# "Fidelity" mentality is no reality: A message for curriculum developers

Deborah Scott Paper presented at AARE, November 1994


## ABSTRACT

This single site case study examined teacher responses to Mathematics K-6, a mandatory, systemically developed and disseminated curriculum document, and possible reasons for these responses. The main finding to emerge from this project was the range of implementation levels and individualisation of classroom practices despite the document's mandatory nature.

Participants were classified into five subgroups according to their general implementation level of Mathematics K-6 andgroup members displayed some common characteristics, particularly with regard to various significant mathematics education issues associated with curriculum change.

## BACKGROUND

As the literature has stated for the past decade (Marsh 1992; 1987, Fullan 1991, Renner 1990, Farrell & Collins 1990, Burkhardt et al. 1988, Wise 1988 and Price 1988 amongst others), the least effective model of curriculum development in terms of ensuring implementation success is the "centre-periphery" or "top-down" model whereby systemically developed innovations are imposed upon schools and teachers with an expectation that implementation will follow as a matter of course. This model and related expectations assume a commitment to the initiative by those who have had no input into its development and success is measured in terms of fidelity of use ie. The extent to which users implement the initiative as intended by its developers.

The single site case study discussed in this paper examined teacher responses to Mathematics K-6, a mandatory, systemically developed and disseminated curriculum document, and possible reasons for these responses.

## RESULTS

There was one overriding theme and several interrelated sub themes to emerge from the data which are supported by the literature. The main theme is "The range of implementation levels" which is underpinned by four sub themes: i) Teachers' personalising their approach to

implementation, ii) Rhetoric versus reality of implementation, iii) Teacher receptivity to change and iv) Teacher competence and confidence and its impact on implementation. These sub themes directly relate to the overriding theme and, in the main, contribute to an understanding of the main theme, by offering, in part, answers to the question "Why is there such a range of implementation levels ?"

Table 1 provides a summary of what data sources were particularly useful in providing information contributing to each of the main themes.

Table 1 : Contribution of data sources to themes

Data Sources
Document analysisSoCQImplementation QuestionnaireInterviewsObservations
Main theme:

1. Range of implementation levels44444444444444
Sub theme:
2. Personalisation of approach4444444444
Sub theme:
3. Rhetoric versus reality444444444
Sub theme:
4. Receptivity to change4444444
Sub theme:
5. Teacher competence & confidence444444444
Key:444Very high44High4Moderate

Main theme: Implementation levels

Five broad levels of implementation were found amongst this group of participants. These have been labelled as: Well above average (Shakers and movers) , Above average (Into the groovers), Average (Steady Eddies) , Below average (Never readys) and Well below average (Blockers). Table 2 (below) indicates which participants were deemed to belong in each category. The "Codes" used being those nominated by each participant and used consistently throughout the study for the sake of anonymity and confidentiality. It is important to note that the average discussed throughout this entire section is based on the staff at this school only in this single site case study. It by no means pretends to incorporate a wider analysis of implementation of Mathematics K-6.

Table 2: Overall implementation level of each participant

CASE CODEOverall
NO.Implementation level
16KWell above average (Shaker & mover)
14MARIAAbove average (Into the groover)
10JANAbove average (Into the groover)

7007Above average (Into the groover)
81992Average  (Steady Eddie)
1484Average (Steady Eddie)
5ONEAverage (Steady Eddie)
11OKAverage (Steady Eddie)
1327Average (Steady Eddie)
122187Below average (Never Ready)
2MARYBelow average (Never Ready)
4πr 2Below average (Never Ready)
6Captain ScarletBelow average (Never Ready)
3Below average (Never Ready)
9SALWell below average (Blocker)
15008Well below average (Blocker)

The fidelity of use  assumption which is associated with the implementation of mandatory curriculum documents would not result in a range of implementation levels as described above, particularly with regard to the Never ready and Blocker groups which employ practices that conflict directly with Mathematics K-6  yet evidence will be provided from the data to support each of the categories.

The practices characteristic of each grouping are based on an extensive analysis of the Mathematics K-6 document. The emphases heralded in the document appear in Table 3 headed “Mathematics Issues” and are rated on their relative complexity and clarity  (Fullan 1991). The complexity rating is based on the degree of change required from past common practice. This refers to complexity in general  based on past experiences professionally developing teachers from numerous schools within this region and this whole school staff. The clarity rating was determined by the in-depth analysis of the document which looked at the

frequency and extent of information within Mathematics K-6 with regard to each issue.  In general these aspects of mathematics education reflect recent trends at both a National (Australian Education Council 1990) and International (Great Britain committee of inquiry into the teaching of mathematics in schools 1982) level in mathematics education.

Table 3: Clarity and complexity rankings of aspects of Mathematics K-6

Complexity
rankingMathematics issueClarity in
Mathematics K-6
NilLanguage based focusHigh
Equity issues (Esp children with special needs)Moderate
All 3 content strands (Space, Measurement & Number)High
LowConcrete materialsHigh
Teaching for understandingHigh
EstimationHigh

ModerateReal life applicationsHigh
Ongoing assessmentHigh
Cooperative learningModerate
HighIntegration of the three strandsLow/moderate
Integrating with other Key Learning AreasModerate
Very highProblem solving/ investigative approach Moderate
Calculators & technology (including computers)Low

The clarity level has somewhat negative relationship with the complexity rating thus compounding the likelihood of such elements appearing within a teachers practice. That is, items with low complexity have higher clarity and are therefore the most likely to be implemented, possibly even by Never readys or Blockers, while those with high complexity mostly have low or moderate clarity and are therefore least likely to be in evidence in classroom practice although potentially employed by Shakers and movers or Into the groovers.

Well above average implementers

Shakers and movers have classrooms with a completely language based, problem solving focus where children investigate mathematical questions with real life applications, often generated by themselves, in small groups. Learning is largely negotiated with the children who have free access to any resources that they may need throughout the sessions. Maths lessons are not independent of other key learning areas and the dominance of mathematics within any one lesson will vary from group to group and day to day. Assessment is done on an ongoing basis and children frequently assess both themselves and their peers. Thus, Shakers and movers demonstrate evidence of all of the desirable practices purported by Mathematics K-6.

Only one participant was deemed to be a Shaker and mover - “K”. She exemplified this category, alluding in interviews to such advanced practices as:

“I’ve just tried to find ways that really get kids involved... and its great when they work in groups, they always work in groups or with a partner... they actually learn off the others.”
“I’ve written out some of their own little problems that they wrote themselves so others can do them...”
“I get the kids to report back, to explain what they’ve done - it is just another way of assessing.” (Source: Interview transcript 14th

September 1992.)

These data were strongly supported by classroom observations where children interacted freely and were constantly on task, often in some

form of peer tutoring arrangement with free access to resources as required, including calculators. On another occasion children were operating in well established peer groups, employing many sound cooperative learning principles in the calculator investigation work they were undertaking and the entire ethos of the classroom which was particularly child-centred and child driven, even the assessment.

Above average implementers

Into the groovers are largely moving towards the type of classroom described above yet there is slightly less flexibility and at times a bit more visible teacher structure than in the Shakers and movers classroom. The elements of cooperative groupwork and problem solving are well in place as is an ongoing assessment program where some, but less, assessment is done by the students.
Of the three Into the groovers , all were observed while only one was interviewed. From the interview, many of the practices outlined above were discussed but, generally with less conviction.

“We use the computer heaps in Maths, everyday ... not calculators though.... and I really like them to work in groups as much as I can but with a K-2 composite it doesn’t always suit.... I try to let them go on their own if I can but some of them need extra help along the way.” -
(Source: Interview transcript 14th September 1992.)

In all three classrooms children were at times observed working cooperatively and at other times arranged in groups but working independently. In general, cooperative learning principles were in place although children still required firm teacher direction in this area. In all cases the main learning processes appeared to be investigative but elements of teacher direction arose in some instances. Children were observed using the computer in pairs in one room on each occasion but there was no evidence of calculators in any of the Into the groover classrooms.

Average implementers

Steady Eddies are mostly keen to attempt new teaching practices which are readily in place in the Into the groovers classroom. Such complex practices as cooperative learning, use of technology and investigative mathematics are attempted at regular intervals but not part of the mainstream running of the classroom. In most cases, some form of formative assessment is in place although a degree of summative assessment is also undertaken. Teaching for understanding is the dominant focus and an abundance of concrete materials is available.

A fundamental difference between Into the groovers and Steady Eddies was the extra support required by the Steady Eddies to attempt certain innovative practices in their classrooms. During informal discussion

and interviews most Steady Eddies showed strong signs of wanting to do "the right thing" in their classrooms but needing support to do so.

"With certain activities sometimes I think... how would you start that off, like investigations, how do you get the kids to understand what it is that you want to get out of the activity." (Source: Interview transcript 7th September 1992.)

During numerous observations we worked on several aspects which they wanted to try but were not confident enough on their own. These aspects included the use of calculators (previously untried), cooperative learning (previously attempted with minimal success) and employing a problem solving focus (didn't quite know where to start). All of these were attempted with a high degree of success and subsequent visits to the classrooms showed signs of further use of these procedures although not constant use.

In general, teachers within the Steady Eddie group could be described as sound implementers of the low and moderate complexity elements with erratic and individual strengths in the high and very high levels (Table 8). Steady Eddies' classrooms were alive with concrete materials and enthusiastic children who were given access to resources in a controlled rather than free manner.

Below average implementers

Never Ready teachers showed spasmodic evidence of some of the more complex teaching practices outlined in Mathematics K-6 and mentioned above. More obvious was the influence of a structured environment, largely whole class instruction and the semi-irregular use of concrete materials. Investigation was almost non-existent although some attempts to integrate maths with other Key Learning Areas were evident. A dominance of the Number strand prevailed as did more formal recording in books.

In several instances, both throughout interviews and observations, Never Ready teachers justified their approach to teaching mathematics. Their reasons for adopting more conventional approaches than those advocated in the syllabus ranged from a lack of confidence to the wisdom of past practice.

"I would like to, it is just a matter of planning ... the problem I've found with teaching the older kids is that there isn't enough drill in the top grades... because it is the basis of your maths and there just isn't any."
(Source: Interview transcript 20th July 1992.)

This group consistently revealed that they had some understanding of what was expected of them by Mathematics K-6 yet they were personally

incapable or unprepared to adopt such practices.

"It (the syllabus) focuses really heavily on groupwork .... I will admit I have tried to do some whole class, especially this year because I was feeling my way on a new grade and I thought to hold control over them, to control the situation more I will do more as a whole class." (Source: Interview transcript 14th September 1992.)

Within this group there were several inconsistencies between data from different sources yet the observation and interview data, complete with justifications, presented the clearest picture of low implementation levels and individualised approaches.

Well below average implementers

The teachers described as Blockers largely teach from texts or workbooks with the use of very few concrete materials. The similarities end there, however, as one of these teachers demonstrated in the interview that she was very aware of the types of practices that she should employ and was keen to try many of them as they were in line with her own personal philosophy yet she needed a lot of support in terms of ideas to get her started with minimum stress. The other teacher knew incredibly little about the Mathematics K-6 syllabus (despite stating that he used it 'sometimes' and described himself as an 'intermediate' user) and was content not to know thus maintaining his original conservative approach to the teaching of number without considering any change whatsoever.

Sub theme: Teachers personalising their approach to implementation

This sub theme is strongly linked with the main theme of varying implementation levels. Data presented in that section will not be repeated here but referred to where appropriate. This part will focus on specific individual practices and the underlying causes for teachers adopting such personalised approaches to implementation. As with the main theme, the fidelity mentality of curriculum developers does not take into account the vast range of past experiences of their clientele and the subsequent impact of these experiences on their decisions when implementing such a document in their classroom.

Even within the five subgroups identified amongst the implementation levels above it is clear that every teacher has personalised their approach to implementing Mathematics K-6. A particularly notable example of this can be seen within the Blockers where the two participants at this level of implementation have extremely different approaches to the innovation but their level of implementation is essentially the same. Thus the groupings identified in the main theme are almost solely based on broad issues evidenced in classroom

practice.

A summary of major influential factors and resulting individualised implementation practices follows in Table 4.

Table 4: Summary of major influences and individualised implementation

CASE CODEMajor influential factorsIndividualistic traits
NO.in implementation
16KNew Zealand training and experiences.Child directed, investigative, interactive environment
14MARIANone identifiable but no acknowledgment of inservice at all. Problem solving focus with degree of effective cooperative learning
10JANHighly teacher training and matching own philosophy. No inservice or support other than peerSome co-op learning, 3 strands, concrete materials not heavily investigative.
7007Very confident about syllabus & own maths knowledge. Mandatory document no influence.Use of computers, not calculators. Use of groupwork and many concrete resources
81992Teacher training influence limited but inservice reasonably high in comparison to others.Heavy text use and very number dominated but great cooperative learning & beginning investigation
1484Own experiences very negative therefore driven to new approaches. Still experimenting with new approaches. Strong on concrete materials and balancing strands.
5ONEMixed bag but teacher training and matching philosophy strong.No observations
11OKAll close but mandatory document and peer pressure strong.Highly resourced and reflective but individualistic
1327Unrelated to own learning experiences and limited inservice but confidence and knowledge quite strong.Good basic implementation, ready to try new ideas and undertake technology, investigations etc.
122187No inservice, greatly lacking in confidence and no influence at all from teacher training.Use of concrete materials and reflective component but too much number and individualistic

2MARYNo inservice at all and no influence at being a mandatory document. Teacher training quite high.Content is totally syllabus based, methods are minimally related - not always resourced etc
4πr 2Teacher training quite high and school level support.Quite traditional but for integration across content strands
6Captain ScarletNot related to own learning experiences at all and minimal teacher training influence, mandatory nature of document no influence but inservice quite high.Linking with other Key Learning Areas very high but mostly teacher centred and ability groupings, not cooperative or interactive
3No inservice, departmental or regional support. Mandatory doesn't count but peer pressure very high.Good grasp of 3 content areas and regular concrete materials ready to attempt more needs help though

9SALNot related to own learning at all, no inservice, lack of confidence, no teacher training influence and peer pressure reasonably high.Virtually nil despite knowing exactly what should constitute good practice.
15008Not related to own learning at all, no influence from teacher training. High level of peer and school level support.Virtually nil - all number and very structured despite extensive inservice and peer support.

Teachers' past experiences are fundamental to these findings and while generalisable patterns were not forthcoming from the data, major contributing influences resulting in specific levels of implementation were able to be identified for most participants. These ranged from their experiences in school mathematics through teacher training, to peer influence and a variety of personal experiences. One major contributing factor was the level of confidence in both their mathematical ability and ability to teach mathematics.

The first group, relating to background experiences could be subdivided into six categories, the scores for each of which are displayed in Figure 1 below.

Figure 1:Teacher background experiences as possible contributing factors to  personalised approach

There are not a lot of clear patterns within this data which might contribute to an understanding of the interplay of factors that influence an individual's level of implementation of an innovation yet there are some minor trends. Firstly, the notable low total scores of the two teachers classified as Blockers. These low scores suggest that they had less background experiences than their peers to influence their teaching of mathematics and subsequently their level of implementation was somewhat lower. Secondly, relevant teacher training to support such a style of mathematics teaching was given a low score by both of the Blockers and two of those categorised as Never readys .

Items 14-26, which required teachers to attribute the extent of the influence of given factors on their use of  Mathematics K-6, subdivided into 10 categories, 3 of which overlapped with the background experiences categories. To give an idea in what proportion each factor influenced the participants the graph in Figure 2 was based on percentage proportions of the individual wholes.

Figure 2:Proportional breakdown of the total of each teacher's declared influences on their own level of implementation

Again, few patterns readily emerge but among those in evidence are: Of the six teachers to attribute absolutely no influence to inservice, one is well below average and three are  below average; Of the three

respondents to attribute absolutely no influence to their teacher training, two are well below average and one is below average; Three of teachers operating at a below average implementation level for their school in Mathematics K-6 nominated peer pressure as a major influence.
While none of these influences is sufficient for restricting a teacher's level of implementation in isolation, in each case of below average or well below average implementation of this document in this particular school, there is one or more major contributing factors that have impacted in a negative way on a teacher's ability and inclination to implement such an initiative. This is shown in Table 5 below.

Table 5: Major negative contributing factors to individual implementation levels for all participants ranked below average

CASE CODEOverallMajor Factor/s
NO.Imp level
122187Below averageOwn maths knowledge, inservice support, teacher training, peer pressure, mandatory document
2MARYBelow averageOwn maths knowledge, inservice support.
4PIE-R-SQBelow averageTeacher training.
6CAPTAIN SBelow averageTeacher training, peer pressure.
3Below averageInservice support, peer pressure.
9SALWell below averageOwn maths knowledge, teacher training, inservice support.
157008Well below averageTeacher training

Sub theme: Receptivity to change

This sub theme is closely related to the last in that a teacher's receptivity to change in combination with their past experiences (both positive and negative) are two of the main factors which will directly impinge upon their overall level of implementation of a given innovation.

According to McKibbin, Joyce & Hersch (1983), amongst any group of teachers, subgroups are able to be identified largely based on their attitude to change. These subgroups of teachers could be placed along a continuum such as the one illustrated below which is based on the categories devised by McKibbin et al. (1983) with a labelled continuum devised by myself (See Fig 3), members of each group displaying similar personality characteristics and subsequently similar usage of a given innovation. Further, McKibbin, Joyce & Hersch (1983) describe these teacher growth states (subgroups) in colourful colloquial terms which illustrate their point so clearly that no additional explanation of the traits of each group is required here. This aspect, not widely addressed within the research literature needs further exploration as it is feasible that a range of interacting factors might lead to the

development of these “implementation subgroups” with personality traits being but one of many contributing factors.

Figure 3  Teacher growth states continuum

OMNIVOREACTIVEPASSIVEENTRENCHEDWITHDRAWN
CONSUMERCONSUMER

This continuum provides a useful framework for discussing the receptivity of these teachers to change in this instance. The categories of  Omnivore, Active consumer, Passive consumer, Entrenched and Withdrawn are able to be applied to this situation but only to a certain degree. Firstly, despite having one teacher labelled as a Shaker and mover and three as Into the groovers , I would not describe any of these people as  omnivores as they are all interested but critical users of Mathematics K-6 and as such have not consumed it in its entirety but adapted and modified it, as one might hope, to fit their specific class needs. I would, however, describe the aforementioned teachers as active consumers.  Therein lies another slight variation on McKibbin et al.’s groupings - Three of the four teachers described as Steady Eddies, I would also describe as active consumers as they are all currently actively engaged in increasing their levels of implementation of various aspects of the innovation as is one of the teachers described as a Never ready . The remaining teacher, 484, at the Steady Eddie level is the only one who’s behaviour is befitting of an omnivore. Four of the five teachers at the Never ready level could best be described as passive consumers and the remaining one would be classed as an active consumer while there is only one teacher (at the Blocker level) deserving of the entrenched label, that is 008 and one non-participating staff member that could be described as withdrawn.

Thus, while all of the participants in this study are able to be categorised using McKibbin et al’s continuum, the order does not fit this group (Refer to Table 6) and the categories, based on personality traits appear to be independent of the actual implementation level and rather describing the level of current activity of a teacher with regard to a particular innovation.

Table 6: Assignment of McKibbin et al’s teacher growth states

CASE CODEOverallTeacher growth state
NO.Implementation level(McKibbin et al. 1983)
16KWell above averageActive consumer
14MARIAAbove averageActive consumer
10JANAbove averageActive consumer
7007Above averageActive consumer

81992AverageActive consumer
1484AverageOmnivore
5ONEAverageNo further data available
11OKAverageActive consumer
1327AverageActive consumer
122187Below averagePassive consumer
2MARYBelow averagePassive consumer
4πr 2Below averagePassive consumer
6Captain ScarletBelow averagePassive consumer
3Below averageActive consumer
9SALWell below averageActive consumer
15008Well below averageEntrenched

Sub theme: Rhetoric versus reality

Much has been written regarding the difference between teacher perception of their own teaching behaviour and reality. In this study, there were two levels of this phenomenon. Firstly, the standard problem that what teachers indicated was their usual practice on a survey and/or stated in an interview did not necessarily correspond with what was happening in their classroom. this was particularly true in the cases of: Captain Scarlet who spoke extensively about problem solving yet no such approach was witnessed within his classroom; 008 who said that there was a lot of merit in the syllabus, particularly certain aspects and then proceeded to implement virtually none of them; 2187 who ranked highly in the surveys but when it came to an interview a truer indication of classroom practice was revealed which was refined even further during observations.

The second example of rhetoric versus reality was more widespread than this, however, as it affected items across the complete data set from the implementation questionnaire in the following way:- Items 53 to 72, while related to the level of implementation, required participants to rank the importance of a particular aspect of Mathematics K-6 rather than their actual level of practice of these aspects. This had not been considered as a potential difficulty in the questionnaire design yet when large differences occurred in the means for almost identical aspects, such as those tabulated below, the decision was made to include only the items which related specifically to classroom practice in determining levels of implementation in the discussion of the main theme.

Table 7 (a):Importance versus practice - real world applications

Applying Maths to the real worldMean score
Item 51: Do I... give children opportunities to apply what they have learnt ?4.9
Item 69: Please rate the importance of... applying Maths to the real world7.5

Table 7 (b): Importance versus practice - integration with Key Learning Areas

Integrating Maths across the curriculumMean score
Item 50: Do I... see Maths as a separate subject ? (Scores reversed for

negative item)3.6
Item 55: Please rate the importance of... Maths across the curriculum6

Table 7 (c):Importance versus practice - calculator use

Calculator useMean score
Item 52: Do I... encourage children to use calculators?
4
Item 55: Please rate the importance of... use of calculators
4.75

The difference between the two perceptions of the same element is evident within the three examples above and this raises yet another issue:- the potential difference between what teachers know should be happening in their classroom, or what they consider to be important, and what actually does happen in their classroom. The battle of theory versus practice therefore exists even within individual teachers' minds. This issue begs further exploration yet needs to be the deliberate focus of another study and is not expanded upon here.

Sub theme: Teacher competency and confidence

The final sub theme is the question of teacher competency and confidence. While it is neither feasible nor desirable to attempt to correlate such attributes with overall levels of implementation, some data, particularly the interview data, indicated some relationship between the two. Of the three participants who expressed least confidence in their own mathematical knowledge, one was well below average and the other two were below average. These teachers were 2187, SAL and Mary. Throughout each of their interviews direct references were made to feeling inadequate and lacking confidence and competence in mathematics and the teaching of it. Mary actually made a specific comment that she felt confident at the level she was teaching at (Kindergarten) but wouldn't if she had to deal with children not much older than that.
A total of four items on the implementation questionnaire related to teacher confidence and competence in the area of mathematics. In general, responses on the implementation questionnaire revealed the same lack of confidence as in the interview with a couple of additional uncertainties as are evident in Figure 4.

Figure 4:Teacher competence and confidence scores (in descending order)

from related items on the implementation questionnaire

Figure 4 shows that SAL and πr 2 are not comfortable using the Mathematics K-6 document. To compound this further, however, SAL also has minimal confidence in her own maths ability and her ability to teach maths. She is the only person who declares herself to be in this position yet Mary has stated that she has absolutely no confidence in her ability to teach maths while 2187 has low levels in both confidence items.

In summary, of the four participants whose total scores of the confidence/ competence related items were noticeably lower, three of these attained an overall implementation rating of below average and the other, well below average. As primary teachers are generalists, not specialists and it is widely acknowledged that few have natural strengths in mathematics, it is not surprising that at least three, if not four, of the participants in this study have had their levels of implementation of Mathematics K-6 curbed by their lack of confidence. For these reasons this issue of teacher competence and confidence

cannot be brushed aside and must be looked at in far greater depth in a subsequent study.

Thus, despite the assumption by systemic curriculum developers, in this instance the NSW Department of Education, that fidelity of use is a reality, all data collected in this study point to the contrary and a constantly increasing number of research based papers are indicating that changes in curriculum development and dissemination practices are essential if higher and more consistent levels of classroom implementation are to come into being. Many of the aspects discussed in this paper require further research if curriculum implementation is to become more effective and state of the art teaching practices are to become a more widespread reality rather than the existing inconsistent mix of activity, passivity and resistance. If change of any real magnitude is to be made, teachers need to be asked how this transformation can be supported most effectively and such practices employed - a sharp contrast to current practices in curriculum change.

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