

CHAPTER FOUR

THE RESEARCH ANALYSIS

Introduction

Chapter Three discussed the design of the study into emotional states. Chapter Four will describe the data that was collected during the research. This will be done by systematically describing the findings from each of the data collection methods used in the study. Themes that emerged from the investigation will be discussed in the following chapter. However, before the analysis of the data is commenced the terms that have been used in it will be defined, and the changes to the research sample will be discussed.

Changes to the Sample

During the course of the study one third grade girl and one fourth grade boy left the class and a fourth grade girl and boy joined it. As variations of this kind are typical of changes that occur in any class during a school year, the researcher did not consider that the findings from the research would be affected.

Mathematics Activity

In the analysis of the data, the term 'Mathematics activity' means any task other than a Mathematics test that is normally undertaken within a Mathematics lesson.

Stress and Worry; Emotions and Feelings

The terms 'stress' and 'worry' are used interchangeably in the discussion about the data and so are the terms 'emotions' and 'feelings'.

Body Language or Non-verbal Language

The words 'body language' and 'non-verbal behaviour' are also used interchangeably in the analysis. The terms represent any observable physical actions that appear to indicate an emotional state. Typical examples of body language actions are smiling and frowning.

Classification of Emotions as Positive and Negative

The analysis of the research is based on Ortony et al.'s (1988) argument that emotions can be classified as being either positive or negative. The authors have defined emotions as valenced reactions to events, agents or objects, with their particular nature being determined by the way in which the eliciting situation is construed (Ortony et al., 1988).

THE CLARKE (1987) SELF-ASSESSMENT RESPONSE SHEET

When the class had completed the first administration of the modified Clarke (1987) self-assessment sheet, a file on each child was commenced. The file contained the words the child had circled on the sheet, any new words she/he had added, the child's response to the question about liking Mathematics and when applicable, her/his given reason.

After the final administration of the questionnaire, three summary sheets were created to assist in the analysis of the data. Each summary sheet was divided into positive and negative responses. The groups were then subdivided into two additional groups: third and fourth grade girls and third and fourth grade boys. Additional words given by the children were noted. (See Table 1 for the words given in the first administration of the self-response sheet and Table 2 for the words given in the second and third administrations of the sheet.)

The summary sheets enabled the researcher to quickly review the positive and negative words that the children had provided, and they assisted her in tallying the frequency of those words. This was done to determine the consistency of the data over the six month period in which the research occurred. Words that could not be categorised as being either positive or negative were left unclassified. However, during subsequent data collection methods, the researcher asked the children to explain whether or not the words stood for 'good' or 'bad' feelings. After the children had explained the meanings of the words, they were classified. Examples of such words included "hungry", "sleepy", "a blank mind" and "sweaty".

Table 1: Words circled in the first administration (July) of the modified Clarke (1987) self-assessment response sheet. The word asterisked was an extra word given by a child. The number in brackets signifies the number of children who circled the word.

Positive Emotions	Negative Emotions
<u>Fourth Grade Boys</u> interested (4) successful (3) happy (5) relaxed (3)	<u>Fourth Grade Boys</u> worried (4) rushed (4) bored (3) confused (1)
<u>Fourth Grade Girls</u> happy (4) relaxed (3) successful (3) clever (2)	<u>Fourth Grade Girls</u> worried (11) rushed (6) bored (4) confused (3) *sick (2)
<u>Third Grade Boys</u> happy (2) interested (1)	<u>Third Grade Boys</u> rushed (2) worried (1)
<u>Third Grade Girls</u> happy (2) interested (4) clever (1) successful (1)	<u>Third Grade Girls</u> confused (1)
Total = 38	Total = 42

Findings

Table 1 shows the positive and negative words that were identified during the first administration of the modified Clarke (1987) self-assessment sheet. "Worried", "rushed", "bored" and "confused" were the negatively valenced words circled by the children. Two children gave an additional word "sick". The word was interpreted as representing a negative emotion. Positively valenced words were: "interested", "successful", "happy", "relaxed" and "clever". No extra positively valenced words were put forward.

Table 2: The words circled in the second and third administrations of the modified Clarke (1987) self-assessment response sheet. The words with one asterisk beside them were extra words given by the children. The words with two asterisks beside them were classified after asking the child whether the word signified a good or bad feeling. The word 'normal' was later classified as a neutral state.

Positive (Sept.)	Negative (Sept.)	Positive (Nov.)	Negative (Nov.)
<u>Grade Four Boys</u> relaxed (4) happy (3) interested (4) successful (2) clever (1) * glad (1)	<u>Grade Four Boys</u> worried (4) bored (6) confused (4) rushed (1) *hate (1) *nervous sometimes (1) **hungry (1)	<u>Grade Four Boys</u> interested (5) clever (1) successful (3) relaxed (4) happy (1)	<u>Grade Four Boys</u> confused (3) worried (2) bored (3) rushed (2)
<u>Grade Four Girls</u> successful (3) interested (5) relaxed (3) happy (1) clever (1)	<u>Grade Four Girls</u> worried (7) bored (9) rushed (7) confused (6) *blank mind (1) *sick (1) *very scared (1) **sweaty (1) **sleepy (1)	<u>Grade Four Girls</u> clever (2) *great (1) interested (5) happy (2) relaxed (1) successful (1)	<u>Grade Four Girls</u> worried (7) bored (3) confused (3) *frustrated (1) *embarrassed (1) rushed (4)
<u>Grade Three Boys</u> interested (2) happy (2) clever (1)	<u>Grade Three Boys</u> worried (1) rushed (1)	<u>Grade Three Boys</u> clever (1) happy (1) interested (2) **normal (1)	<u>Grade Three Boys</u> worried (2)
<u>Grade Three Girls</u> interested (2) successful (1) clever (1) Total = 37	<u>Grade Three Girls</u> (No words recorded) Total = 51	<u>Grade Three Girls</u> interested (1) Total = 31	<u>Grade Three Girls</u> confused (1) Total = 32

The initial administration of the questionnaire showed that there were forty-two negative responses. As the teacher of the class, the high frequency of negative words circled on the questionnaire was a concern. It prompted the researcher to hypothesise about the reasons for its occurrence. One explanation for the finding could have been that the children were uncertain about their ability to successfully complete Mathematics tasks. Another explanation proposed by the researcher was that the questionnaire may not have supplied the most appropriate words from which the children could choose. The researcher hoped that the individual interviews would provide her with data on the children's choice of words.

INDIVIDUAL INTERVIEWS AND FOLLOW-UP INTERVIEWS

The individual and follow-up interviews took place in the front right-hand corner of the classroom as the other children in the class were working on Mathematics activities. That area was chosen because it contained the largest amount of free space in the room.

Each child was asked to explain why she/he had circled particular words on the Clarke (1987) questionnaire. The interviews also investigated whether or not the child experienced physical reactions during Mathematics lessons. If the child responded in the affirmative then she/he was asked to describe the reactions and the type of activity or tasks in which the reactions occurred. The last question of the interview asked the child to place herself/himself on a numberline graded from one to five. This was done so that the researcher could determine the degree of nervousness that each child experienced before completing a written and oral test.

The individual interviews did not provide the researcher with explanations for the words the children had circled on the questionnaire. The lack of data could have been brought about by one or more of the following reasons: the type of questions asked during the interview, the self-consciousness of the children during the interview, the inability of the children to express abstract feelings or the fact that the interviews were held near other children in the class, thus causing the interviewees to feel embarrassed.

The Production of Positive Emotions and Physical Reactions

During the individual interviews the following positive emotions were volunteered by the children: "clever", "successful", "interested", "happy" and "relaxed". Each child in the sample was asked to tell the researcher about a time during a Mathematics lesson in which she/he had experienced the emotions she/he had circled on the questionnaire. When the question was asked in respect to the positive emotions, the most common response was, "during an activity that's not a test". In addition to this, the majority of the children stated that there was a difference between the way they felt when they did an activity and the way they felt when they did a written Mathematics test. For the children who experienced physical reactions during Mathematics lessons there was usually no reaction experienced during an activity while one was experienced during a written test. None of the children stated that they experienced any type of physical reaction during oral tests. The following extracts from individual interviews illustrate these points.

Example One

Teacher: Can you explain or tell me anything more about how or when you feel interested? Maybe what sorts of things we do or is it just Maths? [ie., any activity]

F.L.: Yeah.

Teacher: OK, including activities like the one we're doing now? [a multiplication grid + stencil]

F.L.: Yeah.

Teacher: And even sums on the blackboard or sums on sheets, you're interested in them too? [child nods head] OK.

Example Two

Teacher: Is the way you feel when you do a [written] Maths test different from the way you feel when we do other activities like the one you did today with the faces?

B.R.: Yes.

Teacher: Do you feel less nervous for the activities? More nervous or what? Maybe I should ask if you ever get nervous for the other activities we do?

B.R.: Oh, not really.

Example Three: A follow-up interview

Teacher: We'll just go over your answers to make sure I've got it clear. OK? So you feel happy and terrific just about any time when you do Maths. Is that right?

R.A.: Mmm, hmm.

Teacher: Yes. Yes you do get butterflies in your tummy, sometimes when you do things but only with tests.

R.A.: Yep.

Teacher: Yes. (pause of 2 seconds) Um, but down here I thought you said, that for all Maths you get butterflies until you get started. Or was it only for tests? Maths activities or tests?

R.A.: Just tests.

Negative Emotions and Physical Reactions Experienced During Tests

The majority of the children stated that they had experienced physical reactions during Mathematics lessons. When probed about the task in which the reactions occurred, the children usually replied, "during Maths tests". Further questioning by the interviewer revealed that the strongest physical reactions occurred during written rather than oral tests.

The physical reactions that were discussed during the interviews were: "butterflies", "shaking hands", "hot and sweaty", "funny in the tummy", "sick in the stomach", "I'm hungry and have a headache" (See Physical Reactions under Test Factors in Chapter Four: Emerging Themes).

The emotions that the children experienced during Mathematics tests were all negative. They consisted of confusion, worry, being bored and feeling rushed.

'Confusion' and 'feeling rushed' were experienced during both written and oral tests, but particularly during oral tests. However, the majority of the children who experienced 'worry' during tests only discussed it in relation to written tests. When questioned about the reasons for their worry the children usually related it to marks. The following excerpts from individual interviews illustrate this point.

Example one

M.F.: Because, um, sometimes I get worried because I get um, I get 25 in my [written] Maths test.

Teacher: Twenty-five percent?

M.F.: Yeah.

Teacher: Right. And that worries you?

M.F.: Yeah.

Example Two

K.B.: Sometimes when um, when we, cause I like Maths. I feel happy and when I can't, when I get things wrong I feel worried but when I don't get things wrong I feel worried how I um, how, how well my marks will be in a Maths test and everything.

While concern about marks was the main source of nervousness and worry during tests, other reasons for the children experiencing those emotions were also given to the researcher. One child stated that she became nervous before tests because she realised that she sometimes forget how to do things. Another child stated that she became worried during tests because she was not very good at Mathematics.

Example One

S.B.: And um, I feel a bit, like worried, when we're about to start because um, sometimes like in Maths when I learn things I sometimes forget them.

Example two

K.B.: Well (pause of 2 seconds) worried, because I'm not very good at Maths.

A child in group three stated that she got worried before doing Mathematics activities.

M.F.: First some of the Maths gets easy then it became, it came, it gets harder and harder so I get worry and worried.

Teacher: What are you worried about?

M.F.: Getting it wrong.

Seven children stated that boredom was one of the emotions they experienced during Mathematics lessons. When asked to explain why they felt bored, the children explained that they found the subject of Mathematics boring.

Additional Words Describing Children's Feelings

During the individual interviews seven words that were not on the Clarke (1987) questionnaire were used by the children to describe the emotions they experienced during

Mathematics lessons. The words were: "normal", "embarrassed", "scared", "nervous", "good", "excited" and "terrific".

The word "normal" was a response given twice to the question "How do you feel when you're about to do a Maths test?". The response was classified by the researcher as being neutral. It was not considered to be either a positive or negative response, but rather, a response in which elements of both positive and negative emotions might be found.

Feeling 'nervous' and 'scared' were classified as negative emotions. The two words were used when the children were asked to describe how they felt before they were about to do a written Mathematics test. Nervousness was also experienced by children as they waited to be given the marks for their written tests. Embarrassment too was experienced in relation to marks. The children stated that they often felt embarrassed when they called out their marks so that the teacher could record them in her assessment book.

Feeling 'good' and feeling 'terrific' were classified by the researcher as positive emotions. The children discussed these words in relation to completing Mathematics activities. However, the two children who used the word 'excited', which was also classified as a positive emotion, used it to describe the way they felt before they did a written Mathematics test.

Findings

The following positive expressions of emotion were gained from the analysis of the individual interviews: "happy", "interested", "successful", "clever", "excited", "good", "terrific" and "relaxed". The following negative expressions of emotion were obtained from the analysis of the interview data: "confused", "worried", "nervous", "scared", "rushed", "embarrassed" and "bored". An additional feeling was discussed. It was "I feel normal". This was classified as a neutral state.

There were three main findings from the individual interviews. First, participating in Mathematics activities produced mainly positive emotions in the children while participating in Mathematics tests produced mainly negative emotions. Second, the children were able to describe the types of physical reactions they experienced during Mathematics lessons. Most of the children in the sample claimed that they experienced physical reactions when they felt worried or nervous, and that those feelings usually occurred during written tests. Third, when children discussed the subject of Mathematics they sometimes used expressions of emotion that had not been listed on the Clarke

(1987) self-response sheet. The extra words provided by the children were: "normal", "embarrassed", "scared", "nervous", "good", "excited" and "terrific".

After the analysis of the data from the individual interviews, the researcher found that several of the positive and negative emotion words could be ordered according to intensity. Feeling 'terrific' could be thought of as signifying an extremely high, positive emotional state while 'excitement' and 'happiness' could be thought of as being less intense graduations of the same positive emotion. Similarly, there appeared to be a graduation in the intensity of the negative feelings of 'nervousness', 'worry' and 'being scared'. 'Being scared' signified the extreme level of a particular negative emotion while 'nervousness' was the least intense and 'worry' fell between the two levels. The ordering of emotions was investigated further in the group interviews. Finding graduations in the intensity of some emotions supports Ortony et al.'s (1988) claim that the complexity of an emotion is determined by the degree to which it is a more differentiated form of a simpler affective reaction.

Ortony et al.'s (1988) classification of emotions as being valenced reactions, was supported by some children's use of the word 'good' to describe the way they felt when they did Mathematics activities.

The researcher hypothesised that the positive and negative emotional states that the children had discussed during the interviews could be separated by a band of emotion that children referred to as 'feeling normal'. Within this band a range of mild positive and mild negative emotions were able to be placed. These terms included: "interested", "good", "successful", "clever", "relaxed", "confused", "rushed", "embarrassed" and "bored".

GROUP INTERVIEWS

It was hoped that the group interviews would provide the researcher with more detailed data than that obtained from the individual interviews. This in fact did occur. The children were eager to discuss the researcher's questions. Often extraneous information was volunteered. However, when it was given, the researcher refocussed the children's attention on the question being asked and those responses were excluded from the analysis.

Cohen and Manion (1989) have noted that a disadvantage of group interviews is the tendency of participants to avoid discussing personal matters. In the investigation into emotional states this was found *not* to be true. For example, one group of children spent considerable time discussing their disapproval of a fellow group member's habit of copying work. An explanation for the children's lack of reticence in discussing the researcher's questions might be found in the size of the groups participating in the discussion. Each group was composed of six or seven children. The small group size may have allowed the children to feel at ease with their peers and the researcher and thus allowed them to openly express themselves. Two additional explanations for the children's enthusiasm in responding to the researcher's questions may be that the children did not consider the questions to be personal, and the rapport that the children had developed with the researcher enabled them to speak freely to her.

The individual interviews had provided a large amount of data on the negative emotions that the children experienced during Mathematics lessons. It was therefore hoped that the group interviews would yield an equivalent amount of data on the positive emotions. The researcher also hoped that the group interviews would give her data on the extreme emotions that the children experienced.

When the data from the group interviews were analysed they provided an extensive list of terms that described the emotions. The words were then able to be classified as being either positive or negative. The expressions discussed by the children were: the 'YES action', "I feel terrific", "It feels like a big lift", "awesome", "cool", "good", "proud", "happy", "interested", "embarrassed", "frustrated", "worried", "upset", "rushed", "angry", "annoyed", "bored", "nervous", "let down", "impatient", "scared" and "cranky". The word 'normal' was given, and again it was classified as representing a neutral emotional state.

"Cold and craving for food" was a description of a feeling given by one of the children during the group interviews. After the child had been asked to explain whether the term stood for a good or bad feeling it was classed as a negative emotion.

Positive Emotions

The following positively valenced words were discussed during the group interviews: the 'YES action', "I feel terrific", "It feels like a big lift", "good", "happy", "interested" and "proud". Two additional emotions were used by the children during the group interviews: "awesome" and "cool".

The 'YES Action': 'Feeling Terrific'

In some Mathematics lessons prior to the commencement of the study the researcher had noticed the children raising their arms while their fists were clenched, and quietly saying or mouthing the word "yes". This appeared to happen when a child was extremely pleased with something. The researcher called this the 'YES action' and noted that it only lasted one or two seconds.

The group interviews provided the researcher with the opportunity to discuss the 'YES action'. The researcher used the word 'terrific' to explain the degree of happiness that might have been felt when the children performed the action.

Each of the five groups that were interviewed contained children who admitted that they had exhibited the 'YES action'. As a child in group one explained:

"You feel like you want to chuck a party!"

Asked when that feeling occurred, a girl from group three, stated:

S.B.: Yeah, because when you know it was a hard sum for you and you [the teacher], and you've worked it out and, you [the teacher] say we've got it right, it's, you, you just go 'YES' because it's a automatic reaction.

Two children from group five elaborated on the cause of the 'YES action'.

Example One

J.C.: If it's really hard, like if it was 6X1 I wouldn't really worry about it [giggles] cause it's really easy and if it's like a really hard sum and I get it right, it's better than the easy ones.

Example Two

J.M.: Oh, when I don't know what it really means and I just have a guess at what I think it means and I get it, right.

A girl in group five stated that even though she wanted to exhibit the 'YES action' she did not do it because she thought she would get into trouble. Unlike the response of the child in group three, who described the 'YES action' as being automatic, this child's response showed that she did have some control over the action.

Unexpected success and difficulty level were found to be two factors that determined whether or not a child expressed the 'YES action'.

'Getting a Big Lift'

One girl used the expression "It feels like a big lift" when describing the way she felt when she saw she was quicker at doing a stencil than a child whom the teacher had said was good at Mathematics.

J.C.: ... [working] on a sheet and I put my hand up first and see M.K. still working, it feels like a big lift for me (laughs).

'Feeling Good'

'Feeling good' was used to describe the way a child felt when she obtained a high mark in a written Mathematics test.

J.B.: I feel good when I [inaudible] in a Maths test and I got a high mark like the time I got in the nineties and I usually get in the eighties and I usually try to get in the nineties but I don't.

'Feeling good' was used by another child to explain how she felt after she had successfully completed a question she thought she would get wrong. It was also used by the child to describe the way she felt about being in her present class.

Two children in group four stated that they felt good when they were allowed to work together on a task.

The word 'good' was used by one child to describe the way she felt during a Mathematics activity when another child copied her work.

Teacher: All right, s-s-so he s, you think he's copying from you [yeah]. How does that make you feel?

K.U.: That, um, tha, um, I feel too good, that, that I'm too, I feel that I'm too good at Maths.

The word 'good' was used by the same child to describe the way she felt about learning the amount of Mathematics that she did in her present class.

Teacher: So you feel that you're coming on and making progress?

K.U.: Yeah.

Teacher: And how does that make you feel?

K.U.: Good.

Happiness and Pride

Very few children used the word 'happy' during the group interviews. Group two's children equated the 'YES action' to a degree of happiness.

The word 'happiness' was also expressed in relation to how a child thought his parents felt about his progress in the subject of Mathematics.

M.S.: It doesn't matter what I get, [on a test] she'll [mother] be happy.

'Feeling proud' was discussed only in relation to how the children believed their parents felt about their progress in Mathematics. Two children from one group mentioned the word 'proud'.

J.S.: Um, I think it's just that mum, if I work hard she's proud of me and um, as long as I work hard she'll be be proud of me (giggles).

T.H.: Same as J.

Interest; 'Cool'; 'Awesome'; 'Terrific'

The words 'interested', 'cool', 'awesome' and 'terrific' were used to describe the way the children felt about the types of tasks they were given during Mathematics lessons, and the way they felt about being in their present class.

Example One

K.B.: Cool! I like measuring in Maths.

Example Two

Teacher: Right, so even though you do more tests in this class you don't mind it so much?

Pupils together: Nuh, no, no, no, no, no.

J.S.: It's awesome! [It's fantastic.]

Negative Emotions

The following negatively valenced words were discussed in the group interviews: "frustrated", "worried", "cranky", "scared", "let down", "nervous", "embarrassed", "bored", "angry", "rushed", "upset", "impatient" and "annoyed".

Frustration

The children in the study experienced the feeling of frustration on a number of occasions. Frustration was frequently experienced by a child when she/he could not work out the answer to a question or solve a problem on which she/he had been working. This applied to both Mathematics activities and tests.

T.C.: I sometimes get f-f frustrated, well sort of, when, I'm just stuck.

The most commonly reported instance in which the children experienced the emotion of frustration was during oral tests. This occurred when the teacher read out the questions very quickly. Moreover, feeling frustrated often resulted in the children's minds going blank.

Example One

M.P.: Like, you know the, the answer and you, you read it out and you know it and then you just, your mind goes blank and you don't know anything.

Example Two

Teacher: Do you ever get frustrated when I give you the mental and I go quickly?

Pupils: Yeah. Oh yeah. Yes. (laugh) Yes. Yes.

One child attempted to explain her classmate's preference for particular types of tests in terms of the emotion of frustration.

J.S. : Oh, cause they might be frustrated on the little ones cause they might be used to the big ones and they might be, get frustrated on the big ones cause they might be used to the little ones.

Frustration was also found to occur when a child had not completed a task but was told by the teacher to stop working on it; and/or when a child was interrupted by the teacher or another child during the working out of an algorithm in which large or difficult numbers were being used. In these instances it was the loss of concentration (which resulted from the interruption) that caused the children's frustration.

Example One

K.U.: Specially when they're big numbers like you have to have 22 and then 18 and add on 20 and you're just up to the last one and someone asks you something and you think "Oh great!".

Example Two

S.B.: Ah, when I'm at school and we're about to pack up when you yell out and I'm halfway through a sum then you, you say that you've got a minute to go to finish off. I get really frustrated cause I'm losing my count and

Teacher: ... you

S.B.: I want to finish. Yeah.

Members of group four told of the frustration they experienced when a child from a nearby table kept interrupting them as they worked on their Mathematics. Again loss of concentration caused by the interruption was given as the reason for the children's frustration. A similar situation occurred at table two. When the male members of the group persisted in laughing, calling out the answers and fiddling with objects during Mathematics lessons the female members of the group stated that they felt very frustrated.

A girl in group three described how her friend became frustrated when she was told to do a question differently from the way she had started to do it.

S.B.: I don't know. She just puts it a different way. Like say I had something done on my work and K. doesn't know what's going on and she does it her way and I tell her that she's done it wrong, she gets frustrated. She, she wants to

do it her way and when she gets her test back I go "I told you so" because, it she got it wrong and she's ...

Some children stated that they experienced frustration while working on Mathematics questions at home.

J.C.: Well, when I do some Maths at home and um, I've got it wrong and I have to do it again, I get really frustrated that I can't think of it, when I'm at home.

For one girl in the sample, frustration occurred when her mother made her do Mathematics and she had planned to do another activity.

J.B.: [inaudible] Sometimes mum says "go and do a page of Maths out of your book or something". I get really frustrated because I don't want to do it and I was about to go and do something else.

Anger, Crankiness, Annoyance

The emotion of anger appeared to be closely related to frustration, and for one child, to embarrassment. Anger with oneself or the teacher occurred when children were unable to complete a Mathematics task during a test, an activity or at home.

[Group Five]

Teacher: When might you feel frustrated?

K.U.: When, or, in this Maths test we've just had and I hadn't finished writing down the fraction for the last two and then you [the teacher] just told us to stop and I felt really angry cause I didn't get to finish.

[Group Three]

Teacher: OK. Does anyone else ever feel angry during Maths lessons?

J.B.: I can sort of be embarrassed. I know that I can do that but I get it wrong. I get really mad with myself.

[Group One]

T.H.: Yes, I do. Cause when I can't work it out, something out, I get really angry. I close my bedroom door. I want to scream.

[Group Four]

M.S.: Um, well, I get mad like if I um, know the answer to the question but I can't get it. And then at home, I, I know the answer to the question and I get it and then I forget it again.
(half laughs)

Teacher: All right.

M.S.: And that's when I get mad.

Teacher: Get angry.

M.S.: I end up hitting myself on the head. [Pupils talking at once.]

M.S.: Like me and J.B.
[Pupils then discuss J.B. and how he had copied Bart Simpson who had hit himself on the head during one episode of the TV show.]

Anger was also experienced by children when they made a careless mistake during a Mathematics test or activity.

J.C.: I got angry about, I get mad when I, like when um, I put, when it's one times nought and I put one instead of a nought.

One child stated that her mother became cranky with her when her written test marks were low. Another child said she felt annoyed because the girl she sat next to got higher marks than she did in written Mathematics tests.

'Crankiness', 'annoyance' and 'angry' appeared to be graduations of the same emotion. The emotion of embarrassment sometimes resulted from a child becoming frustrated or angry about something she/he had done.

Embarrassment

Embarrassment about not being able to do something occasionally made a child feel angry with her/himself as the following excerpt from table three's interview shows.

J.B.: Embarrassed sometimes.

Teacher: When you can't do it J.?

J.B.: Yeah.

S.B.: Yeah, that's the same as me.

Teacher: Are you angry with yourself cause you can't work it out?

S.B.: Yeah.

Embarrassment was given as a reason for children not expressing the 'YES action'.

Teacher: Well, something like putting your hand up in the air and going, YES! This is terrific!

M.K.: I'd be embarrassed.

Embarrassment was often experienced by the children when they had to read their written test marks out to the teacher. The following excerpt from table three's interview is a typical illustration of this occurrence.

S.B.: I remember. You sort of feel embarrassed when you have to read your mark out to you. [the teacher]

Teacher: OK.

S.B.: Like, it's embarrassing cause you know everybody's going to get a higher mark than you do. M.K. sometimes laughs at us because we dc n't, don't get it all right.

Being Upset

One child stated that she did not like to leave some boys or girls out of the group in which she was working because she thought it would upset them.

Impatience

The word 'impatient' was used by a girl in the sample to describe the way she sometimes felt during Mathematics lessons. The other children in her group were discussing the word frustration.

J.S.: I get impatient.

The child went on to explain that she became impatient with herself when she could not work out an answer to a question.

Feeling Rushed

'Feeling rushed' was only discussed by one child during the group interviews. The term was used to describe the way the child felt when he completed oral tests.

Bored

Boredom was discussed in relation to three different facets of Mathematics: the type of task done during a lesson, the degree of difficulty of set work and the awarding of a letter instead of a grade for a written Mathematics test. When discussing the third issue, it could have been that the children were using a definition of the word 'bored' that was different from its traditional meaning.

Examples of statements about feeling bored are given below.

Example One

J.C.: I always get an "S" and it's boring.

Example Two

Teacher: So which sort of classroom would you prefer to be in? Last year's?

J.C.: When I thought it over a bit I prefer to be in this one cause

.....

Teacher: Mmm, mmm, cause?

J.C.: (pause of four seconds) Cause it is a lot more interesting. Better than the other one cause we did books more than other kinds of Maths. Just books.

Teacher: And that was boring?

J.C.: Yeah, a bit. Cause we had to do what the book said (laughs).

Example Three

Teacher: Any other comments? [to make about Mathematics]

J.B.: Ah, it's sometimes boring.

Teacher: Boring?

K.B.: It gets boring.

Teacher: Gets boring.

S.B.: Same.

B.R.: Because sometimes it gets too easy.

Teacher: Too easy? That's you. S?

S.B.: Yeah.

J.B.: Sometimes, sometimes things get a little bit easier. You know how to do them but other people don't so you're teaching it to those other people and you have to teach it to others at the same time (B. laughs) and it gets boring cause you already know how to do it.

Example Four

J.S.: Yeah, cause um, that class is real boring. Cause we don't get to, to like it. [The teacher] doesn't try us out to see what we're *really* like. We only get easy stuff we already know.

The children's statements about boredom indicate that teachers need to carefully plan the teaching and learning strategies they use during their lessons. Repetitive drill and practice sessions, and work that lacked a challenge, were found to be the main reasons for the children in the sample considering Mathematics a boring subject.

Nervousness

Only three children mentioned the emotion of nervousness during the group interviews. One girl in group five stated that she nibbled her nails during Mathematics. When asked why that occurred she replied, "Because I get nervous".

Nervousness was the explanation given by a boy in group one for some children's preference for oral tests over written tests. The child believed that written tests made those children feel more nervous than oral tests.

A girl in group three stated that her mother used to get nervous before she did Mathematics tests.

One child in group four claimed that before she did tests she experienced a strange feeling that was hard to understand.

J.S.: ... I don't know if I'm nervous or something or if I'm happy.

Later in the interview.

J.S.: I don't feel nervous at all.

Teacher: *You* don't feel nervous at all.

J.S.: I just get a funny feeling that I don't know what it means ...

Teacher: All right.

J.S.: ... what my body's telling me.

Teacher: All right. You don't know what your body's telling you.

That's fair enough. Sometimes it's hard to tell if it's a good or bad feeling.

J.S.: Yeah.

The emotion that J.S. was experiencing could be construed to be excitement: a partly good, partly bad emotion that produced an adrenalin rush.

Worry and Fear (Being Scared)

When group one was asked if they had any other comments to make about Mathematics tests, three of the six children responded with the words "worried" and/or "scared". These comments however, were not elaborated upon.

Worry was sometimes experienced by a child when she/he thought she/he might have to stop working before she/he had completed a task. On those occasions, worry appeared to be related to the emotion of frustration.

K.B.: Well, like, I'm trying to figure out something and I sorta get worried when you're gonna say stop and that, so, and then I lose what count I'm up to and that. I get frustrated.

The same child spoke about being scared when she did Mathematics. Wondering what grade she would get on her written tests was one cause of her fear.

K.B.: Well, when I do Maths I sorta feel scared [pupils giggle] like, sort of feel what mark I get but I don't, sort of, like, ah, (sighs).

Teacher: Think about the mark you'll get?

K.B.: Yeah. (pause of 2 seconds) Will I do better than, 44 like I did last time and all that, sort of?

'Feeling Let Down'

"You feel let down" was the expression used by a girl in group three to describe the way she felt when she thought other children believed she was weak at Mathematics. The following comment was made while discussing the child's lack of success at getting an easy multiplication algorithm correct. The child's friend agreed with her.

S.B.: Yeah. You feel let down.

K.B.: Yeah, sort of feel like, everybody puts you down.

'Cold and Craving Food'

A girl in group five described the discomfort she felt before doing written Mathematics tests as "cold and craving food, chocolate sometimes".

The Neutral Emotional State: Feeling 'Normal'

"I feel normal" was the response given by a boy and a girl in group five when they were asked to make additional comments about the emotions they experienced during Mathematics lessons. The children did not elaborate on their statements. The researcher classed 'feeling normal' as a neutral emotional state in which the children would sometimes experience mild (or weak) positive emotions and mild (or weak) negative emotions.

Conclusion

The group interviews provided the researcher with more in depth data than either the individual interviews or the first administration of the Clarke (1987) questionnaire.

During the interviews the children were keen to elaborate upon the responses they gave to the researcher's questions. This often generated interaction between students and consequently, resulted in the researcher obtaining more reflective data than that obtained from the individual interviews.

The group interviews enabled the researcher to explore the emotions that were being described in the study and allowed her to investigate emerging themes. The themes that evolved from the data were: tests, the subject of Mathematics, attitudes, beliefs and language as a means of describing the emotions. These themes will be discussed in Chapter Five.

The group interviews were the first data collection method that provided an observable indicator of emotion: nibbling the fingernails.

The analysis of the interview data produced a variety of positive and negative emotions that could be sequenced according to intensity. The data also provided general support for the ordering suggested in the findings from the individual interviews. The additional words that the children discussed during the interviews extended the range of emotions obtained from the individual interviews.

The 'YES action', "I feel terrific", "awesome" and "cool" were considered by the researcher as occupying the highest point in the range of positive emotions. Happiness and feeling good were thought to come below those emotions.

The negative emotions discussed by the children peaked at being scared then descended in intensity from worry to nervousness. Similarly, "feeling cranky", "annoyed" and "angry" were construed by the researcher as three levels of the same negative emotion.

The number of words used to describe the emotions, and graduations of the emotions that were given by the children during the group interviews, support Mandler's (1989) claim that there were innumerable different emotional states.

'Feeling normal' was considered to be a separating level between the extreme positive and extreme negative emotions. The researcher felt that all the other positively and negatively valenced words provided by the children could be encompassed in the words 'feeling normal'. This state of emotion could be considered to include weak (or mild) positive and weak (or mild) negative emotions that interacted with each other so that the overall effect was that of a process of neutralisation. The neutralisation of the emotions resulted in the child achieving a balanced emotional state, or state of equilibrium.

Words that were thought to belong in the neutral state were: "let down", "frustrated", "upset", "embarrassed", "bored", "impatient", "proud" and "interested".

Data from the group interviews showed that unexpected success in a task, and the difficulty level of a task contributed significantly to the emotions that children felt. The joy experienced during an unexpected success, or the joy that result from the successful completion of a difficult task, was given as the reason for children performing the 'YES action'. When the action was being experienced children were in a highly positive emotional state.

The data on frustration and anger support two of Mandler's (1984) arguments. First, that an interruption leads to arousal, which may or may not produce an emotional state. Second, that interruptions are frequently disruptive. Mandler's (1989) claim that his discrepancy theory could be used to explain the emotions experienced during Mathematics lessons appears to be supported by the data from the group interviews.

Ortony et al.'s (1988) argument that emotions were able to produce further emotions, finds support in the data from the group interviews. It was witnessed in the children's discussion about embarrassment resulting from frustration and anger.

The group interviews raised the problem discussed by Ortony et al. (1988) about the inadequacy of language to describe the emotions. This was observed in one child's use of the word 'anger' to describe the way she felt when she had to stop working on an activity before she had completed it, and by another child's description of "a funny feeling" that she could not specify. The problem of language in describing the emotions is a theme that will be discussed in part two of the next chapter.

CLASS DISCUSSION AND FOLLOW-UP DISCUSSION

The questions for the class discussion were formulated after the group interviews had been completed. This was done to verify responses given during the interviews and to investigate themes that were emerging from the data. When questions required a numerical answer the children were asked to respond with a show of hands.

The day following the class discussion a short follow-up discussion was conducted so that some of the responses given during the class discussion could be investigated in more depth. The follow-up discussion was videotaped and audiotaped. A transcription of the audiotape was made.

Positive Emotions

The 'YES Action'

The exploration of the 'YES action' during the class discussion and follow-up discussion verified data about its cause and the frequency of its occurrence. The phenomena can be best summed up by the following response.

J.S.: I only do that some times like, like when I'm really excited about my mark or something. I go "WOW" and I get really excited.

The two most commonly given reasons for the children not expressing the 'YES action' were the embarrassment they might experience if their classmates saw them doing it and their fear of being laughed at. The children went on to explain that if their peers did laugh at them, they would feel embarrassed. This data reinforced the finding from the group interviews that children did have control over the expression of the 'YES action'. It also reinforces Ortony et al.'s (1988) argument that the experiencing of one emotion can lead to the production of another.

Negative Emotions

Embarrassment

During the class discussion and follow-up discussion the emotion of embarrassment was talked about in relation to seven issues:

- * children's minds going blank
- * doing work on the blackboard in front of classmates
- * not showing the 'YES action'
- * being laughed at
- * reading out test marks
- * working on the blackboard in front of strangers
- * the belief that friends might think them stupid at Mathematics.

The following excerpt illustrates one of the above points.

J.G.: Um, um, if you did that, [said "YES"] um, everyone would sort of like look at you and start laughing and you'd get all embarrassed.

Most of the issues relating to embarrassment had been raised in the group interviews. This indicated that the children were providing the researcher with consistent data. The consistency of the data on embarrassment not only served to strengthen the validity of the study but it also assisted in the verification of the themes that were emerging from the research.

Boredom

The emotion of boredom was discussed when the children talked about the subject of Mathematics, the awarding of a letter instead of a numerical grade for written tests and the reason for their parents using Mathematics as a punishment at home. Below are examples of statements made about the term 'boredom'.

S.B.: "U.S." and "S." are really boring sort of, cause you want to see what number you get.

N.A.: In their [parents] day, it [Mathematics] was boring.

L.G.: [Mathematics is] a boring subject.

Nervousness and degrees of Nervousness

During the class discussion the researcher asked the children if they felt more nervous during written Mathematics tests than they did during tests in other subjects. Nineteen of the thirty-one children indicated that they did. However, when the children were asked if they felt more nervous during Mathematics lessons than they did during lessons in other subjects, only ten of the thirty-one children answered in the affirmative. A variety of reasons were given for the children's nervousness. Those reasons will be discussed in the following chapter under the heading of Test Factors: Negative Emotions.

One child compared the high degree of nervousness that she experienced ("really, really, really nervous") to "your worst nightmare".

A typical response to the question "When do you feel nervous?" was "during tests".

J.S.: I don't really get that nervous un, unless it's a real big test.

Worry

Many children stated that they experienced worry during written tests. One of the main causes of their worry was the mark they thought they were going to get for the test.

L.G.: I get, ah I get, um, worried, that I'm going to get a low mark.

Another cause of worry related to going out to work on the blackboard.

J.B.: Cause if you get nervous your mind could go, like, blank because you're worrying about going out in front of the whole class.

'Feeling Normal'

During the follow-up class discussion the children were asked if they could explain the term 'feeling normal'. One child explained it as follows.

K.U.: I have the feeling, when I said *normal*, what I meant was that um, I just felt like I was doing something else. [not Mathematics]

Non-Verbal Actions

During the follow-up class discussion one girl explained that she nibbled her fingernails when she was bored or hungry. A second girl gave a different reason for nibbling her nails.

S.B.: I nibble my nails before a test because sometimes I might be a bit scared or frightened.

Findings and Conclusions

The class discussions mainly provided the researcher with data on the themes that had begun to emerge from the study. However, some data on the extreme positive emotional state and the neutral state were obtained. The class discussions enhanced the validity of the study by providing data that was consistent with data collected from earlier sources.

Negatively valenced words that emerged from the class discussion and follow-up discussion were: "embarrassed", "nervous", "really nervous", "really, really, nervous", "worried" and "bored".

The analysis of the data from this data collection method verified the researcher's assumption that some of the negative emotions experienced by the children could be graded according to intensity. Examples of those emotions included: "nervous" and "really nervous"; "worried" and "really, really worried" (being scared or frightened).

The class discussion and follow-up discussion provided the researcher with some verbal indicators of emotional states. For the extreme positive state it was "WOW". For the extreme negative state it was "your worst nightmare", and for the neutral state it was "your mind goes blank" and "I felt like I was doing something else". The class discussion also provided one example of an indicator that was able to be observed: nibbling the nails.

The analysis of the data indicated that the degree to which a task or event appealed to a child influenced her/his feelings about the task or event. The amount of enjoyment or pleasure that *could* be experienced during an event or task became obvious in the discussion about the 'YES action'.

THE CHILDREN'S JOURNALS

The accounts from the journals were used initially to investigate the emotions that the children experienced before and after written tests. However, as the data was analysed, the statements made in the journals were seen to be a way of verifying the data from the questionnaire, the interviews and the class discussions. Furthermore, the journals provided additional data on the indicators and descriptors of emotional states.

Positive Emotions

The following terms taken from children's journals were classified as being examples of positive emotions: "OK", "glad", "surprised", "relieved", "good", "pretty good", "very good", "very, very good", "great", "proud", "very, very proud", "fine", "happy", "very happy", "very, very happy", "very, very, very happy", "excellent", "real excellent", "confident", "very confident", "all right", "successful", "excited", "interested", "relaxed", "pleased", "wonderful", "terrific", "fantastic" and "much better". The following statements taken from the journals are typical expressions of the positive emotions that the children experienced during Mathematics lessons.

- R.A.:** I feel great because I think I'll get a good mark.
J.C.: I feel O.K.
K.H.: I feel happy.
T.H.: I feel proud of myself.
M.S.: I feel great because I went through and check it.
M.P.: I feel excellent.
N.A.: it feel interested.
K.U.: I feel confident.
B.R.: I feel Great!.
D.W.: I feel real excellent about my result for my Maths test.
S.B.: I feel good.
F.L.: Im glad its over. (a written test)
J.B.: I feel surprised and worried. [Later] I feel reeleefed that it's over [the written test].

Negative Emotions

The analysis of the data from the journals provided the researcher with many examples of negatively valenced words. They were: "unhappy", "sad", "a bit sad", "rushed", "ashamed", "confused", "upset", "really silly", "a little disappointed", "disappointed",

"embarrassed", "bored", "boring". "not very good", "not real good", "nervous", "a bit nervous", "very nervous", "bad", "really bad", "very bad", "annoyed", "mad", "sick", "really sick", "not very well", "YUK", "teeny weeny little bit worried", "worried", "tired", "very, very tired", "scared", "really scared", "dreadful", "disgusted", "extremely worried", "hopeless and miserable", "horrible" and "frightened". Listed below are some examples of journal statements in which negative emotions were expressed.

- B.G.:** it was hard and I feel nervous.
M.K.: I feel ashamed.
S.Ba.: I feel like I am going to get lots of things [wrong] and I am friend.
S.Be.: I feel upset my marks suck!
J.Bo.: Extremely worried.
J.M.: I feel really sick.
M.P.: I feel worried.
M.F.: I feel confused.
J.Br.: I feel hopeless [hopeless] and miserable
J.C.: I feel really mad.
L.G.: still worried, giddy.
H.G.: I feel very very tired
K.B.: I still feel sick.
R.A.: I feel disgusted [disgusted].

The Neutral Emotion: 'Normal'

In their journals, six children stated that they felt 'normal'.

- F.L.:** I feel normal.
 (Describing her feelings before a written test.)

The word normal was used many times by the six children. On one occasion it was used with the word 'OK'.

- R.A.:** normal. nothing is going through my head
 normal OK

STATEMENTS THAT NEEDED CLARIFICATION

Several statements that were made in the children's journals needed to be classified by the researcher as signifying either positive or negative emotions. One statement was not able to be classified at all.

- M.Q.:** I felt very, very hot. (unclassifiable)

R.A.: I feel funny and can't wait to start (positive)

L.G.: I thought it [an activity] was cool. (positive)

K.B.: Cool! (positive)

J.Bo.: I feel as if I can breathe again.

(from a negative state to a positive state)

L.G.: Giddy. (negative)

J.Br.: I feel like I stuffed up. (negative)

Range of Emotional States

Of all the data collection methods used in the research the children's journals produced the greatest variety of positively and negatively valenced words pertaining to the emotions, as well as the highest number of graduations of those words. This finding gives further support to Mandler's (1989) claim that there were innumerable different emotional states.

The data from the children's journals provided the researcher with many indicators of emotion. It also raised two important issues. First, the words used by the children were only a report of, or their perceptions of, an emotion rather than a direct measurement of the emotion. Second, the various methods used to collect data in the research provided general support for each other. This was evident in the consistency of the data being obtained. For example, the terms 'nervous', 'worried', 'scared' and 'happy' were found in all five of the written and verbal data collection methods, while the terms 'good', 'interested', 'rushed' and 'confused' were found in four of those methods. This finding strengthens the validity of the study.

THE RESEARCHER OBSERVATIONS AND THE VIDEOTAPES

Each researcher observation period lasted for ten minutes and was made during normal class lessons. The observations took place over one school week and on an additional day of a second week. During the observation sessions indicators of emotional states were recorded, and their frequency was noted.

The analysis of the data from the researcher's observations found that positive emotions were indicated by: a look of surprise coupled with a smile, saying "YES", smiling and laughing. One indicator of a negative emotion was obtained from the researcher observations. It was frowning.

During the final observation period, the researcher noticed that the children in the group she was observing moved their hands towards their faces when they were told they only had five minutes remaining in the lesson. The children's actions caused the researcher to form an hypothesis about the significance of 'body language' to indicate emotional states. The researcher's hypothesis and the case studies it lead to, are described later in this chapter. (See the section the Need for Additional Data.)

The researcher observations provided guidance for the related video analysis even though only a small amount of data were obtained from them.

Despite the researcher's attempts to have the children become accustomed to working in front of the videocamera, the analysis of the video data showed the children performing a few staged actions. Examples of these were: waving at the camera, exaggerated grins and covering the head or body in order to hide from the camera. However, the majority of the actions that were observed on the videotapes appeared to be spontaneous. This was verified by the independent observer who helped the researcher analyse the data from the videotapes.

The videotaping of the Mathematics lessons commenced while the individual interviews were being held. The first five videotapes recorded the children participating in Mathematics tasks over two school weeks. The machine was set on its tripod facing the group that was being taped. It was moved at least once during the taping session so that the camera would capture as many group members as possible. For a small part of three taping sessions the camera was held by the researcher as she panned across the classroom. This was done to record the actions of the children who were engaged in activities other than the main one being videotaped.

On the second day of videoing the class did a written Mathematics test. In order to capitalise on that particular Mathematics task the recording session was divided between two groups of children. The following day the same two groups were taped as they performed a construction activity. Ten minutes of the recording time was spent videotaping each group. The remaining ten minutes was used to pan across the classroom so that the actions of the children participating in seated activities were able to be recorded. When all five groups had been videotaped the whole class discussion was videotaped.

School holidays and the analysis of the tapes already made, meant that a break of seven weeks occurred between the recording of the first five videotapes and videotapes six,

seven and eight. The last three videotapes were made within ten school days of each other. During that time the children in the class were rearranged so new seating groups had been formed.

When the researcher had completed her analysis of the first five videotapes, they were given to the independent observer to analyse. The aim of the research and the procedure to be used in the analysis were explained to the observer. The independent observer then proceeded to record the actions of each child in each group. On the completion of the independent observer's analysis both the researcher and the observer viewed the tapes together so that a consensus could be reached about the indicators of emotion.

From the analysis of the videotape data, an intercoder reliability of 93.2% was obtained. The construct upon which agreement had to be made was the child's gestures that indicated she/he was experiencing an emotional state. The formula that was used to determine the amount of agreement between the researcher and the independent observer was:

$$\text{Intercoder reliability} = \frac{\text{gesture}}{\text{gesture}} \times 100$$

The first five data collection methods had concentrated on answering the first and second research questions

Can the emotional states of children in a Mathematics environment be described?

Can descriptors of the states be developed?

Those methods had also provided indicators of emotional states.

Data from the questionnaire and the individual and group interviews had shown that it was possible to identify the emotional states that children experienced in a Mathematics environment and that those states could be described.

The analysis of the data from the class discussions and the children's journals enabled the researcher to add to her list of indicators of emotional states. Visual indicators of emotion were obtained from the videotaped data.

The analysis of the videotapes provided the researcher with several actions that were classified as being indicators of positive emotional states. They were: smiling, laughing, grinning, and saying "YES".

The following indicators of negative emotional states were gained from the analysis of the videotapes: grimacing, frowning, biting the fingernails, looking puzzled, slapping the hand to the face and head, breathing deeply and saying "phew", wiping the brow, shrugging the shoulders, and furtive glances.

From the video data the independent observer and the researcher were able to eliminate the actions they considered to be indicators of cognition rather than indicators of emotion. The difference between the two types of indicators and the manner in which they were classified will be discussed in the Case Studies/Non-Verbal Behaviour section of Chapter Five.

CONCLUSION

The recording of the visual indications of emotion enabled the researcher to supplement the verbal and written data she had already obtained.

The analysis of the videotapes indicated that the children enjoyed Mathematics activities. This was deduced from the high frequency of smiles, grins, laughter and 'mucking around' behaviour that was witnessed during the activities. The analysis of the data from activities such as bookwork or stencilwork suggested that it was not always possible to gauge the amount of liking or disliking of those activities because of the minimal number of observable signs of emotion.

Observations made during written tests saw the children displaying a higher frequency of frowns, grimaces and general body actions than they did during the Mathematics activities. Some of the body actions that were observed lasted several minutes, for example, biting a pen or a finger. The children did not appear to enjoy written Mathematics tests. During the oral tests few physical actions were witnessed.

It needs to be noted that the deductions made by the researcher and the independent observer were only their perceptions of the situations in which the children were involved. However, the accuracy of the perceptions was able to be assessed from the analysis of the data from the children's journals and the individual and group interviews.

Data from those sources verified the conclusions reached from the analysis of the videotapes.

PARENT SURVEY

The plethora of data that had been collected during the research, and the unscheduled question about Mathematics that was given during the class discussion, prompted the researcher to shift the emphasis of the parent survey away from data verification and towards a more in-depth study of one of the themes that had emerged. Consequently, only two questions on the survey had relevance to the research. The first question pertained to the parent's belief about their child's liking/disliking of Mathematics. The second question asked parents to consider whether or not their child believed that doing extra Mathematics at home was a form of punishment. For a discussion of the findings from the survey see Beliefs in Chapter Five: Emerging Themes.

Conclusions from the Planned Data Collection Methods

The analysis of the data from seven of the eight data collection methods resulted in the researcher identifying four main emotional states that children might experience during Mathematics lessons: the extreme positive, the mild positive, the mild negative and the extreme negative.

The researcher equated the mild positive and mild negative states with feeling 'normal' or the neutral level of emotion that was found in the data from the interviews, the class discussion and the children's journals. A transition level was thought to exist between the mild and extreme level of the positive emotional states and the mild and extreme level of the negative emotional states. Table 3 provides a summary of the words that were placed under each level of emotion for seven of the eight data collection methods used in the research.

Table 3: A Summary of the Indicators of Emotion found in seven of the Data Collection Methods used in the Research.

	Questionnaire	Individual Interviews	Group Interviews	Class Discussion	Teacher Observations	Videotapes	Children's Journals
Extreme Positive	great	terrific,	cool, 'YES action', terrific, awesome, getting a big lift	'YES action', WOW,	'YES action'	'YES action'	fantastic, excellent, great, wonderful, very very very happy, excited
Mild Positive	happy, clever, successful, interested, happy, glad, relaxed,	excited happy, good, interested, successful, clever, relaxed,	happy, good, proud, interested, I get this funny feeling. I don't know what it means.	excited happy,	smiling	smiling	happy, surprised, good, confident, fine, proud, OK, pleased, successful, relaxed, glad, relieved, all right, much better, interested, happy and relaxed, funny and can't wait to start,
Mild Negative	normal nervous, confused, sweaty, sleepy, blank mind, rushed, bored,	normal nervous, confused, rushed, bored, sad,	normal nervous, cranky, embarrassed, frustrated, annoyed, bored, rushed, 'let down', I wish it wasn't invented.	normal bored, nervous, embarrassed, nibble nails,	normal frowning	normal frowning	normal nervous, bit nervous, sad unhappy, rushed, cranky, ashamed, butterflies, not good, disappointed, bored, tired, upset, YUKKY, confused,
Extreme Negative	worried, hate, sick, hungry, very scared,	worried, scared, sick, hungry,	worried, scared, cold and craving food, angry,	worried, really really nervous, worst nightmare, mad, hate, frightened, scared,	biting fingers or object,	biting fingers or object, grimacing, pulling a face,	worried, annoyed, angry, bad, bad and cold, really bad, mad, scared, dreadful, hopeless and miserable, horrible, frightened, sick,

Table 4: Descriptors and Indicators of Emotional States

Descriptors	Indicator
<p><i>Extreme Positive</i> The ideal state that children would like to attain. This state contains intense feelings of pleasure.</p>	<p>the <i>YES</i> action, I feel terrific. I feel like chucking a party. I go <i>WOW</i> and I get real excited.</p>
<p><i>Mild Positive</i> The state in which a range of positive emotions is experienced. None of the emotions are intense.</p>	<p>I enjoy what we do. The activity is fun. I feel good. I don't feel nervous at all. I feel funny and I can't wait to start. I get a funny feeling. I don't know what it means. laughing, smiling,</p>
<p><i>Mild Negative</i> The state in which a range of negative emotions is experienced. None of the emotions are intense.</p>	<p>Like, you know the answer and then your mind goes blank and you just don't know anything. I wish it wasn't invented.</p>
<p><i>Extreme Negative</i> The emotional state that children most wanted to avoid because of the intensity of the unpleasant feelings they experienced.</p>	<p>I am cold and craving for food. I am extremely worried. I feel hopeless and miserable. I feel really sick. It turns out to be your worst nightmare. grimacing, pulling faces,</p>

Indicators and descriptors for each level of emotion were derived from the data (See Table 4). The interviews, the class discussions and the children's journals provided the bulk of the written and verbal data on the indicators and descriptors of emotional states, while the researcher observations and the videotapes were the sources of data for the visual indicators of emotion.

The parent survey contributed data on one of the themes that had emerged from the research. The emergence of another theme necessitated the collection of additional data. The background to that theme and the methods used to collect data on it are described in the following section.

THE NEED FOR ADDITIONAL DATA: THE STUDY OF BODY LANGUAGE

Background to the Study

The final researcher observation session occurred during a written Mathematics test. Towards the end of the lesson the researcher mentioned that the children only had five minutes to complete their papers. As soon as the statement had been made the researcher noticed that several children in front of her put their hands to their faces and said "OH!". The actions of the children caused the researcher to formulate two hypotheses. First, that in addition to the universally accepted basic non-verbal actions of individuals (Ekman, 1972), each child had her/his own personal repertoire of non-verbal movements (Morris, 1977). Second, that during times of worry or concern a child would put her/his hand up to her/his face (Eunson, 1987).

The first hypothesis was not considered to contribute a great deal to the current study of emotional states since research had already established the existence of basic non-verbal actions across cultures (See Ekman, 1972; Hall, 1976; and Eunson, 1987), and the magnitude of a study into personalised gestures was beyond the scope of the research. Therefore the hypothesis was ignored. The researcher did, however, consider the second hypothesis worthy of investigation because she thought that by knowing the meaning of specific non-verbal actions, educators would be able to determine the emotional states of their students. This type of knowledge would be particularly useful in the identification of emotions such as nervousness or anxiety.

In order to learn more about non-verbal behaviour the researcher reviewed the literature on the subject and the literature on 'body language'. The next section is a brief review of that literature.

Non-Verbal Behaviour

Riedesel and Burns (1977) stated that in Mathematics there were four ways of measuring the affective domain: through the use of non-verbal behaviour, through self-evaluation

inventories, by studying topics within the field of Mathematics and by the use of instruments such as semantic differential scales.

Non-verbal behaviour has been interpreted as meaning communicative behaviour which excludes the use of speech (Neill, 1991). Non-verbal cues can be said to communicate information about emotion, speech, individual differences and interpersonal relationships. Bull (1987) argued that the significance of non-verbal cues needed to be considered in specific social contexts. According to Bull (1987) importance was commonly ascribed to non-verbal cues in the communication of emotion. This stemmed from the observations of Charles Darwin (1872) who claimed that the facial expressions of emotion constituted part of an innate, adaptive, physiological response. Bull (1987) claimed that if the facial expressions of emotion were innate then they constituted a particularly important means of communicating information about emotion.

Evidence supporting the correctness of the innate hypothesis has been obtained from cross-cultural studies (Ekman, 1972) which have shown that facial expressions associated with six emotions (happiness, sadness, anger, fear, disgust, surprise) are decoded in the same way by members of both literate and pre-literate cultures (Bull, 1987).

Many psychologists agree that the face constitutes the prime non-verbal source of information about the emotions (Bull, 1987). Studies of this topic have been based on research carried out by Silvan Tomkins (1962). Tomkins argued that the face was the key site of emotion. According to Tomkins' (1962) theory, the feedback one got from feeling muscles contract was one of the cues that told one what emotion was being felt. Tomkins (1962) claimed that there were one or more unique facial configurations associated with each of the primary affects except happiness - which was expressed primarily in the eyes and lower face.

According to Tomkins (1962) the main configurations of emotion were: interest/excitement; enjoyment/joy; surprise/startle; distress/anguish; shame/humiliation; contempt/disgust; anger/rage and fear/terror. Tomkins considered the first emotion in each set to be the less intense one.

In Tomkins' scheme the positive emotions centred around enjoyment/joy and interest/excitement. Surprise and being startled were what Tomkins called 're-setting' affects and were not in themselves considered to be either positive or negative. Tomkins classed other affects such as anguish, fear, disgust and anger as negative emotions.

Empirical research has been successful in discriminating cues for surprise, happiness, sadness, fear, disgust and anger (Harrison, 1974).

Harrison (1974) stated that the face involuntarily expressed emotion. He also claimed that the expressions the face displayed could be considered reliable indications of emotion. However, Harrison (1974) noted that facial expressions were able to be learnt and displayed even when no emotion was being experienced.

The central importance of non-verbal cues in the expression of emotion has led some writers to regard non-verbal communication as an alternative system to speech because it appears to offer a more reliable indication of people's true feelings. This notion has led to the development and study of 'body language'. Typical of such work is that of Fast. Fast (1970) maintained that 'body language' conveyed an emotional message which was more reliable than the spoken word (Bull, 1987). He also claimed that an awareness of 'body language' helped one understand the importance of an interaction within a specific social context.

According to Bull (1987) a number of researchers have stated that non-verbal behaviour is closely related to speech in terms of syntax, vocal stress and meaning. It has also been suggested that non-verbal behaviour serves a variety of functions in relation to speech and that these can be categorised on the basis of a classification system proposed by Ekman and Friesen (Bull, 1987).

Paul Ekman and Wallace Friesen (1969) stated that the face was the best expressor of emotion and that this was followed by the hands then the total body (Harrison, 1974). Working on facial expressions and body movements Ekman and Friesen (1969) made refined groupings of non-verbal behaviours that were based on origin, coding and use (Harrison, 1974). Ekman and Friesen (1969) have called the classes of performance codes that they have devised emblems, illustrators, regulators, affect displays and adaptors. Each of these performance codes will be described below.

Emblems

Emblems are highly stylised non-verbal signs or sign patterns which are widely understood within the user's culture or subculture. Examples of emblems include the hitchhiker's thumb and the A-Okay sign.

Emblems are performed with intent and awareness. They can be easily translated into a word or phrase. Emblems can exist alone, without any direct relationship to verbal signs. However, they may also be used to reinforce, supplement or countermand verbal information. Emblems often occur in situations where the verbal band is fully used or blocked (Harrison, 1974).

Illustrators

Illustrators are non-verbal signs and sign patterns which are used in conjunction with verbal signs. They index and signal. Illustrators provide a non-verbal commentary on events in the verbal band. They accentuate, clarify, specify, amplify, punctuate and underscore verbal events, primarily through the use of the hands. However, the head, the face and total body movement may also be involved.

Ekman and Friesen (1969) have identified six major types of illustrators: pointers, pictographs, ideographs, spatial, kinetographs and batons. The pointer simply points to a present object. The pictograph draws a picture of an object in the air. The spatial illustrator shows size or relationship. The kinetograph recreates a bodily action. Baton movements accentuate or punctuate. They may beat out the tempo of a verbal statement. The ideograph traces the flow of an idea. Ideographs tend to be rolling or flowing movements that help the receiver see the connection between ideas, or the direction in which a line of thought is moving (Harrison, 1974).

An example of an illustrator is a finger being tapped to the side of the head to indicate madness.

Regulators

Regulators are non-verbal signs or sign patterns that regulate interaction in a communication system. They comment on the relationship between speakers and provide feedback that tells each participant how the interaction is going, what needs to be done next, and when changes need to occur. Regulators provide a flow of signals to ensure that the communication system runs smoothly. Participants are usually unaware of the use of regulators and of the effect they are having. Regulators are performed efficiently by all members within a culture (Harrison, 1974).

Examples of regulators include head nods, eye contact, gestures indicating one wishes to speak or gestures requesting the other person to respond.

Affect Displays

Affect displays are non-verbal signs or sign patterns which indicate emotional states. They may be involuntary, that is, symptoms of an internal state or they may be performed on purpose, as symbols in an interaction. The face is the prime region of affect displays. However, total bodily configuration and vocal tone may also be a cue to positive and negative emotions (Harrison, 1974).

Affect displays are important social signals which can help reduce one's uncertainty about the significant dimensions of an interaction.

Two examples of affect displays are smiling because one is happy or wrinkling one's brow because one is confused.

Adaptors

Adaptors are non-verbal markers that originated in the satisfaction of self needs. Eating and keeping oneself clean are two examples of basic needs from which adaptors have evolved. Over time, adaptors have become a part of our habit repertoire. Adaptors may appear when one is feeling tense, tired or particularly relaxed and satisfied. The producer does not create the adaptor with the intent of communicating. It may be done with little awareness. However, for the observer, adaptors may be a useful indication of the performers' inner state.

Ekman and Friesen (1969) have identified three types of adaptors: self-adaptors, alter-adaptors and object-adaptors. Self-adaptors include actions such as self-touching, soothing, scratching, biting or cracking a part of the body. Nuzzling, touching, kissing or holding another person are examples of alter-adaptors. Object-adaptors make use of an artefact in the environment. The object may be played with, stroked, punched or wielded (Harrison, 1974).

Charles Darwin analysed many gestures and argued that 'relic gestures' (adaptors) were still in our non-verbal vocabulary even though we had forgotten their original meaning (Eunson, 1987).

The most basic of the 'relic gestures' still in use today are the hand-to-mouth and hand-to-head gestures. Touching and scratching in these areas is usually an accompaniment to fear, nervousness, confusion and deliberation. When children are insecure they suck their thumbs. In older people this action may be replaced by nail-biting or chewing pens or spectacle arms (Eunson, 1987).

According to Eunson (1987) bodily gestures can indicate internal emotional states. For example, the hands may be wrung in despair, the ankles may be crossed or locked indicating that a person is stressed. A tense person may jiggle one or two legs up and down whilst seated.

Morris (1977) called the seemingly irrelevant movements made during moments of inner conflict or frustration, 'displacement activities'. Morris (1977) stated that some 'displacement activities' were obvious and some were not. According to Morris (1977), actions could be unconsciously selected so that they masked underlying emotional turmoil. For example, smoothing down a dress that was not creased could be considered to be an expression of discomfort about a situation. Morris (1977) claimed that people developed their own personal displacement habits which they employed whenever internal conflict arose. According to Morris (1977), examples of displacement activities are yawning when bored, putting the hand to the mouth during moments of concentration or boredom and touching the nose when momentarily stressed.

Bodily posture can also be thought to convey meaning about the inner state of an individual. Research by Campbell (1977) revealed that in interesting school subjects students usually sat upright while in boring subjects they tended to slump.

Non-Verbal Behaviour and the Classroom Context

In recent years research has examined commonly used non-verbal signals in educational settings. Studies have focused mainly on teachers and have included investigations into the frequency and intensity of direct eye contact, interpersonal distance, teacher-approval gestures and non-verbal criticisms (Banbury and Hebert, 1992). However, little research has been devoted to the interpretation of specific non-verbal student actions in specific subject areas.

Despite the ambiguity of non-verbal behaviour Neill (1991) claimed that an understanding of it had practical significance for educators. According to Neill (1991) knowledge of non-verbal cues could assist teachers in communicating effectively with

their students; and knowledge of non-verbal behaviour could help teachers understand what was happening within the classroom by providing them with quick and immediate feedback.

Banbury and Hebert (1992) stated that while most teachers were aware of non-verbal communication indexes, many were unaware of the influential role of non-verbal behaviours. Moreover, Banbury and Hebert (1992) argued that teachers needed to realise that if there was incongruity or discrepancy between words and 'body language' the non-verbal message should be considered the most dominant. The authors emphasised the importance of context in interpreting the meaning of non-verbal behaviours. For the authors, context included such things as expressions, gestures, movements, prior and subsequent events and any speech uttered during an event.

An investigation into non-verbal behaviour by Lawes (1987) found that irrelevant behaviours such as playing with objects, putting the hands to the mouth and looking around, especially in combination with each other, could be successfully used to judge that a child did not understand the task at hand (Neill, 1991).

From the review of the literature, the researcher considered that her hypothesis on body language needed to be explored through a series of case studies.

THE DESIGN OF THE CASE STUDIES

The following section describes the constructs and the procedures that were used in the case studies.

The case studies consisted of three groups of children who experienced different levels of nervousness before written tests.

To strengthen the validity of the case studies, a second independent observer was asked to participate in the research. The role of the observer was to record the data from the studies. As a guard against researcher subjectivity, the observer was not told of the researcher's hypothesis, she was only given an overview of the study and shown how to record the data.

The Independent Observer

The independent observer was the school's librarian. The librarian taught the children for one sixty minute lesson a week. She came into the classroom to work co-operatively with the teacher-researcher for six weeks of each term. It was during these times that the librarian acted as a non-participant observer in the study.

There were two advantages of using the librarian as the independent observer in the research. First, she was familiar with the children in the case studies. Second, her involvement in the research meant that the observations occurred in a natural setting. The fact that the observations occurred in a natural setting with a teacher of the children strengthened the reliability of the study.

Determining the Groupings and the Subjects for the Case Studies

The degree of nervousness that the children experienced before doing written tests was determined by the responses they had given to the Likert scale question in the individual interviews. The scale, which was numbered from one to five, was divided into three sections. Each section corresponded to a level of nervousness: low, medium and high.

Children in the low-worry range were those who had placed themselves between numbers one and two on the scale. Children in the medium-worry range were those who had placed themselves between numbers three and four, while high-worry children had chosen a position between four and five on the scale.

Each of the three divisions had two children allocated to it. Whenever possible, a child whose personal habit repertoire included a high frequency of facial gestures was included in each group.

The low-worry group was made up of one third grade girl and one fourth grade girl. The grade four child had a personal habit repertoire that contained a high number of facial touches. The medium-worry group contained two grade four boys, neither of whom had a habit repertoire that included a high number of facial touches. The high-worry group contained a fourth grade girl and a third grade boy. The boy's personal habit repertoire contained a high number of facial touches.

Grading of Mathematics Tasks to be used in the Case Study

Each of the six children were observed performing three different Mathematics activities. The tasks had been graded according to their level of difficulty. The levels were: low, medium and high.

The low-difficulty level activity involved the children in completing a stencil on which simple addition number sentences had been written. The children had to complete each number sentence then colour the area around it according to a colour code on the top of the sheet. When all the sections had been coloured they formed a picture. The medium-difficulty level activity involved the children in pulling apart then reassembling the pieces of a wooden Soma cube. The high-difficulty level task was a written Mathematics test which was completed with the rest of the class.

The Procedure

The independent observer was not told about the grading of the children or the tasks for the case studies. She was merely given a checklist to fill out on each child for each of the three activities in which she/he participated. The checklist contained a selection of non-verbal actions that were ticked each time they occurred (See Appendix G for a copy of the checklist). Whenever the action that the child performed lasted longer than five seconds the letter 'P' (for prolonged) was recorded beside it. Space was available at the top and bottom of each checklist so that the observer could record actions that were not listed on the sheet. In that space the observer was also able to make relevant comments about each child's behaviour.

During each activity the observer sat near the child but did not talk to her/him or participate in the activity in any way. Cohen and Manion (1989) called this observation technique non-participant observation. The decision to use the librarian as a non-participant observer was made in order to strengthen the internal validity of the case studies. At the conclusion of each activity the children who were participating in the studies were asked to record their feelings about the activity. Their statements were written in their journals.

Each observation period lasted thirty minutes and occurred during the class's usual Mathematics lessons. The independent observer came into the classroom four times a week but only three of the lessons were used for observations of the case study children. The eighteen observations took six weeks to complete.

During the weeks that the observations were made, the researcher and the observer did not discuss the data that had been collected. This strategy was used to strengthen the external reliability of the case studies.

Children's Journals

The journals of the children in the case studies were used to verify the data that had been collected on the checklists.

Data Analysis

The following section describes the data that was collected from the cases studies.

Findings from the Independent Observer

For children in the high-worry and low-worry groups the variety of actions and the number of hand-to-head, hand-to-mouth and prolonged actions were found to increase as the difficulty level of the task increased. The greatest variety of actions, the highest frequency of actions and the highest number of prolonged actions occurred with the high-worry children during the written test.

One of the medium-worry children showed an increased number of hand-to-head and hand-to-mouth actions, a prolonged smile and the greatest variety of actions during the medium - and hard-difficulty level tasks (See Table 5). The child was unable to reassemble the Soma cube (the medium-difficulty level activity) and his journal entry for the test (the high-difficulty level task) stated that he found it hard.

The actions of the medium-worry boy contrasted strongly with the children in the low-worry group and high-worry group for the medium-difficulty task. The children in those groups only exhibited a high number of hand-to-head and hand-to-mouth actions in the high-difficulty level task. The medium-worry boy's actions were also different from the other child in his group. The researcher concluded that the subject was an example of a discrepant case (Goetz and LeCompte, 1984).

According to Goetz and LeCompte (1984), a discrepant case constitutes a variation to an emerging rule and acts to refine, modify or elaborate a construct. In the refinement of a construct the categories that have been developed to code the data are altered to fit the

Table 5: The frequency of non-verbal actions made by one of the medium-worry child in the case studies. A word with an asterisk beside it means that one action was prolonged.

Difficulty Level of Task	Finger/hand in mouth (biting, sucking or tapping)	Hand-to-head (forehead, side, scratching, or shaking the head)	Object in Mouth	Miscellaneous Actions (Such as turning around or humming)	Smile	Frowns or Grimace	Total Number of Actions
Easy	0	0	0	5	0	0	5
Medium	1	4	0	3	6*	6	20
Hard	2	19*	5	11	2	1	40

incoming data. By noting the discrepant case in the analysis of the case study data, the two main categories of hand-to-head and hand-to-mouth were created.

The second child in the medium-worry group showed a prolonged jiggling of the feet during the medium- and high-difficulty level tasks, no other actions during the medium task and only four quick actions during the hard task. The boy's jiggling of the feet was interpreted by the researcher as an indication of tension (Eunson, 1987). The actions of the second boy in the medium-worry group constituted an example of a negative case. Goetz and LeCompte (1984) have stated that a negative case was an exception to an emerging rule, and had a function similar to that of a null hypothesis. According to Goetz and LeCompte (1984), a negative case shows the degree of applicability of a construct, and the conditions or circumstances under which it can be expected. This quality assists researchers in the development of theories about a concept (Goetz and LeCompte, 1984).

Findings from the Children's Journals

Data collected from the journals showed that positive emotions dominated during the children's participation in the activities. The following journal statements are typical comments about the activities.

"I thought the activity was great."
"Everything was fun."
"I feel happy and excited."

Only two negative comments were made about the activities. Both comments were made by the children in the mild-worry group upon the completion of the soma cube task. The boys' statements were:

"A bit boring, a bit fun."
"The activity was boring."

After completing the soma cube puzzle, one child in the high-worry group stated that he was happy he had not done any M:thematics.

A range of words describing the emotions and some degrees of emotion were recorded both before and after the written tests. The words used to describe the way the children felt during the tests were: "excellent", "confident", "successful", "good", "happy", "normal", "pretty good", "very happy", "much better", "a bit afraid and a bit happy",

"normal", "very good", "quite good", "relieved", "nervous", "bad", "not too good", "angry", "scared", "worried", "really scared", "very scared", "very nervous", "ashamed", "disappointed and "silly". The written tests produced the highest number of negative responses of any of the Mathematics tasks in which the children participated.

Some of the comments recorded before the written test were:

"I feel good."
"I feel BAD!"
"I feel angry at B.G."
"I feel normal."
"I feel scared."
"I am feeling nervous."

Conclusions and Consequences

The data appeared to support the researcher's hypothesis that the number of non-verbal actions to the face increased when the children experienced nervousness or worry. However, the discovery of the discrepant case and the negative case made the researcher realise that her hypothesis needed to be modified.

The researcher's revised hypothesis stated that:

During Mathematics lessons worry is able to be detected in children through the observation of negative affect displays, such as frowning and grimacing, which are usually exhibited in conjunction with a high frequency and increased variety of prolonged adaptor actions. When worry is not being experienced adaptor actions seldom occur, and positive affect displays, such as smiling and grinning replace the negative ones. The more positive the emotional state the higher the frequency of positive affect displays.

The data obtained from the case studies provided many indicators of emotional states. These were able to be placed in the four levels of emotion that emerged from the main study (See Table 6).

The researcher had planned to finish her investigation into non-verbal actions with the data collected from the case studies. However, after the modification of her hypothesis the researcher thought it would be valuable to determine whether or not her findings could be applied to a wider population.

The Second Viewing of the Videotapes

In an attempt to determine if the findings from the case studies could be applied to the larger classroom population, all the videotapes, except that of the class discussion, were reviewed. The actions that the children made during Mathematics activities were compared to those made during written tests.

As an additional means of investigating the researcher's hypothesis a ninth videotape was made. The videotape showed the case study children completing a written Mathematics test.

Children's Journals

The journals of all the children in the class were re-inspected in order to validate the data collected from the second viewing of the videotapes.

Peer Examination

To strengthen the internal reliability of the data that was obtained from the second viewing of the videotapes, one of the researcher's supervisors reviewed the tapes with the researcher. The supervisor has had previous experience with analysing research data. An intercoder reliability coefficient of 90% was set as the target criterion. Again the construct of gestures was used in the coding process.

$$\text{Intercoder reliability} = \frac{\text{gestures}}{\text{gestures}} \times 100$$

The intercoder reliability coefficient of 91% was obtained.

Data Analysis

The analysis of the second viewing of the videotapes resulted in a list of physical actions that appeared to indicate emotional states (See Table 6 for the summary of the list). The actions were grouped in two ways. First, under the headings of specific emotions, for example, worry, happiness, elation, fear and confusion. Two additional categories were included: no emotion and unclassifiable. Second, the types of actions were classified according to the part of the body to which they were primarily related, for example, the

Table 6: Indicators of Emotional States that were found in the Case Studies and the second viewing of the videotapes.

	Checklist	Journals	Videotapes
Extreme Positive	prolonged, smiling,	excellent, great,	YES action; touching others; laughing; prolonged smile,
Mild Positive	smiling,	exciting good, happy, glad, easy, fun, a bit boring, a bit interesting, enjoyable, relieved, much better, (Graduations of these feelings)	smiling; variety of short actions to the body or an object,
Mild Negative	frowning, yawning,	nervous, ashamed, disappointed, laughing, wailing, confused, silly, a bit afraid, not too good, not so easy but a bit easy, worried	frowning; nibbling fingernails; jiggling foot or body,
Extreme Negative	prolonged actions such as frowning, biting fingers or pen; jiggling feet or body; hand to head; grimacing,	hopeless, very bad, angry, scared,	grimacing; prolonged actions such as finger or pen biting; great variety and high frequency of actions,

hand, the mouth, the head, the body, the eyes and the hair. Some of the categories had subcategories, for example, the category 'head' which included actions such as shaking or nodding the head had a subcategory 'head - face', in which nose wrinkling or pulling a face were examples.

The analysis of the data from the videotapes showed that the category into which the majority of the actions could be placed was the group relating to hand movements, and that this category could be subdivided into smaller categories such as hand-to-head and hand-to-face actions. Examples of actions in the hand category included throwing away a shape, putting a finger or an object in the mouth, wringing the hands, hitting the hand on the desk and wiping the face with a hand. All the other categories contained fewer actions. The body category was the smallest, with only three actions being placed in it: turning around, rocking or jiggling up and down in the seat and jiggling the foot.

The categories pertaining to the various parts of the body were able to be applied to all the examples of emotional states that had been coded during the analysis of the data. It was found that the majority of hand-to-head and hand-to-face actions occurred when the children experienced the emotion of worry, and that the least number of actions to those body parts occurred when the children showed elation. Verification for this finding came from the children's journals.

Unclassifiable actions included things such as talking to a child at another table, shrugging the shoulders, or frowning as a child attempted to look around the video camera to read something on the blackboard. Data of this type was not included in the analysis.

The second viewing of the videotapes provided the researcher with additional data to support her hypothesis about the significance of non-verbal actions in the detection of worry. Further findings on this theme will be discussed under the heading of Case Studies/Non-Verbal Behaviour in the next chapter.

The analysis of the videotape data showed that the type of adaptor actions changed when the children were worried. This finding meant that the researcher again needed to modify her hypothesis on body language. The following observation made during a written Mathematics test is typical of a child experiencing stress:

J.B. was looking at the algorithms on his test paper when he frowned and placed his left thumb in his mouth. These actions lasted for a prolonged period of time.

The researcher's revised hypothesis on 'body language' stated that:

During Mathematics lessons worry or stress is able to be detected through the observation of negative affect displays which are exhibited in conjunction with a high frequency and increased variety of self- and object-adaptor actions, some of which are prolonged. When worry is not being experienced self- and object-adaptor actions seldom occur and alter-adaptor actions become more frequent. Negative affect displays are replaced by positive affect displays. The more positive the emotional state the higher the frequency of positive affect displays.

Findings from the second viewing of the videotapes support Ortony et al.'s (1988) claim that different behaviours can result from the same emotion. For example, worry was exhibited by one child jiggling his legs, by another child jiggling in her seat, and by a third child biting her fingers. The data also supports the Thompson and Thompson (1989) statement that overt signs of enthusiasm for Mathematics are rare.

Short-Answer Responses

In the last week of the study the researcher decided to collect extra data on a theme that had emerged from the research: attitudes (See Attitudes in Chapter Four: Emerging Themes).

The term 'attitude' was defined by the researcher as the liking/disliking of Mathematics, and was thought to be based on the individual's feelings (or emotions) about a person, object or event. Emotions were considered to be the underlying sensations that were experienced as a consequence of the cognitive interpretation of a particular environmental stimuli. Emotions were interpreted as being either positive or negative, unstable and transient. Emotions were abstract in nature but became manifest in speech and/or physical actions.

Additional data on the attitudes theme was obtained by the children in the class giving the researcher a simple written response to the words 'Mathematics', 'Mathematics activities' and 'Mathematics tests'. The short-answer questions were also given as a means of validating verbal and written data that had been collected during the research.

The short-answer activity became the concluding data collection method used in the research.

On a piece of paper, the children were asked to write one or two words that came into their heads when the following phrases were spoken: 'Mathematics', 'Mathematics activities' and 'Mathematics tests'. Each phrase was read out separately then the children were given one or two minutes to record their responses. The activity took about five minutes to complete. Names were placed on the sheets so that the researcher could compare the data from the short-answer responses with data already made given.

The researcher found that in most cases it was possible to classify the words from the short-answer activity as being either positive or negative. When a word was unable to be classified the child who had given the response was asked to explain whether it signified a good or bad feeling.

'Mathematics'

Positively valenced words given in response to this word were: "good", "happy", "OK", "interested", "fine", "cool", "excellent" and "great". Negative responses were: "nervous", "damn", "Oh No!" and "no!".

Several responses needed clarification. They were: "normal" (neutral), "food" (negative), "tests" (negative), "number sums" (good) and "a bit hard" (negative). Overall there were twenty positive responses and ten negative responses.

'Mathematics Tests'

Positive responses given to this word were: "good", "OK", "fine", "happy", "great", "interested", "excellent", and "cool". Negative responses were: "nervous", "Oh No!," "damn", "nervous and worried" and "bad". Again, additional responses were given which required the children to state whether they signified a good or bad feeling. The responses were classified by the researcher as follows: "normal" (neutral), "fun" (positive), "ow now" (negative), "food" (half good and half bad), "don't tell me" (negative), "marks" (negative; half good and half bad), "nibble my nail" (negative), "God!" (negative), "hungry" (negative), "a bit easier" (positive), "oh-oh" (negative) and "oh" (negative). A total of twelve positive responses and sixteen negative responses were recorded for the concept of Mathematics tests. Two responses ("marks" and

"food") were not able to be classified as signifying either positive or negative emotions. They were excluded as data.

'Mathematics Activities'

Mathematics activities were defined as any task, other than a Mathematics test, that was normally undertaken within a Mathematics lesson.

The Mathematics activities that the children were asked to consider in responding to the researcher's request, were those they performed in their normal course of work during Mathematics lessons. The children were told that Mathematics tests were not to be thought of as a Mathematics activity. All the Mathematics activities about which the children could reflect came from the teaching and learning activities advocated by the Mathematics K-6 (NSW Department of Education, 1989) syllabus.

For this concept responses that needed clarification were: "what's it gonna be?" (negative) and "oh man" (negative). The positive responses to the word 'Mathematics activities' were: "OK", "interested", "can't wait", "easy", "happy", "very happy", "yippee", "good", "fun", "fun things", "cool", "cool man!" and "excellent". Negative responses were: "worried", "damn", "boring", "confused", "nervous" and "no!". The total number of negative responses was eight. The total number of positive responses was twenty-two.

This section has discussed the children's responses to the words 'Mathematics', 'Mathematics tests' and 'Mathematics activities'. A range of positively and negatively valenced words were given in response to the three concepts presented to the children.

It should be noted that there were nearly three times as many positive responses given to 'Mathematics activities' as there were negative responses (See Table 7). The strong positive reaction to the word verified the data gained from the first viewing of the videotapes: that the children enjoyed doing Mathematics activities.

The term 'Mathematics tests' produced approximately an equal number of positive and negative responses while the term 'Mathematics' had nearly twice as many positive responses as it did negative responses (See Table 7).

Table 7: Short-answer responses to the concepts *Mathematics*, *Mathematics Tests* and *Mathematics Activities*.

Numbers in brackets show when a response was duplicated. If a response could not be classified by a child as being either a good or bad feeling it was placed under the heading 'Other'.

	Mathematics	Mathematics Tests	Mathematics Activities
Positive	number sums, excellent, good (3), great (3), OK (3) cool, interested, fine (2), happy (4), Total = 19	happy (3), fun, cool, excellent, good (2), great, a bit easier, Total = 10	interested, very happy, can't wait, fun things, yippee, easy, good (3), happy (3), excellent, great, fun (4), cool (2), cool man!, .K Total = 22
Negative	normal nervous, Oh no! (4), food, damn, tests, a bit hard, no! Total = 10	normal (2) ow now or oh no (3), nervous (2), worried (2), damn, oh, don't tell me, marks, nibble my nails, God!, o-oh, bad, hungry, Total = 16	worried, damn, boring, what's it gonna be?, confused, nervous, no!, oh man, Total = 8
Other		food, marks,	

Data from the short-answer response activity were able to be placed in the model of emotional states that had been compiled from the other data collection sources (See Table 8).

Table 8: Data from the Short-Answer Response Activity

	Short Answer Responses
Extreme Positive	excellent, great, cool,
	can't wait, yippee, very happy,
Mild Positive	fun, OK, a bit easier, easy, fun things, fine, interested, happy, good, no sums,
	normal,
Mild Negative	confused tests, marks, nervous, food, hungry, bad, oh man!, damn, boring, don't tell me!, nibbling my nails. what's it gonna be?,
	Oh no! worried
Extreme Negative	God!

SUMMARY

Chapter Four has presented the analysis of the data obtained from each data collection method used in the research. The researcher found that a follow-up class discussion was needed after the planned class discussion, and that a concluding activity of short-answer responses was needed to explore an emerging theme.

An incident that occurred during the final researcher observation session made the researcher realise that she needed to undertake a series of case studies to investigate an hypothesis she had devised on non-verbal behaviour. A brief review of the literature on non-verbal behaviour and 'body language', as well as the design, planning and analysis of the data from the case studies has been included in this chapter.

Findings from the study of emotional states that were found to support findings in the literature have been noted in the data collection methods in which they have occurred. Where the findings from the various data collection methods have touched on themes that have emerged from the research they too have been noted, and their place of reference in Chapter Five has been provided.

The following chapter addresses the themes that emerged from the research. Chapter Five also discusses a model of emotional states that was able to be constructed from the data.