Title: An evaluation of the quality of teacher feedback to students: A study of numeracy teaching in the primary education sector.

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Introduction

It seems timely to conduct research that links two current, major Ministry of Education initiatives, namely The National Assessment Strategy and The National Numeracy Project. This paper links a concern about student achievement in numeracy as identified in the *Third International Mathematics and Science Study* (TIMSS) (Garden, 1996), with what is known about formative assessment, specifically the importance of teacher feedback to students.

Most educators would agree that competence with numbers should be a fundamental outcome of school learning. It requires having a rich network of connections between different mathematical ideas and being able to select and use a range of strategies (Askew, Brown, Rhodes, Wiliam & Johnson, 1997). The Ministry of Education (MOE) defines being numerate as having the "ability and inclination to use mathematics effectively in our lives – at home, at work and in the community" (Ministry of Education, 2001, p.1). In addition, the research and literature on formative assessment focuses specifically on the critical importance of giving quality feedback to students. Constructive feedback is recognised as having a powerful influence on student achievement. Torrance and Pryor (1998) suggest that the argument in "favour of developing and extending the practice of formative assessment is that it will aid learning. This has become a virtually unchallenged axiom, even mantra, of proponents of formative assessment" (p.83).

Quality feedback is a key factor in improving achievement in mathematics (Clarke, 2001; Gipps, McCallum & Hargreaves, 2000). Hattie (2002b), in his presentation at the New Zealand Principal's Federation Conference in June 2002 claimed "if there is one systematic thing that we can do in schools that makes a difference to kids learning, it's this notion of feedback. It is the most significant thing we can do that singularly changes achievement." Gipps (1994) suggests that in order for students to improve, they must have a notion of the desired standard and compare actual performance with the desired performance. Feedback should, therefore, engage in appropriate action to close the gap between the two. Sadler (1989) claims "students use it [teacher feedback] to monitor the strengths and weaknesses of their performances, so that aspects associated with success or high quality can be recognised and reinforced, and unsatisfactory aspects modified or improved" (p.120).

Peddie (2000), in his evaluation of the MOE *Assessment for Better Learning* professional development programmes from 1995 to 1998, claims "future focus needs to be placed on formative assessment and feedback to students and parents" (p.5). He also found teachers' responses to "How do teachers actually give feedback to students?" lacked detail and warranted further investigation. Feedback is conceptually complex and a logistical challenge for classroom teachers. The absence of definitive research about mathematics teachers' feedback practices was the primary motivation for this study.

Study objectives and methodology

This study examined the quality of teacher feedback to students in two New Zealand primary schools. The schools were randomly selected from those currently involved in the National Numeracy Project.

The specific objectives of the research were:

1. To examine how the term feedback is defined in the literature and its relationship to formative assessment with specific reference to numeracy.

2. To examine teachers' perceptions of what constitutes effective feedback in numeracy in two case study schools.

3. To describe current practice of teacher feedback to students during numeracy lessons.

4. To evaluate the quality of teacher feedback to students.

Six teachers were involved in the study. All were either in their first or second year of teaching the national numeracy programme to their students. Data collection involved interviews with the teachers, observations of numeracy lessons, follow-up discussions with teachers after the lessons and document analysis. Eighteen numeracy lessons were observed in total involving students from years one to six. Verbatim transcripts were taken of the dialogue between the teacher and students. During the post-observation discussion, teachers highlighted what they thought was feedback on the transcripts. The transcript was then analysed using Tunstall and Gipps' (1996, pp.395-401) feedback typology (see Appendix 1). This therefore included feedback to individuals, groups and at times, the whole class. The typology distinguished between eight types of feedback:

A1: Rewarding – rewards/reinforcement

This is evaluative feedback at its most positive. Examples include smiley faces, stickers, stars, treats and work seen by the principal.

B1: Approving – verbal and non-verbal

This type of feedback is evaluative and positive and described as a "warm expression of teacher approval of the child's work" (Tunstall & Gipps, 1996, p.396). Examples include a touch, a positive facial expression, use of ticks, and general praise such as very good, well-done and good girl.

C1: Specifying attainment – specific praise, use of criteria

This is described as descriptive and identifies "specific aspects of successful attainment" (Tunstall & Gipps, 1996, p.398). This supports student achievement through specific praise. An example of this is "this is very well done because you have…."

D1: Construction achievement – teacher and student learn together

The description is embedded in conversation and dialogue with the student reflecting "work in progress" (Tunstall & Gipps, 1996, p.399). With this type of feedback, the teacher facilitates the learning process. The child is drawn into explaining or demonstrating achievement using their own work.

A2: Punishing – negative comments, punishments

This is evaluative feedback at its most negative. This signifies complete disapproval. Examples include removal from the classroom, deprivation, destruction of work and removal from a group.

B2: Disapproving – negative non-verbal and verbal feedback

This type of feedback is evaluative and related to general feelings of disapproval. Examples include "I'm very disappointed in you today" or "You could do a lot better."

C2: Specifying improvement – specifying what is wrong

This is descriptive feedback "which teachers use to specify how something which is being learned can be corrected" (Tunstall & Gipps, 1996, p.398). It focuses on the mistakes relating more to student achievement than personal attributes.

D2: Constructing the way forward-mutual critical appraisal

This type of feedback focuses on mutual critical appraisal of the student's work. "Constructing the way forward was used by teachers to articulate future possibilities in learning in a way that looked like a partnership with the child" (Tunstall & Gipps, 1996, p.400).

Table 1 shows the typology in tabular form.

Table 1: Tunstall and Gipps (1996) Feedback Typology

Positive feedback		Achievement feedback	
Evaluative feedback		Descriptive feedback	
A1 Rewarding	**B1** Approving	**C1** Specifying attainment	**D1** Constructing achievement
A2 Punishing	**B2** Disapproving	**C2** Specifying improvement	**D2** Constructing the way forward
Evaluative feedback		Descriptive feedback	
Negative feedback		Improvement feedback	

Areas of concern identified in the literature and research

Widely differing definitions of the term feedback exist. Ramaprasad's (1983) definition is used extensively in education literature. "Feedback is information about the gap between the actual level and the reference level of a system parameter which is used to alter the gap in some way" (p.4). In education this means the learner has to "possess a concept of the standard (or goal or reference level) being aimed for, compare the actual (or current) level of performance with the standard and engage in appropriate action which leads to closure of the gap" (Sadler, 1989, cited in Clarke, 2000a, p.3). Therefore, feedback should involve imparting a "judgment of a child's strategies and skills, or a child's attainment and giving information about the judgment" (Gipps, McCallum & Hargreaves, 2000, p.91).

In contrast to Ramaprasad (1983) and Sadler (1989), Askew and Lodge (2000) adopt a broader definition of feedback to include "all dialogue to support learning in both formal and informal situations " (p. 1). By definition this would therefore include instruction as well.

Carlson (1979) argues feedback is "authoritative information students receive that will reinforce or modify responses to instruction and guide them more efficiently in attaining the goals of the course" (cited in Ovando, 1992, p.4). Clarke (2000b) notes that the definitions advocated by Ramaprasad, Sadler and Carlson emphasise control lying entirely with the teacher whereas research conducted by Black and Wiliam (1998a, 1998b) on feedback focuses on the importance of students' participation the process.

The literature questions the quality of much of the feedback currently being given to students. MacDonald (1991) concluded that the use of feedback to improve understanding was not realised in practice. He stated that teachers' feedback "often lacks thought or depth; students often misunderstand their teachers' feedback…and many students do not attend to teachers' feedback to begin with!" (MacDonald, 1991, p.1).

Sadler (1989) suggests it is easier for a teacher to comment on effort and degree of expertise than concepts mastered and facts learnt. He cites lack of teacher's knowledge of the subject matter [mathematics] and pedagogical content as mitigating factors. These are critical factors in the teaching of mathematics. Clarke (2001) claims that currently teachers give their students too many criteria to focus on, thus making it very difficult for specific feedback to be given.

The Learn Project (Weeden & Winter, 1999) examined feedback from the student's perspective and concluded that much feedback was either unfocused or of little use in improving learning. There was a wide range of forms of feedback, some of which were not understood by students. With younger students there was confusion between feedback on effort and achievement. Focused and specific comments on how to improve work were welcomed by all students. "The variability of feedback reported by students and their sometimes confused perceptions of its intention, supports Sadler's (1998) view that it is the quality, not just the quantity of feedback that merits our closest attention" (Weeden & Winter, 1999, p.10).

The giving of grades, marks and stickers as a form of feedback and the extent to which these should be supported by written comments remains a controversial area in the literature. Tunstall and Gipps (1996) see stickers, for example, as a form of evaluative, positive feedback. Sadler (1989) argues to the contrary. Information fed back to the student was only feedback when it was used to close the gap. Grades, specifically, do not fulfill this role as they provide limited information. Stickers or "tangibles" as Barringer and Gholson (1979) call them, can act in the same way as a grade, distracting students from deriving any learning value from the feedback. They suggest they are inefficient for teaching students.

Anthony (1996) also argues that test scores alone are of limited value. She suggests that when mathematics tests were returned to students, the focus was on the product, rather than the learning process. She claimed:

> Missing from instruction was explicit references to checking procedures and to the value of checking. Regular prompting for students to evaluate the reasonableness of their solutions, the justification of their procedures, the verbalisation of their processes, and the reflection on their thinking, behaviours that lead to opportunities to learn and develop mathematical thinking, were limited (Anthony, 1996, p.45).

Researchers present differing views on the value of praise as a form of feedback. Hattie (2001b) and Sadler (1989) see praise as a valuable component of classroom interactions but not as a form of feedback. Wiliam's (1999) research in the 1970s showed clearly that "praise was not necessarily 'a good thing' – in fact the best teachers appear to praise slightly less than average" (Good and Grouws, 1975, cited in Wiliam, 1999, p.9).

The timing of feedback is critical. Feedback needs to be given as soon as possible after the event (Freeman & Lewis, 1998). They suggest "the greater the delay, the less likely it is that the student will find it useful or be able or inclined to act on it" (Freeman & Lewis, 1998, p.49). Feedback given too early before students have had an opportunity to work on a particular problem or task can be counterproductive. Anthony (1996) argues "low achieving students, in particular, were often interrupted with a prompt or an answer, rather than guidance, when they hesitated or responded incorrectly" (p.44). Feedback given too early impinges on the learning opportunities for students.

Students receive very little quality feedback during a school day. In fact Hattie (2001a) suggests it is only seconds of descriptive feedback for an average student. And more is not necessarily better! Wiliam (1999) comments on the learning of a group of 64 year four students on reasoning tasks. Half of the students were given a scaffolded response when they got stuck by being given only as much help as they needed to make progress. The other half was given a complete solution as soon as they got stuck, and then given a new problem to work on. Those given the scaffolded response learnt more, and retained their learning longer than those given full solutions. When given the complete solutions, students had the opportunity for learning taken away from them. "As well as saving time, therefore, developing skills of 'minimal intervention' promote better learning" (Ibid. p.9).

An examination of the literature has resulted in much theoretical description of feedback practices, though little research has been undertaken to investigate mathematics teachers' actual use of feedback in the classroom. Its complexity and its entwined relationship with teaching, learning and assessment suggests the notion of feedback should be explored further. The literature reveals conflicting views on the degree of specificity of the term and concerns about the reality of implementation in a classroom setting. A "specific and improvement" model needs to be adopted (Clarke, 2002).

The findings

Teachers' perceptions of effective feedback

Teachers struggled to define 'effective feedback' with any detail. The following comment reflects the difficulty one teacher had with the concept.

> *Effective feedback is the kind of thing that hits you in the …oh wow…but it's when you say something which is so significant that makes…well you'd probably give 'I' messages… 'I really like it when you do…' You would probably say, 'Gosh, that's brilliant'…those are the sorts of things… 'How did you get from here to there?'… 'What were you thinking of?'*

At the initial information session teachers reflected on the fact that feedback was not something they had thought about much before. One thought it was unproblematic and just came automatically. Another teacher suggested:

> *A lot of it* [feedback] *is intuition I think.*

Their reactions reflected a belief that feedback was almost so intuitive and normalized into their everyday behaviours that little thought needed to be given to it. One teacher claimed that effective feedback should be about making learning explicit for children so they know what they're doing, why they're doing it and how they are going.

In analysing the reasons for giving feedback, all teachers suggested that it should be positive and constructive. They considered it served a number of purposes: social, managerial and academic. Teachers claimed feedback enabled them to build self-esteem, focus on improvement, motivate students, manage behaviour, rectify misconceptions and elicit thinking.

Some teachers found it difficult to recall what specific feedback they gave to their students. One stated:

> *What do I say? - I'm not sure what I say. You probably would be better to ask my teacher aide!*

Teachers distinguished between oral, written and non-verbal feedback, mentioning that the vast majority of their feedback to students was oral. The amount of oral versus written feedback varied depending on the age of the students. Year 0/1 students received no written feedback. Comments such as well done, good, excellent, neat work and smiley faces were suggested as typical by one teacher. A teacher of year 0/1 students stated:

> *I don't write things down because most of the stuff that we do on the mat is practical. It's not bookwork. It's either demonstrating with equipment...we just talk things through.*

Teachers suggested a portion of their feedback focused on clarifying and/or repeating what the student had just said.

As the numeracy project focuses on strategy and knowledge development, it is not surprising that a number of teachers suggested feedback should focus on strategy development. As Young-Loveridge (2001) points out:

> Strategies are the ways that children solve number problems, in particular, the mental process they use. Knowledge includes the key information, which children need to have in order to apply particular strategies. These are seen as mutually supportive, with strategies and their use leading to the creation of new knowledge, and knowledge providing the foundation for strategies
> (p.74).

In line with this focus, one teacher suggested her feedback involved:

> *Eliciting strategies, sharing with them, talking about their strengths, why they've worked, how they've worked, getting the students to demonstrate the process that they use to get where they've got to.*

Although not supported by those who advocate a 'closing the gap' definition of feedback, several teachers felt that an important component of their feedback to students involved asking questions. Teachers felt that the numeracy project supported this by suggesting they ask "How did you work that out?" after students had given a response to a certain problem. The Suffolk County Council (2001) confirms this focus by claiming open-ended questions form a crucial part of verbal feedback and are used to probe and extend understanding. Teachers should reflect on the types of questions being asked.

> Where questions are used effectively in providing feedback, open questions are often employed to guide and extend thinking alongside closed questions, which determine knowledge and understanding of content. Developing the use of questioning has been identified as an important aspect of promoting assessment for learning.
> (Suffolk County Council, 2001, p.16)

All teachers supported Askew and Lodge's (2000) broad definition of feedback, which is "all dialogue to support learning in both formal and informal situations " (p.1). This is in contrast to a number of current researchers who believe feedback should close the gap between actual and desired performance. Two teachers indicated feedback was synonymous with praise. Teachers also suggested questions and comments about behaviour were feedback.

The quality of oral and written feedback to students

Table 2 presents a breakdown of the feedback in the numeracy lessons.

Table 2: Analysis of lesson transcripts using Tunstall and Gipps' (1996) feedback typology

School	Teacher	Lesson No.	Positive				Negative			
			Evaluative Positive		Descriptive Achievement		Evaluative Negative		Descriptive Improvement	
			Rewarding A1	Approving B1	Specifying Attainment C1	Constructing Achievement D1	Punishing A2	Disapproving B2	Specifying Improvement C2	Constructing the way forward D2
A	1	1		15	1				3	
		2		19	4			1		
		3		20	4			1		
	2	1	1	19				1		
		2	1	12				3	2	
		3		2	4					
	3	1		14	7			4	1	
		2	1	10	4					
		3	1	6	5				1	
B	1	1		18	1					
		2		12				1	1	
		3		7	1			3		
	2	1		12	2	1	1	2		
		2		13	5			2		
		3		8	2					
	3	1		21	2		1	4	1	
		2		35	1			2	2	
		3		16	3			2		
Total 349			4	259	46	1	2	26	11	0

Of the 349 examples of oral feedback recorded during the eighteen lessons, 74% fell into the evaluative/positive (B1) category. This suggests that much of the feedback was judgmental, based on implicit or explicit norms. These comments reflected less on the cognitive aspects of the mathematics learning and more on the effort and attitude of the learner. These responses often appeared so automated that teachers were unaware of the number of times they were repeating a certain response. Interestingly, in all cases but one, the number of B1 responses decreased from the first to the third visit. This is possibly attributable to an increased awareness as feedback was highlighted by the teacher after each classroom observation. 83% of the total feedback observed was evaluative falling into either the positive (A1 or B1) or negative (A2 or B2) categories.

Only 13 % of the feedback was categorized as descriptive achievement (C1 or D1) feedback. Sutton (1997) notes that descriptive feedback "offers information about the specific task, how it was undertaken and the characteristics of the result. It tends to be more neutral in tone, and is much more explicit about expectations and standards" (p.44). She suggests that effective feedback should be more descriptive rather than evaluative.

The reasons given by the teachers for the small number of examples of this type of feedback are complex. One teacher mentioned she was always conscious of the time and tried to work with two mathematics groups each day. She felt a lack of time hindered her ability to have quality interactions for a sustained period of time with individual students. Another reason may reflect the fact that sharing learning outcomes was not a regular part of the lesson sequence, thus making it more difficult for the teacher to focus in on current performance and the next steps.

During the eighteen lessons observed, there were nine occasions when either whole class or group learning outcomes were shared with students. In all but one case this was done orally. Examples included:

> *Today we're going to be practicing counting forward and backwards in twos and doubles and halves*
>
> *We are learning our six times tables*
>
> *We've been learning to make numbers up to 7 (shared at the end of the lesson)*

Clarke (2001) notes, "a significant feature of effective feedback in many studies is the importance of informing children of the learning objective of the task" (p.19). Research suggests that students are more "motivated and task-oriented if they know the learning intention of the task, but they are also able to make better decisions about how to go about the task" (Ibid.). Other benefits included students showing more concentration, taking ownership of their learning, asking the teacher for task instructions less frequently and checking their own and each other's work against the learning outcome and achievement criteria. Sometimes the learning outcome was mentioned in passing and was quite general.

> *We're practicing our multiplication and we're aiming for instant recall.*
> *We're doing division. Why do we need to know how to divide?*

No teacher consistently shared learning outcomes with the whole class or with the small group they were working with during the lessons observed by the researcher. The numeracy booklet *Getting Started* (Ministry of Education, 2003) and Hill and Hawk's (2000a) *Making a Difference In the Classroom* suggest this is sound teaching practice. One teacher came to the realization that sharing learning outcomes was a valuable idea:

> *One of the things that has just occurred to me is that we often forget to tell children the reasons why we're doing something and it's not just because I said so. We could tell them what they are about to learn and then get them to tell you at the end how they think they've gone about it.*

Written feedback

Mathematics books provide an effective medium for providing written feedback to students about their progress. Results showed written feedback lacked specificity. 62 samples of written feedback were obtained from students' mathematics books (years 2-6). 61% of this feedback was of the positive/evaluative (A1 or B1) type as illustrated in Table 3. Consequently, the written feedback provided few constructive suggestions about ways in which students might improve their work. Four examples of marks or grades were recorded. Teachers also considered ticks and crosses were examples of positive and negative feedback.

Table 3: Analysis of written feedback in student mathematics books.

Type of feedback	Examples	Quantity (N=62)
A1 Rewarding (positive/evaluative)	Smiley face Stickers	4
B1 Approving	Ticks Excellent work Well done Brilliant Great Good work Good Accurate and neat Well set out You are amazing You are really starting to understand this	34
C1 Specifying attainment	Great. You are an accurate pattern spotter. Great. You are starting to show the process.	4
D1 Constructing achievement		0
A2 Punishing		0
B2 Disapproving	Keep it tidy Remember to fold your page in half Untidy work Concentrate on setting out	7
C2 Specifying improvement	Correct inaccuracies Make changes to this diagram Please leave a line between sums Look at your number placing. Large number in the front for division.	13
D2 Constructing the way forward		0

When teachers were asked why their comments were predominantly evaluative and positive, some suggested that a "global" comment was much easier to write within the timeframe that was available to them. Clarke (1998) argues that effective marking can "provide clear feedback about strengths and weaknesses in their work, and recognise, encourage and reward children's effort and progress" (p.81). Black, Harrison, Lee, Marshall and Wiliam, (2002), in their follow up to *Inside the Black Box* (Black & Wiliam, 1998a), suggest teachers should spend more time on certain pieces of work to ensure that they give good feedback and, in order to make time for this, either do not mark some work, or only mark a third of their students' books each week.

There was no evidence to show that students responded to the teacher's feedback. For example, a comment from a teacher suggested a student should make changes to a diagram. This was not actioned by the student. The Suffolk County Council (2001) suggests that a response to feedback should be expected as long as comments by the teacher are "brief, clearly written and easy for the learner to understand" (p.24).

It has to be acknowledged that in analysing the written feedback, it was difficult to determine the nature of the teacher/student conversation that accompanied it if in fact there was one. This questions the applicability of the categories 'constructing achievement' (D1) and 'constructing the way forward' (D2) of Tunstall and Gipps' (1996) feedback typology for written comments. There were also examples of feedback that were two types in one comment:

> *Awesome graphing but remember to label axes* (B1/C2).

Evidence gained from an examination of students' mathematics books suggests that teachers currently give students too many of the same type of mathematical question to complete. Students should be given fewer examples with more time spent on marking and discussion (Clarke, 2002). Where appropriate, students should mark their own work rather than their peers', as this provides opportunities to learn from incorrect answers.

Instruction and feedback

From an interpretation of the lesson transcripts, the data suggest a disparity between the quality of instruction and the quality of feedback. While instructional strategies observed in the classrooms supported an appropriate connectionist orientation towards numeracy teaching and learning, feedback dialogue and strategies did not. Feedback tended to be affective, reflecting what was good or bad about the work or the person.

The issue of whether questions are feedback is debated in the research. Those advocating a specific "closing the gap" definition would claim that questions are a component of instruction not feedback. However, The Suffolk County Council (2001) argues questions can be a vital feedback tool. "Developing the use of questions has been identified as an important aspect of promoting assessment for learning" (p.16). Questions are used to test understanding and to develop thinking.

In the following example, the questions were highlighted incorrectly as feedback by the teacher. The students were involved in a division activity sharing out gold coins between "pirates".

Teacher:	*If we share 18 gold coins between 9 pirates how many would each get?*
Student 1:	*2*
Teacher:	*Are we right?* [question to the group]
Students:	*Yes*
Teacher:	*O.K. Now we're going to share 18 gold coins between 2 pirates how many would each get?*
Student 2:	*9*
Teacher:	*How did you know?*
Student 2:	*I just counted*
Teacher:	*Is it OK to count?* [teacher asking student]
Student 2:	*Yes* [Shares out gold coins]
Teacher:	*What's she doing?* [teacher asking group]
Student 3:	*Sharing out the coins between the two pirates*
Teacher:	*This is how we can record it. 18 ÷ 2 = 9*

When asked why the questions were highlighted, the teacher stated she wasn't really sure but thought it appeared to be feedback because something was being said back to the student.

If Ramaprasad's (1983) specific "closing the gap" definition of feedback is used, then clearly these comments do not constitute feedback. These examples illustrate a lack of understanding of the terms feedback and instruction and confusion about the difference between the two. Nevertheless, if Askew and Lodge's (2000) broader feedback definition of "all dialogue to support learning in both formal and informal situations" (p.1) is used, then technically the teachers are correct.

Discussion

The teachers in this research adhered to a very broad definition of feedback, similar to the one supported by Askew and Lodge (2000). As Hill and Hawk (2000b) found in their research of low-decile secondary schools, "not all teachers had a common definition of feedback" (p.6). The existing profusion of definitions of feedback hinders the development of unifying principles regarding the giving of feedback. Some teachers remained confused and unable to clearly articulate their understanding of the term.

More recent definitions appear to fit on a continuum. At one end, Askew and Lodge (2000) claim feedback is almost everything that happens in a classroom. At the other end, Ramaprasad's (1983) definition, modified by Sadler in 1989 for educational purposes, focuses quite specifically on an improvement model; that of closing the gap between desired and actual performance. Tunstall and Gipps' (1996) notion of feedback appears to fit somewhere in the middle as it encompasses both negative and positive feedback as well as evaluative and descriptive feedback. Given these variations in definition, it is hardly surprising teachers found the concept multifarious and challenging and confused feedback with instruction.

'Closing the gap', the feedback definition promoted by Sadler (1989) and Hattie (2002b), provides a more effective, practical framework for teachers. It may reduce the confusion between feedback and instruction. Feedback involves a perception of a gap between a desire learning outcome or goal and his or her current state and an understanding of the action taken by the learner to close the gap and attain the desired goal. Or put more simply, feedback should involve a discussion regarding the next steps in a student's learning. Hill and Hawk (2000b) identify this as 'feed forward' and argue that it should be "directly related to and should build on the feedback that has been given" (p.7).

Despite some teachers suggesting feedback remained *unproblematic, intuitive and automatic*, this research proposes that giving quality feedback is a highly developed skill requiring a focused and deliberate approach. Tunstall and Gipps (1996) argued that a "judicious combination of both evaluative and descriptive types of feedback by the teacher creates the most powerful support for learning" (p 403) and that feedback was most effective when it focused on improvement and achievement. This research suggests that a "judicious combination" was not evident and that students in the classes received very little specific, descriptive feedback. Gipps et al. (2000) and Hattie (2002a) have found similar results in their research. Feedback should make reference to the quality of the work and how to improve it. In mathematics more feedback is needed on the nature and quality of the mathematical thinking and less on task completion and behaviour.

Exactly why so much feedback focused on evaluative praise rather than extended discussion about the quality of the work is an interesting issue. Torrance and Pryor (1998) argue one reason derives from the "efficacy of behaviourist reinforcement systems" (p.40) associated with assertive discipline programmes. In an attempt to manage student behaviour, schools have developed "praise cultures". This "culture" is also being transferred to dialogue about student achievement. One of the primary

schools involved in the research was a low decile, inner city school with students from many different ethnic backgrounds. A percentage of these students were new to New Zealand. Managing student behaviour was a critical part of the teaching and learning process. Teachers were constantly praising on-task behaviour and were consistently verbalizing and reinforcing routines. In this school, feedback became an instrument of socialization.

Improving Feedback

Learning outcomes can be shared both orally and in written form. Clarke (2001) suggests that:

> sharing of a learning intention is, however, more complex than simply repeating what is in the teacher's plan...In order for the learning intention to be shared effectively, it needs to be clear and unambiguous, so that the teacher can explain it in a way which makes sense (p.20).

Where possible, teachers should change the learning outcome into "child-speak" if, in its original form, it would be inaccessible to students. Students should discuss their personal understanding of the learning outcome and what they need to do to achieve it. The learning outcomes can be recorded in mathematics books. Clarke (1998) suggests that students should be asked to "write the learning outcome under the title and the date. This could be school policy so that it is expected practice by teachers and children" (p.66). She also suggests that when the work is marked "a very brief, general comment is made by the side of the learning intention such as very well achieved, achieved, needs more help, perhaps initialled by the teacher" (Clarke, 1998, p.67).

In support of sharing learning outcomes with students, the literature suggests "dramatic changes … in children's application and attitude to their work and learning" (Clarke, 1998, p.55) occur when learning outcomes are made explicit to students. Children are more motivated and task oriented with the focus being on the learning rather than the learner. As the teachers in this research were generally not sharing learning outcomes as a regular part of their lesson, this may have contributed to the lack of specificity of the feedback.

Generally the teachers paid little attention to the quality of their written feedback. It appeared to be a low priority for them. Feedback should focus on improvement, not merely consist of a range of evaluative comments. Clarke (2000b) argues "the purpose of marking children's work appears to be clear: it provides valuable personal feedback to children about their performance and related improvement" (p.36). Written feedback is always a "poor substitute for oral face-to-face feedback" Clarke (2000b, p.44). Comments should relate to the planned learning outcomes, be legible and clear in meaning, recognise the student's achievement and clearly indicate the next steps needed for the student to progress. Students must be given time to "absorb and act upon or consolidate the feedback comments…A response to feedback should be expected as long as the teacher's comments are brief, clearly written and easy for the learner to understand" (Suffolk County Council, 2001, p.24).

The researcher found no evidence of students monitoring themselves against individual targets in number. Just as students often have individual targets or goals for written language, the same can apply for mathematics. Teacher feedback can then be directed towards the degree of achievement of a specific target. The Assessment Reform Group (1999) showed that "significant progress [is] made by children who have been trained to be self-evaluative…Current thinking about learning acknowledges that learners must ultimately be responsible for their learning since no-one else can do it for them" (cited in Clarke, 2001, p.39). Clarke suggests that when self-assessment is linked to the learning outcome, the child's "progress, persistence and self esteem is improved" (Ibid.).

The plenary needs to become an integral part of the mathematics lesson. It should involve students reflecting on learning outcomes "followed by a teacher summary, unravelling misconceptions and providing links with future learning" (Clarke, 2001, p.40).

The teachers indicated that they had no idea whether the learners understood the feedback they were being given, either in oral or written form. It had never occurred to them to ask. Teachers should routinely talk to students about the quality of the feedback given to them. This could involve identification of examples of helpful or unhelpful feedback. This alerts students to the importance of considering and using feedback and gives the teacher valuable information about the effectiveness of their practice. In part 2 of the Gillingham project, Clarke and McCallum (2001) noted that the "children have demonstrated their natural desire to focus on improvement rather than the more negative correction and revealed, through interviews, remarkable perception about their roles as learners in the feedback process" (p.62).

Conclusions

Raising achievement in mathematics involves focusing on what students learn, how they learn and how teachers intervene in the process. Feedback is a component of the intervention process. It has emerged as a key means to facilitate the learning process playing a multiple and multifaceted role in the learning of mathematics. To date little research has been undertaken to investigate mathematics teachers' actual use of feedback in the classroom. Based on data gathered and the literature and research, this research draws a number of key conclusions.

Teachers were unclear about what constitutes effective feedback. The plethora of definitions of the term 'quality feedback' adds to the confusion and is unhelpful for teachers. Feedback should identify what has been done well, what still needs improvement, and should give specific guidance on how to make that improvement. The feedback process should involve clear expectations about student learning and performance, an explanation of the specific criteria to judge the students' achievement, steps to improve performance and a shared understanding of 'quality'. Feedback can be effective if it empowers students with strategically useful information. Feedback inherently should be about helping students to 'learn' more effectively rather than getting students to do 'x' more effectively.

Inherent in the notion of feedback is an understanding of 'quality' work. The teachers indicated mathematics presented particular difficulties in demonstrating what 'quality' work looks like, especially when working with very young primary school students who could neither read nor write. A number of teachers pointed out that 'quality' work in written language, for example, was easier to determine.

Sharing learning outcomes with students was not seen as a key part of mathematics instruction. The literature suggests this is critical for it provides a framework for specific feedback to be given.

Teachers confused instruction with feedback, indicating many instructional strategies were feedback. This research concludes that questioning, for example, is a form of instruction rather than feedback. Quality feedback should be given in conjunction with quality instruction.

The imbalance in feedback type is problematic. As 84% of the feedback was evaluative, few students received specific, descriptive feedback. This suggests that many valuable learning opportunities are being lost in a desire to be positive.

The issue of praise and feedback is complex and warrants further research. In this research feedback appeared submerged in a desire for teachers to give positive evaluative feedback to their students. Praise can make students feel good without necessarily improving achievement. Praise needs to be given appropriately. It is the nature, rather than the amount of feedback that is critical when talking to young people about their work.

The quality of the written feedback mirrored the quality of oral feedback. Both were primarily evaluative. Written feedback provided few constructive suggestions about

ways in which students might improve their work. The 'praise' culture was just as evident in written feedback as it was in oral feedback.

During their involvement in this research, teachers improved the quality of their feedback, evidenced by the decreasing number of evaluative feedback comments. Being involved in this research raised teachers' awareness of feedback. To date there had been no opportunities for teachers to reflect on this.

Two teachers indicated they were unaware of the extent to which the learner understood their feedback. Teachers need to take the opportunity to talk to students about the quality of the feedback they are receiving and to discuss the extent to which the learner comprehends the feedback.

This research concluded that the quality of the feedback to students will be improved as teachers become more familiar with the stages of numeracy development. The stages facilitate the simultaneous development of strategy and knowledge. This will enable teachers to have a clearer notion of quality work by understanding what is at the next stage in a child's numeracy development.

Tunstall and Gipps' (1996) research used young students (six and seven year olds), whereas this research evaluated feedback to students from years zero/one to six (five to ten year olds). While the typology was useful for analysing oral feedback, it proved problematic for written feedback. The results indicated that there were no examples of D1 and D2 feedback. Inherent in the typology's constructivist approach to feedback, specifically constructing achievement (D1) and constructing the way forward (D2), is the notion of teacher discussion and conversation with the student. Obviously this was not possible or preferable to record in written form. This includes sections that focus on "next steps" or improvement without being accompanied by interaction between the student and the teacher. Generally, the Tunstall and Gipps (1996) typology was a useful framework for analysing oral feedback but needs modification for the analysis of written feedback. This involves the construction of an improvement category without dialogue with the student.

Recommendations

Recommendations for teacher development

Teachers would benefit from having someone with expertise analyse their feedback to determine what is effective and what is not. Being involved in this research was the first occasion that the teachers had gained access to analysed data on their feedback to students. Generally, teachers are given few opportunities to reflect on the quality of their feedback.

It is vital that students have a clear notion of the learning outcomes for each lesson. This enables the student to know the purpose of the activity, thus transferring much of the responsibility for the learning from the teacher to the student. Information about the learning outcome also gives the student important pointers as to the focus of the task. The learning outcome may require a translation into "kid speak" to aid understanding. Teachers' feedback should consciously focus on scaffolding a student's understanding to the next level. The strategy levels in the numeracy project provide an excellent guide for this.

Teachers would benefit from developing their skills in formulating comments to indicate specific actions students should take to deal with misconceptions and inaccuracies.

Feedback should not become submerged in a desire for teachers to give positive evaluative feedback to their students. Positive feedback can make students feel good without necessarily improving work. Praise needs to be given appropriately.

The plenary session serves to support the learning that has taken place during the mathematics lesson. Teachers should endeavour to make time for this at the end of the mathematics lesson or include it at the beginning of the next block of time.

Schools need to address feedback as a whole school issue, as it will only be truly effective when embedded in a whole school policy which is consistently applied. Decisions about how work is marked should be discussed at school level to ensure consistency across the school. Feedback needs to become an important part of policy, procedures, planning and performance. The purposes of feedback, both oral and written, must be clear to all those involved, especially teachers, students and parents. Schools need to work with parents to explain any changes to marking policy and practice. Anghileri's (2000) advice is such that "if teaching approaches change so that children learn connections then the outcome could be a new generation of mathematical thinkers who will be autonomous learners driven on by their fascination with numbers" (p.139). What has emerged is the importance of feedback in supporting successful learning.

Recommendations for future research

This project has identified several areas that would benefit from further research. Even though the project focused on feedback from the teacher to the student, continued research needs to focus on encouraging learning dialogue both between

teachers and students and between students and students. Good feedback involves a two way process. Given support, teachers engage with such extensions to their current practice readily (Watkins 2000).

There appears to be a valuable role for the typology (Tunstall & Gipps, 1996) to be used in the development of teacher skills. Longitudinal studies would enable the use of the typology to be explored over a length of time in association with professional development intervention activities in feedback and formative assessment. Research in the use and value of the typology in the secondary sector should be considered. Refining and validating the feedback typology model for written feedback is an area that needs further consideration also.

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Appendix One: Tunstall and Gipps (1996), Feedback Typology

Evaluative Feedback		Descriptive Feedback	
Positive Feedback		**Achievement Feedback**	
Rewarding	**Approving**	**Specifying Attainment**	**Constructing achievement**
A1. Rewards/reinforcement. Examples include smiley face, stickers, stars, treats and work seen by the principal.	**B1.** Verbal and non-verbal positive feedback e.g. *that's a very good essay, you've done well.* Examples include a touch, a positive facial expression, use of ticks, and general praise such as *very good, well-done and good girl/good boy.*	**C1.** Specific praise, use of criteria. Teacher-directed, factual, work focussed e.g. *that was a very good essay because…* and *this is very well done because you have …*	**D1.** Teacher and student learn together. Praise integral to description during conversation e.g. *that was a great essay. What made it so good?* (Response from student) *I agree, and as well as that ...etc)* The description is embedded in conversation and dialogue with the student reflecting "work in progress" (Tunstall & Gipps, 1996, p399). With this type of feedback, the teacher facilitates the learning process. The child is drawn into explaining or demonstrating achievement using their own work.
Punishing	**Disapproving**	**Specifying Improvement**	**Constructing the way forward**
A2. Negative comments, punishments e.g. *Poor work, repeat. Child removed from class, group.* Examples include removal from the classroom, deprivation, destruction of work and removal from a group.	**B2.** Negative non-verbal and verbal feedback. Reprimands. Includes 'facials', tone of voice, volume, gestures etc. e.g. *you could have done better than this. The introduction is too short...etc.* Examples include *"I'm very disappointed in you today"* or *"you could do a lot better".*	**C2.** Specifying what is wrong. It focuses on the mistakes relating more to student achievement than personal attributes. Correction of errors, more practice given, training in self-checking e.g. *you could have improved your essay by….*	**D2.** Mutual critical appraisal of the work. "Constructing the way forward was used by teachers to articulate future possibilities in learning in a way that looked like a partnership with the child. Alternative strategies given, suggestions rather than telling, questioning as part of discussion, e.g. *... what are your next steps?*
Positive Feedback		**Achievement Feedback**	
Evaluative Feedback		**Descriptive Feedback**	