

Researching Numeracy Teaching Approaches in Primary Schools

OPPORTUNITIES AND CONSTRAINTS TASK

Description

To identify the factors perceived to be most significant in relation to effective classroom communication, the research team devised an interview based *Opportunities and Constraints Task* based on the work of Sullivan and Mousley (1996). Factors identified as a result of trialling in non-Research school settings were recorded on two sets of cards – an orange set for those factors identified as likely to impact successful classroom communication, a green set for those factors believed to contribute to unsuccessful classroom communication. Teachers were asked to rank the factors in each category and provide reasons for their first three choices. Members of the research team administered this task in individual interviews with each classroom teacher in October 2001 and March 2003.

Analysis

The *Opportunities and Constraints Task* data were coded and entered into a database with fields for each card used in the task. Cards were scored according to their rank order. Results were summed and percentages calculated to show the proportion accepting each factor, the proportion choosing a particular factor as their first preference, and the proportion choosing the factor as one of their first three preferences. The latter figure was also divided by the proportion rejecting the factor to give an index of how significant the factor was seen to be overall. A subsequent analysis looked at the extent to which teachers attributed successful classroom interaction to internal or external factors, for example ‘my relationship with my students’, as opposed to ‘availability of resources’.

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Suggestions for administering the 'Opportunities and Constraints' Instrument in 20 minutes

1. Read the instructions for Prompt A (Orange cards) to the teacher.
2. When they have sorted the factors into two piles collect the pile that the teacher regarded as not contributing to the success.
3. Ask the teacher to rank the influential factors (remaining cards) in order from most to least influential. NOTE more than one card can be in any level.
4. While the teacher is arranging these cards in order, record the cards that were considered not to be a factor by writing down the letters on the back of the cards in the place provided on the record sheet.
5. Once the teacher has arranged the influential cards turn them over, record their corresponding letters on the record sheet in rank order (more than one letter can appear in each level).
6. Turn over only the first three levels the teacher has used and ask for their reasons for selecting these levels.
7. Record the comments in the space provided.
8. Use the same process for Prompt B (Green Cards) 'Difficulty in communicating about mathematics'

These suggestions are based on the trials that we carried out. Some teachers take a long time to arrange their cards and we found that the above method was the most efficient. We recommend the interview takes place in a quiet area so the teacher is able to concentrate on the task.

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OPPORTUNITIES AND CONSTRAINTS

Opportunities and Constraints Interview

	STATEMENT PROMPT A		STATEMENT PROMPT B
A	my relationship with my students	A	my relationship with my students
B	time available for planning	B	the lack of time available for planning
C	level of parents support and/or interest in children's learning	C	level of parents support and/or interest in children's learning
D	class size	D	class size
E	my own motivation level	E	my own motivation level
F	students' prior knowledge and experience	F	students' prior knowledge and experience
G	the availability and/or accessibility of resources	G	the availability and/or accessibility of resources
H	what else is happening in our school or community	H	what else is happening in our school or community
I	what else I have to do today	I	what else I have to do today
J	our own school maths program	J	our own school maths program
K	my knowledge of maths	K	my knowledge of maths
L	access to detailed information about my students' understanding of maths	L	access to detailed information about students' understanding of maths
M	previous experiences as a teacher	M	students' attitude towards learning
N	the School Numeracy Coordinator	N	interruptions to the lesson
O	the way I taught this topic previously	O	hard to handle children
P	the School Principal	P	I was not feeling well
Q	my personality		
R	my self image as a teacher		
S	text books the school uses		
T	other teachers at the school		
U	students' attitude towards learning		
V	what I learned in lectures and tutorials at university		
W	PDs I have been attended		

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OPPORTUNITIES AND CONSTRAINTS

I would like to ask you about factors that may have an impact on the way you communicate in your mathematics teaching.
There are two sets of cards to go with this prompts respectively.

1. SUCCESS IN COMMUNICATING ABOUT MATHEMATICS

PROMPT A (Orange cards)

Look at these (shuffled) cards. Imagine that you have been successful in communicating about mathematics with the class or a small group
– **Sort the cards into two groups: the factors that are likely to have contributed to that success and those which did not.**

RANK	FACTORS	COMMENTS
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
Not considered		

2. DIFFICULTY IN COMMUNICATING ABOUT MATHEMATICS

PROMPT B (Green cards)

Look at these (shuffled) cards. Imagine that you have had difficulty in communicating about mathematics with the class or a small group
– **Sort the cards into two groups: the factors that are likely to have contributed to those difficulties and those which did not.**

RANK	FACTORS	COMMENTS
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
Not considered		

NAME:	PROJECT USE
SCHOOL:	

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OPPORTUNITIES AND CONSTRAINTS TECHNICAL REPORT

Prepared by Duncan Rasmussen

Description

The Opportunities and Constraints data were collected in the early stages of the project and at the end. In this report these two sets of data have been referred to as initial and final. Each interview involved a set of orange cards and a set of green cards. A *teaching factor* was written on each card. During the interview teachers were asked to assess the factors on the orange cards in relation to a successful teaching experience. They were asked to classify and order them. The procedure was repeated with the green cards but in relation to a less-than-successful teaching experience.

At the beginning of the interview teachers were asked to classify the cards (the orange cards and later the green cards) into two groups according to those factors that affected their teaching and those that did not. For this report these have been called the accepted factors and the rejected factors. After making the two groups teachers were asked to order the accepted factors from most important to least important.

The initial and final interviews, each with orange and green cards, produced four groups of data that are represented in the following four tables. In each table the first column lists abbreviated descriptions of the factors. The next three columns give in order, percentages of teachers accepting that factor, percentages of teachers ranking that factor first and percentages of teachers ranking that factor in the top three. The last column, Ratio, gives the ratio of the top-three ranking rate to its rejection rate for any given factor. For example, in the Initial Orange table the figure 10.0 in the second row under Ratio indicates that *students' attitude towards learning* was ranked in the top three approximately 10 times for every time it was rejected. The ratio was calculated by $(\% \text{ First Three}) / (100 - \% \text{ Accept})$.

Each table has been sorted on the basis of descending order of percentage of acceptance. Factors that have been given an asterisk (*) are internal to the teacher whereas those not starred are external to the teacher.

Initial Orange

Initial Orange	% accept	%1st choice	%First 3	Ratio
My relationship with students *	96	41	54	13.5
Students' attitude towards	95	35	50	10.0
Students' prior knowledge	93	34	46	6.6
Own motivational level *	93	35	49	7.0
My knowledge of maths *	89	29	36	3.3
Availability of resources	87	15	19	1.5
Previous experiences *	87	16	26	2.0

Time available for planning	75	19	25	1.0
Way I taught previously *	74	26	34	1.3
Access to information on students	74	11	14	0.5
My personality *	71	12	17	0.6
PDs I have attended*	70	6	9	0.3
Class size	67	12	16	0.5
Self image as a teacher *	63	14	16	0.4
School maths program	61	6	9	0.2
Other teachers at the school	40	4	5	0.08
Level of parent support	38	5	6	0.1
School numeracy coordinator	30	1	1	0.01
What else is happening	30	0	0	0.01
Text books used	28	2	4	0.05
What else I have to do *	20	0	1	0.01
What I learned at uni *	18	2	3	0.04
School principal	14	0	0	0.01

Table 1 Initial Orange

Final Orange

Final Orange	% Accept	% First Choice	% First Three	Ratio
Students' prior knowledge	95	28	50	10.0
Students' attitude towards	95	33	45	9.0
My relationship with students *	94	25	46	7.6
My knowledge of maths *	93	22	34	4.9
Own motivational level *	93	22	39	5.6
Availability of resources	89	14	22	2.0
Previous experiences *	85	8	16	1.1
Time available for planning	80	25	38	1.9
Access to information on students	79	13	24	1.1
PDs I have attended *	77	4	7	0.3
Way I taught previously *	66	5	8	0.2
School maths program	64	7	12	0.3
Self image as a teacher *	61	7	10	0.3
Class size	61	7	11	0.3
My personality *	58	5	12	0.3
Other teachers at the school	41	1	2	0.03
School numeracy coordinator	41	2	4	0.06
Level of parent support	29	1	2	0.03
Text books used	21	0	1	0.01
What else is happening	20	1	1	0.01
What else I have to do *	16	1	3	0.04
What I learned at uni *	16	1	1	0.01
School principal	12	0	0	0.00

Table 2 Final Orange

Initial Green

Initial Green	% Accept	% First Choice	% First Three	Ratio
Interruptions to lesson	83	27	45	2.6
Students' attitude towards	76	25	41	1.7
Own motivational level *	71	19	34	1.2
Students' prior knowledge	69	21	31	1.0
Time available for planning	69	24	38	1.2
Hard to handle children	66	22	34	1.0
Availability of resources	60	11	23	0.6
I was not feeling well *	52	11	17	0.4
Class size	48	15	18	0.4
What else I have to do *	44	8	19	0.3
What else is happening in	43	9	16	0.3
My knowledge of maths *	43	11	15	0.3
Access to information on students	40	11	14	0.2
My relationship with students *	40	8	12	0.2
School maths program	19	2	2	0.03
Level of parent support	17	3	5	0.06

Table 3 Initial Green

Final Green

Final Green	% Accept	% First Choice	% First Three	Ratio
Interruptions to lesson	82	24	43	2.4
Students' attitude towards	76	22	41	1.7
Students' prior knowledge	73	19	35	1.3
Hard to handle children	70	21	36	1.2
Time available for planning	65	19	33	0.9
Availability of resources	65	12	24	0.7
Own motivational level *	62	11	22	0.6
Access to information on students	50	16	25	0.5
Class size	48	6	17	0.3
My knowledge of maths *	43	7	13	0.2
I was not feeling well *	43	11	18	0.3
My relationship with students *	42	6	12	0.2
What else is happening	35	6	13	0.2
What else I have to do *	31	4	7	0.1
Level of parent support	13	0	2	0.02
School maths program	13	1	2	0.02

Table 4 Final Green

Observations

A preliminary examination of all four tables shows that order in respect to percentage of acceptance (% accept) provides a very good guide to ordering in the other categories. In other words, factors that have a high level of acceptance also tend to have high ranking as first choice, inclusion in the top three and a high top three to rejection ratio. The reverse is true for factors at the bottom of the tables.

Orange Cards

The data of both the initial and final interviews for the Orange Cards divide naturally into three groups: lower, middle and upper. The lower group of factors, those factors accepted by 40% of teachers or less, is consistent across the two interviews. In each case they are the same factors with the order almost the same. *School numeracy coordinator* moves above *level of parent support* in the final interview, perhaps a result of the project.

The composition of the upper group is also quite stable over the initial and final interviews. The same factors appear in both, and in both cases the factors accepted most often are *my relationship with students*, *students' attitude towards learning* and *students' prior knowledge*. The very high ratio value of *my relationship with students* (13.5) and *students' attitude towards learning* (10.0) in the initial interview eases back in the second interview. These changes are partly because a small change in a figure close to 100%, related to a small rejection figure, will result in a large change in that ratio.

It should be noted that the acceptance rate does not always provide a good guide to the other criteria. Although *previous experience* gains a high acceptance rate (87% and 85%), it does not often get first ranking (8% in the final interview).

The list of factors ordered in this way suggests that the focus of teachers is on the immediate dynamics of the classroom. Factors such as *my relationship with students*, and *students' attitude towards learning*, factors that impact on each lesson, rate highly whereas factors more remote from the immediate classroom scene such as *school principal*, *what I learned at uni*, or even *school maths program* are relegated to lower ratings.

Green Cards

The data in these tables have been separated into top and lower groups by a line that marks the point where approximately two thirds of teachers (65%) or more have accepted that factor. The factor chosen most frequently in both the initial and final interviews was *interruption to lesson*. This factor was also rated first most frequently and it was placed in the top three most frequently. *Interruption to lesson*, *students' attitude towards learning*, *time available for planning* and *students' prior knowledge* on the green cards all rated highly in both interviews. The factor *own motivational level* dropped out of the top group (defined in this arbitrary way) in the final interview.

Orange/Green Card Comparison

Teachers chose proportionally less green-card factors (51% in the final interview) than orange-card factors (60% in the final interview). In my experience during interviews,

although teachers were thinking more globally in relation to the orange cards, they were thinking of a specific failure when they were using the green cards. They therefore tended to attribute the failure to a specific factor such as *time for planning*. This would explain the lower number of factors chosen, and also explain lower percentages for any one factor since failures were attributed to different specific factors by different teachers.

The attribution of failure to specific causes for a specific occasion perhaps explains other differences between the orange and green cards. For example, in relation to successful teaching (orange cards), teachers rate the factor *my relationship with students* very highly, but with the green cards it gets a more moderate ranking. It is considered to be an important factor in a success but not, in general, with a failure. The same is true for *my knowledge of maths*. Similarly *own motivational level* although rated highly with the orange cards in both the initial and final interviews is rated more moderately in relation to less successful teaching as indicated in the Final Green table.

Factors that rate highly on all four tables are *students' attitude towards learning*, *students' prior knowledge* and to lesser extent, *availability of resources*. *Students' attitude to learning* is ranked second on all four tables.

Factors Internal and External to the Teacher

Factors internal to teachers (indicated by stars) are scattered through both 'Orange' tables. Despite this the factors *my relationship with students*, *own motivational level*, *my knowledge of maths*, and *previous experience* provide a solid representation of internal factors in the upper group of both tables. One observation is that these factors directly affect the teaching dynamics. Other internal factors such as *what I learned at uni*, or *what else I have to do today* are not seen as being as relevant in dealing with the immediate demands of the classroom and appear further down both tables. The 'Green' tables provide a contrast. All the internal factors are in the lower group in both tables except for *own motivational level* in the Initial Green table. In general, teachers have attributed lack of successful teaching to external, not internal, factors.

Main Observations

The Main Observations are as follows:

- There is agreement between initial and final data.
- There is agreement between rankings on the basis of the four criteria.
- Factors linked closely to the classroom situation are more highly ranked.
- *Students' attitude to learning* is ranked second on all tables.
- *Interruption to lesson* is most popularly chosen as a cause of less successful teaching.
- In less-than-successful teaching situations teachers tend to attribute blame to external factors.