Teacher feedback to students in numeracy lessons:

Are students getting good value?

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Constructive feedback is recognised as having a powerful influence on student achievement. Hattie (2002) says, "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." However, feedback is conceptually complex and a logistical challenge for classroom teachers.

There are widely differing definitions of feedback. Early definitions such as the one promoted by Kulhavy (1977) focused on correctional aspects, telling the learner if a response was correct or incorrect. The more recent definitions appear to fit on a continuum. At one end, Ramaprasad's (1983) definition, modified by Sadler in 1989 for educational purposes, focuses quite specifically on an improvement model of closing the gap between desired and actual performance: "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). 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). So feedback should involve imparting a "judgement of a child's strategies and skills, or a child's attainment and giving information about the judgement" (Gipps, McCallum, and Hargreaves, 2000, p. 91).

Tunstall and Gipps' (1996) notion of feedback appears to fit somewhere in the middle of the continuum, as it encompasses both negative and positive feedback as well as evaluative and descriptive feedback. At the other end, Askew and Lodge (2000) claim feedback is almost everything that happens in a classroom: "all

dialogue to support learning in both formal and informal situations " (p. 1). This would include instruction. So it is not surprising that Hill and Hawk (2000b) found, in their research on low-decile secondary schools, "not all teachers had a common definition" (p. 6).

The literature questions the quality of much of the feedback currently being given to students. MacDonald (1991) concluded 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!" (p. 1). 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.

Sadler (1989) suggests it is easier for a teacher to comment on effort and degree of expertise than on concepts mastered and facts learnt. He cites teachers' lack of knowledge of the subject matter and pedagogical content as mitigating factors. These are critical factors in the teaching of mathematics.

What is and is not feedback?

Sadler (1989) says that grades, marks, and stickers are not a form of feedback. Information fed back to the student constitutes feedback only when it is used to close the gap. Grades do not fulfil this role, as they provide limited information. Stickers (or their equivalent) can act in the same way as a grade, distracting students from deriving any learning value from the feedback (Barringer and Gholson, 1979).

What about praise? Hattie (2001a) 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" (p. 9). But Hill and Hawk (2000a) note that while praise should not be a substitute for feedback, it should be given alongside feedback. Collectively, praise and feedback form powerful teaching strategies.

Are questions feedback? Those advocating a specific "closing the gap" definition would claim that questions are a component of instruction, but the Suffolk County Council (2001) argues that 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 can be used to test understanding and to develop thinking.

Timing

Timing is critical. Feedback needs to be given as soon as possible after the event. Freeman and Lewis (1998) suggest that "the greater the delay, the less likely it is that the student will find [the feedback] useful or be able or inclined to act on it" (p. 49). However, feedback given too early, before students have had an opportunity to work on a particular problem or task, can be counterproductive.

Students receive very little quality feedback during a school day. In fact, Hattie (2001b) suggests the average student receives only seconds of descriptive feedback. But more is not necessarily better!

Studying feedback

The lack of definitive research about teachers' feedback practices in mathematics was the primary motivation for this research. 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 to:
- examine how feedback is defined in the literature;
- examine teachers' perceptions of what constitutes effective feedback in numeracy in two case study schools;
- describe current practice of teacher feedback to students during numeracy lessons; and
- evaluate the quality of teacher feedback to students.

Six teachers, three from each school, were involved in the study. All were in their first or second year of teaching the national numeracy project with 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, involving students from Years 1–6. Verbatim transcripts were taken of the dialogue between the teacher and

the students. This included feedback to individuals, groups, and, at times, the whole class. During the post-observation discussion, teachers highlighted what they thought was feedback on the transcripts. These instances of feedback were sorted into eight types using Tunstall and Gipps' typology (see Table 1). They distinguish broadly between evaluative (positive and negative) and descriptive (achievement and improvement) feedback.

TABLE 1: Feedback Typology (derived from Tunstall and Gipps, 1996)			
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. Examples include a touch, a positive facial expression, use of ticks, and general praise such as: *Very good* *Well-done* *Good girl/good boy,* *That's a very good essay,* *You've done well.*	**C1.** Specific praise, use of criteria. Teacher-directed, factual, work focused, e.g., *That was a very good essay because...* *This is very well done because you have ...*	**D1.** Teacher and student learn together. The description is embedded in conversation and dialogue with the student reflecting work in progress. With this type of feedback, the teacher facilitates the learning process. The child is drawn into explaining or demonstrating achievement using their own work. 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*
Punishing	*Disapproving*	*Specifying improvement*	*Constructing the way forward*
A2. Negative comments, punishments. Examples include removal from the classroom, deprivation, destruction of work and removal from a group, e.g., *Poor work, repeat.* *Child removed from class, group.*	**B2.** Negative non-verbal and verbal feedback. Reprimands. Includes "facials", tone of voice, volume, gestures etc. Examples include: *You could have done better than this.* *The introduction is too short.* *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 is 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?*
Negative Feedback		**Achievement Feedback**	
Evaluative Feedback		**Descriptive Feedback**	

Teachers' perceptions of "effective feedback"

Teachers struggled to define "effective feedback" in 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 normalised 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.

Teachers considered feedback 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. The two junior class teachers suggested that the main purpose of feedback was social, i.e. to raise student self-esteem and to help students enjoy school and mathematics:

> It's part of that positive reinforcement thing...You want to build their confidence which is a big thing with maths. Building self-confidence is a big one with maths because often I'll find that they know it but they're not just confident enough to speak up. I think you need feedback that's on their wavelength so that's probably why I say "fabuloso" or "you're a star".
>
> Being a new entrant class, I want them to think that this is a fabulous place...at this stage I want everybody to feel good about themselves ...if it's feedback about the actual maths thing, if it's correct, that's wonderful – a double whammy isn't it. But at this stage, I want them to go home from here thinking, "Wow! I'm coming back tomorrow."

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!"

Three teachers focused on the need for feedback to focus on improvement. One stated:

> I would understand effective feedback to be feedback that allows the child to understand where they are in relation to whatever it is they're getting feedback on and what they need to improve on but what they're really good at, and what they've done really well...and if it's got to be critical, I think it has to be a positively critical thing. That's what I think effective feedback would be – feedback that can make them improve.

The claim "to help them move on" was mentioned by a number of teachers, but this was not articulated with respect to individual students during the classroom observations. Usually less specific feedback was given.

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. Teachers suggested that 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 that feedback should focus on strategy development. 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.

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 problem.

And finally, one teacher astutely pointed out that:

> There is no point in giving feedback if it's going nowhere...you're trying to ...progress the child on, so it's got to be understood and it's got to be useful and it's got to be motivating that they then

> want to go on and find out what the next stage is and it's got to mean something to the students as well.

Although most teachers struggled to define "effective feedback" with any degree of specificity, they elaborated on many valid reasons for giving feedback. These included social, managerial, and academic reasons. Five teachers felt feedback was a high priority for them.

How teachers currently give feedback to students

Table 2 presents a breakdown of feedback in the 18 lessons, using Tunstall and Gipps' eight feedback categories.

Evaluative feedback involves a judgment by the teacher based on implicit or explicit norms. Descriptive feedback is task and outcome oriented. Of the 349 examples of oral feedback recorded over the six lessons, 83 percent was evaluative, and 74 percent fell into the evaluative/positive (B1) category. This type of feedback is described as a "warm" expression of teacher approval of the child's work. Examples include a touch, a positive facial expression, use of ticks, and general praise, such as very good, well done, good girl/good boy.

Tunstall and Gipps (1996) suggest that descriptive achievement feedback has the biggest impact on children's learning. Only 17 percent of the total oral feedback was descriptive, and only 13 percent was descriptive achievement feedback (C1 or D1). No feedback was recorded as focusing on mutual critical appraisal of the student's work (D2). This is the type of feedback where teachers articulate future possibilities, in partnership with the child.

Interestingly, with the exception of one teacher, the number of examples of B1 feedback decreased from the first to the third visit. Teachers indicated in the post-observation discussions that they were becoming much more aware of what they were saying to their students.

Written feedback

A total of 62 samples of written feedback were obtained from students' mathematics books (Years 2–6). Of this, 61 percent was of the evaluative/positive (A1 or B1) type. The written feedback given to students lacked specificity, and 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 to be examples of positive and negative feedback.

In analysing the written feedback, it was difficult to determine the nature of the teacher/

student conversation that accompanied it, or if there was such a conversation. This raises questions about the applicability of the categories "constructing achievement" and "constructing the way forward" (D1 and D2 of Tunstall and Gipps' typology for written comments).

Instruction and feedback

Teachers confused instruction and feedback. After each classroom observation, teachers highlighted what they considered to be examples of their feedback to students. In the following examples, the questions were highlighted as feedback. In this first example, 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 he 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.

In this next example, the students were discovering the patterns of timetables on the hundreds board.

Teacher: Now we'll try [counting] in 2s. [It should be easier.]
Task: Using the hundreds board to determine patterns for different multiples
[Teacher: What's the pattern for the 2s.]
Student: It goes in stripes
[Teacher: What are we adding on each time we go down.]
Teacher: Counting in 5s What's the pattern?
Student: Yes, stripes too.
[Teacher: How come the 2s and the 5s do stripes and it's different for the 2s]

Asked why she had highlighted the questions, this teacher made a similar response: she was asking a child a question as part of the feedback process.

Discussion

The teachers in this research adhered to a very broad definition of feedback, similar to the one supported by Askew and Lodge (2000). Some teachers remained confused and unable to clearly articulate their understanding of the term. Two teachers indicated feedback was synonymous with praise. Others suggested questions, instruction, and comments about behaviour were all types of feedback.

Much of the feedback reflected less on the cognitive aspects of the mathematics learning, and more on the effort and attitude of the learner. Teachers' responses often appeared so automated that they were unaware of the number of times they were repeating a certain response.

The reasons given by the teachers for the small number of examples of descriptive 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 individuals or small groups of students.

Another reason for more general feedback being given may reflect the fact that no teacher consistently shared the learning outcomes with students. The focus of the learning was not made explicit at the outset of the lesson. During the 18 lessons observed by the researcher, there were nine occasions when either whole class or group learning outcomes were shared.

Yet Clarke (2001) notes that "a significant feature of effective feedback in many studies is the importance of informing children of the learning objective of the task", and suggests that students are more "motivated and task-oriented if they know the learning intention of the task,

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

but they are also able to make better decisions about how to go about the task" (p. 19). Other benefits include 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. The numeracy booklet *Getting Started* (Ministry of Education, 2003) and Hill and Hawk's (2000a) *Making a Difference in the Classroom* suggest this is critical, as it provides a framework for specific feedback to be given. One teacher came to the realisation 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.

Torrance and Pryor (1998) argue that one reason for much feedback being focused on evaluative praise, rather than an extended discussion about the quality of the work, 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. Teachers were constantly praising on-task behaviour and were consistently verbalising and reinforcing routines. In this school, feedback became a critical instrument of socialisation.

Clarke (2000b) argues that "the purpose of marking children's work appears to be clear: it provides valuable personal feedback to children about their performance and related improve-ment" (p. 36). Generally, the teachers in this research paid little attention to the quality of their written feedback, and it appeared to be a low priority for them. Their feedback provided few constructive suggestions about ways in which students might improve their work. Teachers indicated that a "global" comment was much easier to write within the timeframe that was available to them.

The teachers also pointed out that they had no idea whether the learners understood the feedback they were being given, either in oral or in written form. It had never occurred to them to ask. There was also 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.

Inherent in the notion of feedback is an understanding of "quality" work and the conceptual framework of steps needed for a child to improve. The teachers indicated that 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. Four teachers stated that as the numeracy project material was new to them, the conceptual steps for learning were not embedded or automated.

As indicated by the highlighting of questions in the lesson transcripts, teachers confused instruction with feedback, indicating that many instructional strategies were feedback. 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. However, if Ramaprasad's (1983) specific "closing the gap" definition of feedback is used, then clearly the highlighted questions do not constitute feedback. This research maintains that questioning is a form of instruction rather than feedback. Quality feedback should be given in conjunction with quality instruction.

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. But to do this, it needs to be "specific to the task, in both the positive and critical. It should be descriptive rather than judgmental and should involve the learner wherever possible to improve the chance of it being understood and acted on" (Hill and Hawk, 2000b, p. 7).

Whether oral or written, feedback should make reference to the quality of the work and how to improve it. Ultimately, feedback should be about learners becoming more effective learners. In mathematics, more feedback is needed on the nature and quality of the student's mathematical thinking, and less on task completion and behaviour. Tunstall and Gipps (1996) argue 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 is most effective when it focuses on improvement and achievement. A "judicious combination" was not evident in the oral and written feedback in this research, and students in the classes appeared to be receiving very little specific, descriptive feedback. Many valuable learning opportunities seemed to be being lost in the desire to be positive.

Despite some teachers suggesting that feedback was unproblematic, intuitive, and automatic, giving quality feedback is a highly developed skill requiring a focused and deliberate approach. There appears to be a valuable role for the typology of feedback (Tunstall and 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.

Although Tunstall and Gipps' (1996) research involved young students (aged 6–7 years), in this research their typology worked well for students aged 5–10. Research in the use and value of the typology in the secondary sector should be considered. However, while the typology proved useful for analysing oral feedback, it was problematic for written feedback. Inherent in the typology's constructivist approach to feedback is the notion of teacher discussion and conversation with the student, which written teacher feedback could not display.

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).

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 (2000) advises 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). This research shows the importance of feedback in supporting successful learning.

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