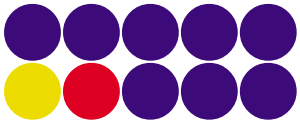

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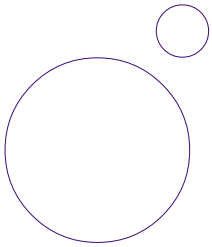

Report of the evaluation of the Count Me In Project

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

by

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Count Me In Too

1996 Report

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Executive Summary

An investigation of the Early Numeracy Project (Count Me In) (NSW Department of School Education) was conducted throughout its duration. This section presents the summaries appearing at the end of each major section in the final report. It is organised according to the findings that emerged from several data gathering strategies, namely, questionnaires, semi-structured interviews, task-based interviews and observations. The purpose of the investigation was to determine the impact of Count Me In (CMI) on those concerned and thus provide some feedback to the instigators of the project.

Summary of Interviews with Consultants

The following points summarise the findings of the pre- and post-project interviews with the four mathematics consultants involved in the project. They are a reflection of the general trends indicated in the data. Hence, all points may not apply to all consultants.

1. Consultants indicated that, to varying degrees, they had been personally and professionally developed during the course of the project, but that it had often been physically exhausting.
2. It was considered that teachers had become more reflective about their practice, had changed their classroom practice and had developed a deeper understanding of how children learn mathematics.
3. While the final test and observations made by the consultants throughout the project indicated that children from all ability ranges improved academically, this improvement seemed to be more pronounced for children in the middle to upper ability ranges.
4. Consultants gained a great deal of intrinsic satisfaction from the observable positive outcomes of the children and teachers.
5. The emergence of networks and collegial support groups in schools was perceived to be a valuable outcome of the project.
6. Consultants considered the classroom support to be a significant factor in the success of the project.
7. Most teachers were perceived to have gained a great deal, both professionally and personally, from the project. Consultants felt that the reasons why a few teachers had not benefited from the project was due to factors beyond their control.
8. While initial concerns about organisation, implementation, documentation, events and resources were never realised for some consultants, a few issues relating to organisation remained unresolved for at least two consultants.
9. Consultants expressed the need for a collegial support group for themselves. Some also felt that

an overall coordinator could provide more direction for much of their work in schools.

10. Consultants considered that additional time and funds needed to be made available for more extensive training of teachers in the beginning of the program and that they required more training in the operation of equipment (such as video cameras) that was vital to the assessment of the children.

11. It was felt that future projects of this nature could utilise the knowledge and experience of many teachers involved in the 1996 project.

Summary of Questionnaire Data Findings

Questionnaires were sent to all teachers participating in the project and their respective principals and deputy/assistant principals at the end of term 3. The questionnaires were designed to collect relevant demographic and biographical details about participants and to elicit perceptions about the program's effectiveness. A number of findings emerged from an analysis of the questionnaire data:

1. Generally teachers and executive staff members were positive about the overall outcomes of the project regardless of initial reasons for participating.

2. All teachers acknowledged that they had changed their classroom practice as a result of their participation in the project.

3. All teachers considered that they had gained knowledge relating to content, strategies, how children learn mathematics or that their prior beliefs about these things had been reaffirmed by their involvement in the project.

4. Executive staff considered teachers involved in the project to have benefited both professionally and personally. The project was also seen to have a positive impact on other staff members not involved in the project.

5. Teachers found contact with consultants, colleagues and teachers from other schools invaluable for their professional development and requested that more opportunities for this type of professional dialogue be provided.

6. The role of the consultants and the relationships they established with individual teachers was considered crucial to the success of the project.

7. All teachers and executive staff members considered that the project had positive cognitive and/or attitudinal outcomes for the children in their classrooms.

8. Approximately one-third of teachers thought that the aims of the project were not clearly articulated during the initial inservice day and that there was

some degree of information 'overload'. However, subsequent meetings were considered more helpful once the project was in progress and teachers were more aware of their roles.

9. Teachers and executive staff shared similar concerns about time required for certain aspects of the project, namely the video-taping of assessment segments.
10. Teachers requested more guidance or clarification, particularly in the form of documentation, for most aspects of the project.

Summary of Case Study Teacher Findings

Three teachers were selected for case study research. This involved two semi-structured interviews with each of the teachers, one at the start of the project and one at its conclusion. While confirming a number of findings from the questionnaires, data from the three case study teachers provides additional information about the success of CMI.

1. The commitment of teachers can play a vital role in the success of the project. Teachers who had higher expectations for themselves and their students at the start of the project indicated that more of their anticipated outcomes had been realised.
2. Despite initial reasons for participating in the project, teachers found at least some aspects to be both professionally and personally stimulating.
3. Reactions to the initial inservice day varied, with only one teacher confident that the day clearly delineated her role and the overall aims of the project .
4. Throughout the project teachers were apprehensive about certain aspects. Providing enough 'time' to complete the assessment of the children was a major concern for all case study teachers. While one teacher quickly resolved the problem, it became a significant source of anxiety for another.
5. All case study teachers considered that they had developed professionally. They considered their content knowledge of mathematics to have improved and their understanding of how children learn mathematics to have increased.
6. All case study teachers indicated that they had changed their classroom practice (by varying degrees) as a result of CMI. They asked more challenging questions of their children and allowed them more opportunities to explore, discuss and reflect on their mathematics. Two teachers considered the impact of the project would influence their teaching for the rest of their careers.

7. While one teacher considered the project to have benefited children of average ability more than the others, two teachers thought that children of all levels benefited, but that the more able students progressed more rapidly.
8. Two teachers indicated that children were more aware of their thinking strategies for solving problems and were able to clearly explain how they solved computations.
9. The role of the consultants was considered to be vital to the success of the project by all teachers, for numerous and various reasons. Namely, the on-going in-school support was considered more valuable than one-off inservice days; the presence of an outside expert provided credibility to the work being conducted in the eyes of the rest of the school; and as a mediator between schools - the consultants kept teachers informed of progress in other schools.
10. Collegiality was seen to be an important aspect of the project. Teachers valued the discussions they had with teachers from their school involved in the project and with teachers from other schools.

Summary of Children's Task-based Interviews and Observational Data Findings

All children who participated in CMI were assessed individually at the start of the project and at its conclusion using the Schedule for Early Number Assessment (SENA). The SENA test involves the presentation of a number of 'tasks' or problems to a child in an interview situation. The interviewer must elicit a child's most sophisticated strategy and then determine where each response might be categorised with in a framework of predetermined stages or levels of development.

In addition, observational data was gathered via a number of classroom visits and video-taping of children. The data provided from these observations are presented in this report as three scenarios.

A number of findings emerged from the task-based interviews and classroom observational data regarding student outcomes that corroborate the anecdotal comments made by consultants and classroom teachers. An analysis of the data reveal the following findings:

1. Approximately three-quarters of children in the sample were using more sophisticated strategies to solve simple addition and subtraction problems at the end of the instructional period than they were at the start of the project.
2. Approximately 90% of children in the sample progressed at least one stage on two or more aspects of numerical development.

3. Children determined to be initially the most advanced made the greatest progress, while children of lower ability progressed at a slower rate.
4. Many children not only used sophisticated strategies to solve computational problems, but were able to justify their responses by clearly explaining their thinking.

Count Me In Too

1996 Report

Report of the Evaluation of the Count Me In Too Project

This report contains findings of an investigation intended to evaluate the impact of the Early Numeracy Project (Count Me In) conducted by the NSW Department of School Education during terms 2 and 3 of the 1996 school year. It includes information obtained from a questionnaire distributed to all participating classroom teachers and their principals and deputy/assistant principals, interview data from three case study teachers and the four consultants, task-based interview data from a sample of children involved in the project and observational data obtained from classroom visits and video recordings.

Design and Methodology

Materials and Procedure

Interviews with Consultants

The four consultants involved in the CMI project were interviewed on two occasions. The two female and two male consultants were interviewed at the start of the project to gather information pertaining to their backgrounds and to establish their expectations and concerns for the project. A second interview was conducted at the end of the project to ascertain their perceptions about the effectiveness of the program in terms of professional development of the teachers involved and for themselves, and in terms of the learning outcomes of the students involved. All interviews were audio-taped and transcribed before being analysed for emerging themes. To maintain the anonymity of the consultants, data from the interviews will be synthesised rather than be presented as individual case studies.

Questionnaires

Questionnaires were sent to all teachers participating in the project and their respective principals and deputy/assistant principals at the end of term 3. Both questionnaires consisted of two parts. The first part of the teacher questionnaire was designed to collect relevant demographic and biographical details about each teacher and their school. It contained questions pertaining to school district, student population, teacher age range, teacher qualifications, years of experience and the like. The second part contained open-ended questions intended to elicit teachers' perceptions about the program's effectiveness in relation to their professional development and its impact on the learning outcomes of the students in their class.

The first part of the Principal and Deputy/Assistant Principal Questionnaire also sought demographic details about each school and contained questions

identical to those in the first part of the Teacher Questionnaire. Part two contained open-ended questions intended to elicit executive staff members' perceptions about the project's effectiveness in relation to the professional development of their staff and its influence on other aspects of the school community.

The questionnaires were distributed by the mathematics consultants, completed anonymously and returned to the researcher by mail to maintain confidentiality of the people involved. Quantitative data was collated and presented in tabular form. Qualitative responses were analysed for emerging themes or categories. Once an initial identification of themes was made data was further analysed with the help of the qualitative analysis program NUD*IST (1994). A copy of each questionnaire appears in Appendix A.

Teacher Case Studies

Three teachers were selected for case study research. The case study teachers were selected on the basis of certain criteria. Namely, the desire to include teachers from at least two different school districts and the inclusion of teachers with a range of experience with the majority being female. The selected teachers were contacted by telephone or in person to ensure that they fully understood the intent of the study and the procedures involved before giving their consent. Following teachers' consent, the school principals were asked for approval for the case study to be conducted on school grounds. The final selection of teachers for case study development rested ultimately on their willingness to be included in the study.

The procedure involved two semi-structured interviews with each of the teachers, one at the start of the project and one at its conclusion. The first interview was intended to gather information about the school and relevant biographical details of the teacher to allow a contextual story to be constructed for each case study. It also included questions relating to each teacher's perceptions and expectations of the CMI project. The final interview sought to elicit teachers' comments pertaining to the outcomes of the project. In addition, a number of informal discussions and classroom observation sessions took place throughout the duration of the project. Notes were taken by the investigator during these informal sessions and used to elaborate on the contextual story of each teacher.

All interviews with case study teachers were audio-taped and transcribed for analysis. Reporting of the case studies will involve two sections. First, the context of the school and biographical details of the individual teacher will be presented, but will exclude information that might disclose the identity of the school or teacher. For this reason, the school districts from which the teachers were selected will not be

reported. Secondly, teachers' expectations of the project and their perceptions of its impact on themselves and their students will be reported.

Task-based Interviews with Children

The Schedule for Early Number Assessment (SENA) was used by all teachers to assess their children at the start and at the conclusion of CMI. The sample of responses presented here was not selected randomly, it was compiled from those results which participating teachers and their consultants made available for inclusion in this report.

SENA has been developed over the past five years and has been used extensively by teachers and researchers to assess the early arithmetical development of young children (Wright, 1996). It involves the presentation of a number of 'tasks' or problems to a child in an interview situation. Examples of tasks include: asking the child to say the number words from one to twenty, or given two covered collections of counters and asking the child how many in all. It is the role of the interviewer to elicit a child's most sophisticated strategy and then determine where each response might be categorised with in a framework of predetermined stages or levels of development (see Appendix B).

In the case of CMI, all interviews were video-taped and later analysed by the classroom teachers with the assistance of district consultants. For most teachers, it was the first time in which they were required to interpret such data and allocate responses to specific stages within a learning framework, hence the findings reported here must be considered in that light. Having teachers assess the development of the children in their own classrooms was an integral component of CMI and for this reason considered worthy of including in a report on the project's outcomes. By including results of tests conducted and interpreted by the teachers involved in the project itself, it not only serves a purpose by presenting student outcomes, it also acknowledges the extent of teachers' newly acquired knowledge and skills.

Observational Data of Children

Throughout the duration of CMI, a number of classroom visits were made by the researcher to observe the project in operation. In addition, extensive video-taping of five children was undertaken by each classroom teacher involved in the project. The video recordings were analysed in conjunction with other observational data to provide 'snapshots' of children as they developed throughout the project. The data provided from these observations are presented in this report as three scenarios. Each scenario is accompanied by a brief contextual description and discussion of its significance to the overall development of the children.

Results

Reporting of all interview data and responses to open-ended items on the questionnaires will give prominence to the individual voices of the people in question. First, data from interviews with the four consultants will be presented, followed by a summary of the questionnaire data provided by teachers and principals and deputy/ assistant principals. Third, case study data will be presented and finally, the results of task-based interview data collected at the start and conclusion of the project from a sample of children with be presented.

Consultants

Background

The consultants had teaching experience ranging from 12 to 25 years, with three originally trained as primary school teachers and one as a secondary mathematics teacher but with extensive experience in primary education. In addition to their initial 2 or 3 year teacher education, they had all completed further education at either the bachelor or masters level and one was currently studying for a PhD in mathematics education. None of the consultants had worked as mathematics consultants before, though one had been a computer education consultant. They all had varied experiences outside the normal classroom, including, administrative responsibilities, Special Education and ESL teaching, involvement in the Maths Recovery and BLIPS projects, and lecturing at the undergraduate level to preservice primary teachers.

Three consultants emphasised the fact that their interest in mathematics developed after completing their formal schooling, usually during their teacher education programs. It was considered that “bad teaching” at high school had prevented them from achieving their full potential in mathematics rather than any lack of ability on their part. They emphasised that they were motivated to “change” the way mathematics was taught in schools so as to give all children the opportunity to be successful in mathematics.

In short, the consultants were highly motivated individuals with a vast amount of practical experience in teaching children. In addition, their interest in further education meant that they were familiar with research and theory currently directing mathematics education.

Interview Results

Analysis of the pre- and post-project interviews resulted in three major categories emerging. Namely outcomes, responses and needs. Each of these categories have been further subdivided into a number of sub-themes and are discussed below.

Outcomes

During the initial interview the consultants referred to a number of outcomes they anticipated would occur as a result of the CMI project and during the final interview they commented on how these outcomes did or did not eventuate. These anticipated and eventual outcomes concerned themselves, the teachers they would be working with and the children involved in the project.

The consultants considered that their involvement in the project would impact upon themselves both professionally and personally. One consultant thought that the project would give "me a deeper professional understanding of early ...number skills" and another expected "to gain a lot of skills in diagnosing problems and then working through programs with children". When asked in the post-project interview whether their anticipated outcomes for professional development had occurred, they all commented that they had "learnt a lot about ... how children learn mathematical knowledge" and two commented on how they had learnt "about working with teachers". One thought that an impact had been made "on a variety of levels to enrich me - personally, professionally and as an educational leader". However, another consultant considered that:

> It happened to a certain extent, probably not as much as what I'd envisaged. I think I got a more global picture of what children are learning than what I thought I'd get at the beginning. I think I became much more attuned to what kids were actually thinking.

On a more personal level, consultants anticipated that working with small groups of teachers in their classrooms would be "fulfilling and most enjoyable", providing them with some "intrinsic" reward. Their comments at the end of the project indicated that all the consultants experienced "enjoyment" from their involvement and many of them had also developed strong personal links with classroom teachers "to the extent that we'd sit back talking after school to 6 or 7 o'clock at night about what had happened in their class and about general educational issues". Related to this emergence of consultant-teacher "friendships", was the establishment of "networks" between individual schools and the consultants. These networks helped the consultants feel "comfortable" when working in the different schools.

The consultants also had expectations for the teachers involved in the project, namely that they would achieve positive outcomes "both personally and professionally". It was hoped by all the consultants that not only would teachers "change" their classroom practice but that they would "become more reflective generally about their teaching". While it was anticipated that the content knowledge of teachers would be improved, each consultant stressed the desire to improve teachers' knowledge of "how children learn

mathematics". It was hoped that teachers would be able to "ascertain clearly where the children are in their understanding and knowledge, ... tailor the teaching to fit the needs of the children" and provide "much more meaningful learning for them".

At the end of the project, each of the consultants felt that their initial expectations for teachers had been surpassed. Not only was it considered that the teachers were now "able to look at children learning in a different and deeper way", they also referred to teachers who had confided in them that they had "gained a knowledge, a power" to deal with mathematics.

> They felt empowered to talk about mathematics. That was really exciting. They felt special because they felt that they'd been selected to do something really good, really interesting. A couple of teachers would say that it's one of the best things they'd ever done.

Three consultants had reservations about the impact of the project on at least one teacher in each of their districts. One consultant felt that one teacher would not "have learnt much at all" because she could not "put aside some (preconceived) ideas of what the kindergarten curriculum was", always expressing the view that "things were too difficult for her class" and that the classroom was often "unruly and the children were not focused on what they were doing". Another consultant thought that one teacher had not gained as much as the others possibly due to an incompatibility of their "teaching styles", but it was thought that even she would have "definitely learnt things". The third consultant considered that "another agenda" in one school inhibited the success of the project and was unsure that practices developed during the course of the project would be continued once her support in the classroom was removed.

The last major outcome of significance to consultants was the impact the project had on the children involved. Consultants varied on their anticipated outcomes for children, but they all considered both academic and affective issues important. While three consultants commented that they wanted to provide "challenges" for the children involved in the project, it was also a concern that lower ability students "actually achieve something mathematically before ... they decide they can't do mathematics". One consultant felt unsure that the children would "necessarily get much out of it in the short term", since it would more likely "take me and the teachers a while to understand and to use this information" and that in the meantime "we could even slow-up instruction". Again consultants indicated that their expectations had been surpassed by the extent of outcomes achieved by most children. Two consultants noted that academic outcomes were noticed almost immediately.

> We started to see positive academic outcomes straight away. That was just mind blowing. I remember about two-thirds the way through term 2 I had a lot of my own conflict with what these children were showing us they could do, what was in the Syllabus and what the teachers had actually planned in their programs. The three things just didn't match. The children were quite beyond these things. ...Academically it was a wonderful thing to happen for them.

Three of the consultants commented on the fact that the testing procedures built into the project had revealed that all children had improved to some extent. It was also thought that "even though it has been great for all kids, ...in some ways its widened the gap" since "some kids took-off" and others "made slower progress". However, even if children didn't make progress "we in some ways were able to unmask what was happening for those kids".

One consultant was impressed by the positive attitude towards mathematics that developed in many of the children. Teachers had reported to the consultant that "the children are talking about mathematics in the playground ...about these patterns that they've seen and what they've noticed".

Responses

The project elicited a number of emotive responses from the consultants during the initial and post-project interviews. The comments that fell into this category were further divided to form the subcategories of excitement, apprehension and frustrations.

During the initial interview consultants spoke about being "excited about the whole idea", however apprehensions about aspects of the project seemed to be more pressing for at least two consultants at this stage. Concerns related to the overall organisation of the project, the actual implementation of the work with teachers, the accompanying documentation and particular events.

> After that initial excitement I thought that the project was very disorganised. In terms of it didn't seem to have guidelines or the purposes of the project weren't clear to me. There was very little on paper. ...I felt that we were doing exciting and important work but how that was going to operate I was unsure. It was explained to me that it was organic in nature and participants would help determine the direction of the project. ...I understood that, but it still left me with a level of apprehension about the organisation.

> We're sitting here Thursday, planning Monday's inservice. I have great problems with that. We don't know exactly what we'll be doing, as far as I'm concerned. On Monday we're going to go through this, but what are the teachers then got to do?

To a lesser extent, consultants were also initially concerned about the apparent lack of resources, namely "funding" and the related issue "time". One consultant was particularly concerned about the project being "underfunded" and the necessity to "give the teachers and consultants a great deal more training in the initial learning framework".

The post-project interview indicated that many of the initial apprehensions "did not become a reality" but for two consultants in particular, some major concerns remained unresolved. One consultant was "feeling a little bit frustrated about today's meeting" because she was not informed of certain requirements until it was "too late" and another thought that "the disorganisation of the project continued to...hamper the implementation". In addition, other "frustrations" had emerged. Three of the consultants remarked that at times they were "physically exhausted" because they were "rushing from one class to another" or having to travel long distances to schools in the country. It was felt that their own learning was "inhibited" by their inability to spend more time with "one group of children". One consultant remarked the "busyness of schools" gave the "sense that I was imposing by asking them to do something". It was also considered a problem that some schools had been chosen to participate in the project "where the principal was very enthusiastic, but the staff were surprised to be in it. They weren't as committed". For one consultant, it "got to the stage where I disliked going to" one teacher's classroom.

Despite frustrations and some initial apprehensions not being resolved, consultants were still excited generally about the project. In particular, they found working with teachers in their classrooms most "exciting" and considered it a significant factor leading to the success of the project. Three of the consultants commented that they had "enjoyed the collegiality" that often developed between the three teachers and themselves. Just being able to "share the ups and downs of something...and bounce ideas around" was valued highly. Consultants were excited particularly when teachers commented to them "that their teaching had changed and they would never teach maths the same again" or that they had seen "the light go on for the kids".

Needs

The needs category emerged from an analysis of the post-project interview transcripts. Comments that fell into this category dealt with the needs perceived by the consultants to make the project more successful if they were to be involved in a similar venture in the future. Perceived needs revolved around three major subcategories, people, events and resources. Many of these needs emanated from comments that were identified in other categories. For instance, from the people subcategory, "collegiality" was noted to be helpful by consultants when working with teachers and many of them

developed informal links with other consultants. For one consultant it "was what I needed and what he needed too - it was very important", but others "would have liked closer contact" with other consultants so that they could share ideas and "get moral support". Two consultants thought that such contact should in future be formalised and it was suggested that there needed to be a person "in the role of coordinating the program" and be responsible for keeping records of meetings and talking to consultants about the direction they were taking in schools. It was thought that such a person needed to be someone other than a Department of School Education staff member, because although they were perceived to be "always willing to listen and give me support" others thought that they were too far away or "too busy" to allocate the attention required.

Two of the consultants felt that there needed to be better training in the beginning for both the teachers and themselves to use video cameras and that the teachers needed "a much better idea of how to administer the SENA". Funds for resources was a major issue for two consultants since "a lot of contact and cardboard" had been purchased with district office money that was intended for the entire year and the number of video cameras "was limiting the things you could do".

Consultants also felt that many teachers involved in the project in 1996 "would make excellent lighthouse people as a network system to visit schools next year" and that this somehow needed to be built into the project in future. Finally, one consultant expressed the need to trial the program with a number of "small schools where you've got one or two teachers on staff" because it was felt that such a context was different to anything else trialed and it could not be assumed that they would operate like other schools.

Summary of Interviews with Consultants

The following points summarise the findings of the pre- and post-project interviews with the four mathematics consultants involved in the project. They are a reflection of the general trends indicated in the data. Hence, all points may not apply to all consultants.

1. Consultants indicated that, to varying degrees, they had been personally and professionally developed during the course of the project, but that it had often been physically exhausting.
2. It was considered that teachers had become more reflective about their practice, had changed their classroom practice and had developed a deeper understanding of how children learn mathematics.

3. While the final test and observations made by the consultants throughout the project indicated that children from all ability ranges improved academically, this improvement seemed to be more pronounced for children in the middle to upper ability ranges.
4. Consultants gained a great deal of intrinsic satisfaction from the observable positive outcomes of the children and teachers.
5. The emergence of networks and collegial support groups in schools was perceived to be a valuable outcome of the project.
6. Consultants considered the classroom support to be a significant factor in the success of the project.
7. Most teachers were perceived to have gained a great deal, both professionally and personally, from the project. Consultants felt that the reasons why a few teachers had not benefited from the project was due to factors beyond their control.
8. While initial concerns about organisation, implementation, documentation, events and resources were never realised for some consultants, a few issues relating to organisation remained unresolved for at least two consultants.
9. Consultants expressed the need for a collegial support group for themselves. Some also felt that an overall coordinator could provide more direction for much of their work in schools.
10. Consultants considered that additional time and funds needed to made available for more extensive training of teachers in the beginning of the program and that they required more training in the operation of equipment (such as video cameras) that was vital to the assessment of the children.
11. It was felt that future projects of this nature could utilise the knowledge and experience of many teachers involved in the 1996 project.

The Questionnaire

The Teachers

Demographic and Biographical Data of Participating Teachers

Twenty-six questionnaires were returned, representing approximately 70 percent of the total number of teachers involved in the Count Me In Project. A summary of the results for part one of the questionnaire are presented in Table 1.

Table 1 *Demographic and biographical details of respondents to teacher questionnaire (n=26)*

Category	Details	Percentage
Gender	Female	85.0%
	Male	15.0%
School Size *	100-200 students	11.5%
	201-300 students	23.0%
	301 + students	62.0%
Nature of Population **	High % NESB	19.0%
	High % Aboriginal	12.0%
	Predominantly Anglo Saxon	54.0%
	Low socio-economic	35.0%
	Middle Socio-economic	58.0%
	High Socio-economic	3.8%
Age range (years)	20-30	23.0%
	31-40	38.0%
	41-50	31.0%
	50+	8.0%
Teaching Experience (years)	1-5	8.0%
	6-10	19.0%
	11-15	23.0%
	16-20	38.0%
	21+	12.0%
Current Year Level	Kinder	34.5%
	Year 1	31.0%
	K/1	19.0%
	Yr1/2	11.5%
	K/1/2	4.0%
Years Teaching Current Level	1-3	38.0%
	4-7	31.0%
	7+	31.0%
Highest Level of Teacher Ed *	Diploma of Teaching	38.0%
	Bachelor Degree	38.0%
	Teacher's Certificate	15.0%
	Masters Degree	4.0%
Undertaking Further Teacher Ed	Yes	12.0%
	No	88.0%

* Not all respondents completed this question.

** Some responded to more than one category.

Analysis of Classroom Teacher Responses to Questionnaire

Findings reported in this section were obtained by analysing open-ended responses for patterns and key themes. Four major categories of responses emerged: participation, outcomes, responses and needs. Each of these categories will be discussed briefly giving prominence to the teachers' voices as much as possible, therefore utilising quotes that typify teacher perceptions.

Participation

Fifteen percent of teachers who responded to the questionnaire indicated that the final decision to participate in CMI was not made entirely by themselves. For these teachers, the final decision was made by the "principal", "other teachers" or by the "entire school" at a staff meeting. Another 11% indicated that their final decision was influenced by the "respect" and admiration they held for the district consultant that introduced the school to the project. The desire for professional development was the most often cited reason for participating in CMI with 65% of teachers indicating that their involvement was an opportunity for "professional development and to strengthen maths teaching skills" in the early childhood years. Generally, teachers thought the project would benefit them professionally by helping their "understanding of maths concepts to increase", by providing them with "ways of extending children" in their classes and by informing them of "how children learn and acquire number skills".

Thirty percent of teachers referred to personal reasons for deciding to participate in CMI. For instance, a number of teachers commented that they found the whole CMI concept "exciting" and were personally "interested in learning about any new programs or teaching strategies". Another teacher considered herself to be "bored" with teaching maths and was hoping to "get my teeth into something" to relieve the boredom.

Responses

Teachers recorded their affective responses to most aspects of the project. In particular they considered events, key people and documents. For instance, a number of events that occurred throughout the project triggered mixed reactions amongst the respondents. The initial inservice day was generally viewed negatively, including 20% of respondents who considered "the aim of the project was not clearly outlined nor what was expected of us" and the fact that many found the "new terminology confusing" and too much to absorb in one day. Three teachers indicated that they would "like to re-visit the theory side of the project" now that they more fully understand its aims and how it was to operate. The second session, however, was viewed much more positively:

> The second session with n...(lecturer's name) was excellent - where we viewed videos of children being taught and discussed what they were 'learning' and how they were being 'taught' - but it would have been more useful earlier-on in the program.

The initial and final video taping sessions of the children for assessment was considered "time consuming" and "difficult" by 19% of respondents. Despite this, many of the same respondents also considered the assessment process to be "extremely useful" and "helpful" as it gave teachers "a chance to focus on individuals and assess their growth" and taught them "to focus on the strategies not the answers".

Due to the perceived benefits teachers gained from "professional dialogue" with colleagues, consultants and teachers from other schools, a plea for "more opportunities for schools in the district to get together" with their consultants was a recurring request. Similarly, time spent "sharing knowledge, problems and anecdotes" with their colleagues and teachers from other schools was viewed positively by 35% of respondents, with many expressing the need to extend this contact by arranging for teachers to observe the "successful practices and activities" of others. One teacher suggested that:

> Now that it has been run, I feel the next group would benefit from a teacher explaining the project initially, ...to give a better overall view of how it is run in the classroom.

Other events that teachers found valuable were the opportunities to not only observe math consultants teach, but to observe their own students engaged in learning, thinking and reflection:

> I found it fascinating watching children engaged in lengthy times of thinking and reflection. We gave them the opportunity and time to do this and watched amazed at their concentration.

As an 'event', the Early Numeracy Project in its entirety, received overwhelming and unconditional support from 81% of respondents:

> It's a great way to inservice teachers. Inservicing is always more powerful when a number of teachers from the same school can benefit from it. Thanks - I've thoroughly enjoyed it and I'm no longer bored.
>
> An enormous beneficial experience for all involved, especially as an STLD as it was used well with primary children who need a strategy and to be directly taught.

Positive comments about aspects of the project were made by all teachers despite their reasons for participating in the project initially. However, teachers who participated "at the request of the principal" were more likely to have reservations about some elements than those who felt that they needed the "professional development".

The role of key people in the numeracy project was perceived by teachers to be a crucial element. In particular, the "supportive consultant" was viewed by at least 3 teachers as a major determining factor in deciding whether to participate in the project or not. Furthermore, reference to "helpful discussions", "helpful advice from our consultant", the expert knowledge of consultants, and respect for a consultant's "professional judgement" pervaded responses to almost every question for 31% of respondents. The overarching perception of teachers was that the success of the project depended to a great extent on the consultant - both the relationship they had with them and their expertise was considered important:

I have a lot of respect for n....'s (consultant's name) professional judgement and I valued n....'s interest in the project. ...It has been a lot of work and involvement, but very worthwhile. I do not believe it could have been successful without the tremendous input we had from n.....

The only negative comment that was made about a consultant indicated that "too many ideas from a very helpful consultant" resulted in 'overload' given the short time frame of the project and that "more time to develop a program of lessons with other participants would have been helpful".

Other people that figured greatly for 35% of teachers responding to the questionnaire were "colleagues" and "teachers from other schools". To a lesser extent, contact with "university lecturers" was also considered invaluable:

> I've learned new strategies from working with n....(consultant's name), and discussing ideas/activities with the other project teachers at other schools and how these activities fit into the learning framework.
>
> The half day sessions with colleagues and consultants was invaluable when we shared knowledge, problems, interesting happenings in our classrooms and spent some time watching children being assessed on the video.

Thirty-one percent of responses from teachers referred to documents such as the *Mathematics Syllabus K-6* (1989) or to documentation supplied as part of CMI that outlined the project's theoretical perspective and classroom activities supporting the Learning Framework. For example, a number of teachers considered that they had benefited from the "additional reference to the current syllabus" with 23% of the opinion that the Learning Framework gave them "more detail ...than I've learnt from the curriculum":

> Learning about the 'Learning Framework' - I can see/understand where individuals fit in, and therefore what I need to teach them in more detail and more specifically than I've learnt from using the curriculum.

At least two respondents indicated a need for more documentation from the project coordinators in the form of "lessons ...providing a step by step approach from using concrete materials ...to the abstract" or "activities which could be used to support the SENA test".

Outcomes

The final category in which responses fell referred to outcomes of the project. This category was by far the largest of those emerging from the data. Teachers referred to outcomes in a number of different areas. For the purposes of analysis of this report it is helpful to subdivide this category into outcomes pertaining to: teacher professional knowledge; attitudinal changes; classroom practice; children's knowledge and skills; and children's affective responses.

Teacher professional knowledge related to comments about content knowledge, knowledge of strategies and of how children learn. Almost all teachers expressed the notion that they now felt they had a "greater understanding of content and strategies children need and use". The project allowed some teachers to go "beyond what has been seen as 'kindergarten maths'". For those teachers already familiar with the content and strategies presented "..it has refocussed my attention on how to most effectively teach these strategies."

Many teachers felt that their attitude to teaching mathematics had already been quite positive and therefore did not change significantly as a result of their involvement in the project. However, 42% of teachers commented that they were now more "enthusiastic", "confident about teaching mathematics" or no longer "bored" by their teaching of the subject.

All teachers acknowledged that they had made changes to their classroom practice. While some commented on the increased "use of games" or the adoption of a more "hands-on" approach, others considered that they now encouraged "higher levels of thinking" from their children, taught "specific strategies", teach more to the "individual levels" of their children and encourage more discussion in the classroom by allowing "the children to discuss their methods a lot more and to learn from each other".

It was the view of every respondent that the children in their class had benefited by their involvement in the project. Sixty-two percent of teachers felt that the final assessment of the children confirmed their observations that there was increased "understanding of math across all ability groups". With the lower ability children developing "strategies previously undeveloped and higher ability students extended". However, a small number indicated that the less able children did not progress as much as the higher ability children. Thirty percent of respondents commented on the children's

increased confidence, enjoyment and enthusiasm to solve problems and use large numbers. Many teachers noted that their students were able to "think", "reflect" and "to talk about maths" as a result of their involvement in the project.

Needs

Almost three-quarters of the teachers responding to the questionnaire considered there were shortcomings of the project. These were often expressed in the form of perceived needs. Comments that fell into this category were further divided into the four sub-categories resources, guidance, knowledge and contact. For instance, under the sub-category of resources, the need for more "time " to be allocated to almost every aspect of the project was made by 46% of respondents. Some thought that the "program needed to be extended beyond two terms so that the work begun can be continued". In particular, the request was made for additional time to train themselves to conduct the assessment sessions more effectively and that professional assistance be given to help with video-taping the children.

Another perceived need emerged in the form of guidance. Thirty-one percent of respondents expressed the desire for more clearly defined "aims of the project" so that they might know exactly "what was expected" of them. To a lesser extent, teachers indicated a need for more guidance in the form of "specific activities for children at each stage in the Framework", especially at the start of the project. Guidance or clarification was sought on almost every aspect of the project by at least one respondent.

In relation to the need for knowledge, two respondents indicated that they would have liked the opportunity to "re-visit the theory" once the project was established. Others wanted more "expert knowledge sooner" from their consultant .

Finally, the overwhelming positive reaction to contact with colleagues, teachers from other schools, consultants and university lecturers saw respondents wanting more opportunities for "professional dialogue". One teacher suggested that "the half days for planning could be planned with other participating schools to discuss what they are doing and get new ideas".

The Executive

Demographic Data of Executive Staff Questionnaire

Eleven questionnaires were returned, representing approximately 69% of the total number of executives in schools involved in the Count Me In Project. Members of the executive staff at some schools were also the teachers participating in the project. These staff members were not required to complete both questionnaires as many items were similar. A summary of the results for part one of the questionnaire are presented in Table 2.

Table 2 *Demographic details of respondents to principal and deputy/ assistant principal questionnaire (n = 11)*

Category	Details	Percentage
School District	Clarence/Coffs Harbour	27.0%
	Lismore	9.1%
	Parramatta	36.0%
	Port Jackson	27.0%
School Size	100-200 students	18.0%
	201-300 students	9.1%
	301 + students	73.0%
Nature of Population *	High % NESB	36.0%
	High % Aboriginal	9.1%
	Predominantly Anglo Saxon	55.0%
	Low socio-economic	64.0%
	Middle Socio-economic	55.0%
	High Socio-economic	0.0%

* Some responded to more than one category.

Analysis of Executive Staff Responses to Questionnaire

As for the Teacher Questionnaire, open-ended responses were analysed to identify key themes. Four major categories emerged: participation, responses, outcomes and changes. Each of these categories will be discussed briefly in the following section. First, it must be stressed that many executive staff members felt that they were unable to comment on some aspects of the project because they were not involved directly and relied on the verbal reports of those who were involved. Hence, some comments echo those presented in the section dealing with the Teacher Questionnaire.

Participation

Generally, the decision to allow teachers to participate in CMI was ultimately that of the principals. The reasons behind such decisions were numerous and quite varied. Only 27% of returned questionnaires indicated that the decision to participate in the project had been made in consultation with the teachers who were to be involved. Other reasons cited made reference to teachers' desires for professional "development in early numeracy" and their "keenness" to be involved in any "new program". The desire for teachers to be professionally developed was mentioned by 36% of respondents. Some principals indicated that they hoped "to see improved teaching strategies" or that their teachers would "get more knowledge", while others valued the "in school" model that encouraged "people to examine practice" and were not willing to let "opportunities for innovation" to be missed. One principal indicated that

his or her own personal "interest in mathematics" had been a contributing factor to making the final decision to participate in CMI.

While the desire to "see improved learning outcomes for children" was a determining factor for 36% of respondents, 18% were "positively influenced" by the district consultant. One principal and staff indicated that they had made the ultimate decision to participate in the project based on the "impressive" presentation of their consultant. Another school chose to become involved because the staff agreed with the consultant's "philosophies" on mathematics education.

Responses

Executive staff members were asked to comment on their teachers' responses to the CMI project. Eighty-three percent of comments in this category were overwhelmingly positive. Respondents perceived the reactions of their staff to the project as being "enthusiastic", "interested, committed, receptive, flexible, open-minded" and "excited to share what they are discovering about their children's learning". There was general support for the model of school-based learning and a great deal of praise for the "outstanding support" provided by consultants.

The remaining 17% of comments in this category were framed more negatively, with the majority (80%) originating from one respondent. The executive staff member responding from one school perceived a participating teacher to be apprehensive about the "level of commitment", the "amount of time" required to complete some components and the "variation between the program and the syllabus". Another respondent considered the response of teachers was "positive on the whole although teachers sometimes were frustrated *with the* added workload".

Outcomes

Outcomes of the project were referred to more often than comments in any other category. Respondents included outcomes for the teachers involved in CMI directly, for other staff members and for the children involved in the project. Teachers were perceived to have "improved their teaching strategies", "increased their understanding of the syllabus", improved their "confidence and attitude toward maths" and been "inspired" by the results of the project. While one executive staff member felt that the benefits would have been far greater if the project had started from the beginning of the year, a few were concerned about the workload and time needed to video-tape each child during the assessment components of the project. Teachers were perceived to be re-examining their "personal philosophies" regarding mathematics and expecting "higher levels of thinking" from their students. In short, the project was

seen by executive staff to impact upon teachers lives, both professionally and personally.

Eighty-two percent of respondents indicated that the project had positive outcomes on other staff members. These outcomes ranged from "interested to hear about activities and strategies" to many asking "for copies of relevant materials" and some even "trialing many of the teaching and assessment strategies".

The impact of CMI was perceived by 100% of respondents to produce positive outcomes for the children. They were seen to have improved their "understanding of mathematical concepts", "increased their enthusiasm and confidence" for the subject, "developed oral expressive skills in reasoning" and "developed higher-order thinking skills". There were no negative outcomes reported regarding the children *involve*d in the project.

Changes

Responses in this category referred to suggestions to change some aspect of CMI. Twenty-seven percent of respondents thought that, from their perspective, no aspect of the project needed to be changed. The majority of comments recommending change referred to the video-taping and the length of time required to complete the task. The remaining suggestions were aimed at capitalising on the positive outcomes already evident. For instance, some felt that the project should have "started at the beginning of the year" to maximise the benefits to the children. Another felt that there should be "more input by teachers" because "they have a lot to contribute too". A number of respondents felt that the program needs to have some "follow-up" in the form of inservicing for other staff members so that the "children will not loose the momentum" for learning. It was also suggested that teachers involved in the project in 1996 "need continuing guided reflection meetings" to help them continue their work and that more "feedback" about how other schools were functioning was essential to gauge their own progress.

Summary of Questionnaire Data Findings

In short, a number of findings have emerged from an analysis of the questionnaire data:

1. Generally teachers and executive staff members were positive about the overall outcomes of the project regardless of initial reasons for participating.
2. All teachers acknowledged that they had changed their classroom practice as a result of their participation in the project.

3. All teachers considered that they had gained knowledge relating to content, strategies, how children learn mathematics or that their prior beliefs about these things had been reaffirmed by their involvement in the project.
4. Executive staff considered teachers involved in the project to have benefited both professionally and personally. The project was also seen to have a positive impact on other staff members not involved in the project.
5. Teachers found contact with consultants, colleagues and teachers from other schools invaluable for their professional development and requested that more opportunities for this type of professional dialogue be provided.
6. The role of the consultants and the relationships they established with individual teachers was considered crucial to the success of the project.
7. All teachers and executive staff members considered that the project had positive cognitive and/or attitudinal outcomes for the children in their classrooms.
8. Approximately one-third of teachers thought that the aims of the project were not clearly articulated during the initial inservice day and that there was some degree of information 'overload'. However, subsequent meetings were considered more helpful once the project was in progress and teachers were more aware of their roles.
9. Teachers and executive staff shared similar concerns about time required for certain aspects of the project, namely the video-taping of assessment segments.
10. Teachers requested more guidance or clarification, particularly in the form of documentation, for almost every aspect of the project.

Teacher Case Studies

School and Teacher A

The Context

School A is an inner-city primary school with a preschool attached. There are approximately 290 students enrolled currently and 9 classes in the K-6 range. The students come from "mixed socio-economic backgrounds", but mainly draw from the low to middle-class groups. Thirty-five percent of the student population is of Koori origin with a number of ethnic minorities represented in the remaining 65%. There is a fairly high proportion of transient students that oscillate between the urban and a rural environment. The school philosophy is one of collegial support and classes are structured to encourage this philosophy. For instance, teacher A is one of two Kindergarten teachers and a Year 1 teacher whose classes are grouped together for instruction. The three teachers collaborate and rotate responsibilities for each key learning area.

Teacher A

Teacher A is a female Kindergarten teacher, with 21 years teaching experience - 15 years at the current school. While having experience teaching a variety of grades, she has spent nearly 16 years on Kindergarten classes. She initially trained at Armidale Teacher's College where she completed 3 years of teacher education, specialising in infant education. She has not undertaken further accredited training since then, but has been "heavily involved in inservicing and continuing education courses, particularly dealing with *Aboriginal Education".*

Background in mathematics and teaching mathematics

Teacher A has always enjoyed mathematics, having completed it to the Higher School Level (HSC). While she did not consider herself to be "a fantastic mathematician", she liked the maths "that is relevant to day-to-day living and that's the side that ...I emphasize when teaching maths to young children". Despite this fairly positive and practical view of mathematics, Teacher A considered herself not to "have a mathematical mind", feeling that she only learnt what she needed to know in the classroom "but didn't go beyond that". She attributed this mainly to a "lack of confidence" in her ability to deal with more "difficult" problems and the fact that she considered herself not to be a "risk taker".

Teacher A particularly liked teaching "junior maths" because it was "hands-on". She emphasized the fact that she "heavily used concrete materials, especially with the younger kids as a support and as a visual thing". When teaching

mathematics to children she likes "to work slowly through all the steps so that things are taught along the way and I try to eliminate gaps" in *the children's learning.*

Initial impressions and expectations of CMI

One of Teacher A's reasons for becoming involved in the CMI project was because of her lack of confidence in mathematics she thought it would help her with "ideas" in the classroom. She also indicated that the amount of support from the Department of School Education also made it look like a "positive thing to do".

Teacher A's reaction to the initial inservice day for teachers was also positive. She thought that "things were clearly spelt out and the information we received was good". Her initial impressions were that it was a worthwhile project for both herself, her colleagues and the children in their classes.

Personally, Teacher A hoped to "gain some knowledge and lots of ideas for activities...to have a better knowledge of the kids, better and quicker ways of assessing, ...and to match appropriate activities to the levels of development of children" from her involvement in the project. However, her "ultimate aim" was for the children "to improve" and to "enjoy maths". Her expectations of the consultant attached to her school were not clearly defined at this stage, but she thought that the consultant would be able to provide activities, a "good link with other schools" and "help put it all in perspective".

A major concern for Teacher A initially was how much "time" was going to be involved. However, she already felt that "we've learnt something already with the assessment task and I think that that's m*ade the time worthwhile".*

Final impressions and perceived outcomes

Teacher A's impressions of the CMI project at its conclusion remained positive. She described it as "a fantastic experience" that "was probably one of the best projects I've ever been involved in" because "it was very practical" and well "supported by reading material", inservice days and consultants. She considered it to have "inspired her to teach mathematics in the future".

Initial concerns regarding the time required to assess the children in her class were resolved early in the project. By working together the three teachers were able "to manipulate our day so that we could get some time to do the assessments". The final testing was considered to be much "easier" because they "were much faster" and more organised with their time and classes.

In relation to outcomes of the project, Teacher A felt that her "content knowledge was broadened" and she had developed a greater "depth of understanding" of how children learn mathematics. She was confident that she

was able to challenge all the children in her class and no longer felt restricted by what was seen as "kindy maths". She considered herself to be better at "knowing the level of the kids" so that she could "take them to the edge as often as" she could, but at the same time keeping them "feeling secure". Teacher A now felt that kindergarten children were "more capable" than what she had previously thought and that "it is just how you present the work" that makes the difference. She also felt that "the knowledge I've gained about the kids will always be part of what I teach".

The relationship that developed between Teacher A and the consultant, and between the consultant and the children was of particular importance to the teacher. The consultant was described as "a very caring teacher" whom the "children loved working with". It was felt that the consultant's presence in the room allowed "maths to become more vital to them and much more exciting...we were all building on a shared knowledge". The consultant was also seen to be a "mediator from the outside, someone other than just the three of us who could talk about what we were doing". A significant role of the consultant was to keep Teacher A and her colleagues informed of "what other schools were doing" so that they did not feel isolated in the project.

When considering the impact of the project on the children in her class, Teacher A was excited by the general "improvement in the academic ability of all children", but in particular, she considered it "startling" to see how much the "more capable children" gained. She described the "gap between the more capable and the less capable" children being "widened because the bright ones" were challenged and able to cope with the work. However, she also thought that while the gap may have become more pronounced, they were now able to "locate the areas of concern for the slower children" and "have more definite directions to work on" with these children. The slower students remain a concern for Teacher A, in that she would like to know "more ideas" for helping them.

Besides the role of the consultant being a major contributing factor to the success of the project, Teacher A considered a number of other aspects to be important. For instance, she considered the "stages" of development as presented in the Learning Framework useful because she could now quite "easily build on that knowledge and move them through the stages". The stages provided a type of 'map' for Teacher A so that she would know where to direct her children next. In addition, she felt that "having three teachers was important ...because we could always report back to each other". The "good working relationship" between the three teachers involved in CMI at School A meant that they could provide "a lot of support for each other". As mentioned earlier, the strong support by colleagues in the school was also a significant factor in

overcoming some concerns about the amount of time required to assess the children at the start of the project.

Throughout the final interview, Teacher A spoke of the project as something 'special' in which she had the privilege of participating in. Teachers in School A not involved in CMI and friends teaching in other schools were seen to be "jealous that I've had such a good chance to be professionally developed" through this project. She thought that while she and her colleagues could "always inservice people...its the involvement that keeps you enthused. One-off things aren't as good, you need an on-going project". She also echoed the sediments of two consultants when she commented that had the project "been for the whole year I might have been exhausted". This exhaustion seemed to be as much a result of mental fatigue brought-on by the amount of new knowledge and reflection required, as well as the physical requirements of extra work and time needed when something 'new' is first implemented in a classroom.

School and Teacher B

The Context

Primary School B is situated on the western fringes of an urban environment. It has an enrolment of approximately 440 students drawn mainly from the middle socio-economic levels of society. It is comprised mainly of students from a white Anglo-Saxon background. The school was described as being part of a "very close knit" and stable community with a "very supportive and interested parent body". While the school had been established for more than fifty years, it was undergoing major renovations to the older building and extensions in the form of new classrooms for their "expanding" population.

Teacher B

Teacher B is a female Kindergarten teacher in her first year of full-time teaching. She has had 7 years experience as a casual teacher where she had the opportunity to teach a variety of grades. It is her first year at School B and indicated a preference for teaching upper primary. She did her initial training as a mature-aged student at the University of Western Sydney, Nepean where she completed a 3 year Diploma of Education. She is now doing her fourth year through the University of Newcastle by correspondence. With only 2 subjects to complete for her Bachelor degree, she has found studying difficult while "working full-time, with a family".

Background in mathematics and teaching mathematics

Teacher B had done advanced mathematics to Year 10 and then left school and did another 2 years of mathematics as part of a chemistry certificate at TAFE. She has always enjoyed and liked maths because she "was very good at it". As a mature-aged student she found it difficult during her teacher training because "everything had changed so much". She indicated a preference for "drill and practice" because she "liked the rules...there was just a couple of ways of doing it and you knew what you had to do". Solving problems where there were no clear guidelines caused her great difficulty. However, she felt that she now had "a handle on it" and enjoyed doing problem solving with Years 5 and 6. She considered teaching kindergarten the number facts from 1-9 "a bit mundane" especially when she felt they could go beyond the level of work i*ndicated in the Syllabus.*

Initial Impressions and expectations

Teacher B was open about the fact that she was "roped into" CMI by her principal. She "wasn't particularly interested" in the project because of her university work. This meant that she was quite apprehensive and unsure about her commitment to the project because she did not know "how much extra work it was going to be". Despite this reluctant participation, she claimed that "finding out how far children can go" had been exciting.

Her initial impressions of the project were that it "was just all too much, too quick" and she was still unsure of what was expected of herself. "Time" was a recurring concern for Teacher B. She felt that the testing had "taken-up" too much time and that the work in progress was beginning to cut into preparation time for other subject areas. She had no expectations of the program in regards to her own professional development, but thought that it "would allow children who are a bit gifted in mathematics the opportunity to go a lot further" and that it would provide her with a "better *profile" of each child.*

Final impressions and perceived outcomes

Teacher B's initial concern about there not being "enough time" continued to frustrate her for the duration of the project. "It took more than the time allocated to us and we had to put some of our own release time into" the project. During this interview it was revealed that Teacher B had continued working on her "program from the syllabus that we normally go through" and keeping the CMI work separate and additional. She felt that she now had to "catch-up" with the usual kindergarten program because CMI had stopped.

Despite the feeling that she "didn't understand all" the theory, she considered herself to have a much "better understanding of how children learn mathematics" and

the stages they go through. However, she felt she still had difficulty judging "the progression of children who were really battling" and that it was the "middle group" of children that made the most progress. It was thought that the "slow and bright children" had not shown much progress and she was now "apprehensive about how far you could actually take kindergarten children". She considered the "analysis of the testing" to be unhelpful because she found it difficult to "work out what they did and didn't know".

While the academic outcomes for the children in her class had not been what she expected, Teacher B thought that the way she taught mathematics had changed. She would now "ask harder questions" and "let the children explore more and make decisions for themselves". She also thought that her content knowledge had increased.

Teacher B considered the support of the consultant in her classroom to have been one of the "most helpful" and "vital" aspects of the whole project. She "often repeated some of the activities that the consultant did...or I... did them in a slightly different way". Teacher B also felt that her working relationship with another staff member involved in the project "had been terrific" and that they had both "gained a lot by talking to one another".

At the end of the project, Teacher B was still concerned that she could not "find where some things fitted into the Syllabus" and that she needed to continue on her normal kindergarten program so that she did not "miss out on things". While she remained apprehensive of the time commitment involved with such a project, she realised that "it's a case where you've got to give the time to get something back".

School and Teacher C

The Context

School C is a small urban primary school with approximately 160 enrolments. There are 9 staff members, including a support teacher for children with learning difficulties (STLD) who was one of the teachers involved in CMI. The school draws its students mainly from the lower socio-economic levels of the community, with 12% coming from Brethren families. The school population is predominantly of white Anglo-Saxon origin and is considered to be fairly stable in that there are few students leaving or entering the school throughout the year in grades other than kindergarten.

Teacher C

Teacher C is a female teacher, with 18 years teaching experience. She has spent 7 years at the current school. While having experience teaching all grades from Kindergarten to Year 6, she has spent only 2 years

teaching the current level. She initially trained at Kuring-gai Teacher's College where she completed 3 years of teacher education and gained her Bachelor of Education externally from Armidale University about 14 years ago. Since that time she has attended numerous inservices dealing mainly *with English and HSIE.*

Background in mathematics and teaching mathematics

Teacher C enjoyed maths at school having undertaken the 2S course for her HSC and then starting a mathematics course at TAFE but having to withdraw from the course due to changed circumstances at work. She 'thought' herself to be "good at it, but I don't think I'm good at teaching it". She attributed her inability to teach maths effectively to the fact that she could not "really understand why (the children) can't do it and how I'm going to help them". While Teacher C still described her attitude towards mathematics as "very good", she thought that she "used to be better at it than I am now and I think its just from teaching - I think that my brain has just 'had it'". She also felt that her lack of enthusiasm for teaching mathematics was partly due to School C introducing "a really horrible text book".

Initial Impressions and expectations of CMI

Initially, Teacher C was not concerned about the aims of CMI, she saw it as an opportunity to "learn a whole lot of maths" and rekindle her enthusiasm for the subject. Unfortunately, she was rather disappointed by the first inservice day, although she hastened to add that she was also "ill on that day" and found it difficult to concentrate. However, she came away feeling that the "whole thing was not hanging together properly. I felt that they'd given us something and there were all these gaps in what I understood". She was concerned about her involvement in the project in that she felt "they didn't state it clearly enough exactly what I was going to be doing". However, once the consultant started visiting her classroom she began to "think more about maths and ... discuss maths for hours". She particularly started to "look at the math syllabus" more critically and question some of its content and the "order" in which things are presented.

Teacher C hoped that involvement in CMI would not only improve her teaching of mathematics, but that the children in her class would "see maths as something enjoyable". She also saw it as a positive thing for the whole school to become involved in.

Final impressions and perceived outcomes

At the conclusion of CMI, Teacher C thought the project had been "exciting". While it was thought that she "didn't learn as much" as expected, it was felt that she would eventually know much more because of her intention to "carry on with it. It's given me the basis to build-on". She now thought that her initial conceptions of CMI were

mistaken and expressed the desire to be involved in planning the future of the project in other schools.

A number of aspects or events were considered to be particularly beneficial to the success of the project in Teacher C's classroom. In particular, the second "meeting we had with n...(consultant) and n...(lecturer) was fantastic. ...it was great to listen to someone who was really excited about it". Because the support teacher was also involved in the project it meant that when the consultant visited there were three teachers working in her room. This was considered an advantage because it "allowed me to concentrate on one little group. I could see how far they could go ahead". The initial testing was also viewed as extremely helpful as it allowed her to identify strategies the children were using. According to Teacher C, there "was no aspect of the project that didn't help me in some way or other".

Outcomes of the project were viewed very positively for both herself and the children in her class. Not only did her content knowledge of mathematics increase but her understanding of the content had improved. Teacher C also considered that her understanding of how children learn maths had improved greatly.

> I didn't realise how difficult some children find it to count. I had no concept of that at all. I just thought that you practice counting and then they can do it. When I've taught children to count-back I haven't understood why they couldn't do it. I never thought to get them to count from numbers other than zero, I thought that if you could count from zero to a hundred then you could count from nineteen. I've never broken it down, never realised that some kids just can't do that.

Teacher C kept referring to the fact that she was more aware of each child's level and could therefore teach them accordingly. She believed this understanding of where "the children were at" resulted in them being constantly challenged academically and helped maintain their enthusiasm for mathematics. Coupled with this, was the fact that the way she taught maths had "changed dramatically". Teacher C referred to a number of "new" teaching strategies that were intended to help the children become more autonomous in their learning. For instance, the children "are now given the opportunity to come and tell me things that they've discovered rather than me telling them. They tell me all sorts of things that I didn't expect". She also gave them more opportunities to "share what they've discovered by talking to other children". As a result of her new teaching strategies, improved understanding of the content knowledge and insights into how children learn maths, it was felt that the children were actually "progressing faster than they were" at the start of the project and that they "can actually tell you how they've solved a problem".

> Children are able to explain things a lot better. They're actually thinking about the way they could work things out, they realise that there is a strategy you can use. They used to think in maths that you either know the answer or you don't, but now they know that there must be a way to work it out.

It was the view of Teacher C that "children from all levels improved in some way". Even new enrolments who had only been in the program for a short time "had picked it up from the other kids, the positive attitude, the enthusiasm".

As expressed by other case study teachers, Teacher C considered the consultant's role extremely important. However, it was not just the support in the classroom that was viewed positively, but the fact that the presence of someone from "outside the school" made "it more official" and "seem more important in the eyes of others". She considered herself lacking in "authority" or the "confidence in her knowledge base" to suggest changes in the way mathematics was taught at her school. However, she now felt that CMI "has proven to me that I'm right and at least now I can say with a little bit more confidence what I think".

The overall impact on the way she taught mathematics was thought to be due largely to the duration of the project and the fact that it was based in the classroom. Such characteristics of the project made it "more effective than going to an inservice course for a day or after school because you could actually put it into practice". Teacher C felt that the project would "have a lasting effect" on her "teaching because some of the things fit in with things I've been interested in". Having learnt about metacognition at university she "had these ideas floating around in my head and...with the maths, we put it into practice".

While Teacher C saw only positive things emerge from her involvement in CMI, there were a few aspects she thought needed changing. It was considered that the second inservice day be held "much earlier and the first session could have been better organised". It was also felt that her "teaching would have improved at a faster rate" had she more opportunities to talk with teachers from other schools, consultants and lecturers earlier in the project. The only concern she had now related to what was to "happen to these children now?"

To summarise her reflections about the project, Teacher C concluded her final interview stating that what she had "learnt most is that there is an awful lot I still don't know. I've still got a lot to learn". She felt that this statement expressed where she now 'was' in her professional understanding of mathematics after 18 years of teaching - just starting.

Summary of Case Study Teacher Findings

While confirming a number of findings from the questionnaires, data from the three case study teachers provides additional information about the success of CMI.

1. The commitment of teachers can play a vital role in the success of the project. Teachers who had higher expectations for themselves and their students at the start of the project indicated that more of their anticipated out**c**omes had been realised.
2. Despite initial reasons for participating in the project, teachers found at least some aspects to be both professionally and personally stimulating.
3. Reactions to the initial inservice day varied, with only one teacher confident that the day clearly delineated her role and the overall aims of the project .
4. Throughout the project teachers were apprehensive about certain aspects. Providing enough 'time' to complete the assessment of the children was a major concern for all case study teachers. While one teacher quickly resolved the problem, it became a significant source of anxiety for another.
5. All case study teachers considered that they had developed professionally. They considered their content knowledge of mathematics to have improved and their understanding of how children learn mathematics to have increased.
6. All case study teachers indicated that they had changed their classroom practice (by varying degrees) as a result of CMI. They asked more challenging questions of their children and allowed them more opportunities to explore, discuss and reflect on their mathematics. Two teachers considered the impact of the project would influence their teaching for the rest of their careers.
7. While one teacher considered the project to have benefited children of average ability more than the others, two teachers thought that children of all levels benefited, but that the more able students progressed more rapidly.
8. Two teachers indicated that children were more aware of their thinking strategies for solving problems and were able to clearly explain how they solved computations.
9. The role of the consultants was considered to be vital to the success of the project by all teachers, for numerous and various reasons. Namely, the on-going in-school support was considered more valuable than one-off inservice days; the presence of an outside expert provided credibility to the work being conducted in the eyes of the rest

of the school; as a mediator between schools - the consultants kept teachers informed of progress in other schools.

10. Collegiality was seen to be an important aspect of the project. Teachers valued the discussions they had with teachers from their school involved in the project and with teachers from other schools.

TASK-BASED INTERVIEWS WITH CHILDREN (SENA TEST)

Analysis of the SENA test included determination of a level or stage on each of five aspects concerned with the numerical development of young children. These five aspects relate to a child's:

(a) level of sophistication of counting and other strategies to solve relatively simple addition and subtraction problems (Arithmetical Stages);

(b) facility with forward number word sequences (FNWS);

(c) facility with backward number word sequences (BNWS);

(d) ability to identify numerals; and

(e) understanding of tens and ones (in the case of more advanced children).

The predetermined stages used by teachers to classify each of these aspects were devised by Wright (1994) and presented to teachers as part of a Learning Framework to assist them with the assessment and interpretation of their students' outcomes. The classification systems are presented in this report as an appendix to aid analysis of the data (see Appendix B). It was considered unwarranted to include a lengthy discussion of each model here, but more extensive explanations are provided by Wright (1994).

Before presenting the results it is important to note two aspects of the data gathering component. First, while the CMI project comprised the whole of terms 2 and 3 of the school year (approximately 21 weeks), the instructional sessions involving the children were delayed until the teachers had attended the introductory inservice day and initial testing had been completed. Hence, time spent instructing children was reduced to about 15 weeks in most classrooms. Given the short duration of actual instructional time and the fact that the majority of teachers were inexperienced in the new teaching strategies and content to be presented, it is unrealistic to expect a major enhancement in outcomes for all children participating. Secondly, without a control group to make comparisons, the results must be interpreted in relation to the qualitative comments concerning student achievements provided by the consultants and teachers in their questionnaires and interviews. Considering the results in this way provides a type of 'triangulation' which helps to validate the findings. Further validation of results is provided by making reference to similar findings in the research literature.

SENA Findings and Analysis

At the start of the CMI project 61% of children in the sample were determined to be at Stage 1 or lower on the Arithmetical Stages model and only 6% at Stage 3 (see Tables 4 and 5). At the conclusion of the project, 73% of children had advanced by at least one stage, with 53% determined to have reached Stage 3. This indicates that after just two terms in the CMI project, nearly three-quarters of the children in the sample were using more sophisticated strategies to solve simple addition and subtraction problems.

Similarly children's abilities to recall forward and backward number word sequences and to say the number words before or after a given number showed general improvement. For instance, 24% and 65% of children were initially assessed at Stage 2 or less for forward and backward number word sequences, respectively. At the conclusion of the project, 87% attained Stage 3 or greater for FNWSs and 81% attained Stage 3 or greater for BNWSs. The significance of this improvement is witnessed in excerpts from classroom video-tapes (discussed in the next section) where children utilised their FNWS skills to help them solve simple addition and subtraction problems presented with and without concrete materials.

In the initial assessment, 3 children (8%) could not identify some or all numbers in the range 1 to 10 (that is, Stage 0), 84% could identify numbers in the range 1 to 10 or 1 to 20 (Stages 1 and 2), and 8% could identify numbers to 100 (Stage 3). In the final assessment, 38% of the sample had reached Stage 3 with 62% advancing at least one stage.

Table 4 *Assessment of the numerical development of children in a K/1 class in May and September 1996*

Student	Gender	Year	Arithmetical Stages (Max.5)		FNWS (Max. 5)		BNWS (Max. 5)		Numeral Identification (Max. 4)		Base Ten Strategies (Max. 3)	
1	F	K	1	2	3	5	2	5	1	1	1	1
2	F	K	1	2	4	5	3	3	1	1	1	1
3	M	K	1	3	3	4	2	3	1	1	1	1
4	M	K	2	5	5	5	5	5	3	3	1	2
5	F	K	2	3	4	5	2	3	1	1	1	2
6	M	K	2	3	4	5	3	5	2	3	1	1
7	F	K	1	2	4	5	0	5	1	3	1	1
8	M	Yr 1	2	3	5	5	5	5	1	3	1	1
9	M	Yr 1	2	3	5	5	5	5	1	3	1	1
10	M	Yr 1	2	3	5	5	5	5	1	3	1	2
11	F	Yr 1	1	2	4	5	2	5	1	2	1	1
12	M	Yr 1	1	1	3	4	0	3	1	2	0	0
13	M	Yr 1	1	3	4	5	3	4	2	2	1	1
14	F	Yr 1	1-2	3	5	5	5	5	3	3	1	1
15	M	Yr 1	2	3	3	4	3	5	2	2	1	1
16	F	Yr 1	2	3	4	5	3	5	1	3	1	1
17	M	Yr 1	1	1	3	3	0	3	1	1	0	0
18	F	Yr 1	1-2	3	5	5	5	5	3	3	1	2
19	F	Yr 1	2	2	4	4	1	3	1	1	1	1

Children's understanding of the tens and ones structure of our number system is crucial to their understanding of more advanced number concepts and operations involving numbers greater than 10. Nineteen children in the sample were assessed on their understanding of base ten strategies. Eighty-nine percent were unable to see ten as a unit of any kind (Stage 1) at the start of CMI and 21% were determined to have advanced to Stage 2 at the final assessment. The small percentage of improvement is understandable given the advanced understanding required to respond correctly to these base ten questions and the very young age of the children involved.

Table 5 *Assessment of the numerical development of children in a Kindergarten class in May and September 1996 **

Student	Gender	Year	Arithmetical Stages (Max.5)		FNWS (Max. 5)		BNWS (Max. 5)		Numeral Identification (Max. 4)	
1	F	K	3	3	3	5	1	4	1	3
2	F	K	1	2	2	4	0	0	1	2
3	M	K	2	3	3	5	3	4	1	3
4	M	K	1	2	0	1	0	1	0	1
5	F	K	1	1	1	3-4	0	0	0	1
6	F	K	1	1	1	1	1	1	0	2
7	F	K	1	2	1	4	1	3	1	2
8	M	K	2	3	2	2	0	3	1	2
9	M	K	1	3	3	5	2	3	1	3
10	M	K	3	3	4	5	1	3	2	3
11	F	K	1	2	3	5	2	3	1	2
12	F	K	1	3	4	5	1	4	2	3
13	M	K	1	1	4	5	1	5	1	2-3
14	M	K	2	3	3	5	3	4	2	3
15	F	K	*	*	3	5	1	4	1	3
16	F	K	0	0	1	3	0	0	0	0
17	F	K	0	0	0	1	0	0	0	0
18	F	K	0	0	0	0	0	0	0	0

* This group of children not tested for base ten strategies

* * Data not available

Summary of Children's Progress on SENA

Across the five aspects of numerical development, 33 of the 37 children in the sample advanced at least one stage for two or more models. Of the 4 children that showed little or no progress, three were initially at the lowest stage for almost all models. While these children may have improved to some degree on the final assessment, it was not sufficient to move them to the next stage. In addition, one-third of the sample who progressed two stages in any model were the children who were initially the most advanced (Stages 2 or 3). This finding corroborates comments made by case study teachers, consultants and some respondents to the teacher questionnaire, that children of lower ability seemed to advance more slowly than the brighter children. It is understandable that while all children might have progressed, the rate of progression varied. Thus, in the words of a consultant "the gap between the lower and higher ability children widened". This phenomenon was also noted by Wright (1996) in his study of 34 Kindergarten children. He found that "relatively large gains" were "made by the children who were initially the most advanced" (p. 50).

Classroom Scenarios

The three scenarios presented here typify the strategies children were being encouraged to develop throughout the CMI project. They illustrate the progression from counting-on with concrete materials to a more sophisticated strategy involving mental calculation where no external aids were involved. The setting for each scenario is described briefly and is accompanied by an excerpt from the transcript of the video-tape or observational notes. This is followed by a brief discussion that highlights the significance of each episode in respect to the children's overall strategy development.

Scenario One

Five Kindergarten children and their teacher are sitting on the floor at the back of the classroom. The teacher has a bundle of straws with her. She selects a particular number of straws and drops them into a small bucket in front of the children. The children are informed of the number of straws in the bucket and are required to calculate the total number once some more straws are added. They cannot reach the straws to touch or count them.

Teacher: I'm tired of dropping all these straws, so I want you to pretend I'm dropping them in the bucket. So 13 straws (no straws are shown) and this many more (shows 3 straws) is....

(All children immediately raise their hands to provide the answer. Janice subvocalises 14, 15, 16 with her hand already raised.)

Edward: 14

Janice: I got 16.

Teacher: Let him work it out. Count with me...13 (holds up one straw at a time) 14...15...

Children: 16

Teacher: Good. Let's try another. 17 and this many more (holds up 3 straws).

(All children raise their hands immediately to respond. Sam moves his fingers and subvocally counts-on from 17. Janice and Greta also subvocalise as they count-on from 17, but do not use their fingers to keep track of the numbers.)

Greta: 20.

Teacher: Yes. (They check the answer together by counting-on from 17 and use the straws to keep track of the numbers.)

(The process is repeated for increasingly more difficult numbers - 23 and 3 more, 35 and 4 more.)

In this scenario Kindergarten children are being encouraged to count-on from numbers other than one with the assistance of concrete materials. They are using their knowledge of forward number word sequences (FNWS) to help them count-on from the starting number provided by the teacher. At the point where the transcript starts, the teacher is encouraging the children to make a conceptual leap in their learning. That is, the first bundle of straws is no longer presented and they must pretend it exists, holding the number stated by the teacher in their heads while they count-on three more. The teacher is scaffolding their learning towards a more abstract concept of number by using an activity in which the children are familiar. However, the most difficult aspect of the task - the counting-on - is still represented concretely.

All of the children were noted to have subvocalised while counting-on and two were observed using their fingers to keep track of their counting. The subvocalisation and finger counting are typical of children at this early stage of arithmetical development and help identify children experiencing difficulty with the counting-on strategy. Once the initial bundle of straws was no longer required by the children, the teacher was free to select larger and more difficult numbers from which the children were required to count-on from.

Scenario Two

Two Kindergarten boys are seated at their table. Two other children are sitting opposite them doing the same activity, but independently. The teacher is close to their table, but working with other children. Each pair of children have an up-side-down ice-cream container and ten counters. The two boys take it in turns to cover their eyes while their partner removes some counters and hides them under the ice-cream container. On this occasion, Ben takes 3 counters and hides them from his partner, Scott.

Ben:	Open your eyes.
Scott:	(Pointing to each counter he subvocalises as he counts them. After counting 7 counters, he makes an immediate response.) 3!
	(He lifts the container to check but does not count them. He is satisfied that he is correct.)
Teacher:	(Hearing Scott's reply, the teacher asks him to explain how he determined the answer.) How come there's 3?
Scott:	'Cause there's 7 up there and (touches each counter) 8, 9, 10. Your turn. Close your eyes. (Ben closes his eyes and Scott places 5 counters under the container). Open.
Ben:	(Counts subvocally the 5 remaining counters as he touches each one. He responds immediately after counting.)
	5.
Teacher:	How did you know there were 5?
Ben:	Because there was 5 on top and 5 and 5 is 10.

The children in this scenario are practicing their number combinations to 10, but with only one part of the whole visibly represented by concrete materials. Both boys count by ones to determine the number of counters visible, but neither needs to count-on to calculate the remainder hidden under the container — they seem to know what number is needed to make 10. Ben's knowledge of number facts is illustrated when he immediately recognises "5 and 5 is 10". Scott, however, uses counting-on to justify his answer to the teacher. These children have moved beyond the counting-on strategy to calculate number combinations to 10, but still use it to explain how they derived their answer or to check if unsure of an answer. The concrete materials are still necessary as evidenced by the fact that both boys needed to count one-by-one when the number of counters was greater than 4.

Scenario Three

Two Year 1 children are sitting at their table rolling three dice. The three numbers on the dice are added and if the total corresponds to a numbered card on the table they collect the card. They have almost completed the activity with only a few numbered cards remaining on the table. The teacher is nearby working with another group of children.

Jason: (Rolls the dice.) 5 and 4 is 9 and one more is 10. (No subvocalisation or counting of fingers is required, but he raises his eyes to look at the ceiling for an instant while adding 5 and 4 to make 9.)

Oh! No 10, your turn.

Leah: (Rolls the dice and subvocalises 5, 6, 7 as she points to the dots on the die.) 5 and 2 is 7 and another 2 is 9. No 9. I can't go.

Jason: (Rolls the dice.) 1 and 1 is 2 and 2 is 4. Yeah there's a 4. Game finished. (Calling to teacher.) Mrs N... we're finished.

(The two children continue to roll the dice despite there being no numbered cards left on the table. Jason rolls the dice.)

6 and 5 is 11 and another 5 is ...(looks at ceiling for an instant) ..16.

Teacher: How did you know 11 and 5 is 16?

Jason: Because 5 and 1 is 6 and then add on 10 and that's 16.

This scenario shows two children using slightly different strategies to help them add three numbers. Jason is using quite a sophisticated mental computation strategy that relies on his understanding of parts and whole number combinations. He does not need to count-on, nor does he use his fingers to keep track of his mental calculations. He remembers that "6 and 5 is 11" but does not know what 11 add 5 makes. He applies a strategy that is not unlike the procedure used in the vertically arranged addition algorithm—the two numbers in the ones column are added first and then 10 more is added. Leah, on the other hand, still needs to count-on to determine "5 and 2 is 7". However, she did know that "7 and another 2 is 9" indicating that she is already committing some number facts to memory.

In the first scenario the teacher was very much scaffolding the children's learning as they needed prompts to help them apply the counting-on strategy correctly. The second scenario saw the children applying the strategy spontaneously and building-up their familiarity with number combinations to ten. The final scenario illustrates the

level of strategy sophistication many children involved in the project were able to attain. In each episode, the teacher encouraged the children to justify their answers by asking them to verbalise their thinking strategies. As reported by case study teachers and comments made by respondents of the Teacher Questionnaire, the ability of children to apply and explain their thinking strategies was enhanced greatly by teachers constantly asking them to justify their answers.

Summary of Children's Task-based Interviews and Observational Data Findings

A number of findings that emerged from the task-based interviews and classroom observational data regarding student outcomes corroborate the anecdotal comments made by consultants and classroom teachers. Unlike the anecdotal data, the task-based interviews allowed some of these findings to be quantified and the video-tapes provided observable evidence that can be used to authenticate the findings. In short, an analysis of the task-based interview data taken from a sample of 37 children and excerpts from observational data reveal the following findings:

1. Approximately three-quarters of children in the sample were using more sophisticated strategies to solve simple addition and subtraction problems at the end of the instructional period than they were at the start of the project.
2. Approximately 90% of children in the sample progressed at least one stage on two or more aspects of numerical development.
3. Children determined to be initially the most advanced made the greatest progress, while children of lower ability progressed at a slower rate.
4. Many children not only used sophisticated strategies to solve computational problems, but were able to justify their responses by clearly explaining their thinking.

Final Summary and Conclusions

An initial aim of this investigation was to determine the impact of the Early Numeracy Project on teachers and their students so as to provide feedback to the project organisers. The various data gathering techniques of questionnaire, semi-structured interviews, task-based interviews and observational strategies resulted in numerous findings concerning the outcomes of the project. While the findings have been presented under headings corresponding to each data gathering technique, a sense of the overarching outcomes of the project can be gained by referring to the commonalities of each section. For instance, it was evident from case study data, interviews with consultants and questionnaire findings that generally teachers benefited from their involvement in CMI both professionally and personally. Teachers increased their knowledge and understanding of mathematical content, of strategies and of how children learn mathematics. They changed their classroom practices by allowing their students to take more responsibility for their own learning, by providing more discussion time in math lessons and by encouraging their children to be more reflective.

Evidence that children benefited from the project is provided by the results of the SENA test and corroborated by findings from the questionnaires, interviews with consultants and observational data. While all children were given the opportunity to develop increasingly sophisticated strategies to solve computational problems, it was generally the more academically able that progressed the most.

Findings from consultant and teacher interviews, and teacher and executive staff questionnaires indicate that the classroom-based model of professional development was a major factor in the success of the project. Similarly, the role of the consultants was vital - as mediators between schools, providers of expert knowledge and mentors with whom teachers might engage in professional dialogue.

A number of modifications to the existing project may be warranted given the corroborated evidence provided by consultants, teachers and executive staff. These include the need for more time to complete certain aspects of the project, particularly the assessment components, and the need for more training in the use of video equipment.

Finally, contact with colleagues, teachers from other schools, consultants and lecturers was invaluable for all those involved in the project. Hence, providing more collegial group gatherings could be beneficial for the ongoing success of the Early Numeracy Project.

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Appendix B

Model for Development of Early Arithmetical Strategies

Stage 0: Emergent Counting. Cannot count visible items. The child either does not know the number words or cannot coordinate the number words with items.

Stage 1: Perceptual Counting. These children are limited to counting items they can perceive (i.e. see, hear or feel)

Stage 2: Figurative Counting. Children can count concealed items but may include unnecessary activity. For example, given a collection of 5 items and a collection of 3 items (both screened) the child will count from 1 in an attempt to determine the total number of items.

Stage 3: Initial Number Sequence. The child typically counts-on rather than counting from 1 when solving tasks involving hidden items. These children count-on to solve additive and missing addend tasks and may use counting-down-from strategies (eg 17-3 as 16, 15, 14 - answer 14) but not counting-down-to strategies (eg 17-14 as 16, 15, 14 - answer 3).

Stage 4: Intermediate Number Sequence. Children typically choose the more efficient counting-down-from and counting-down-to strategies, and using strategies that involve procedures other than counting by ones.

Stage 5: Facile Number Sequence. The child can use a range of strategies that involve procedures other than counting by ones but may include counting by ones. For instance, the child might solve an additive problem using strategies such as compensation, adding to ten, or commutativity.

Model for the Construction of Forward Number Word Sequences (FNWSs)

Stage 0: Emergent FNWS. Cannot produce the FNWS from 1 to 10.

Stage 1: Initial FNWS up to 10. The child can produce a number word sequence from 1 to around ten. The child cannot produce the number word just after a given number. Dropping back to 1 does not occur at this stage.

Stage 2: Intermediate FNWS up to 10. The child can produce the number word just after a given number but drops back to 1 when doing so.

Stage 3: Facile with FNWSs in the range 1 to 10.
Produces the number word just after a given number in the range 1 to 10 without dropping back, but typically drops back for numbers after 10.

Stage 4: Facile with FNWSs up to 30. The child produces the number word immediately following given numbers in the range 1 to 30 without dropping back.

Stage 5: Facile with FNWSs up to 100. Produces the number word immediately following given numbers in the range 1 to 100 without dropping back.

Construction of Backward Number Ward Sequences (BNWSs)

Stage 0: Emergence of BNWS. Cannot produce the BNWS from 10 to 1.

Stage 1: Initial BNWS from 10 to 1. Can produce the BNWS from 10 to 1 but cannot produce BNWSs from number words less than 10. The child cannot produce the number word immediately before a given number, and the "dropping back to 1" strategy is not available to the child.

Stage 2: Intermediate BNWS from 10 to 1. The child can produce the number word immediately before a given number up to 10, but typically drops back to 1 when so doing.

Stage 3: Facile with BNWSs up to 10. Produces the number word immediately before a given number in the range 1 to 10, without dropping back, but typically drops back to 1 for numbers after 10.

Stage 4: Facile with BNWS up to 30. Produces the number word immediately before given numbers in the range 1 to 30 without dropping back.

Stage 5: Facile with BNWSs up to 100. Produces the number word immediately before given numbers in the range 1 to 100 without dropping back.

Model for the Development of Numeral Identification

Stage 0: Emergent Numeral Identification. Cannot identify some or all of the numerals in the range 1-10.

Stage 1: Numerals to 10. Can identify numerals in the range 1-10.

Stage 2: Numerals to 20. Can identify numerals in the range 1-20.

Stage 3: Numerals to 100. Can identify one and two digit numerals.

Stage 4: Numerals to 1000. Can identify one, two and three digit numerals.

Model for the Development of Base-Ten Arithmetical Strategies

Stage 1: Initial Concept of Ten. The child does not see ten as a unit of any kind. The child's focus is on the individual items that make up the ten. A necessary condition for attaining Level 1 is attainment of at least Stage 3 in the Stages of Early Arithmetical Learning.

Stage 2: Intermediate Concept of Ten. Ten is seen as a unit composed of ten ones. The child is dependent on re-presentations* of units of ten such as hidden ten-strips or open hands of ten fingers. The child can perform addition and subtraction tasks involving tens where these are presented with materials such as covered units of tens and ones. The child cannot solve addition and subtraction tasks involving tens and ones when presented as written number sentences.

Stage 3: Facile Concept of Ten. The child can solve addition and subtraction tasks involving tens and ones without using materials or re-presentations of materials. The child can solve written number sentences involving tens and ones by adding or subtracting units of ten and ones.

* A re-presentation can be thought of as a mental replay of a prior experience (ie in reflection) that is distinct from and separated in time from the experience itself.