

# Assessment Strategies: Using Multimedia to Promote Transfer to Classroom Practice

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This study set out to investigate whether assessment strategies for mathematics classrooms transfer to real world practice when learnt within an authentic context. A multimedia program was designed to incorporate characteristics of 'situated' learning environments and cut to CD-ROM. Preservice teachers used the program in their mathematics method classes, and they and their supervising teachers were interviewed regarding their use of strategies while on professional practice. Results show that all students used a variety of assessment strategies, and according to the beliefs of the students themselves, were influenced in their use of strategies by the multimedia learning environment.

## Learning Assessment Strategies

The lack of transfer of pedagogical skills from the theory of teacher education to the practical reality of the classroom has been a source of concern to teacher educators for some time. Several writers have expressed concern that despite the emphasis in teacher education courses on 'reformist' methods of teaching mathematics, teachers frequently revert to methods of teaching derived solely from their own experiences as students (Ball, 1994). Others have noted that preservice teachers' experiences in classrooms during their professional practice have proved inadequate because often students observe teaching 'driven by texts and tests', or are ill equipped to detect the subtle differences between quality and mediocre teaching (Mousley & Sullivan, 1995). Despite the variety of innovative and effective assessment techniques, teachers generally continue to limit their means of assessment to a narrow range of pencil-and-paper methods (Australian Education Council, 1991; National Council of Teachers of Mathematics, 1995).

The present study set out to explore the use of a multimedia program on assessment strategies within a preservice teacher mathematics method unit, and to investigate the extent of transfer of strategies to classroom practice. The learning environment was designed according to critical characteristics of situated learning (described in Herrington & Oliver, 1995; Herrington & Oliver, in press), which focused on the creation of an authentic context, activity and assessment, together with expert performances, multiple perspectives, opportunities for collaboration and reflection, and coaching and scaffolding by the teacher. Transfer was thought to have occurred if firstly, students using the interactive multimedia program on assessment had a good understanding of the types of assessment appropriate in the mathematics classroom and were able to articulate this understanding; and secondly, they employed a variety of the assessment techniques shown in the program, as opposed to the predominant use of pencil-and-paper tests (Cognition and Technology Group at Vanderbilt, 1993).

## Design and Development of the Multimedia Program

In order to produce an effective learning environment on the issue of assessment in mathematics, it was necessary to provide preservice teachers with the experience of observing expert teachers using different types of assessment in classrooms. McLellan (1993) points out that a situated context can be represented in *the actual work setting, a highly realistic or 'virtual' surrogate of the actual work environment or an anchoring context such as a video or multimedia program* (p. 8).

In order to use the first method, the actual work setting, it would have been necessary to take groups of preservice teachers to a large number of schools and to have them observe expert teachers in their classes, in addition to their professional practice. This scenario, while authentic, may not have provided efficiencies within a teacher education program. As Spiro, Feltovich, Jacobson and Coulson (1991) contend, learning a complex concept from 'erratic exposures to complex instances with long periods of time separating each encounter, as in natural learning from experience, is not very efficient' (p. 30).

The second context recommended by McLellan (1993) as acceptable for situated learning, a 'virtual surrogate' of the actual work environment (such as aircraft simulators), was also ruled out very quickly on the basis of prohibitive costs of development, and lack of resources within the university for use of the finished resource.

The anchoring context seemed the most viable. A video, or series of videos, as an anchoring context was rejected because of the linear format which could not provide ready student access to expert performances and multiple perspectives. Audio-tape and text did not provide the appropriate visual elements to allow peripheral observation of the authentic classroom context, important elements in real-life learning.

One medium that did not have these restrictions was computer-based multimedia. The combination of video clips, sound, text and graphics meant that interactive multimedia was capable of supporting 'the kinds of more intimate, supportive, learning environments called for by the constructivist perspective' (Perkins, 1991, p. 22), and presenting it in an efficient and accessible format. Multimedia would also enable a 'criss-crossing of the conceptual landscape' in such a way that relevant examples can be explored in close-proximity to each other (Spiro et al., 1991, p. 30). In addition, several exemplary published packages within Australia—notably *Investigating Lake Iluka* (1993), *Exploring the Nardoo* (1996), and *Learning about Teaching* (Mousley, Sullivan, & Mousley, 1996)—provided valuable models for the development of successful multimedia learning environments.

Preservice teachers using the program to investigate assessment strategies would need to be able to observe experienced teachers in the field demonstrating a range of strategies and techniques, and to then reflect on the most appropriate strategy to use in a particular situation. Video clips of classroom scenes and interviews appeared to be an appropriate means to provide such opportunities to the students who would use the program. Other important requirements of the program were that the context would need to be situated in a real or simulated classroom, and authentic activities could require students to address the problems of assessment and to select their own alternatives to paper and pencil tests. It was

essential to provide multiple perspectives on assessment, and in so doing, focus strongly on the classroom experience. On this basis, the elements included in the final multimedia program were:

- Video clips of teachers using various assessment techniques (see Table 1)
- Video clips of teachers' comments of the strategies
- Video clips of children's comments on the strategies to present their own thoughts
- Interviews with experts in the field to provide theoretical perspectives
- Reflections by third year preservice teachers to provide practical advice
- Text descriptions of each assessment category
- Teacher and children work samples
- An electronic notebook to enable students to copy text and to write their own ideas
- Problems and investigations to enable the students to complete authentic tasks.

Assessment strategies were identified from the literature and are listed below, together with the scenario appearing in the video clips, in Table 1.

Table 1  
*Assessment Strategies Featured in the Multimedia Program*

Assessment Type	Technique	Scenario
Observing	Checklists	Teacher observing students and marking a checklist
	Anecdotal	Student doing problem, teacher writing the record
Questioning	Higher order	Teacher asking how and why questions
	Factual	Teacher asking basic facts questions employing wait-time
	Open-ended	Teacher and students working on good questions
Interviewing	Structured	Teacher doing a Newmann Error Analysis
	Open	Teacher interviewing on understanding of a concept
	Parent	Teacher interviewing parent
Testing	Diagnosis	Teacher using calculator to diagnose
	Performance-based	Students attempting a tangram activity
	Pencil and paper	Teacher discussing student errors and misconceptions on a test
	Multiple choice	Teacher giving instructions for a test
	Problem solving	Teacher giving a problem and developing a rubric with students
	Attitude	Teacher asks: what do mathematicians do?
Reporting	Oral	Student presenting an oral report to the class
	Written	Teacher giving advice on how to do an investigation
	Portfolio	Leafing through student portfolio of work
	Investigation	Marking an investigation
	Modelling	Teacher viewing students modelling projects
Self - Assessment	Journals	Teachers explaining how to write a journal
	Reflective prompts	Teacher directing class to fill in a lesson check
	Self questioning	Teacher going through a self-question checklist
	Peer assessment	Teacher getting students to write their own questions

## The Study

The interactive multimedia program on assessment was cut to CD-ROM (Herrington, Sparrow, Herrington, & Oliver, 1997) and introduced to a class of approximately 24 preservice secondary teachers studying mathematics education method. The students were

midway through the first semester of the second year of their course. The lecturer was asked to recommend six students who might be considered as 'typical case' (Miles & Huberman, 1994) with an equal representation of gender, to be observed and interviewed for the study. Students were grouped in pairs as they preferred to maximise collaborative interactions.

To begin the lesson, the lecturer held a discussion with the students on the issue of assessment in mathematics. The discussion was prompted with questions such as: What does assessment mean in mathematics? How were you assessed in mathematics when you were at school? Minimal instruction was given in the use of the program itself, except for a brief introduction to the elements of the program and how each could be accessed through the main 'menu', the classroom interface. Students were given an authentic and complex activity to investigate while using the program, simply in the form of two letters. The activity required the group of students to assume the identity of new teachers in a school given responsibility to prepare a report to staff on assessment strategies. The request has been prompted by a letter to the school from a parent whose child becomes very anxious before each test, and who requests whether there are alternative means of assessment that could be used in mathematics. The six students were observed using the interactive multimedia resource over three weeks in their normal class time.

Approximately five weeks after the conclusion of the use of the assessment multimedia package in their mathematics method course, the six students in the main study completed a two week professional practice in six different metropolitan schools. All the students were required to teach mathematics classes in this practice, and it was expected that they would have the opportunity to implement different assessment strategies. In order to assess whether students used a variety of assessment strategies during their mathematics classes on professional practice, both the students and their supervising teachers in the schools were interviewed and the comments were analysed.

Students were given a list of the assessment techniques featured in the interactive multimedia program on assessment (Table 1) and asked whether they had employed any of the strategies listed. The questions mirrored those asked of the supervising teachers to assist structural corroboration of data. Findings are presented below, with names substituted with pseudonyms.

## The Findings

A situated view of transfer is not one that suggests that a person can acquire a set of skills that can be lifted and applied in a totally novel situation. The view of transfer adopted by the proponents of situated learning and used here, is that knowledge is more likely to be transferred to novel situations when it is learnt in the context of use and is 'a central or integral part of one's cognitive structure' (Prawat, 1992, p. 375).

It appeared from analysis of the comments made by students that assessment issues had been incorporated into their cognitive structures. They spoke openly and knowledgeably about assessment issues after teaching practice. They acknowledged the complexity of the area but were well acquainted with the types of assessment that might be suitable in the mathematics classroom, and they used appropriate language with familiarity and ease. None of the students thought that being unaware of appropriate assessment strategies was a relevant factor in their teaching practice. The students were also aware of the usefulness of assessment in performing

more functions than the summative appraisal of students' understanding (for example, as listed by authors such as Burton, 1992; NCTM, 1995; Clarke, 1988) including: to improve the teaching of the child, to inform the teacher, and to make instructional decisions.

Comments by the majority of students indicated that they were aware of many important roles for assessment, and that it could be used, as noted by Jonassen (1991) as 'less of a reinforcement or behaviour control tool and more of a self-analysis and metacognitive tool' (p. 32). For example, Louise distinguished between 'formal' and 'informal' assessment when asked whether assessment was necessary on short professional practice:

It depends what you mean by assessment. When we used the multimedia, it looked at questioning and monitoring as part of assessment and some people don't think that is assessment. So I think maybe formal assessments like long investigations where a lot of work is done, maybe that's not necessary, but I think the informal like questioning and monitoring is. (Interview with Louise)

Carlo also pointed out that assessment has a critical role in helping him to monitor his own performance as a teacher:

As a teacher, you need to know where they're at and the objectives you've set yourself. I think it's quite important because you have a feel for how you're doing, especially if you can see that they're learning something. It actually allows you to assess your own teaching. (Interview with Carlo)

The students were able to speak knowledgeably and confidently about the issue of assessment. Lave and Wenger (1991) point out that learning the language and stories of a community of practice is necessary for full participation in that practice, and the students' ability to speak both within and about the practice was clearly evident in their discussion.

The second indicator of transfer as described above, was that students employed a variety of the assessment techniques, shown in the multimedia program, in the classes they taught while on professional practice. The findings for each student were analysed and evaluated. These findings are given for one student only, as an example, below.

#### *Example of Students' Use of Assessment Strategies: Rowan*

Rowan completed his professional practice in a co-educational, government high school catering for Years 8-12. Under the supervision of Rob, Rowan taught Years 8, 9, 10 and 11 mathematics. Rowan's and Rob's reports of the assessment strategies used during the professional practice are presented in Table 2.

Table 2

*Assessment Strategies used by Rowan During Professional Practice*

Source	Observing	Questioning	Interviewing	Testing	Reporting	Self-assess
Rowan	Anecdotal records and checklists	Factual questioning	Open interviewing	Two formal tests	None	Reminders as reflective prompts
Rob	None	Factual questioning	Open interviewing	Pencil and paper test of parabola	None	None

While Rowan's supervising teacher was not aware of any observation of students, Rowan himself reported that he tried to use both types of observing presented in the interactive multimedia program on assessment, particularly anecdotal records:

I was trying to do both of these actually, not fully into the checklists, but observing and ... writing down some little notes about how certain ones were doing ... if you've got those little notes there you can see that they've been having a problem. (Interview with Rowan)

Rowan admitted to having a problem with group questioning, pointing out that he found it difficult not to use rhetorical questions, a point also made by Rob. Nevertheless, he showed that he was willing to use the strategies and try to perfect his techniques:

Towards the end, in certain classes I was asking the How and Why questions. To actually find out where they're at, I prefer to use individual questions, you know, going around ... then I'll tend to use like all three types of questioning techniques. (Interview with Rowan)

Both the supervising teacher and Rowan concurred that he used open interviewing to help students who were having difficulty understanding mathematical concepts, and that this assistance was provided on Rowan's own initiative. Rowan used two pencil-and-paper tests during his professional practice. The tests were administered in a formal manner, as explained by the supervising teacher:

[He] stood at the front of the room explaining that it was a test, what they were to have on their desk, pens, pencil and calculator, gave out the test, ensured everyone knew it was 2 pages, right you've got 40 minutes, look at the clock, get to work. (Interview with Rob)

Rowan explained, however, that he used the results as the basis of a discussion on students' understanding of the problem. This procedure was demonstrated in the scenario on pencil-and-paper testing on the interactive multimedia program. Rowan's comment reveals an insight which suggests his use of the tests was to gain a true assessment of students' understanding rather than to obtain a score:

The teacher wanted me to keep the tests for my own record, but the last day was a sports test and only 10 [students] were there, so I—this was interviewing as well—I went through the test and discussed things and clarified things where they'd got it wrong and to see whether they actually did know it. A lot of the time in a test they get it wrong but they still might understand the concept. That's all part of assessment, not just whether they got it right on the day. (Interview with Rowan)

Rowan did not use any reporting strategies to assess students' understanding during his teaching practice, nor did he use any self-assessment techniques other than encouraging students to assess their own understanding at regular intervals.

Rowan appeared to use a variety of assessment strategies in his classes during professional practice. Like the other students, he was limited in the strategies he could use by the time constraints of the placement. Rowan's comments reveal a far deeper understanding and application of assessment than was evident to his supervising teacher.

The remaining students' uses of assessment strategies are summarised in Table 3. Many of the students expressed concern about the difficulties associated with implementing procedures and techniques in a short space of time on professional practice. All the students in the study, were limited in the types of assessment strategies they could use, but chose varied methods of assessment when they had the discretion to do so.

## Discussion

Prior to the commencement of the study, a prediction was made that the students would use a variety of assessment techniques in their mathematics classes during teaching practice, and this was true of all six students. In spite of the fact that one student reported the prediction to be untrue and another was unsure, all the students did use a variety of strategies. Evidence to support this conclusion was provided by the students on their own admission in interviews, and this was generally corroborated by their supervising teachers.

If students had reported using only pencil and paper tests to assess students, only *Testing* strategies would have been used. However, as shown in Tables 2 and 3, all the students used

assessment strategies from the *Questioning* and *Interviewing* groups, most used *Observing* and *Testing*, and some students used *Reporting* and *Self-assessment* strategies. Generally, the students used the assessment strategies that had been predetermined for use by the supervising teacher. However, this was supplemented by the use of strategies that were under the students' own control.

Table 3

*Assessment Strategies Used by Students during Professional Practice*

Source	Observing	Questioning	Interviewing	Testing	Reporting	Self-assess
Evie	Anecdotal records	Mainly higher-order	Open and structured interviewing	Pencil-and-paper problem solving activity (formal requirement)	None	None
Teacher: Carol	Notes on individual students	Mainly factual recall	Open interviewing	As above	None	None
Louise	None	Higher order and factual recall	Open interviewing	Informal pencil-and-paper tests	Students report orally to the class	None
Teacher: Michael	None	Factual recall	Open interviewing	Informal pencil-and-paper tests	As above	None
Carlo	Informal observation	Open-ended questioning	Open interviewing	Mental tests to start Year 8 lessons	Observed modelling	Informal reflective prompts
Teacher: Peter	None	Factual recall questions	Open interviewing	None	None	None
Zoe	Checklists & anecdotal records	Higher order	Open interviewing	None	Oral reports	None
Teacher: James	None	Factual recall	Open interviewing	None	Oral reports	None
David	Anecdotal	Higher order questions	Open interviewing	Pencil and paper test	Students explain their solutions on blackboard	Occasional reflective prompts
Teacher: Frank	Anecdotal	Open ended questions	Open interviewing	Pencil and paper test	As above	None

Analysis of the data shows that all the students could speak knowledgeably and confidently about assessment, and all the students used a variety of techniques to assess children's understanding. The students appeared to be influenced very strongly in their use of assessment strategies by the supervising teacher. However, even when assessments had been planned in advance by the supervising teacher, all students used techniques that they were able to use without the contribution or agreement of the supervising teacher. Five of the six students attributed their use of assessment techniques to the interactive multimedia program. Two factors militated against a realistic appraisal of whether the students' use of the assessment program influenced their adoption of a variety of assessment practices in a real-life classroom: the substantial influence of the supervising teacher, and the brevity of a two week professional practice. The choice of the professional practice nearest to the use of the

interactive multimedia program meant that any transfer effect could more reliably be attributed to the influence of the situated learning environment on assessment rather than an accumulation of influences and practice in the students' entire course.

While many models of transfer exist, it was difficult to find an appropriate model of transfer to use in the study. While transfer did appear to occur within the parameters given, many questions remain about the types of transfer and whether the effect is long-term, for example: What is an effective model of transfer for situated learning environments? Do students apply assessment strategies presented in the interactive multimedia program when working as fulltime teachers? Is there long-term retention of assessment strategies?

Ideally, the students needed to be appraised in the real world context, possibly in their first or second year as practising teachers, and over a lengthy period of time. (Such a follow-up study is currently under way, where data is being collected from the four students who are teaching, and who are now in their second year.)

Nevertheless, in the current study, the multimedia program on assessment influenced the types of strategies students employed and their thinking about assessment as they taught mathematics and other classes during their professional practice in schools. Further research is needed to verify these tentative findings.

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