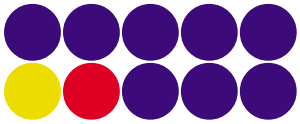

Count Me In Too

1999 Report

The Impact of Count Me In Too on the Professional Knowledge of Teachers

A report prepared on behalf of the NSW Department of Education & Training

by

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Count Me In Too

1999 Report

This report is the fourth in a series to be produced for the New South Wales Department of Education and Training as part of its ongoing monitoring and evaluation of the Count Me In Too Project. Other reports produced to date include:

1. Report of the evaluation of the Count Me In Project 1996. This report focused on the impact of Count Me In on the professional development of teachers.
2. Report of the Count Me In Too Project 1997. This report examined the degree of agreement between teachers when judging the arithmetical ability of young children on the Schedule for Early Number Assessment (SENA), a performance-based assessment instrument used in Count Me In Too to monitor students' arithmetical abilities.
3. The Mathematical Achievement and Self-concept of Kindergarten and Year 1 Children: Report of the Count Me In Too Project 1998. This report examined the impact of Count Me In Too (CMIT) on the mathematical achievement and self-concept development of Kindergarten and Year 1 children.

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Executive Summary

The current investigation was conducted in Terms 2, 3 and 4 of the 1999 school year. In general terms, its aim was to explore the impact of Count Me In Too on the professional knowledge and classroom practices of teachers.

Twelve teachers from 4 primary schools and their corresponding Mathematics Consultants participated in the investigation. To determine whether changes to teacher knowledge and practices occurred as a result of their involvement in CMIT, data from two research tools were combined and compared-concept mapping and semi-structured interviews.

Results of Concept Mapping

Analysis of the concept maps constructed during the first concept mapping session revealed a number of features characterising teachers' professional knowledge prior to their involvement in CMIT. Namely:

1. A relatively high number of key nodes and node links associated with pedagogical knowledge;
2. A relatively low frequency of features associated with mathematics content knowledge, children's cognition and source of knowledge; and
3. A minimal level of integration between the different types of knowledge as evidenced by the low frequency of crosslinking.

From the first map constructed in May to the second concept mapping session in October/November a number of changes were evident. These included:

1. A decrease in frequency of key nodes and node links categorised as content knowledge;
2. A relatively large increase in frequency of features associated with pedagogical knowledge and knowledge of children's cognition; and
3. A slight increase in the level of integration between the different types of knowledge as evidenced by the increase in the frequency of crosslinks.

Analysis of Interview Data

The evidence derived from interviews verified findings of the concept mapping exercise. Basically, Count Me In Too did have an impact on the professional knowledge of teachers. In particular, there was an increase in teachers' pedagogical knowledge and their knowledge of how children learn mathematics. The increase in the degree of 'connectedness' between the different types of teacher knowledge that was evidenced by the increase in the

frequency of crosslinks in the second concept mapping exercise was also verified by comments made by teachers during the interviews.

Teachers considered there to be four major aspects of the CMIT program:

1. The accurate assessment;
2. Grouping according to ability;
3. The enormous variety of activities; and
4. The stages of development.

Teachers who were exposed to CMIT longest, were able to 'see' the vital connection between each of these aspects more than other teachers. They were also the teachers who reported more significant changes to their classroom practices.

Changes to Classroom Practice

Changes to classroom practice varied from teacher to teacher, but more significant changes were reported by teachers and consultants in the classrooms where CMIT had been operating longest. The following list is indicative of the changes commonly referred to by teachers and corroborated by mathematics consultants. They included:

1. Decreased use of textbooks and stencils;
2. More higher level questioning by the teacher;
3. More classroom discussion about strategies used to solve mathematical problems;
4. Grouping of children for instruction according to ability;
5. Greater use of 'genuine' group work;
6. Greater use of games and concrete materials considered appropriate to the various abilities of children;
7. Less teacher-directed lessons and more child-centred lessons;
8. Less written work by teacher and children; and
9. More mental and oral work by children.

Count Me In Too

1999 Report

The Impact of Count Me In Too on the Professional Knowledge of Teachers

Introduction

This report presents the findings of an investigation into the Count Me In Too project operating in Department of Education and Training (DET) schools throughout New South Wales in 1999. It is the fourth in a series of reports to be produced for DET as part of its ongoing monitoring and evaluation of Count Me In Too (CMIT). Previous reports have focused on the impact of the project on the professional development of teachers (Bobis, 1996), the degree of agreement between teachers when judging the arithmetical ability of children on the performance-based assessment instrument used in CMIT (Bobis, 1997) and on the mathematical achievement and self-concept development of children involved in the project (Bobis & Whitton, 1999). A fifth document (Bobis, in press) presents the findings of an investigation designed to study the longer term impact of Count Me In Too and suggests guidelines for its successful implementation.

The investigation reported here was conducted in Terms 2, 3 and 4 of the 1999 school year. In general terms, its aim was to explore the impact of Count Me In Too on the professional knowledge and classroom practices of teachers. More specifically, it was designed to address the research questions:

1. Does Count Me In Too have an impact on the professional knowledge of teachers?
2. If so, how does the professional knowledge of teachers change as a result of their involvement in Count Me In Too?
3. What experiences and factors do teachers report as influencing these changes?
4. Do teachers perceive that changes in their professional knowledge have had an impact on their classroom practices? If so, how?

Background to the Study

Origins and Aims of Count Me In Too

In 1996 the NSW Department of School Education trialed an early number project (Count Me In) in thirteen schools throughout NSW. The project initially involved four DET mathematics consultants, over thirty-five K-2 teachers and approximately one thousand students from thirteen schools across NSW, Australia. The aim of the project was to develop the knowledge of K-2 teachers in early number with the ultimate aim of improving young children's mathematical abilities.

The project was extended in 1997 to include fifty-three DET funded schools, forty mathematics consultants and over one hundred and sixty teachers. In 1998 the project involved seventy-eight DET funded schools, two hundred and fourteen self-funded schools, over one thousand teachers and approximately twenty thousand K-2 students. In 1999 a further 76 DET funded and 167 self-funded government primary schools undertook training in Count Me In Too. The majority of DET funding has gone to schools drawing from low socio-economic populations.

Count Me In Too employs a work-based model of professional development. This means, that mathematics consultants work in classrooms alongside teachers. It is important to note that the model of operation in self-funding schools will depend on the amount of resources allocated to the project by the schools. In some cases, funding may exceed that provided to DET funded schools. Hence, the amount of in-class support will vary from school to school, but basically the aim is for consultants to assist teachers with the implementation of the learning framework espoused by the CMIT project. Generally, this is achieved by consultants helping teachers assess the mathematical development of children in their class, and by helping them plan and implement developmentally appropriate learning and teaching experiences.

Rationale and aims for the 1999 study

The 1996 evaluation of Count Me In (CMI) focused on the impact of the project on the professional development of teachers. Open-ended questionnaires and semi-structured interviews revealed that, generally, teachers considered that they had gained knowledge relating to mathematical content, teaching strategies and of how children learn mathematics. Some teachers reported that while they had not necessarily gained any new knowledge, the project had reaffirmed their existing knowledge and had helped them see the practical implications of that knowledge. Hence, it was found that many teachers reported changes to their classroom practice (by varying degrees) as a result of their involvement in the project (Bobis, 1996). They reported that they asked more challenging questions of their children and allowed them more opportunities to explore, discuss and reflect on their mathematics.

The proposed investigation intends to extend these findings by exploring the impact of Count Me In Too on the professional knowledge and classroom practices of teachers more explicitly. Rather than relying on teachers' self-reports of change to their knowledge and practices, this study will aim to document what knowledge and practices changed and how they changed.

Research Plan

To determine whether changes to teacher knowledge and practices have occurred as a result of their involvement in CMIT, data from two research tools will be combined and compared-concept mapping and semi-structured interviews.

Concept mapping has been used to examine how individuals change and organise their knowledge (Jones & Vesilind, 1996; Novak & Gowin, 1984). It has been shown to be a powerful and sound method for assessing conceptual change and allows researchers to see how knowledge is restructured over time (Cary, 1986; Markham, Mintzes, & Jones, 1994).

Participants

Participants were drawn from the Sydney Metropolitan area. Initially, 13 teachers from 4 primary schools and their corresponding Mathematics Consultants participated in the investigation. Only 12 teachers were available for follow-up interviews, so the final number of participants was 17[1]. While the final selection of teachers for inclusion in the study rested on their willingness to participate, a number of criteria were considered. Namely, the desire to include teachers of both genders, drawn from a variety of school districts and with a range of teaching experiences.

Mathematics Consultants were approached initially via telephone. The project was explained over the telephone. Follow-up material was then mailed to provide the consultants with the same information in writing before they made their final decision to participate in the study or not (see Information for Participants Appendix A). Once a consultant agreed to participate in the study, discussions occurred in regard to the recruitment of teachers from their district who were likely to start CMIT in the near future.

Teachers were then introduced to the study and invited to participate in it by their Mathematics Consultants. Teachers were provided with the form 'Information for Participants'. Interested teachers were then contacted via telephone or in person by the researcher to verify their understanding of the investigation and to seek their decision as to whether they wished to participate in the study. Both the teachers and mathematics consultants were asked to sign a Consent Form (See Appendix B).

[1] One school had two consultants working with the staff on CMIT. The district utilises the expertise of teachers trained in CMIT previously to assist with the induction and training of new schools and their staff.

Procedure

Teachers

Teachers were relieved from teaching for approximately 2-3 hours on each of two occasions-once at the start of the study just prior to their involvement in the CMIT project, and again approximately 4 months later. On the first occasion, teachers received standardised instructions on how to draw concept maps and were given an opportunity to draw a practice map about sample topics, such as sports. They were then given a short break before being asked to draw a concept map about the *knowledge they have to allow them to effectively teach mathematics.* After another short break, but within an hour of completing their concept maps, each teacher was interviewed. The purpose of the initial interview was threefold.

1. It provided an opportunity for teachers to explain their concept maps to the interviewer;
2. It allowed the concept map to be used as a prompt to solicit teachers' knowledge about teaching mathematics to young children; and
3. It was used to gather information relating to the experiences and factors teachers perceive as being responsible for their existing knowledge of mathematics (content knowledge), the teaching of mathematics (pedagogical knowledge) and how children learn mathematics.

During the initial interview, teachers were allowed to modify their map (using a different coloured pen) if they desired. Questions adapted from Jones & Vesilind (1996, p. 95) were used to prompt discussion of each teacher's concept map (see Interview Schedule for Teachers Round 1 in Appendix C).

On the second occasion, teachers were asked to study their previous map and to decide if they would like to either draw a new map, modify and redraw the old map, or leave the old map as it was. After drawing their second map, teachers were interviewed and asked questions adapted from Jones & Vesilind (1996, p. 95). See Interview Schedule for Teachers Round 2 for a complete list of questions (Appendix D).

As was the case with the initial interview, teachers were allowed to modify their concept map, using a different coloured pen, at any time throughout the interview. All interviews were audio-taped and later transcribed for analysis with the assistance of the computer program NUD*IST (1997).

Consultants

Consultants were interviewed formally on one occasion. The main aim of interviews with consultants was to provide another perspective on the impact the

CMIT program may have on the professional knowledge of teachers. The information gained from these interviews was used to triangulate data gathered via the scoring of concept maps and analysis of interviews with teachers.

A semi-structured interview was used to establish consultants' perceptions of teacher participants' knowledge regarding mathematics content, pedagogy, and of how children learn mathematics, prior to their involvement in CMIT. It was also used to ascertain their perceptions of the impact CMIT may have had on the knowledge of the teachers in question. In particular, evidence regarding changes to classroom practices that could be attributed to involvement in CMIT was sought. Appendix E contains the Interview Schedule for consultants.

Analysis

Researchers using concept mapping usually adopt a scoring scheme to assign a numerical value to each map (e.g. Chinnappan, Lawson & Nason, 1999; Jones & Vesilind, 1996). Such scoring systems often rely on information being categorised as examples, hierarchies, crosslinks and the like. For example, a concept map entry considered to fit into the example category would be awarded 1 point, but if a hierarchy2 was evident, 5 points would be awarded and if a crosslink3 occurred, 10 points would be awarded. The rationale for such a scoring system being that hierarchies and crosslinks indicate a greater "coherence and complexity" of knowledge than examples (Jones & Vesilind, 1996). However, such quantitative methods have not always been considered appropriate and some researchers have used only qualitative methods to analyse concept maps (e.g. Williams, 1998).

For the purposes of this study, an analysis that relied solely on a quantitative or a qualitative analysis of the maps was considered inappropriate. Attempts to apply a scoring system similar to that outlined above ignored the 'type' of knowledge possessed by teachers. Since an aim of this study was to investigate the impact of CMIT on the professional knowledge of teachers it was more revealing to simply note the frequency with which each type of knowledge occurred. Hence, the basic units used in the quantitative analysis were key nodes, links and crosslinks associated with a 'type' or 'source' of knowledge.

A ***node*** is a point on a concept map specifying a concept, term or 'piece of information'. Key nodes usually occur as the first level in a hierarchical arrangement of nodes moving from the general to the specific. However, a node was given key node status if sufficient emphasis was indicated during the construction of the map (e.g. via repeated circling or the use of bold lettering) or in the interview. An instance of a ***key*** node in Figure 1 is 'Topics'.

Links are the connecting lines between nodes and indicate the existence of a relationship between the nodes. When a link is made between nodes from two different hierarchies, they are referred to as ***crosslinks***. While noting the frequency of links provided information regarding the number of knowledge components a teacher associated with each node, recording the frequency of crosslinks indicated a degree of 'connectedness' of a teacher's knowledge.

Data gained from the interviews were used to provide the context in which knowledge represented by the key nodes, links and crosslinks was structured or in which changes to knowledge occurred. An initial analysis revealed a number of themes from the first round of interviews that were also identified in the concept maps. Two significant themes or categories of information that emerged were labelled generally as 'types of knowledge' and 'source of knowledge'. Subsequent analysis with the computer program NUD*IST (1997) revealed that the first category could be further broken down to the sub-categories of content knowledge, pedagogical knowledge and knowledge of children's cognition. Many teachers used the various types of knowledge or source of knowledge as key nodes in their concept maps (see for example the concept map by Theresa in Figure 2 and the map by Karen in Figure 3). Together, the concept maps and the interviews provided 'snapshots' of each teacher's knowledge at two points in time.

Results and Discussion

This section presents and discusses the findings of the investigation. Biographical information is provided first, followed by quantitative data derived from an analysis of the concept maps. A selection of concept maps considered to be representative of the sample has been included to assist with an explanation of the results. The same concept maps will be the focus of the qualitative analysis of interview data.

Biographical Information of Teachers

A summary of the biographical data for each of the teacher participants is presented in Table 1. Teachers' real names were substituted with an alias. It can be seen from Table 1 that teachers ranged in their teaching experience from 2 to 31 years, with the majority currently teaching infant classes. There were 11 female teachers and 1 male teacher from 4 different schools. It is important to note that Eve and Sharon were from a self-funded school and did not receive in-class assistance from their consultant to implement the program to the same extent as other teachers involved in this study.

Table 1. *Biographical information of teachers participating in the study (n = 12).*

Teacher	School Code	SchoolSocio-Economic Status	Teaching Experience in	Current Grade being taught	Highest Teaching Qualification
Eve*	A	Mid to high	19	2	Dip.Teach
Sharon*	A		2	1	B.A.Dip.Ed
Robyn	B	Low to high	13	1	BEd
Karen	B		16	Kinder	BEd
Donna	C	Low to mid	25	Kinder	BEd
Sandy	C		31	ESL/Reading Recovery, Yr 1 & 2	T.Dip. Grad.Dip.TESOL
Janice	C		20	Kinder	BTeach
Theresa	C		7	3	BTeach
Celia	D	Mid to high	5	Kinder	BEd
Harry	D		12	4	BEd
Julie	D		26	2	BTeach
Lorna	D		20	5/6	MEd

* Denotes a teacher from a self-funded school that received no or little in-class support.

Analysis of Concept Maps

As previously noted, the basic units of analysis were key nodes, links and crosslinks associated with a 'type' or 'source' of knowledge. The key nodes categorised as a type of knowledge were further sub-divided to include the categories of content knowledge, pedagogical knowledge and knowledge of children's cognition. Examples of key nodes that were categorised as content knowledge from Figure 1 are 'Topics', 'Language', 'Symbols' and 'Problem Solving'. The lines linking each of these key nodes to an example of content, such as 'prime' and 'subtraction', were categorised as node links. Hence, in Figure 1 (concept map constructed by Theresa during the first round of interviews) there are 4 instances of key nodes pertaining to the teacher's content knowledge, 37 instances of links to more specific examples of content knowledge and 1 instance of a crosslink stemming from the key node 'Problem Solving'.

Of the 12 teachers participating in the study, 10 elected to modify their original concept map during the second round of interviews and 2 teachers (Theresa and Sharon) decided to draw new maps. Table 2 summarises the mean number of key nodes, links and crosslinks for each category of knowledge for the whole teacher sample on the two occasions in which concept maps were constructed. Individual results for teachers are presented in Tables 3 to 14. While all concept maps were unique, the maps constructed by Theresa, Eve, Karen and Julie were considered representative of the sample and are included to assist discussion of the concept mapping results and the interview data. Concept maps were redrawn with a computer graphics program to allow them to be more easily read (see Figures 1, 2, 3, 4 and 5).

Table 2. *Analysis of Concept Maps for Round 1(and Round 2) n = 12*

Information	Mean Number of Key Nodes	Mean Number of Node Links	Mean Number of Crosslinks
Types of Knowledge			
Content	1.7(0.9)	6.8(4.5)	0.2(0.5)
Pedagogical	4.2(4.5)	31.8(37.9)	1.5(1.8)
Children's Cognition	0.8(3.3)	4.6(11.8)	0.4(1.3)
Source of Knowledge	1.3(1.5)	7.3(8.3)	0.7(0.7)

Table 2 highlights a number of features typical of the maps constructed during the first concept mapping session. These include:

1. The relatively high number of key nodes and node links associated with pedagogical knowledge;

2. The relatively low frequency of features associated with mathematics content knowledge, children's cognition and source of knowledge; and
3. The minimal level of integration between the different types of knowledge as evidenced by the low frequency of crosslinking.

It is evident that concept maps constructed prior to the commencement of CMIT contained more key nodes associated with teachers' pedagogical knowledge than any other type of knowledge. This category encompassed a wide range of knowledge regarding how teachers teach mathematics. For example, it included key nodes relating to teachers' knowledge of grouping children for instruction, their knowledge and use of resources and of various assessment strategies. Such key nodes were linked to numerous examples illustrating teachers' familiarity with the variations existing with in each of these sub-categories. The large number of pedagogical knowledge node links can be explained in this way. For instance, the first concept map constructed by Theresa (see Figure 1) links 4 examples to the key node 'equipment' and 5 examples to the key node 'evaluating'. Further characteristics of Theresa's concept maps are summarised in Table 3.

Key nodes relating to teachers' content knowledge were less frequently represented on the concept maps than those relating to pedagogical knowledge. This was mainly due to the fact that teachers grouped their content knowledge under one key node. Eve's concept map (Figure 4) illustrates how she used a single key node, titled 'Topics', to encapsulate all her mathematical content knowledge. Major content areas relating to the strands in the NSW Syllabus, Mathematics K-6 (1989), were then linked to this single key node. On the other hand, she used 6 key nodes to map all the pedagogical knowledge she possessed. Table 4 summarises the characteristics of Eve's concept map.

Table 3. *Analysis Of Concept Map by Theresa at Round 1 (and Round 2)*

Information	Number of Key Nodes	Number Of Node Links	Number of Crosslinks
Types of Knowledge			
Content	4(1)	37(10)	1(1)
Pedagogical	3(2)	25(20)	2(2)
Children's Cognition	0(3)	1(19)	1(6)
Source of Knowledge	0(0)	0(0)	0(0)

Table 4. Analysis of Concept Map by Eve at Round 1 (and Round 2)

Information	Number of Key Nodes	Number Of Node Links	Number of Crosslinks
Types of Knowledge			
Content	1(1)	5(6)	0(2)
Pedagogical	6(6)	40(47)	7(9)
Children's Cognition	1(1)	5(6)	1(3)
Source of Knowledge	0(0)	0(0)	0(0)

The initial concept maps constructed by Theresa (Figure 1) and Julie (Figure 5) are typical of those containing a large number of key nodes and node links categorised as content knowledge. It will be noticed from their concept maps that both these teachers recorded numerous examples of content, thus making their tally of node links quite large compared to other teachers who gave few or no specific examples of content (compare, for example, the concept map summaries for Eve in Table 4 to Julie's in Table 5).

Table 5. Analysis of Concept Map by Julie at Round 1 (and Round 2)

Information	Number of Key Nodes	Number Of Node Links	Number of Crosslinks
Types of Knowledge			
Content	3(3)	15(15)	0(1)
Pedagogical	6(7)	41(48)	0(0)
Children's Cognition	1(1)	8(8)	0(0)
Source of Knowledge	0(0)	0(0)	0(0)

The overall low mean score for key nodes relating to the way children learn mathematics is explained by the fact that such knowledge was not represented in 4 of the 12 teachers' initial concept maps (see the concept summaries for Theresa, Donna, Sandy and Janice in Tables 3, 6, 7 and 8 respectively). This does not mean that these teachers knew nothing about children's cognition before undertaking CMIT. Instead, it may indicate that such knowledge was not of sufficient importance to these teachers to be given recognition as a key node at this point in time.

Table 6. Analysis of Concept Map by Donna at Round 1 (and Round 2)

Information	Number of Key Nodes	Number Of Node Links	Number of Crosslinks
Types of Knowledge			
Content	0(0)	0(0)	0(0)
Pedagogical	3(3)	79(93)	3(3)
Children's Cognition	0(6)	0(6)	0(0)
Source of Knowledge	3(3)	33(35)	0(0)

Table 7. Analysis of Concept Map by Sandy at Round 1 (and Round 2)

Information	Number of Key Nodes	Number Of Node Links	Number of Crosslinks
Types of Knowledge			
Content	1(1)	6(7)	0(0)
Pedagogical	7(7)	15(19)	2(3)
Children's Cognition	0(0)	0(2)	0(1)
Source of Knowledge	2(3)	20(22)	2(2)

Table 8. Analysis of Concept Map by Janice at Round 1 (and Round 2)

Information	Number of Key Nodes	Number Of Node Links	Number of Crosslinks
Types of Knowledge			
Content	1(1)	1(1)	0(0)
Pedagogical	7(8)	18(26)	0(0)
Children's Cognition	0(1)	0(2)	0(0)
Source of Knowledge	0(0)	0(0)	0(0)

Source of knowledge was a category of information prevalent in the concept maps of 5 teachers during the initial concept mapping session. While 7 maps contained no reference to the source from which teachers perceived that they had gained their knowledge, such information was elicited from all teachers during the follow-up interviews. It was decided to include this category in the quantitative analysis of the concept maps given that some teachers actually used this category to help organise most of the knowledge represented by their concept map (see for example the concept map by Karen in Figure 3).

Table 9. Analysis Of Concept Map by Karen at Round 1 (and Round 2)

Information	Number of Key Nodes	Number Of Node Links	Number of Crosslinks
Types of Knowledge			
Content	0 (0)	0 (0)	0 (0)
Pedagogical	1 (1)	13 (30)	0 (0)
Children's Cognition	1 (1)	5 (9)	2 (4)
Source of Knowledge	4 (5)	17 (24)	0 (0)

Table 9 summarises the characteristics of the concept map by Karen. It will be noted from Table 9 and Figure 3 that there were 4 key nodes categorised as source of knowledge-'Initial training', 'Post-training', 'Learning experiences' and 'Teaching experiences'- for the first concept map. A fifth key node, 'CMIT', was inserted during the second mapping session. The high frequency of node links in this category is a result of Karen structuring her concept map based on the source from which she obtained her knowledge. Concept maps drawn by Sandy and Donna used this category to structure their maps in a similar way to Karen. While Robyn and Harry included key nodes that were categorised as source of knowledge, they did not use them to structure their maps to the same extent as the other three teachers. Tables 10 and 11 provide summaries of Robyn and Harry's concept map characteristics.

Table 10. Analysis of Concept Map by Robyn at Round 1 (and Round 2)

Information	Number of Key Nodes	Number Of Node Links	Number of Crosslinks
Types of Knowledge			
Content	1(1)	3(3)	1(1)
Pedagogical	2(4)	19(23)	1(1)
Children's Cognition	1(21)	7(8)	0(0)
Source of Knowledge	6(6)	13(13)	6(6)

Table 11. Analysis of Concept Map by Harry at Round 1 (and Round 2)

Information	Number of Key Nodes	Number Of Node Links	Number of Crosslinks
Types of Knowledge			
Content	2(2)	11(12)	0(0)
Pedagogical	9(9)	41(45)	0(0)
Children's Cognition	1(1)	5(5)	0(0)
Source of Knowledge	1(1)	5(5)	0(0)

Another feature relating to initial concept maps that is highlighted in Table 2 is the minimal level of crosslinking. Crosslinking between the different types and source of knowledge occurred in 7 teachers' initial concept maps (see for example, the crosslink between 'children's needs' and 'Outcomes' in Figure 4). While more crosslinks were evident from features associated with pedagogical knowledge than any other type or source of knowledge, these were still proportionally low given the high frequency of key nodes associated with this type of knowledge. For example, Tables 11, 12 and 13 illustrate how both Celia and Lorna had relatively high numbers of key nodes and node links associated with pedagogical knowledge, but had few or no crosslinks between the different types of knowledge. The small number of crosslinks indicates that there may be a lack of integration between the different types of teacher knowledge that in turn may influence the way teachers teach.

Table 12. Analysis of Concept Map by Celia at Round 1 (and Round 2)

Information	Number of Key Nodes	Number Of Node Links	Number of Crosslinks
Types of Knowledge			
Content	0(0)	0(0)	0(0)
Pedagogical	4(4)	34(39)	1(1)
Children's Cognition	2(2)	14(14)	0(0)
Source of Knowledge	0(0)	0(0)	0(0)

Table 13. Analysis of Concept Map by Lorna at Round 1 (and Round 2)

Information	Number of Key Nodes	Number Of Node Links	Number of Crosslinks
Types of Knowledge			
Content	0(1)	0(2)	0(0)
Pedagogical	6(6)	37(44)	0(0)
Children's Cognition	1(1)	4(4)	0(0)
Source of Knowledge	0(0)	0(0)	0(0)

A comparison of the means for the two mapping exercises reveals several trends in the concept map changes. From the first map constructed in May to the second concept mapping session in October/November it is evident that there was:

1. A decrease in frequency of key nodes and node links categorised as content knowledge;
2. A relatively large increase in frequency of features associated with pedagogical knowledge and knowledge of children's cognition; and
3. A slight increase in the level of integration between the different types of knowledge as evidenced by the increase in the frequency of crosslinks.

It will be noted from Table 2 that the mean number of key nodes and node links categorised as content knowledge actually decreased quite dramatically in the second concept mapping exercise. This is because the frequency with which this type of knowledge was represented on the concept maps remained relatively stable from one mapping session to the next for most teachers. However, there was one exception to this which caused a huge decrease in the overall frequency of features related to mathematical content knowledge being represented on the second round of concept maps. The initial concept map constructed by Theresa contained a large number of key nodes and node links in the category of content knowledge (see Figure 1 and Table 3). During the second concept mapping session Theresa constructed an entirely new map that contained few features of the first (see Figure 2). Hence, while examples of content knowledge dominated the first map, the second map contained few examples of content knowledge. The reasons for such a massive restructuring are explored more fully in the section reporting the analysis of interview data. While Sharon also drew a new map, it contained the same information as the first map in regard to content knowledge. Thus there was no decrease in the number of key nodes and node links relating to this category (see Table 14).

Table 14. Analysis of Concept Map by Sharon at Round 1 (and Round 2)

Information	Number of Key Nodes	Number Of Node Links	Number of Crosslinks
Types of Knowledge			
Content	1(1)	5(5)	0(0)
Pedagogical	3(5)	19(21)	2(1)
Children's Cognition	1(2)	6(11)	1(1)
Source of Knowledge	0(0)	0(0)	0(0)

Another trend noticeable from a comparison of the means presented in Table 2 is the sharp increase in key nodes and node links in the category of pedagogical knowledge and children's cognition. For example, Theresa's initial map (Figure 1) does not contain any reference to children's cognition, but her second map (Figure 2) contains 3 key nodes and 19 node links in respect to this type of knowledge. This indicates a huge increase in her knowledge of how children learn mathematics-the stages of mathematical development and the strategies children use to help them solve mathematical problems at each stage.

The second map constructed by Sharon was also changed by way of additional key nodes and node links related to pedagogical knowledge and knowledge of children's cognition. However, features associated with content knowledge remained unchanged (Table 14). Similarly, node links added to Karen's concept map during the second mapping session reveal an increase in both pedagogical knowledge and knowledge of children's cognition (refer to Table 4 and Figure 3). It is obvious from the increase in frequency with which key nodes and node links related to pedagogical knowledge and children's cognition occur, that such knowledge assumed more importance at the time their second concept maps were constructed.

It is interesting to note that teachers from the same school often displayed similar concept map changes. For instance, an examination of concept maps for the group of teachers from School D (Julie, Harry, Celia and Lorna) indicates no change in regard to the number of features associated with children's cognition (refer to Tables 5, 11, 12 and 13 respectively). The reason for such minimal change is explained by the fact that due to other commitments at the school, implementation of CMIT had been delayed. Hence, the teachers had not had the opportunity to become familiar with all aspects of the program. It also indicates that it may take teachers longer to feel 'ownership' of knowledge associated with children's cognition, while knowledge associated with pedagogy was assimilated into teachers' maps more readily.

Another trend in concept map changes is the slight increase in the level of integration between the different types of knowledge as evidenced by the increase in the frequency of crosslinks. While the number of crosslinks increased overall, concept maps constructed by Janice (Table 8), Harry (Table 11), and Lorna (Table 13) contained no crosslinks even after the second mapping session. Harry and Lorna were still to experience the full implementation of CMIT and therefore, it might be too early in the program to see major changes occurring to their concept maps. However, the reason for Janice's lack of integration can be explored more thoroughly through an analysis of the interview data.

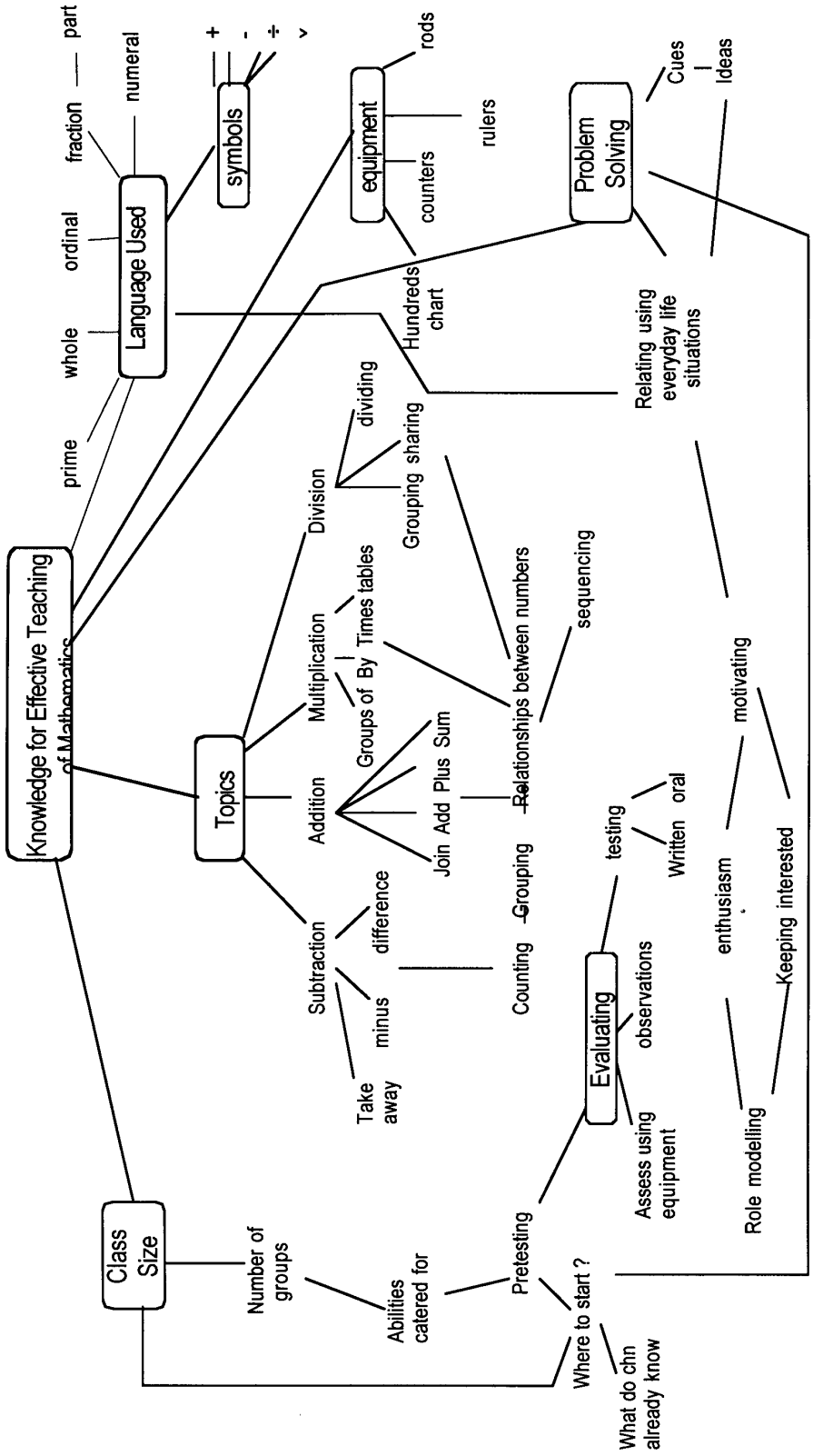

Figure 1 *Concept map constructed by Theresa during the first concept mapping session*

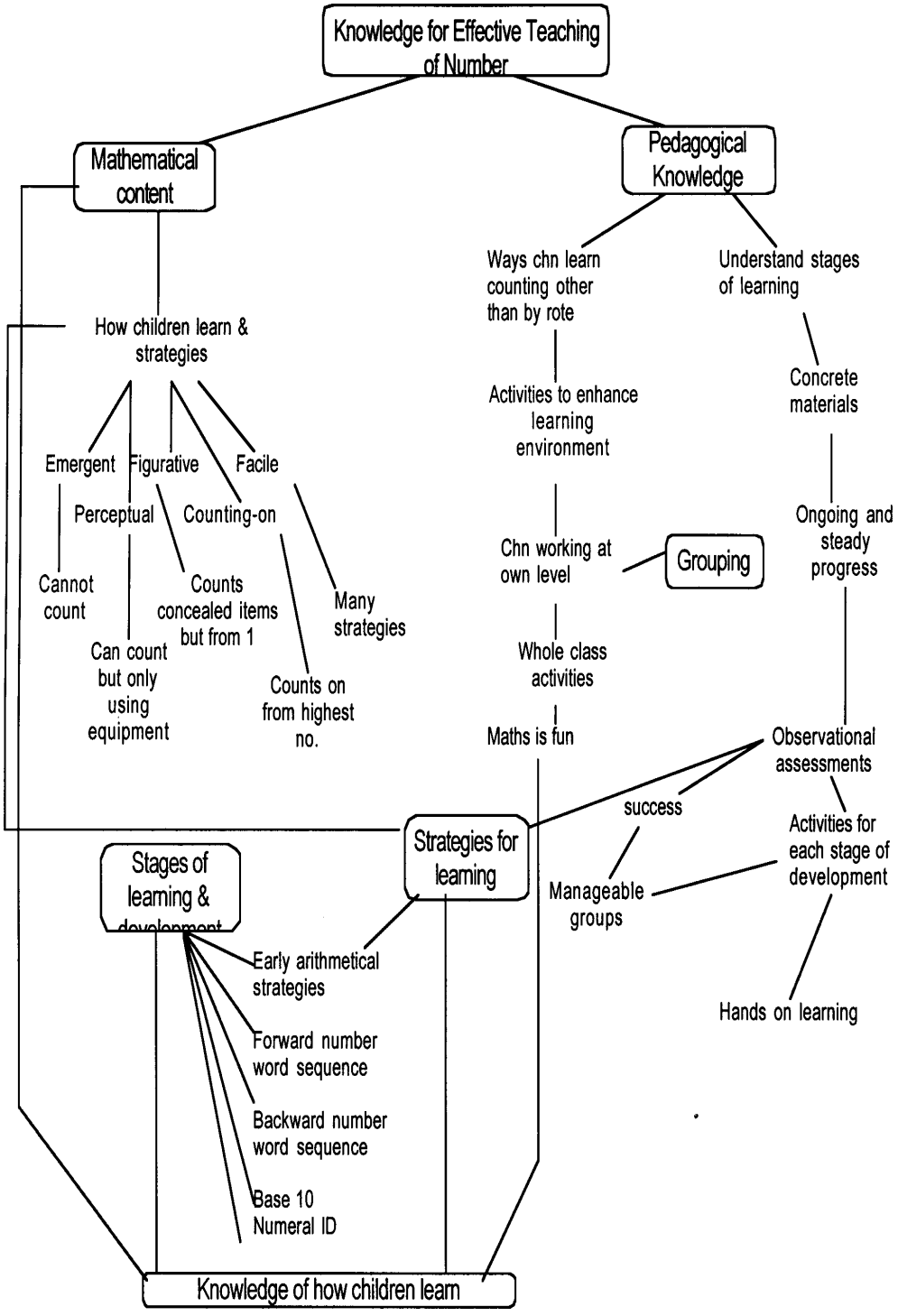

Figure 2 *Concept map constructed by Theresa during the second concept mapping session*

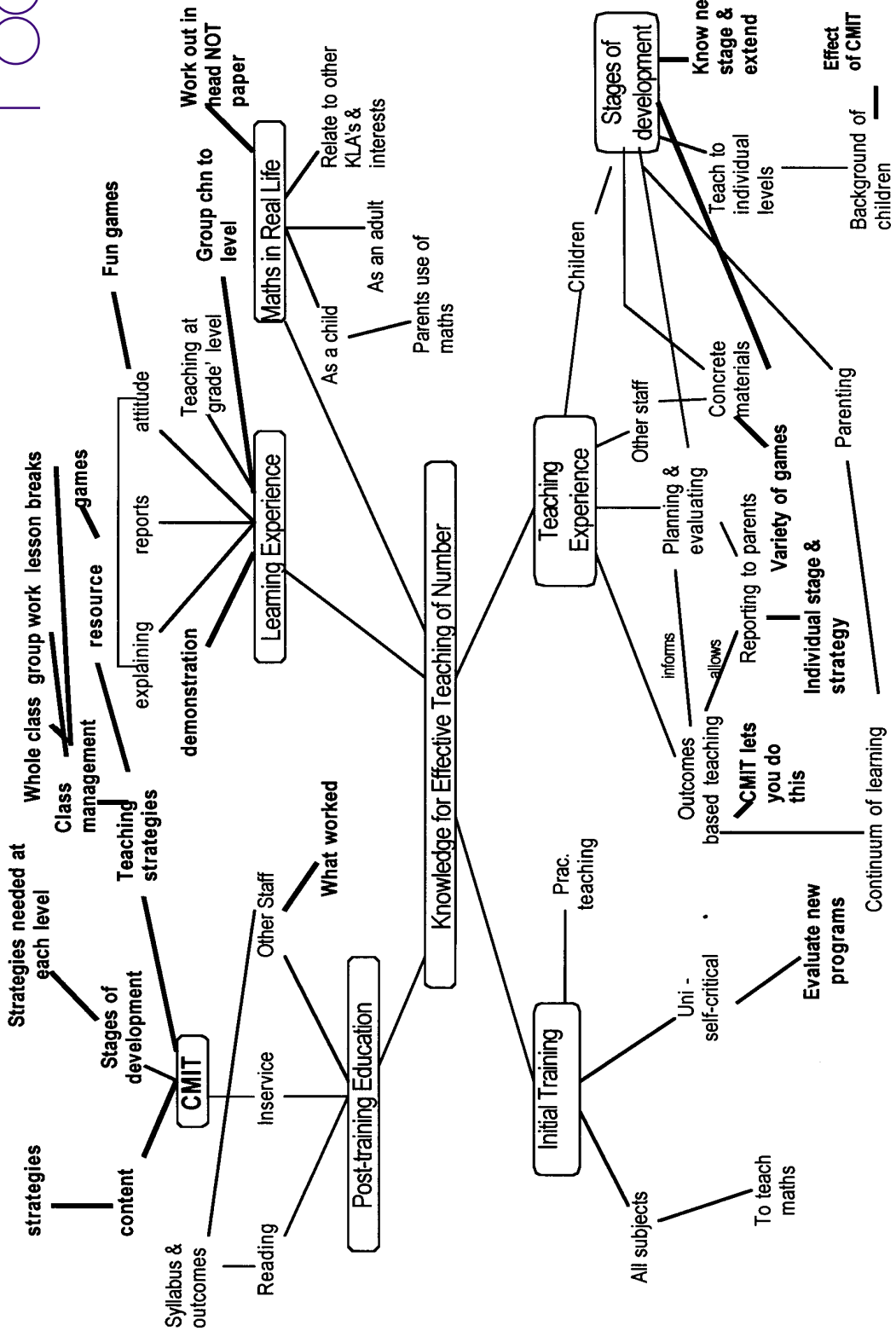

Figure 3 *Concept map constructed by Karen. (Bold type indicates changes made during the second concept mapping session)*

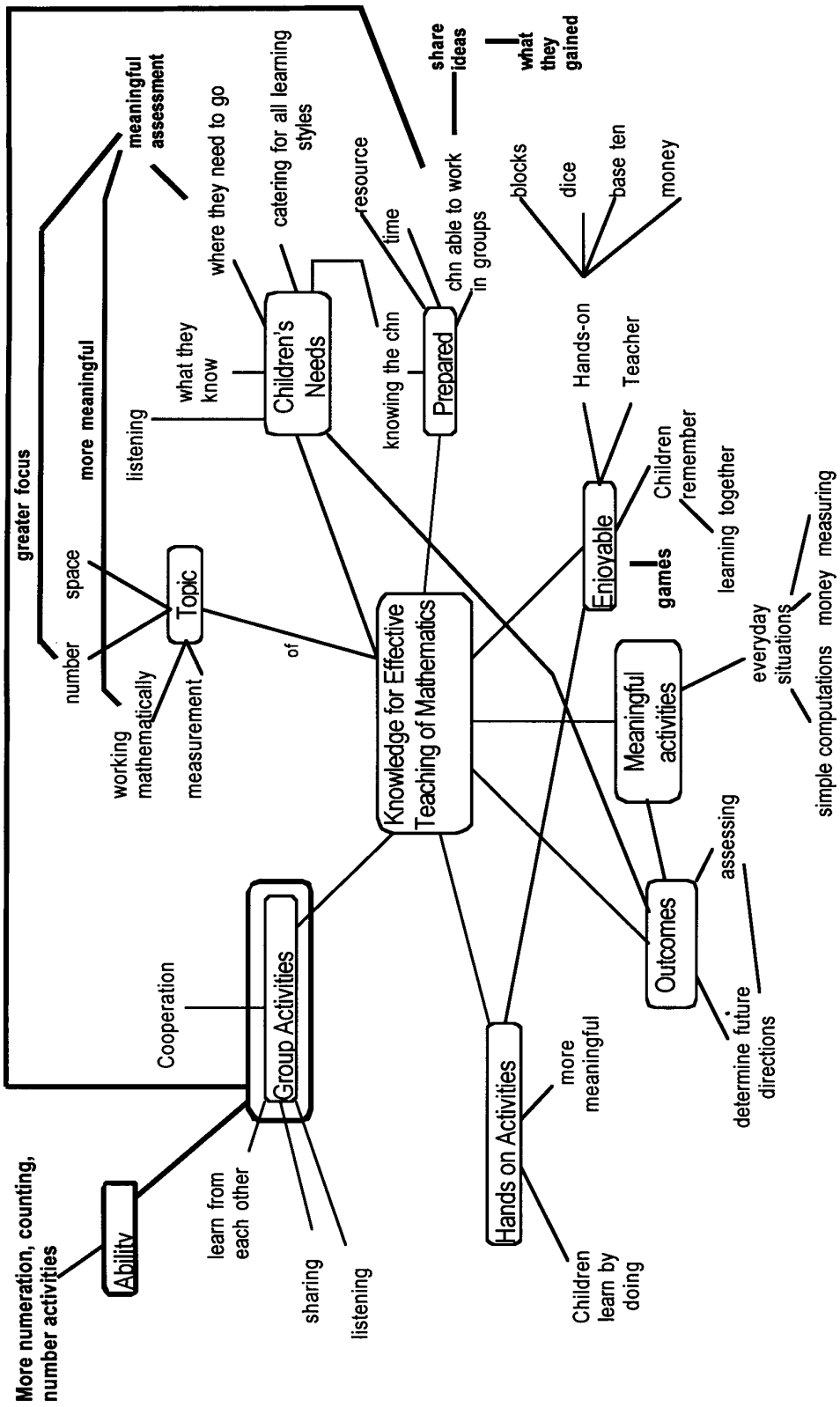

Figure 4 *Concept map constructed by Eve. (Bold type indicates changes made during the second concept mapping session)*

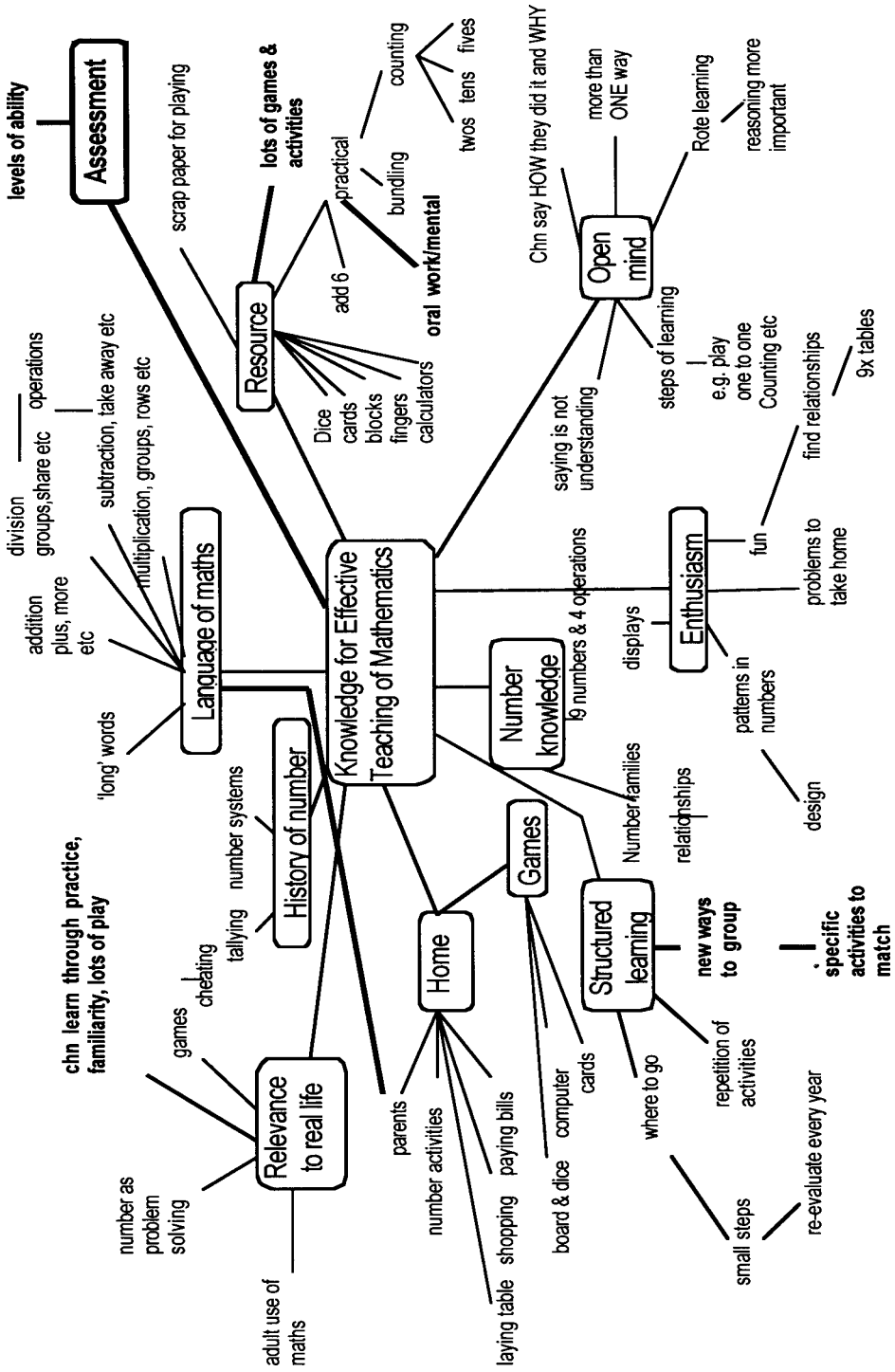

Figure 5 *Concept map constructed by Julie. (Bold type indicates changes made during the second concept mapping session)*

Analysis of Interview Data

The two significant categories of information used to analyse the concept maps-'types of knowledge' and 'source of knowledge'-were also used to analyse the interview data. While content knowledge, pedagogical knowledge, and knowledge of children's cognition were distinct subcategories of 'types of knowledge', it was evident from the concept map analysis that the two latter subcategories were to be the major focus of teacher interviews. It was also evident from the second interviews, that a third category relating to 'perceived changes in practice' was necessary since much of the discussion centred around how new knowledge had changed teachers' classroom practices. Where applicable, excerpts from interviews with the consultants will be used to authenticate information contained in the teacher interviews.

The following discussion of the interview data is structured around the three major categories and their subcategories. It will be noted, however, that excerpts from the second interviews contain information pertinent to two or three subcategories or that discussions of one subcategory will lead into a discussion of another. This reflects a growing 'connectedness' of teacher knowledge and corresponds to the increase of crosslinks on teachers' concept maps during the second mapping session.

Types of knowledge

Content knowledge

During the initial concept mapping exercise, 8 teachers included information relating to mathematical content knowledge in their concept maps. In the accompanying interviews, each teacher emphasised the importance they attached to their own knowledge of mathematical content. Usually, aspects relating to content knowledge were the first nodes to be included on a concept map and the first to be discussed in the interview. For example, Eve, a Year 2 teacher with 19 years teaching experience, began her explanation of her initial concept map: "to start off with I thought that I needed knowledge of the topic and then I wrote the different strands of maths...I thought that I needed a fair bit of knowledge about that".

Content knowledge dominated the explanation of Theresa's initial concept map with more than 60 percent of the discussion devoted to mathematical content. A Year 3 teacher with 7 years teaching experience, Theresa, like all other teachers in the study, was confident that she knew the content necessary to be an effective teacher of mathematics.

Comments made during the second interviews correspond with the concept map findings that CMIT had little impact on teachers' content knowledge. This also reinforces the impression given by teachers from

the first interview, that their mathematical content knowledge was well developed prior to CMIT. All teachers indicated that their "knowledge of content had been reinforced rather than added too" and that it was more "the means" by which it is taught that was different.

Pedagogical knowledge

Three topics emerged from the pedagogical knowledge subcategory as major issues-group work, activities and assessment. The first round of interviews revealed that 10 of the 12 teachers used group work to instruct their children in mathematics prior to CMIT-or more accurately, what they considered to be group work. Reports from consultants indicate that in reality, few teachers were doing "genuine" group work prior to CMIT. 'Genuine' group work, according to one of the consultants, is when children are required to "collaborate to complete a task". Children sitting in "table groups but working individually" was not considered to be genuine group work by consultants. While Theresa commented in her first interview that she was "very certain of grouping" her children for mathematics, the consultant's perception was quite different.

> *When I first entered the classroom there was no space at the front of the room. The tables were arranged to allow groups of six or eight students... They were table groups... I think the main criteria for grouping the students was behaviour. It didn't allow for whole class work, for circle games or ability groups.*

Generally, teachers did not use ability groups prior to CMIT, but placed children "in their table groups" with each child working separately. More commonly, it was noted by consultants that "they have been mixed groups and social groups and that grouping the children for maths for development of certain skills is new..." for most teachers. Another consultant commented that the teachers at one school "really were not working with groups... They can see that it is manageable, they can see it does work, but they are still coming to terms with doing it themselves".

Once CMIT got underway, it became obvious to teachers that grouping the children according to ability was an essential strategy if children were going to be provided with instruction appropriate to their stage of development. For example, Karen, a kindergarten teacher with 16 years teaching experience, noted that "previously, I wouldn't have so much catered for where they were individually. I tended to have a mixed group but with this you really need to group according to ability".

Janice, a kindergarten teacher with 20 years teaching experience, was one of the teachers not using group work for mathematics prior to CMIT. She commented in her second interview:

> I was surprised when I looked at this (concept map) and I hadn't written down anything about grouping,

> but prior to doing the program I wasn't grouping for maths. I knew it was something I needed to address but I wasn't doing it. I group them for literacy.

Management of group work remained an unresolved issue for many teachers. For example, Robyn, a Year 1 teacher with 13 years teaching experience, commented that when she "wasn't using CMIT" she "wasn't using group work" and that she "still found the supervision of the groups hard in CMIT". Other teachers indicated that they found the group work difficult to manage. Celia, a Kindergarten teacher with 5 years experience found herself "jumping from one group to the other and I would end up with a behavioural problem and probably close the whole thing down... I really need a parent with each group of children". Some teachers indicated that they had developed personal strategies to manage the group work. Eve explained her way of managing group work in the second interview:

> Probably in maths I used social groups more before and now I am not sure if I am doing it properly....I have the same activity, but it depends on the ability of the group as to which way they do an activity...I just change the level of the game. I don't actually change the rules. So they usually rotate because that was the only way I could manage it, to rotate and have different levels.

It is apparent from interviews with the consultants and the second interviews with the teachers that grouping children according to ability for instruction in mathematics was a relatively new strategy for most teachers. From the interview data, it seems that most teachers needed to learn how to manage genuine group work in their classrooms-some are still grappling with the problem.

Teachers not only needed to know *how to manage* group work, they had to learn what to do with the children once they were grouped. It was evident from the first round of interviews and the concept maps that teachers placed great importance on the use of concrete materials and practical activities prior to CMIT. All 12 teachers included nodes related to the use of concrete materials and "hands-on" activities in their initial concept maps. Harry, a Year 4 teacher with 12 years teaching experience, typifies the view of other teachers in the study. He emphasised the importance of having "enough resource in the classroom" and making sure that there was an "emphasis on hands-on...before you go into higher levels" of work with the children.

During the second round of interviews it became obvious that many teachers found in necessary to reconsider their use of activities and concrete materials in the classroom. Generally, teachers were overwhelmed by the extent and variety of the activities and resources their consultants introduced as part of CMIT. Most teachers indicated that the activities were mostly new. For example

Donna, a kindergarten teacher with 25 years teaching experience, commented "I really didn't have much of a supply of games for maths before". Janice considered the variety of activities would now allow her to teach "the way I would have liked to have always been doing it but didn't necessarily have the resource there to be able to". Similarly, Karen thought "that the trouble in the past was you could think of maybe two games but this is just like a huge wardrobe...". Unfortunately, the "huge wardrobe" of activities also seemed daunting to teachers. Three teachers commented during the second round of interviews that "getting the resource prepared...was overwhelming" to start with.

Four teachers considered that they were already familiar with many of the activities, but Sandy, an executive teacher involved in Reading Recovery and teaching Years 1 and 2, commented that "the knowledge of those stages of development helped us use those resources more effectively". This sediment was supported by a consultant talking about Eve's change in knowledge and classroom practices:

> She uses games. She used them before CMIT, but that was often a game that was just a game. Now she chooses a game that suits the kids stage of development and that is the difference.

Hence, the introduction of a huge variety of activities and games provided teachers with new and appropriate resources to use in the classroom. Even if the activities were familiar to teachers, the CMIT program "reinforced the value of those games" and teachers perceived this helped them teach mathematics more effectively.

A third element of pedagogical knowledge that teachers focused on was the assessment instrument used in the CMIT program-the SENA (Schedule for Early Number Assessment). While all 12 teachers included comments regarding assessment in their initial concept map and interview, none had experienced individual assessment similar to the SENA for mathematics. According to all 12 teachers in their second interview, the SENA's strength lay in its ability to "pin-point where a child is at" more successfully than assessment strategies they had previously used. The assessment was considered a vital component of the program by Janice. She was able to see the link between the assessment and other aspects of the CMIT program: "To do the assessment in the beginning allows you to know how to group them. The activities then allow you to instruct them at a level appropriate to their understanding". Similarly, Theresa thought that:

> The children learn so quickly with the CMIT program that you have to be really on the ball with where they are at. They can learn a concept in any group and this can happen in one lesson, all of a sudden there is the answer, then they are off to the next group.

The SENA was also the aspect that received most criticism from teachers because of the "enormous amount of time" required to assess in this manner. However, some teachers, like Julie, a Year 2 teacher with 26 years teaching experience, realised that "to an extent the games can be used as an assessment in themselves as you go along".

Knowledge of Children's Cognition

While teachers learnt about new strategies to group their children and gradually built-up their repertoire of activities and resources, they considered the most significant change to their knowledge was in regard to how children learn mathematics.

> For me it has been very worthwhile to note how the children learn...I've learnt about grouping and using equipment, materials and things like that, but I think my deeper understanding of how children actually learn about number has changed the most.
>
> (Donna, Kindergarten teacher)

Although 8 of the 12 teachers made some reference to "stages of development" or "how children learn" in their initial concept maps and interviews, it was always stated in general terms or related to 'stages' in the mathematics curriculum documents. For example, Karen explained in her first interview that:

> ...stages of development I guess links to their age, but just because you're 10 doesn't mean you're at this stage. So it's really being aware of the continuum of development...because they're in Year 6 it doesn't mean they're going to be in stage 3...I'd relate it more to what most kids in that class could do.

During the second round of interviews, Karen remarked that she would have noticed children using different mathematical strategies before, but she "wouldn't have known what it meant. Whereas now I have a label to put on that child. They are counting-on. So now I know what I'm looking for".

The terms given to the stages of number development were not adopted by all teachers so readily. Two consultants agreed that it takes time for teachers to adopt the terminology and then feel comfortable using it. The consultant working with teachers from School D (Celia, Harry, Julie and Lorna) commented that "they're not using the terminology yet. It's too early. At the moment they are trying to cope with learning new ideas..". Similarly, the consultant working with Eve and Sharon agreed that "it tends to come later. I have found after they have done the interviewing, and I have worked with them for about five weeks, then they start to use the terminology of the framework and stages of development". These comments are supported by the fact that none of these teachers specifically mentioned the names of any stages of development in their second

concept map and interview session. These teachers referred to the stages of development in more general terms than teachers from schools that had been involved in CMIT for a longer period of time. For example, all teachers from School C made comments similar to Donna's:

> I am now using the CMIT level rather than just saying they are the better group. Whereas you know they are the better group but you are not fully aware of what they can and can't do. This course has made me really aware of where they are really at... The process of development is clearer to me.

The teachers from School C all spoke about the terminology giving them "a common vocabulary which is a bit more explicit". It was also felt by teachers at this school that knowledge of the framework helped them communicate with other teachers and "explain the children's development to parents" better.

Knowledge of the stages of development had implications for teachers' classroom practices. While reports of changes made to classroom practices varied from teacher to teacher, it was noted that teachers in the schools where CMIT had been operating longer, perceived the changes to be more significant. For example, Karen and Donna both commented that they were "doing things earlier with the children" than they would have done before CMIT. Teachers also felt that they were now able to cater for a wider ability range in the class and extend those children who were more capable:

> Before I was getting everyone to a certain level and then worried about the children who weren't there yet. Now I am facilitating the ones that need extension more because they are going forward. There is not a limit to where you are going to stop. If they are in kindergarten and they can do addition or they can understand subtraction then we go with it.
>
> (Donna)

Finally, the following quote from Theresa reflects the realisation of how all her knowledge is interconnected. Coupled with her decision to construct a completely new concept map (see Figure 2) during the second mapping exercise, the quote is indicative of how she has now reconceptualised her teaching of mathematics.

> I have learnt so much about how children learn and how it all links together. My knowledge links to what the children learn and how they learn. The strategies and the mathematical content-it is all interlinked.

Source of Knowledge

When referring to their source of knowledge during the initial interview, "teaching experience" and "other teachers", were mentioned by all 12 teachers. While most teachers made reference to their "initial teacher

education", it received greater emphasis from the more recently trained teachers. Teachers who had been teaching longest gave greater emphasis to "experience", "the children they taught" and "other teachers". Inservice and post-initial education were only briefly mentioned by three teachers-one of whom was Sharon, a Year 1 teacher with 2 years teaching experience, who had just started a Masters Degree part time.

During the second interview, all teachers were asked to comment on what they felt was the source of their new knowledge. Without exception, teachers referred to their consultants. Harry, actually joked about the consultant and her "suitcase" of endless activities. A few teachers mentioned other staff members also had been a great source of new ideas. Another particularly noteworthy source of knowledge, was the book, Developing Efficient Numeracy Strategies: Stage 1 Number (1999), produced by the NSW Department of Education and Training and distributed to all government schools in NSW.

Perceived Changes to Practice

An aim of this study was to report on the perceived changes to classroom practice as a result of teachers' involvement in CMIT. Without observation of classrooms to verify teachers' and consultants' perceptions it cannot be stated with a high degree of certainty that all changes recorded here have occurred exactly as teachers report. The following discussion needs to be considered in this context.

Besides the changes to grouping children for instruction and the inclusion of a greater repertoire of activities, other changes to classroom practice were noted by teachers in the second interview. Most commonly, teachers commented on there being "more practical activity in the classroom than before" and "more mental and oral games which you can use...as a lesson break." While a few teachers considered that they would now use no, or less of a textbook to help them teach mathematics, two teachers showed reluctance to let go of textbooks: "I still use the textbook... I'm not relying just on the CMIT games." Julie commented that she "will still need worksheets to find out who can do things in the written form, but perhaps not quite so many".

Other changes to practice included a change in content focus and a change in the type of questions that the teachers asked. For instance, Eve considered that the mathematical content she taught had changed as a result of her involvement in CMIT. She made the point that she felt she was "now much more focused on the numeration and actually working mathematically" than ever before. Eve also noted that there was more discussion about mathematics in her classroom by the children: "They talk about the maths, why they got it and how they got it. I never had that before". Karen noted how she was asking different types of questions:

> You are asking how did you do it? Can you show us how you did it? Then I ask if that was a quick way or a slow way. I didn't ask these type of questions before. It's better because they can see how they figure things out.

The consultant working with Theresa noted many changes to her classroom practice. While the consultant perceived her to have been "using whole class teaching where children worked predominantly on stencils" prior to CMIT, she now "moves around the groups and observes" the children doing "activities that are mostly based on games".

The consultant working with teachers from School D thought that it was too early in the program for major changes to classroom practice to occur. All consultants agreed that while they perceived changes to classroom practice by all teachers, it was difficult for them to know if those changes continued when they were not present. However, comments made by consultants working with teachers at Schools A, B and C about perceived changes to practice, generally corroborated those made by the teachers themselves. For example, Theresa from School C, commented that:

> I am using a lot more resources than I would have used previously in maths and I will continue to do so. I have learnt so much about the program that it would be very much a huge shame not to use the program in the future..It has increased my knowledge immensely and therefore I can now put that across to the children. I would like to see-using this teaching approach-where it will get the children in the future.

While talking about the changes she had perceived occurring in Theresa's classroom practices, the consultant confirmed that "major changes" had occurred and that "she wants to do it and wants to keep it going". Alternatively, a teacher from School D, where CMIT had only been operating for a relatively short time, commented that "it simply reinforces the idea that kids learn through practice and practical activity...just five minutes of my routine has changed...I'll probably use the games when I've got a few spare minutes-instead of reading a story". When the consultant working at School D was asked if she perceived any changes to classroom practice, she thought that she might "a little further down the track, but not now. It's too soon". Such comments from consultants verified teachers' perceptions regarding change or the lack of change to classroom practice.

In short, changes to practice varied from teacher to teacher, but more significant changes to classroom practices were reported by teachers and consultants in the classrooms where CMIT had been operating longest. The following list is indicative of the changes commonly referred to by teachers and corroborated by a mathematics consultant. They included:

* decreased use of textbooks and stencils;
* more higher level questioning by the teacher;
* more classroom discussion about strategies used to solve mathematical problems;
* grouping of children for instruction according to ability;
* greater use of 'genuine' group work;
* greater use of games and concrete materials considered appropriate to the various abilities of children;
* less teacher-directed lessons and more child-centred lessons;
* less written work by teacher and children; and
* more mental and oral work by children.

Summary and Conclusion

This study was designed to address a number of research questions. Namely:

1. Does Count Me In Too have an impact on the professional knowledge of teachers?
2. If so, how does the professional knowledge of teachers change as a result of their involvement in Count Me In Too?
3. What experiences and factors do teachers report as influencing these changes?
4. Do teachers perceive that changes in their professional knowledge have had an impact on their classroom practices? If so, how?

The evidence derived from an analysis of the concept maps, coupled with data from interviews with the teachers and consultants indicates that Count Me In Too did have an impact on the professional knowledge of teachers. In particular, there was an increase in teachers' pedagogical knowledge and their knowledge of how children learn mathematics. This was evident in the second concept mapping exercise which indicated a relatively large increase in the frequency of key nodes and node links associated with pedagogical knowledge and knowledge of children's cognition. It was also verified by teachers' and consultants' interview data. An increase in the degree of 'connectedness' between the different types of teacher knowledge was evidenced by the increase in the frequency of crosslinks in the second concept mapping exercise and verified by comments made by teachers during the interviews.

Together, the data gained from the concept maps and the interviews revealed that teachers considered there to be four major aspects of the CMIT program-the accurate assessment; grouping according to ability; the enormous variety of activities; and the stages of development. Teachers who were exposed to CMIT longest, were able to 'see' the vital connection between each of these aspects. As Janice stated:

> To do the assessment in the beginning is really important-you know how to group them and then you know the activities to provide them with to be able to instruct them at a level appropriate to their understanding..

Not all teachers saw the link between each of these 'aspects' of the program. However, evidence suggests that teachers exposed to CMIT longest started to realise that while having the resources was important, it was not enough. They needed the knowledge of children's stages of development to enable them to match an activity to a child. They also needed to realise that grouping according to stages of development was an effective means by which children of similar ability could be instructed.

The consultant was the most influencing factor attributing to the changes in knowledge reported by teachers. Other elements that contributed, to a lesser degree, included the book, *Developing Efficient Numeracy Strategies: Stage 1 Number* (1999) and other staff members.

While changes to practice varied from teacher to teacher, more significant changes to classroom practices were reported by teachers and consultants in the classrooms where CMIT had been operating longest. It was noted, however, that without observation of classrooms to verify teachers' and consultants' perceptions regarding changes to classroom practices, it cannot be stated with a high degree of certainty that all changes recorded have actually occurred.

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Appendix A

The University of Sydney

Faculty of Education

Sydney NSW Australia 2006

Chief Investigator: Dr Janette Bobis

Tel: 9351-4536 Fax: 9351-4765

INFORMATION FOR PARTICIPANTS

Teachers and Consultants involved in Count Me In Too (CMIT)

Thank you for taking an interest in this project. The following pages are intended to inform you of the aims and requirements of the 1999 evaluation of CMIT so that you can decide whether you would like to participate or not.

Title of Project: The Impact Of Count Me In Too On The Professional Knowledge Of Teachers.

Aim

The main aim of this study is to explore the impact of CMIT on the professional knowledge of teachers. It is designed to address the following questions:

1. Does Count Me In Too have an impact on the professional knowledge of teachers?
2. If so, how does the professional knowledge of teachers change as a result of their involvement in Count Me In Too?
3. What experiences and factors do teachers report as influencing these changes?
4. Do teachers perceive that changes in their professional knowledge have had an impact on their classroom practices? If so, how?

Two groups of people will be involved in this project-teachers and DET mathematics consultants.

Teachers

Teachers who agree to participate in the study will be relieved from teaching for approximately 3 hours on two occasions-once at the start of the study just prior to involvement in the CMIT project, and again approximately 3-4 months later. On the first occasion, you will receive instructions on how to draw concept maps (sometimes referred to as 'mind maps' or 'webbing exercises'. See example on page 2.) You will then be asked to draw a concept map about the teaching of mathematics.

Within an hour of completing your concept map, you will be interviewed. The purpose of this interview is to provide an opportunity to explain your concept map to the interviewer. The interview will also be used to gather information relating to the experiences and factors you perceive as being responsible for your current knowledge of mathematics, and the teaching of mathematics to young children.

During the second interview, you will be asked to study your previous map and to decide if you would like to either draw a new map, modify and redraw the old map, or redraw the old map as it was. You will then be interviewed once again so that you can explain your concept map and discuss any factors you perceive to have contributed to any changes that may have been made since the first interview.

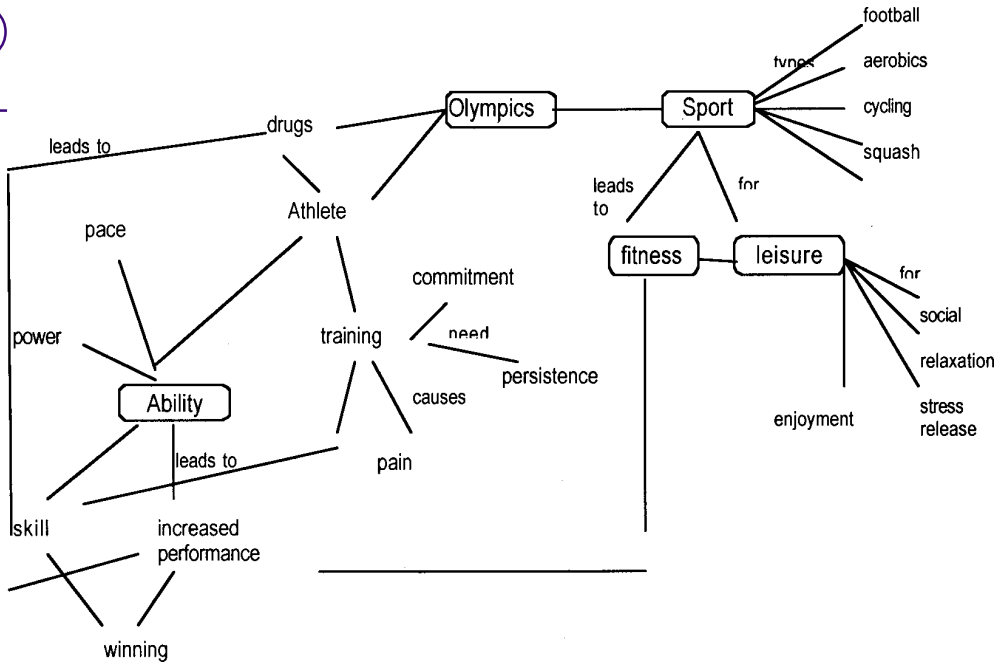
While both interviews will be audio-taped and transcribed, all references to your name, school and district will be substituted with an alias. Throughout the study your identity will remain **anonymous** and all information will be treated as **confidential**. Your participation is voluntary and you may withdraw from the study at any time without penalty or prejudice.

Consultants

Consultants will be interviewed for approximately one hour on two occasions- once at the start of the study, and again approximately 3-4 months later. The main aim of the first interview is to establish your expectations of CMIT outcomes in regard to changes in the professional knowledge of teachers. The second interview will aim to document your perspective concerning the impact CMIT may have on teachers' knowledge of mathematics content and of how children learn mathematics. You will be asked to comment on these aspects with reference to the teachers you assisted in the CMIT project. The information you provide will help consolidate information gathered from teachers via concept maps and interviews.

Both interviews will be audio-taped and transcribed. All references to your name, the names of teachers, schools and districts will be substituted with an alias. Throughout the study your identity will remain **anonymous** and all information will be treated as **confidential**. Your participation is voluntary and you may withdraw from the study at any time without penalty or prejudice.

Figure 1 *An example of a concept map for "Sport" by a student teacher.*



Any person with concerns or complaints about the conduct of a research study can contact the Manager of Ethics and Biosafety Administration, University of Sydney, on (02) 9351-4811.

Appendix B

The University of Sydney

Faculty of Education

Sydney NSW Australia 2006

Chief Investigator: Dr Janette Bobis

Telephone: 9351-4536 Fax: 9351-4765

CONSENT FORM

Title of project: The Impact Of Count Me In Too On The Professional Knowledge Of Teachers.

I agree to be interviewed (twice) as part of the Count Me In Too project. I understand that the information gained from these interviews will be used for the sole purpose of assessing the effectiveness of the CMIT project. I agree to the interviews being audio-taped and later transcribed. I understand that my identity will remain anonymous and that I may withdraw this permission at any time without penalty or prejudice.

I have read (or have had explained) and understand the Information for Participants Statement and Consent Form and understand the purpose of this study.

Participant

Name: (Please PRINT) _____

SIGNATURE: _____

DATE: _____

Witness

Name: (Please PRINT) _____

SIGNATURE: _____

DATE: _____

Any person with concerns or complaints about the conduct of a research study can contact the Manager of Ethics and Biosafety Administration, University of Sydney, on (02) 9351-4811.

Appendix D

Interview Schedule for Teachers Round 1
Instructions to Interviewer

Equipment: Tape Recorder and blank audio-tape, samples of concept maps, blank paper for teacher constructed concept maps, blue, black and red fine-tipped pens.

1. Confirm that the teacher:
   * has signed consent form,
   * understands the purpose of the study and their role as a participant (see below),
   * understands that information they provide will be kept confidential,
   * understands that the interview will be audio-taped but that they can stop the tape any time they wish,
   * understands that they can withdraw from the study any time they wish with out penalty.

Purpose: The purpose of this interview is to provide an opportunity to create and explain your concept map. The interview will also be used to gather information relating to the experiences and factors you perceive as being responsible for your current knowledge of mathematics, and the teaching of mathematics to young children.

N.B. These questions are a guide only. They may be used as prompts to help focus the discussion around the 'professional knowledge' of individual teachers involved in CMIT. Questions may deviate.

2. Provide teacher with concept map sample 1, 'Sport'. Explain the purpose of concept maps and how they are created. For example, draw attention to the way ***links*** are made between concepts and the way ***hierarchies*** are structured. Note links between hierarchies etc.
3. Repeat explanation for concept map sample 2 if necessary.
4. Allow teacher to draw a practice concept map on topic of choice e.g. sport, Science & Technology etc
5. Answer any questions teacher may have in regard to concept maps.
6. Short break if needed.
7. Ask teacher to draw a concept map about the "Teaching mathematics to young children". Another short break, but within an hour of completing the concept map ask teacher the following questions to prompt discussion of his/her concept map:
8. Tell me everything you can about your concept map?

9. Were there concepts you weren't sure where to put?
10. Which aspect(s) of your map are you the most certain of?
11. Can you tell me more?
12. Which aspect(s) of your map are you least certain of?
13. Can you tell me more?
14. Can you identify where this (these) knowledge/concept/ strategy came from?
15. **Teachers may modify their map (using a different colour pen) if they desire throughout the interview.**

Appendix E

Interview Schedule for Teachers Round 2

Equipment: Tape Recorder and blank audio-tape, concept maps from first interview, blank A3 paper for new teacher-constructed concept maps, blue, black and red fine-tipped pens.

1. Confirm that the teacher:

* understands the purpose of the follow-up interview (see below),
* understands that information they provide will be kept confidential,
* understands that the interview will be audio-taped but that they can stop the tape any time they wish,
* understands that they can withdraw from the study any time they wish with out penalty.

Purpose: The purpose of this second interview, is to consider the impact CMIT has had on your knowledge and to discuss the factors you perceive have contributed to changes in your knowledge since the first interview.

Concept Map Task

Look at the concept map drawn during your first interview. While reviewing your map, consider changes that you would like to make that reflect *new knowledge*. In particular, focus on

(a) **mathematical content** (knowledge of new content or strategies that have benefited your personal mathematical development or are necessary for children in your class to learn);

(b) **pedagogical knowledge** (knowledge related to teaching strategies, lesson & class management and knowledge of resource used by you to teach maths); and

(c) **knowledge of how children learn mathematics** (e.g. stages of development and ways to help children learn mathematics better)

You may draw a new map or modify your original map. You may modify your map, using a different coloured pen, at any time throughout the interview.

Follow-up questions

N.B. These questions are a guide only. They may be used as prompts to help focus the discussion around the 'professional knowledge' of individual teachers involved in CMIT. Questions may deviate from those presented here.

10. Did you change your map from the one you drew last time?

If changes were made:

11. Were any changes a result of new mathematical content or strategy knowledge?

12. Were any changes a result of new teaching strategies or knowledge of new activities and resource for teaching mathematics?

13. Were any changes a result of new knowledge of how children learn mathematics?

14. Can you identify where this (these) changes to your knowledge came from? For example, was there anything that you read, heard, saw, or did that influenced the changes?

15. What made you want to change your map?

16. Which aspect(s) of your map do you think has changed most?

17. Which aspect of your map do you think has changed least?

18. Do you think that any changes in your knowledge that you have just mapped have had an impact on the way you teach mathematics to children? Can you give some examples?

If no changes were made:

1. Why do you think that you did not gain any new knowledge since our first interview?

Appendix F

Interview Schedule for Consultants towards end of Study

Instructions to Interviewer

Equipment: Tape recorder, audio tape.

1. Confirm that the consultant:

* understands the purpose of this interview and their role as a participant (see below),
* understands that information they provide will be kept confidential,
* understands that the interview will be audio-taped but that they can stop the tape any time they wish,
* understands that they can withdraw from the study anytime they wish with out penalty.

Purpose

This interview aims to document your perspective concerning the impact CMIT may have on teachers' knowledge of mathematics content and of how children learn mathematics. You will be asked to comment on these aspects with reference to the teachers you assisted in the CMIT project.

N.B. The following questions are a guide only. They may be used as prompts to help focus the discussion around the 'professional knowledge' of individual teachers involved in CMIT. Questions may deviate from those presented here.

1. In regard to the teachers involved in this study, do you think that CMIT had an impact on their:

(a) Math content knowledge?

(b) Pedagogical knowledge?

(c) knowledge of how children learn mathematics?

2. If so, how? If not, why not?

3. Can you give specific examples for (a), (b), (c) in relation to the teachers you were working with?

4. What factors do you perceive to be responsible for the changes (or for no change) to have occurred)? Refer to specific elements of the program or other (events, people etc)

5. In your view, do you think that changes in teacher knowledge (that can be attributed to involvement in CMIT) have led to changes in classroom practices?

6. If so, can you give some specific examples? If not, why do you think this is the case?