analysis is a structured interview that pinpoints difficulties students encounter as they solve word problems. The interview begins by asking the student to do a problem with which they are experiencing some difficulty. The teacher then asks the following questions in order: (1) Read me the question, please, (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 how you work it out, (5) Now write down the answer. In order, these questions provide an indication of whether or not the student is having difficulty in reading, comprehension, transforming the problem to mathematical symbols, using mathematical procedures, or determining the correct answer.

Samples:

An example of a useful problem to help diagnosis

Reflections:

Minh: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Ken Clements

Scenario:

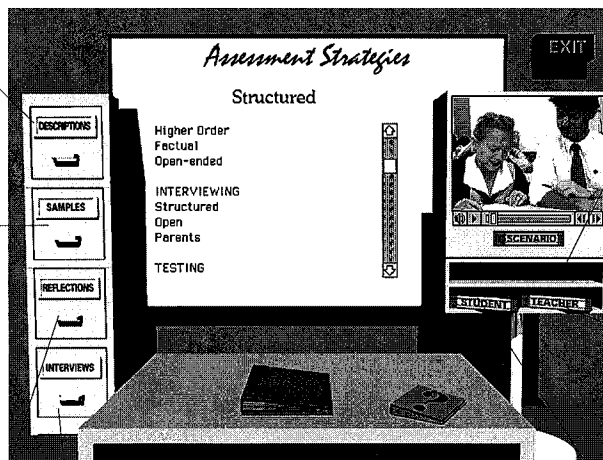
Video clip of a teacher conducting a structured interview with a student

Teacher:

The teacher's comment on structured interviews

Student:

A student's comment on difficulties associated with word problems

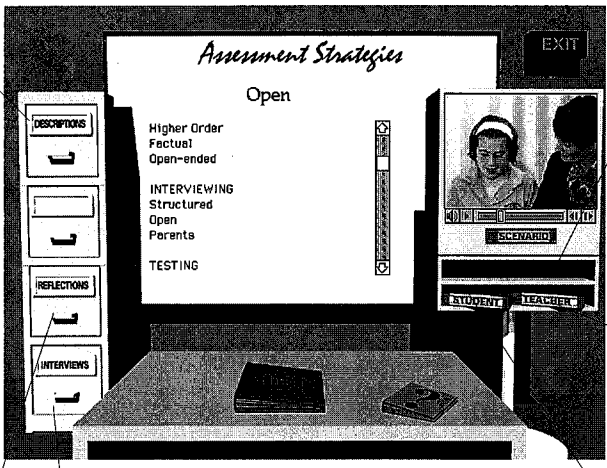


STRATEGY: Open interviews

Description:

An open interview or conference does not follow a set sequence of questions like the structured interview. Instead the interview relies on discussion between the teacher and the student with questions arising incidentally. It is a good idea to begin an open interview with the student engaged in some sort of mathematical activity. Ask the students to talk about how they are solving the problem then ask questions that result from their progress. Extend the problem and search for the student's deeper understanding of concepts and relationships.

Some students will find it difficult to explain their thought processes. They may need to be given longer periods of time (wait time) to formulate their responses. In some circumstances it may be profitable to tape record the interview so that follow up records can be made. As students are solving a problem try to avoid giving students directions and rewards for certain responses. The aim is to assess the student's mathematical thinking, rather than a teaching episode. Interviews may be conducted with individuals or small groups of students and the focus of the interviews may be mathematical ideas or students' attitudes and beliefs about mathematics.



Scenario:

Video clip of a student discussing her work with her teacher

Teacher:

The teacher's comment on open interviews

Student:

A student's comment on the value of having a conference with the teacher

Reflections:

iddie: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Gilah Leder

STRATEGY: Parent interviews

Description:

Often teachers need to discuss the progress of individual students with their parents. Such discussions can shed light on environmental factors that may be influencing aspects of learning, such as motivation.

Parents may be able to advise teachers about areas of mathematics where students have confided that they may be having difficulties. Valuable information may be gained from parents as they are able to see their children doing their mathematics in a context that is quite different from the regular classroom.

Samples:

An example of a questionnaire which can be used to gain information about students from their parents

Reflections:

Maria: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Nerida Ellerton

Scenario:

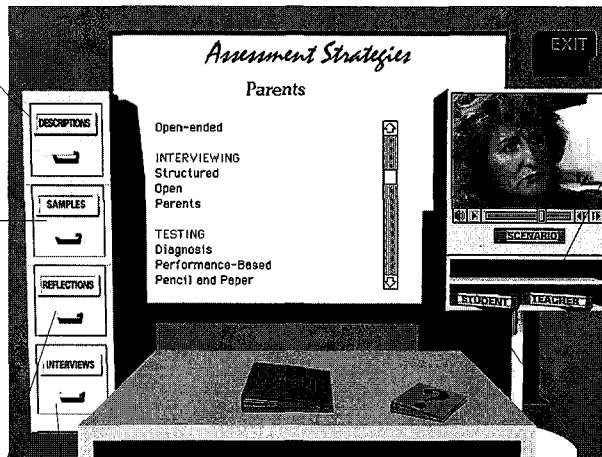
Video clip of a teacher discussing a student's progress with his mother

Teacher:

The teacher's comment on the value of consultation with parents

Student:

A student's comment on how his mother helps him with his mathematics

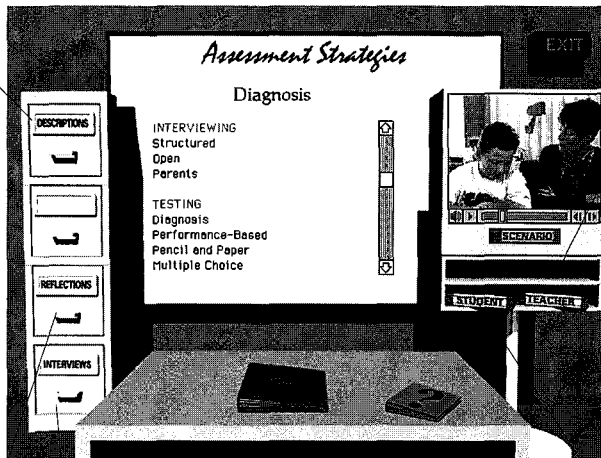


STRATEGY: **Diagnosis**

Description:

Diagnosing students' difficulties in mathematics is an important aspect of teaching. This can be done through testing or interviewing and appropriate teaching can follow. Diagnostic teaching is a teaching strategy that is based on identifying areas of student difficulty and then suggesting challenging tasks that cause the students to confront those misconceptions. Discussion can then be used to resolve conflict and develop a better understanding.

The teacher's task is to use well chosen tasks or problems that will enable students to confront their misconceptions. In the case shown on the video clip on the CD-ROM, the teacher is aware that the student has difficulty with decimals and place value and is using the calculator to perform the addition. The conflict for the student arises when he sees that the result the calculator produces is different from his prediction. Ensuing dialogue with the teacher will help the student in his understanding of the concept.



Scenario:

Video clip of a teacher diagnosing a student's difficulties

Teacher:

The teacher's comment on questioning techniques

Student:

A student's comment on an unexpected answer

Reflections:

Bailey: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Helen Mansfield

STRATEGY: Performance-based

Description:

Performance-based testing involves making an assessment while the student is involved in performing a mathematical activity. The activity will often involve the use of materials. If a teacher's objective is to have students use multibase arithmetic blocks to represent the subtraction of whole numbers, it makes little sense to assess such an objective with a paper and pencil test item. It would be more appropriate to observe, question and assess the students as they are involved in the practical use of these materials.

Other outcomes may be assessed as students are involved in practical activities. For example, a teacher may observe the mathematics that the student chooses to use as well as specific content skills like computation and measurement procedures.

Performance-based testing may be done individually or in groups. An example of an assessment task might be to provide students with a choice of measuring equipment, (students select what they need) and require them to measure the volume of an irregular solid.

Samples:

The tangram puzzle

Reflections:

Peter: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Helen Mansfield

Scenario:

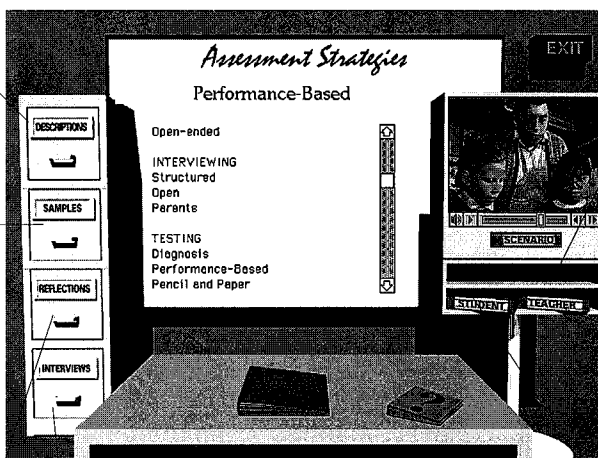
Video clip of a teacher observing students complete a tangram puzzle

Teacher:

The teacher's comment on performance-based assessment

Student:

A student's comment on the use of concrete materials to solve problems



STRATEGY: Pencil and paper

Description:

This is the traditional form of assessment used by mathematics teachers. Pencil and paper tests can be easily constructed, and marked or graded, and they provide a quick way of determining the ranking of students in a class. It must be noted however, that pencil and paper tests have limited use and are not sufficient to fully assess students' understanding of mathematics and other important outcomes such as attitudes and beliefs. Often tests only assess skills and facts that have recently been taught by the teacher. Nevertheless, tests can be designed to assess a variety of outcomes such as conceptual understanding, applications and problem solving abilities, as well as the more common fact recall and skill demonstration.

It is important to note that test questions may test knowledge in more than one of these categories and that the type of knowledge being tested may vary depending upon the age and experience of the student. When designing a test, a teacher should consider using questions that are written in a realistic context, that relate to the way students learned the mathematics, that contain real rather than contrived values, and that enable the student to display what they know rather than what they don't know.

Samples:

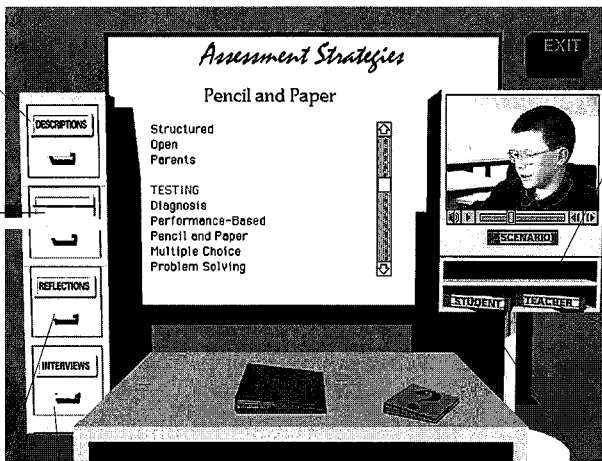
An example of the test items used in the scenario

Reflections:

Kerry: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Helen Mansfield



Scenario:

Video clip of a teacher and students discussing a pencil and paper test

Teacher:

The teacher's comment on reviewing tests

Student:

A student's comment on the value of discussing test results

STRATEGY: Multiple choice tests

Description:

Multiple choice test items are included in many formal tests, particularly those produced by state or national testing agencies. They are used because they are easy to score and they often provide statistical data that enables teachers to make comparisons between students within their class, and with a state or national average. An example of a multiple choice test item is:

At 3 o'clock, a 5 metre tree casts a shadow of 10 metres, while a nearby building casts a shadow of 40 metres. How high is the building?

- A 20 metres
- B 25 metres
- C 35 metres
- D 50 metres
- E 80 metres

Some multiple choice tests have been developed to help teachers diagnose student errors in, for example, whole number computation. As multiple choice test items offer only a set number of choices, generally 4 or 5, the items provide limited information on the different thinking that students employ as they solve a problem. The choices themselves are usually the final result of having solved a problem, and so focus on product rather than process.

Samples:

An example of a multiple choice test item

Reflections:

Richard: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Ken Clements

Scenario:

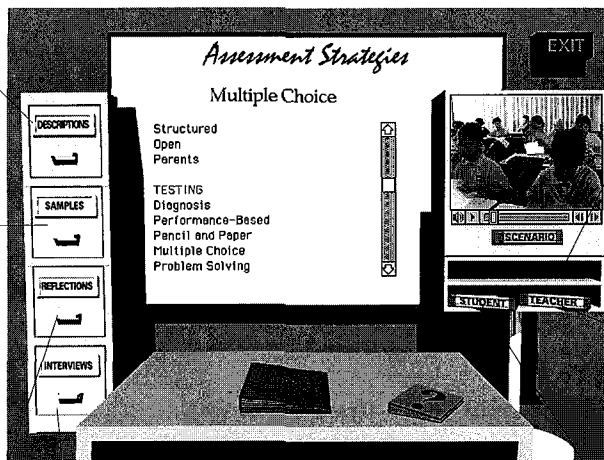
Video clip of a teacher explaining multiple choice items to a class

Teacher:

The teacher's comment on the value of multiple choice test items

Student:

A student's opinion of multiple choice tests



STRATEGY: **Problem solving**

Description:

A mathematical problem requires students to reach a solution that does not involve the simple application of a standard procedure or algorithm.

In solving such problems students are likely to use strategies or heuristics such as drawing a table, estimating, looking and finding a pattern, listing possibilities, and so on. The choosing and using of these strategies provides an indication of how good the students are at solving mathematical problems.

Performance criteria to assess problem solving can be developed to indicate the depth of mathematical knowledge on a particular task. This may take the form of a rubric. For example, a rubric for problem solving might be a C grade for a response that was complete but shows no extension. B grade would be indicated by a solution that is well presented and indicated good understanding. An A grade would be for students who formed generalisations and indicated extensions of the problem. Many different rubrics have been suggested, however, these can also be developed and agreed to by the teacher working in conjunction with students.

Examples:

An example of a problem

Reflections:

Maggie: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Alan Schoenfeld

Scenario:

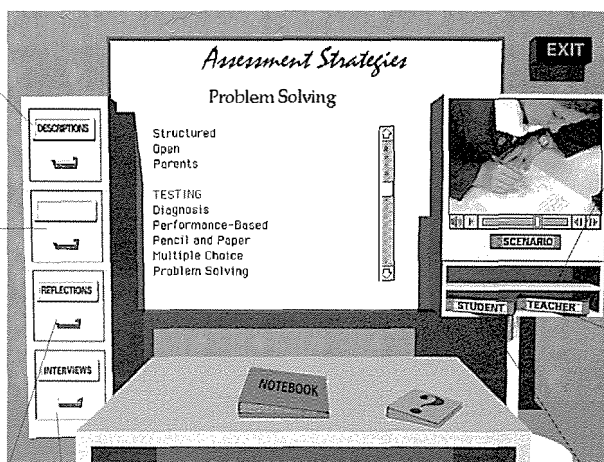
Video clip of a teacher setting a problem

Teacher:

The teacher's comment on using problem solving

Student:

A student's opinion of solving problems



STRATEGY: **Attitude**

Description:

Student attitudes are an important area that have direct consequences in determining how well students achieve and develop mathematically. Students' attitudes may be considered as feelings or beliefs about mathematics. These feelings or beliefs may be of an emotional nature, such as a person's anxiety towards mathematics, through to less emotional states, such as a liking for mathematics. The other end of the continuum provides a more cognitive attribute such as a person's belief about why it is important to study mathematics. Certain beliefs, such as a student's view about the nature of mathematics have been linked to student achievement in mathematics and whether or not, given a choice, they would elect to study the subject.

There are many ways to gain knowledge about students' attitudes towards mathematics. This can be done through observation by the teacher as the students are involved in a mathematical activity. A more formal assessment can be made through tests and may provide useful data for the teacher to modify his or her program. Often attitudinal tests provide the student with a statement and a request to make a choice on how much they agree—often ranging from strongly agree to strongly disagree. Projective tests are another way to assess feelings and beliefs.

Samples:

An example of a student's impression of a mathematician

Reflections:

Bernard: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Gilah Leder

Scenario:

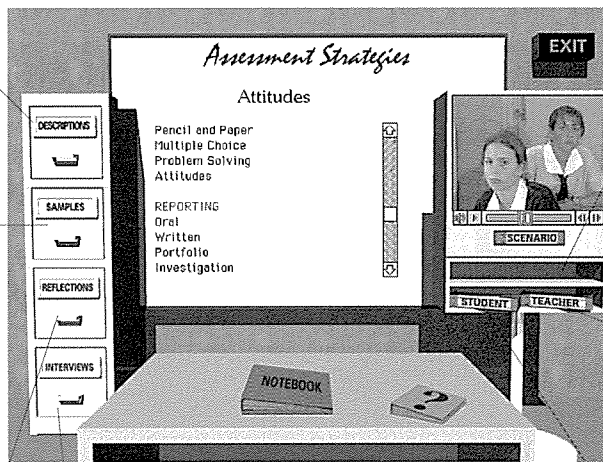
Video clip of a teacher asking a class to describe what a mathematician does

Teacher:

The teacher's comment on the importance of assessing student beliefs

Student:

A student's comment on what mathematicians do

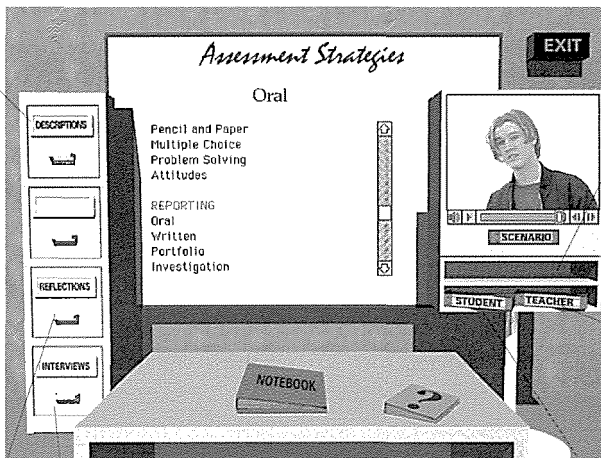


STRATEGY: Oral report

Description:

Oral reports involve students individually or in groups communicating the results of a mathematical activity. Communication is an important mathematical process that needs to be assessed. Giving an oral report may cause anxiety for some students and a supportive environment should be developed in which they are encouraged to speak without peer comment or evaluation.

If students are reporting on a group activity the teacher may wish to assign the role of reporter to one of the group. Clear directions on how this student can be assisted by the others will need to be given. The role of reporter can be changed to give every student a chance to report on an activity. Alternatively, the presentation may be shared so that all students are involved. It becomes the responsibility of the group to make sure that the reporter is fully and adequately briefed. The teacher may need to give clear directions and assistance on what is required in the report; for example, the report may look at explaining the problem, and justifying the findings and the strategies that were used in its solution as well as commenting on the difficulties that were encountered. In this way, the teacher can assess the use of mathematical content and processes, and the use of appropriate mathematical language.



Scenario:

Video clip of a student giving an oral presentation to the class

Teacher:

The teacher's comment on oral presentations as an assessment tool

Student:

A student's opinion of oral presentations

Reflections:

Tan: A preservice teacher's reflections on using the strategy

Interviews:

An interview with Paul Cobb

STRATEGY: **Written report**

Description:

A written report can be a short summary describing, for example, what the student learnt in a particular lesson or it can be a longer report describing an extended mathematical activity such as an investigation or a modelling problem. Clear guidelines can be given by the teacher to structure the student's report. The structure may be specific to the problem. For example, a problem on designing models of houses using cubes could require students to write a report in the form of an advertising brochure for prospective home buyers. A teacher may wish to give limited directions on the structure of the report, wishing to see the students' own ways of communication. Alternatively, a general structure for the report may be suitable for more abstract investigations and could use sections where students are asked to state what they know about the problem, what they did, and what they found out.

In assessing such reports, teachers may wish to identify students' understanding of the problem, the appropriateness of the mathematical content used, the quality of the mathematical processes displayed, the attitudes towards the task, and the overall structure and organisation of the report.

Samples:

An example of a problem which could be used to produce a written report

Reflections:

Marika: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Paul Cobb

Scenario:

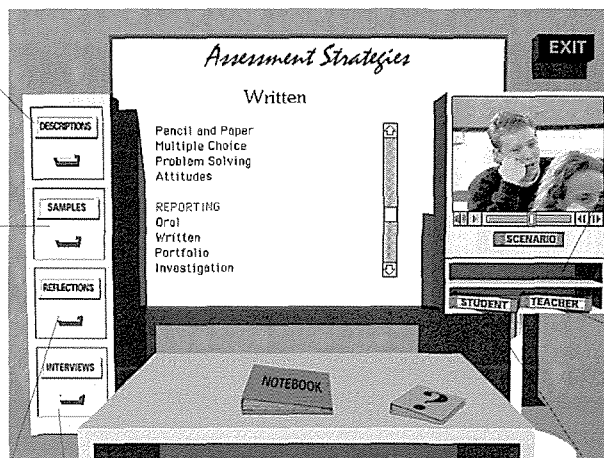
Video clip of a teacher giving students an activity on which to write a report

Teacher:

The teacher's comment on the activity

Student:

A student's comment on written investigations



STRATEGY: Portfolio

Description:

This is a collection of student work generally compiled over a long period of time, for example, a term, semester or year. Consequently, a portfolio gives a good indication of student development, not only in mathematical achievement but in attitude as well. Portfolios also help students reflect on and monitor their own development.

Often pieces of work may be chosen by the teacher but students could also choose their pieces of work. Work may be selected on the basis that it is the student's best work; the piece that shows the most progress or simply the student's favourite example. Each piece of work can be dated and kept in a scrapbook containing a table of contents. This material can form the basis for parent or student interviews and is useful in helping teachers write student reports. Students can also take home the portfolio resulting in important communication between school and parents. It may be appropriate to mark or grade a portfolio, in which case a holistic approach could be used with important criteria, such as creativity, being included. Materials that can be included in a portfolio include such things as solutions to problems and investigations, students' reflections on their work in mathematics, students' views about mathematics, drawings, students' made-up problems, and students' corrections of their work.

Samples:

An example of a student's communication with his teacher about an item in his portfolio

Reflections:

Antonio: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with David Clarke

Scenario:

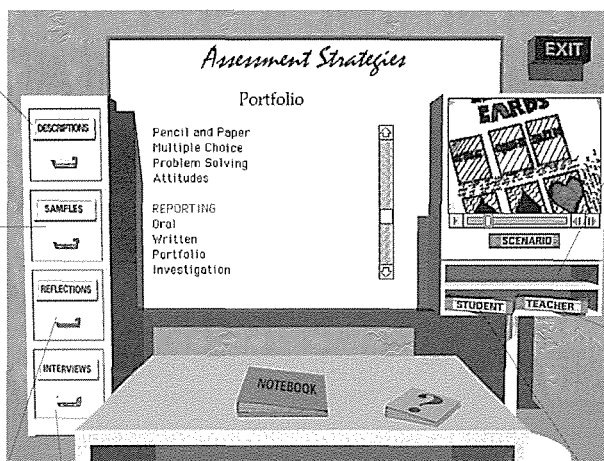
Video clip of a student's portfolio

Teacher:

The teacher's comment on ways of using portfolios

Student:

A student's comment on the type of work she puts in her portfolio



STRATEGY: Investigation

Description:

An investigation often results from the presentation of an open situation that can be extended and explored with the use of mathematics. The situation may be a problem, a puzzle, a rule or simply a mathematical statement or diagram. ‘Cutting Cubes’ is an example of a mathematical investigation and is shown below:

If a cube of edge 10 cm is sliced in various ways the cuts or cross-sections form interesting shapes. Investigate the cuts.

As students investigate a situation they will use mathematical processes such as drawing diagrams, tabulating, making conjectures, looking for and finding patterns, generalising results, explaining and proving. Investigations do not necessarily result in a single rule or right answer. Hence the assessment of an investigation focuses on the processes that students use as well as the choice of content and its application. Communicating the result of an investigation may require the student or a group of students to present a report or a display which will enable the teacher to assess many of the above processes. Alternatively, these processes may be observed as the students are involved in the activity.

Samples:

An example of a student’s investigation

Reflections:

Joanna: A pre-service teacher’s reflections on using the strategy

Interviews:

An interview with Max Stephens

Scenario:

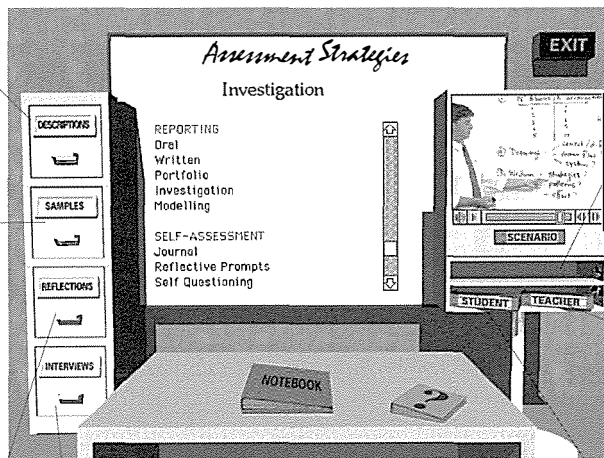
Video clip of a teacher introducing an investigation

Teacher:

The teacher’s comment on the use of an investigation as an assessment tool

Student:

A student’s opinion of investigations



STRATEGY: **Modelling**

Description:

A modelling problem involves students using mathematics to solve problems that occur in the real world. Problems like planning a party or designing a carpark are real situations that involve the students in using mathematical content as well as a number of mathematical processes. Processes include firstly choosing the mathematics that is needed, then finding solutions, using the mathematics, interpreting those solutions in the context of the original problem, checking to see if there are ways of improving the model to gain better solutions, and finally communicating the results of the task. Assessment may occur at any point in the modelling processes; for example, a teacher may wish to concentrate his or her assessment on the students' ability to choose the appropriate mathematical model and may pose a problem that simply asks what variables one would need to measure if the problem involved the cost of painting your bedroom. A modelling project may culminate in a final report produced by a group of students.

A modelling project can be viewed as a good example of *authentic* assessment where the assessment task is embedded in a context that students would normally experience in real life.

Samples:

An example of a marking key for a modelling problem

Reflections:

Lyssa: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Alan Bishop

Scenario:

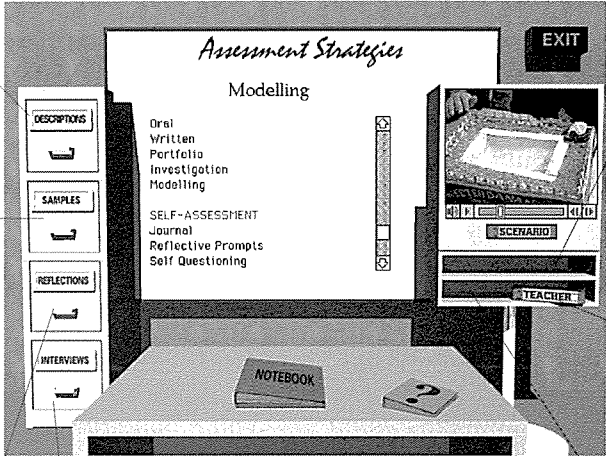
Video clip of a teacher examining students' modelling projects

Teacher:

The teacher's comment on checklists

Student:

The teacher's comment on using modelling problems for assessment



STRATEGY: **Journal writing**

Description:

Asking students to keep a journal or a diary of their mathematical experiences can provide teachers with an opportunity to directly assess students' achievements, as well as enabling students to make judgements about their own capabilities. Journals can also give insights into the way students feel about their learning, their beliefs and the difficulties they are experiencing.

Journals can be used regularly after each lesson or less frequently to reflect upon a topic of work. Students can be asked to write descriptions recounting their learning experiences, summarising the knowledge they have learnt, and discussing and questioning ideas and issues related to their new learning. To assist students in their journal writing teachers can provide focus questions such as the following: What did you learn about in today's lesson? What puzzled you? What was one thing that you learnt today? What was hard/easy? What did you discover? What questions do you have about today's lesson? Journals can be assessed by taking account of the frequency with which entries are made, whether adequate summaries are provided, and whether student self-questioning is in evidence. In implementing journals in your classroom, it is important to provide class or homework time for completion and to value its use by including it as an important component of a student's overall assessment.

Samples:

An example of a journal entry

Reflections:

Carlo: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Max Stephens

Scenario:

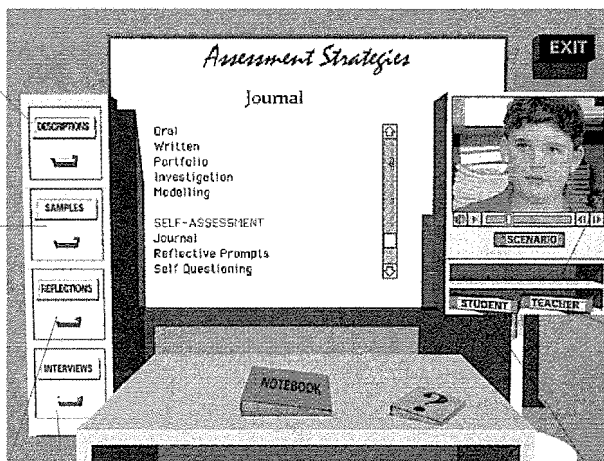
Video clip of a teacher and students discussing what might go in a journal

Teacher:

The teacher's comment on the value of journal writing

Student:

A student's comment on journals



STRATEGY: **Reflective prompts**

Description:

The lesson check provides a useful strategy for introducing the notion of writing about the mathematics that one is learning. The approach provides a structured set of questions that prompt students to reflect on their own learning. The lesson check can be used at the end of a mathematics lesson, where each student is asked to complete it. The lesson check has been used effectively where it is given, for example, once a week or at the end of a topic of work. More frequent use may result in the activity becoming tedious for students. A written response from the teacher about the student's reflections will support the value of the exercise as well as suggesting further action that could be taken.

Similar checklists can be designed that require students to make self assessments about their abilities in mathematics. Students could be asked to rate themselves on mathematical content such as their understanding of fractions or on processes such as their ability to communicate. Students could be given this type of rating scale at the beginning of a topic and at the end to record perceived progress. These ratings could then form the basis of valuable discussion with the teacher.

Samples:

An example of a completed lesson check

Reflections:

Debbie: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with David Clarke

Scenario:

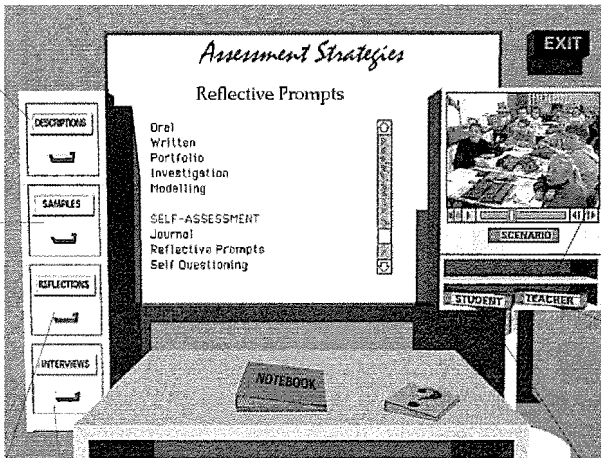
Video clip of a teacher and students discussing the use of the lesson check

Teacher:

The teacher's comment on the value of reflective prompts

Student:

A student's opinion on using the lesson check



STRATEGY: **Self-questioning**

Description:

The progress that students make in their learning and achievement depends upon their abilities to make self judgements about the way they will proceed (planning), about how they are going along the way (monitoring), and about how well they went when they get there (evaluation).

These self assessment processes termed *metacognition* are critical factors in successful learning in mathematics and other areas of learning. They can be prompted by the teacher with such questions as: How shall we go about solving this problem? What factors do I need to consider before I start? Is this making sense? How is this method helping? Can I find a better way to do this? Does the answer make sense?

Another approach is to have other students model these questions as problems are being solved or as learning is taking place. Similar questions can be provided on posters or on handouts that are kept and referred to by the student. The use of these external prompts will help students internalise the ability to ask their own questions.

Samples:

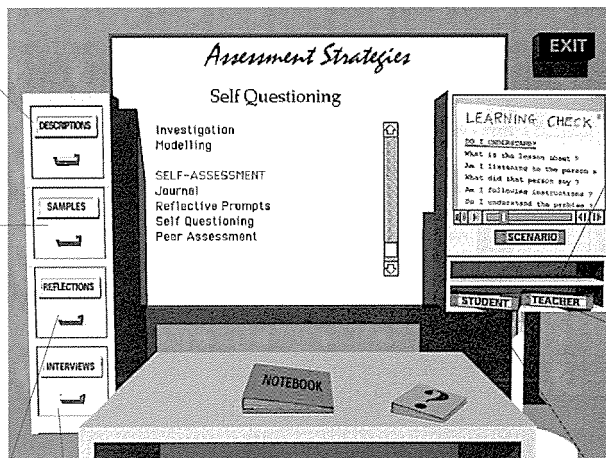
The learning check poster

Reflections:

Nydia: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Gilah Leder



Scenario:

Video clip of a teacher explaining a series of learning check questions

Teacher:

The teacher's comment on the value of self-questioning

Student:

A student explaining the questions he asks himself as he is learning

STRATEGY: **Peer assessment**

Description:

Asking students to develop their own assessment task is a useful strategy for assessing students' current understandings of a mathematical idea or topic. For example, students could be given the following mathematical terms and asked to use some or all of them to make up questions for their friends to solve.

90 km/h, 180 km, 2 hours, 45 km, 30 minutes

The teacher can gain useful assessment information based on the questions that are posed as well as the answers that are offered. Similarly, after studying a mathematical topic, students could be asked to list the important ideas encountered in the topic and to devise questions for each idea that could then form the basis of a class test. Alternatively, students could be given aims and objectives taken from relevant curriculum documents and asked to write questions that matched the aims.

Useful class discussions could focus on the difficulties of certain questions, and the differences between questions that required thinking and those that simply required fact recall. Students could also be required to provide correct answers and marking schemes for each question.

Samples:

An example of a student's question

Reflections:

Imma: A pre-service teacher's reflections on using the strategy

Interviews:

An interview with Gilah Leder

Scenario:

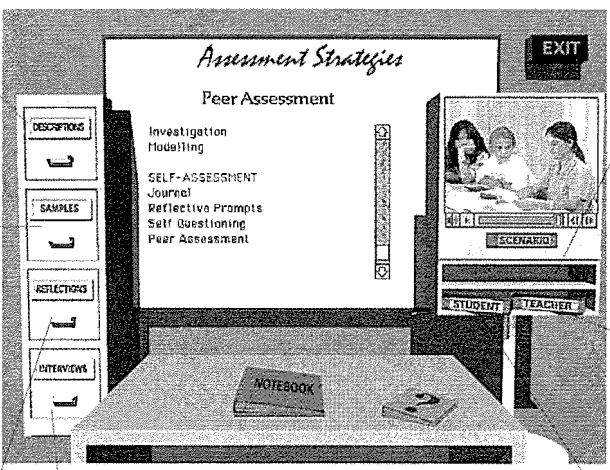
Video clip of students planning an assessment task

Teacher:

The teacher's comment on the use of peer assessment

Student:

A student's comment on the questions she develops



Assessment advice for facilitators

If you are a facilitator using the program with teachers or preservice teachers, you may wish to assess participants after they have completed one of the investigations.

Authentic assessment is a very important aspect of the situated learning model upon which this multimedia program is based. It would be inconsistent with the approach to present a resource based on authentic contexts and tasks and then to assess participants with a paper and pencil test or essay.

The following pages give a suggested method of assessing teachers' use of the program and the learning that has occurred in a meaningful, enjoyable and authentic manner. A sample handout is reproduced on the following page suggesting an authentic assignment which could be given to preservice teachers, consisting of two parts: an oral presentation to the class and a written report.

Participants can work on the investigation for an agreed number of hours. An arrangement can be made for a class presentation to be done by each group with a written report to follow.

If different groups in the class are completing different activities, an announcement will need to be made at the start of each presentation about the context of the presentation and the role the audience is required to assume. A suggested context for each activity is given below:

- Investigation 1:** The presentation is made to a special staff meeting called to discuss and evaluate a proposal to adopt alternative approaches to assessment in mathematics.
- Investigation 2:** The presentation is made to a staff meeting called to discuss the school policy of using multiple choice tests to assign students to ability groups prior to admission to first year high school.
- Investigation 3:** The presentation is made to a School Council meeting where one of the items on the agenda is a proposed new report form.
- Investigation 4:** The presentation is made to a Board of Directors meeting of Ace Academic Press on whether to accept a new title for the Maths is Marvellous series entitled *Ten Terrific Tests*.
- Investigation 5:** The presentation is made to a Professional Development Question Forum on current issues in mathematics teaching.

A sample assignment

Groupwork

Students are invited to work in small groups

Authentic task

A realistic task is set, requiring users to interact with the program

Oral presentation

An oral presentation is to be given to the class

Details

Due dates, scores and other administrative details are provided

Written report

A written report is to be completed and submitted

Assignment details

Part 1

You will be given an investigation to do using a multimedia program on assessment in mathematics. You will need to work in small groups of 2-3 people.

The activity will require you to imagine that you are a mathematics teacher in a school and to observe teachers using assessment strategies in their classrooms, to talk with them and their students, and to consult with experts and student teachers. The interactive multimedia program will allow you to do this and you will work on the program for hours.

At the conclusion of this time, depending on the activity, you need to present a report to teachers, boards of directors or a school council meeting about your findings, and to make recommendations on assessment.

As well as presenting your report, you will also be part of the audience for other groups' presentations. You will need to imagine that you are a member of the school's staff, board of directors or other group and then evaluate each group's findings and recommendations from a real-life perspective.

Part 1 requirements:

Dates: Weeks x-y: Multimedia program/compilation of report
Week z: Presentation to class

Length of presentation: 10 minutes

Score: 40% (group score)

Part 2

Part 2 of the Assignment requires you to write up the presentation given to the class and present it as you would a formal written report in a real-life situation.

Part 2 requirements:

Due date: Due on ...

Length of report: 2-3 pages

Score: 60% (group score)

Peer assessment of presentations

Teachers and participants can use peer assessment to evaluate each others' presentations. However, they need to be informed of the criteria for assessment before they present. A sample evaluation form is given below:

Evaluation Form	
Your name: _____	
Group no. _____	
Presenters' names: _____	

Criteria:	Score out of
✓ Effectiveness of argument How persuasive was the group's proposal? Were you convinced of the value of the suggestions?	____ /5
✓ Proposal's practicality Were the suggestions practical and able to be implemented? How convinced were you that the suggestions would work?	____ /5
✓ Argument well supported Was there sufficient evidence to support the proposal? Did you feel they had researched the problem well?	____ /5
✓ Presentation skills How well did the group present the report? Did the presentation hold your attention?	____ /5

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Setting up the software

Minimum computer configuration

Macintosh	PC
<p>In order to use the program you will need:</p> <ul style="list-style-type: none"> • A 68040 or Power Macintosh Computer running System 7.0 or greater • 640 x 480 colour monitor • 12 Megabytes of RAM • Double-speed CD-ROM drive • Thousands of colours • Fonts: Geneva and Times 	<p>In order to use the program you will need:</p> <ul style="list-style-type: none"> • An 80486 or better • 640 x 480 colour monitor • Windows 95 or Windows NT • 16 Megabytes of RAM • Double-speed CD-ROM drive • Thousands of colours • Fonts: Arial and Times New Roman

Loading the software

Macintosh	PC
<ol style="list-style-type: none"> 1. Place the CD into the CD-ROM player 2. Double click on the icon to view the files on the CD 3. If you need to install QuickTime 2.5, (a program which enables you to play the videos in the program on your computer) click on the installer in the file included with the program. It is named <i>QuickTime Installer</i>. The program will automatically install but you will need to restart your computer before you use the program. 4. Double click the <i>Assessment Strategies</i> icon to run the program. 	<ol style="list-style-type: none"> 1. Place the CD into the CD-ROM player 2. Double click on the icon to view the files on the CD 3. If you need to install QuickTime 2.5, (a program which enables you to play the videos in the program on your computer) click on the installer in the file included with the program. It is named QT32. The program will automatically install but you will need to restart Windows before you use the program. 4. Double click the <i>Assess</i> icon to run the program.

Running the program

1. Wait until the EXIT sign turns green
2. Click on the Help icon if necessary
3. Use the scrolling box on the whiteboard to view the available assessment strategies
4. Click one of the strategies printed in black to choose a strategy to investigate
5. Click within the interface to select the various information elements contained for each assessment strategy.

Quitting the program

Click on the EXIT sign in the top right hand corner to quit from *Investigating Assessment Strategies in Mathematics Classrooms*.

Trouble shooting guide (for Macintosh and PC)

Problem	Solution
The Assessment Strategies program does not run.	Check that your machine is using the correct operating system (OS). For example, this program will not run under Windows 3.1.
Nothing happens when elements on the screen are clicked.	Wait until the EXIT sign turns green.
The video doesn't play (on PC).	Check that you have run the <i>QuickTime Installer</i> program.
The image on the screen is pixelated or banded.	You may be using a computer which uses only 256 colours or less. The program will run best on a computer capable of using 'thousands of colours'.
Documents from the <i>Samples</i> drawer won't copy.	You cannot copy from the <i>Samples</i> drawer.
You cannot copy to the notebook.	The notebook may be full (the total amount is about 15 A4 printed pages). Save the full notebook, delete the text and save the new one with a different name.
You cannot find the cursor in the notebook, or the cursor is not flashing.	Scroll through the notebook a line or two. You will notice the cursor flashing.
You cannot reload your notebook file.	You may have worked on your notebook material and saved it in a Word Processor file. These files cannot be loaded into the program, only plain text files can. Save the file as a Text Only file, and load back into the program.

or comments or feedback on the resource, contact:

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Bradford Street,
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