Count Me In Too and the *Basic Skills Test* in New South Wales

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Mean scores on the New South Wales *Basic Skills Test* (BST) in the period 1996-2002 among 71 *Count Me In Too* (CMIT) schools from across the whole of the state were analysed. In conjunction, background data on the schools and their staff perceptions of CMIT were gathered. The results showed that the mean Year 3 BST numeracy score increased steadily and significantly during the period, while all other BST scores remained approximately constant. The increase in the Year 3 numeracy score was not consistent across all the schools sampled, and various background factors were found to be associated with the size of the increase. The implications of these findings are discussed.

Count Me In Too (CMIT) is an early number project designed by the New South Wales Department of Education and Training (DET) and initiated in 1997. It has three major components: (1) a theory of numeracy development based on research by Steffe and Cobb in the USA and Wright in Australia (Wright & Gould, 2000), developed over several years and formalised into a Learning Framework in Number (Wright, 1998); (b) an individualised Schedule for Early Number Learning used to place each child at a point within this framework (NSW Department of Education & Training, 1998); and (c) a professional development program designed to assist teachers better understand how children learn arithmetic (Bobis & Gould, 2000). CMIT does not provide curriculum materials in the usual sense: Teachers are expected to make use of their increased awareness of how children learn to develop their own teaching strategies and materials.

Several small studies have evaluated CMIT. Bobis and Gould (1999) found a positive impact of CMIT on the mathematical achievement of a class of Year 1 students, compared to a matched class in another school that had not been involved in CMIT. Bobis (2001) conducted three case studies of schools which had been identified as showing significant improvement in numeracy achievement subsequent to the implementation of CMIT. The executive and staff at these three schools agreed that the improvement could be attributed to a myriad of factors which had helped build a positive school climate, including a whole-school focus on numeracy, on-going professional development, a supportive leadership team, and structural changes designed to assist implementation of the program.

These two studies were both limited in size and time. In 2001, the DET asked us to investigate long-term trends in numeracy achievement in a statewide sample of CMIT schools, and if possible to find factors which might be associated with superior performance. The indicator of numeracy achievement used was the Basic Skills Test (BST). The BST is a written test of numeracy and literacy given in Year 3 and Year 5 in all New South Wales public schools and in most private schools. The numeracy component comprises 30 multiple-choice questions covering the Measurement and Space strands as well as Number. The test has been developed by the DET over a 12-year period using Rasch modelling and test-equating techniques which have ensured that scores are reported on a fixed scale, and—within the limits of computer scored testing—may be regarded as a most valid and reliable numeracy assessment instrument.

Most schools had implemented CMIT starting in Kindergarten and very few students exposed to CMIT had yet reached Year 5. The DET therefore felt that the effect of CMIT

would be most likely shown in the Year 3 BST numeracy scores—despite the fact that only about one half of the Year 3 BST items refer to the Number strand.

Our approach to this evaluation had three components:

1. An analysis of trends in BST scores over the period 1996-2002 in a statewide sample of 71 schools where CMIT had been successfully implemented.
2. An identification of factors differentiating a subsample of 15 of these schools with sustained, temporary, or negative growth in Year 3 BST numeracy scores.
3. An exploration of how various background factors were related to growth in BST scores across the entire sample.

We first describe the method of sample selection, data collection and analysis. Then we report on each of the three analyses and end with a discussion of their implications.

Method

In October 2001, consultants in each of the 40 DET districts were asked to nominate 4 schools which satisfied two criteria: (1) CMIT had been implemented in all classes in at least Years K-2 since at least 2000, and (2) all CMIT teachers were using the CMIT Learning Framework in Number to guide their teaching of the Number strands. From these nominations, we first eliminated schools which did not meet the criteria. Then we selected up to 2 schools per district, where there was a choice choosing schools which were as different as possible (e.g., one rural and one urban school). We obtained what we felt was a representative sample of 71 schools. Only one of the 40 districts was not included, and only 7 districts were represented by a single school.

Mean BST scores for each year in the period 1966-2002 (Year 3 & 5, numeracy & literacy) were provided by DET for all the schools in our sample. To compensate for variation in BST performance from year to year, all scores were converted to z-scores. Thus, a z-score of 0 corresponds to the state mean score for that year. (A z-score of 1 is one standard deviation above the state mean for that year.) School mean z-scores ranged from -1.2 to +1.4.

An appraisal instrument was constructed to gather background information on each school and the perceptions about CMIT of the principal, the CMIT coordinator, and the school staff currently involved in CMIT. (We would be happy to supply copies of this instrument on request.) The DET consultants administered the instrument in November 2001 during visits to the schools selected from their district. Of the 71 schools in the sample, 65 submitted responses.

Analysis 1: Trends in BST Scores

In the 71 schools, the annual school mean z-scores on the four BST scales varied from -1.21 to 1.38. The average annual standard deviation was 0.36, with little variation from year to year or across the four scales. Figure 1 shows the overall mean scores on each scale.

The graph shows that, with one exception, average BST performance in the schools in the sample was below the state mean throughout the period. The Year 3 literacy score and the Year 5 literacy and numeracy scores oscillated in a narrow band around a z-score of -0.07. The Year 3 numeracy score, on the other hand, after varying within the same range between 1996 and 1999, showed a substantial increase and in 2000-2002 averaged -0.01. The period 1997-2000 was the time when the 71 schools were progressively implementing CMIT: 3 schools started in 1997, 23 in 1998, 35 in 1999 and 10 in 2000.

To explore the relation between CMIT implementation and Year 3 BST numeracy scores more closely, we examined individual school means to ascertain where the greatest change occurred. The greatest change was found to occur in the first year of CMIT implementation in all classes in one grade (at least). The mean change was an increase of 0.057. The next largest increase occurred in the year after such implementation (0.040). By contrast, the mean change in the first year that Years K-2 CMIT students sat the BST was only 0.030, and there was even a small mean decrease (-0.014) in the year CMIT was first introduced in Year 3.
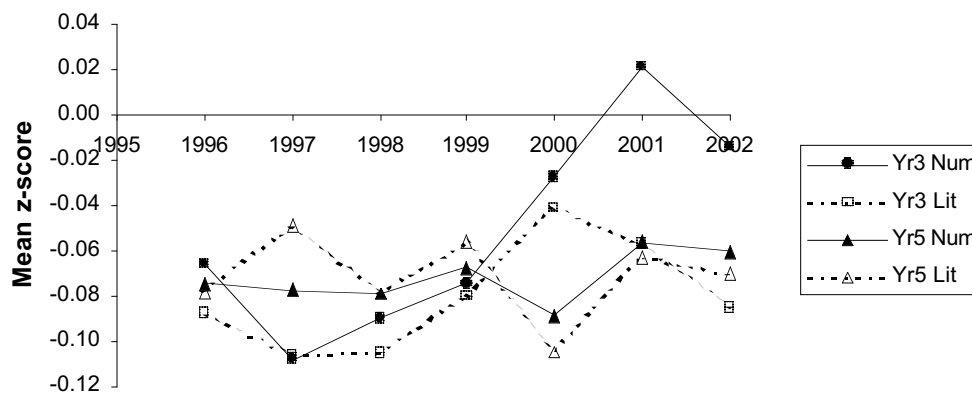

Figure 1. Mean BST scores 1996–2002.

Analysis 2: Patterns of Change in BST Scores

For the remainder of this paper, the terms "BST score", "BST performance", and "BST results" refer only to the Year 3 numeracy score.

We expected that most schools would show a jump in BST scores at the time of CMIT implementation. In fact, changes in school mean scores varied from -0.47 to 0.88. We decided to use 0.30 (the average standard deviation of annual changes in Year 3 BST numeracy scores in 1996-2002) as a benchmark for an educationally significant change in a school's mean score. On this criterion, 16 schools showed a significant increase and 8 showed a significant decrease in Year 3 numeracy scores in the year of CMIT implementation.

Not only did schools vary widely in their BST performance at the time of CMIT implementation, they tended to show rather haphazard variations before and after that time. We were, however, able to identify three groups (each containing five schools) that showed a clear pattern of change around the time of implementation of CMIT:

Group A: Sustained improvement. These schools showed a significant increase which was sustained over the next two or three years.

Group B: Temporary improvement. These schools showed a significant increase which was not sustained over the next two or three years.

Group C: Negative improvement. These schools showed a significant decrease which was sustained over the next two or three years.

In an attempt to identify school factors which could be related to the different patterns, we compared responses to the appraisal instrument among these three groups of schools. There were responses from all 15 principals and CMIT coordinators and a total of 67 CMIT teachers (19 from Group A, 22 from Group B and 26 from Group C).

Staff Perceptions

The teachers in all 15 schools were consistent in their identification of the most important factors that had assisted them in implementing CMIT. The three main factors selected were:

- professional development (72%);
- more explicitly focussed teaching (65%);
- better understanding of how children learn mathematics (63%).

The last two points are closely related, several respondents indicating that their more focussed teaching stemmed from their better understanding of children's learning. A typical comment was, "It has given me a better understanding of how children learn maths and my teaching focus has become more explicit".

There were some differences between the three groups of schools in their judgements as to the main processes followed in implementing CMIT:

Organisational change. This factor was mentioned more often by the school principals in Groups A and B (7 out of 9 responses) than in Group C (1 out of 5). However, almost all CMIT coordinators in all three groups mentioned organisational change (as did the coordinators in most of the schools not in these three groups). The respondents felt that organisational change was a natural consequence of a total school focus on numeracy and went hand in hand with an increased emphasis on professional development. For example, one teacher said, "The changes in maths teaching since the introduction of CMIT have been supported because of the time given to plan collaboratively and to take part in professional development".

Resource development. The need to develop additional resources was mentioned less often by the CMIT coordinators in Groups A and B (5 out of 10) than in Group C (4 out of 5). A similar difference was found in teacher comments (25% of teachers in each of Groups A and B, compared to 70% in Group C). Many teachers from schools not in Groups A, B, or C also indicated a stronger emphasis on resource development than teachers from Group A schools. Typical Group A responses were "Children have more group work and less textbook orientated maths" and "CMIT has been a breath of fresh air for the children and the staff. We are developing mathematical thinking rather than rote learning". Typical responses from other schools were "CMIT is a great program which needs to be supported by the department through in-servicing and resources" and "A main benefit is the establishment of resources which can be accessed quickly."

Provision of release time. Release time (particularly for student assessment) and general assistance from support staff was mentioned more often by the teachers in Group A (30%) than in Groups B and C (10%). Typical comments were "Support staff to work with a group was a great help" and "Being released for testing made a big difference".

Generalisation of these results must be regarded as speculative because they are based on the responses from a small number of schools. However, the response rate of 4.5 teachers per school, the fact that the 15 schools comprise a mixture of schools with differing degrees of success in the BST, and the fact that comments from across the whole sample support the results, all suggest that the results are reliable.

Background Factors

From the BST results and responses to the Background Questionnaire, five external factors were identified which seemed to differentiate the three groups of schools:

- Initial scores. The BST score in the year before CMIT implementation was generally lower in Group A (mean -0.57) than in Group B (mean 0.06) and Group C (mean 0.22).
- Disadvantage. Four out of the 5 schools in Group A were disadvantaged, compared to only 3 out of 10 in Groups B and C combined.
- Percentage of Aboriginal students. The average percentage of Aboriginal students in Group A was 20%, compared to 2% in Group B and 4% in Group C.
- Percentage of NESB students. The average percentage of NESB students was 4% in Group A, compared to 20% in Group B and 38% in Group C.
- Teacher turnover. Teacher turnover in Years K-3 since the first implementation of CMIT was lower in Group A (35%) than in Group B (40%) and Group C (50%). However, there were no differences in school size or student turnover.

Since the small numbers of schools involved (less than a quarter of our sample) render these findings speculative, the suggested associations were investigated in the whole sample in Analysis 3.

Analysis 3: Background Factors Related to Change in BST Scores

To further examine the relation of the five background factors identified in Analysis 2 to changes in BST performance, we analysed the data from all 65 schools for which we had received responses to the appraisal instrument.

For this analysis, we used the change in BST score from the year before first implementation to the year after first implementation (i.e., over the first two years of implementation) as our measure of CMIT effect. We shall refer to this two-year change as a school's *implementation gain*. By contrast with the previous analysis, we had to ignore the question of whether any change at the time of implementation was sustained in subsequent years.

The implementation gain ranged from -0.66 to 1.02. On this measure, 22 schools showed a significant increase (i.e., more than 0.30) and 11 showed a significant decrease.

Initial Scores

Group A schools initially had very low BST scores in comparison to other schools. Their better performance in comparison to Group B and Group C schools could therefore have been a form of regression to the mean: Group A schools may have improved because they were weak to start with, not because of any relation between CMIT implementation and BST numeracy performance.

To investigate this possibility, we found every school's BST mean score in 1996-1997 (before most schools had started to implement CMIT). We then formed a further group (called Group X) consisting of the five lowest schools not already included in groups A, B, or C. The 1996-1997 mean score was -0.64 in Group X compared to -0.57 in Group A, showing that these two groups of schools were initially very similar in terms of BST scores. However, the mean implementation gain was much greater in Group A: 0.56 compared to -0.02 (a small decrease) in Group X. This result implies that the improvement observed in Group A schools was not simply due to their lower initial scores.

Disadvantage

In the whole sample, 25 schools were disadvantaged and 40 were not. The mean implementation gain was 0.11 in the disadvantaged schools and 0.10 in the others. The indication in Analysis 2 that changes in BST scores were greater in disadvantaged CMIT schools was not confirmed.

Percentage of Aboriginal Students

In the 46 schools with a low percentage of Aboriginal students (5% or less), the implementation gains were scattered on both sides of zero—some schools showing substantial increases and others showing substantial decreases. The mean gain in this group was 0.05. Most of the remaining 19 schools showed a positive implementation gain, some of them very large. The mean gain in this group was 0.20. The difference between the mean gains in the two groups was significant at the 5% level.

Figure 2 shows that annual mean Year 3 BST numeracy scores in the two groups. The high Aboriginal enrolment schools showed a pattern of improvement similar to that shown in Figure 1 but at a lower level. By comparison, the schools with low Aboriginal enrolments performed consistently above average and did not show such a clear increase.
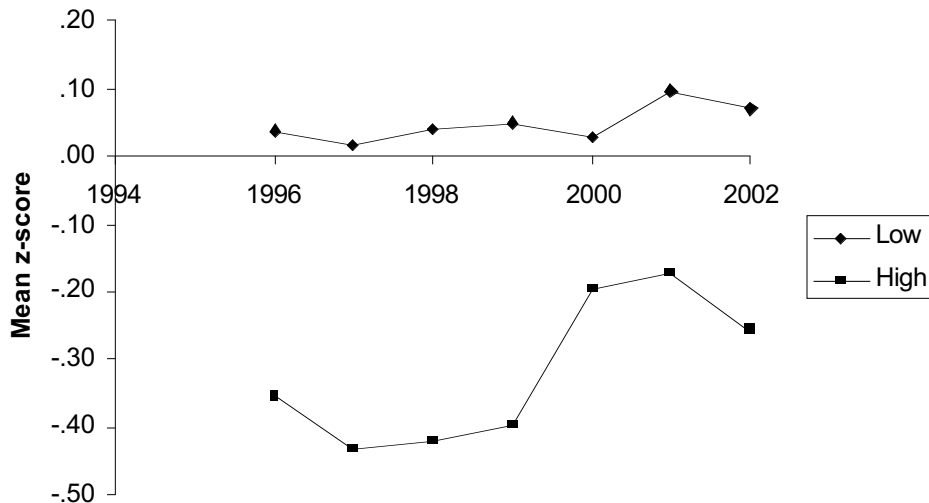

Figure 2. Mean Year 3 BST numeracy scores 1996-2002, by Aboriginal enrolment.

Percentage of NESB Students

With a few exceptions, the data showed that the higher the percentage of NESB students in a school, the lower was the implementation gain. The mean gain in the 36 schools with up to 5% NESB enrolment was 0.18, and the mean gain in the remaining 29 schools was 0.02. The difference was significant at the 5% level.

Figure 3 shows the annual mean Year 3 BST numeracy scores in these two groups. Scores in the high NESB enrolment schools were consistently higher than in the low NESB enrolment schools. Both improved over the period 1996-2002, but the gap decreased substantially over the period 1998-2000, when 68 of the 71 schools implemented CMIT.
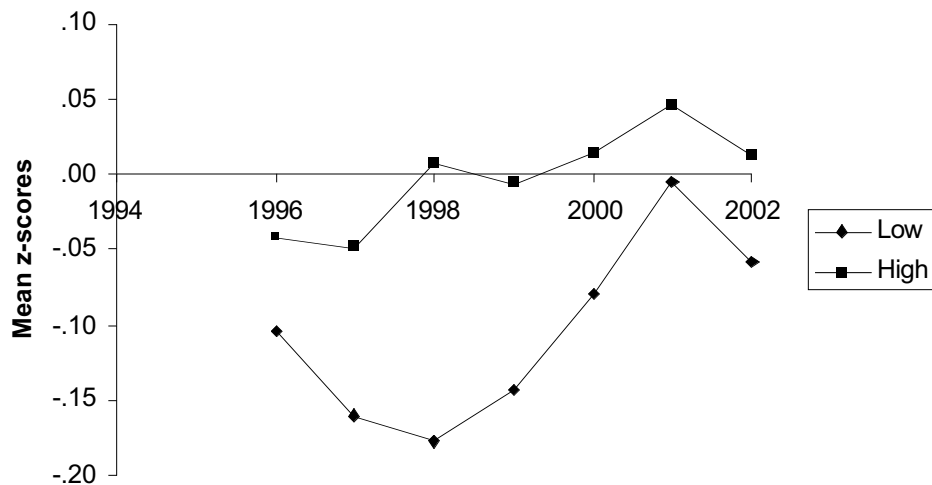
Figure 3. Mean Year 3 BST numeracy scores 1996-2002, by NESB enrolment.

Teacher Turnover

The implementation gain was positive in most of the 18 schools where all the teachers who had implemented CMIT were still at the school; the mean gain was 0.18. In the remaining 47 schools, positive and negative gains were more evenly distributed and the mean implementation gain was 0.08. However, the difference was not statistically significant. The suggestion in Analysis 2 that schools with lower teacher turnover tended to have higher implementation gains was not confirmed.

Discussion

In interpreting the results of this evaluation, we are aware that we are not dealing with experimental data. While it is possible that the implementation of CMIT caused the effects observed, there might also be other causes and, indeed, CMIT might itself be an effect rather than a cause. We shall accordingly limit ourselves to discussing associations which have causal explanations, for which alternative explanations are unlikely, or for which corroborating evidence can be found.

It seems clear to us that it was the implementation of CMIT in the 71 schools in the sample which caused the increase in Year 3 BST numeracy scores shown in Figure 1. When CMIT is introduced into a school, the formal professional development sessions are continued in the form of regular meetings of the lower primary teaching staff. Numeracy is made a priority, and general changes in their teaching of mathematics result (Bobis, 2001). The present study confirms the value that all teachers place on the professional development and the more focussed teaching which accompany the introduction of CMIT (Bobis & Gould, 2000). It is therefore to be expected that the introduction of CMIT would have a general effect on numeracy teaching in the lower primary school, and that this effect would be reflected in Year 3 BST numeracy scores even before the students who have experienced CMIT teaching in Years K-2 reach Year 3. On the other hand, it is unlikely to have any effect on literacy teaching in Year 3 or (because upper primary staff have not usually been involved in CMIT) BST Year 5 scores.

This argument is further strengthened by the finding that schools which showed a sustained increase in Year 3 numeracy scores tended to place more emphasis on being given assistance to make changes in their teaching rather than on the supply of resource materials.

Changes in teaching would have a more general effect that the supply of CMIT-specific materials.

It is also difficult to find any other explanation for the observed increase in Year 3 numeracy scores. Figure 1 shows that the increase was far above what might be regarded as the "natural variation" shown in the other BST scores. Any general factor affecting the 71 schools in 1996-2002 would surely have led to improvements across all BST scores. Nor can the changes reflect any general improvement in NSW schools (e.g., resulting from an increased emphasis on numeracy), since in that case the raw numeracy scores would increase but the z-scores would remain constant.

We therefore feel confident in concluding that the implementation of CMIT in the sample schools has had a definite impact on Year 3 numeracy scores. It should be noted that the increase is not huge: For a student near the middle of the range, it corresponds to about 1 mark or an increase in percentile rank of about 5%. Nevertheless, considering that CMIT was not designed to increase BST scores, the effect is significant.

In this study, we have been unable to identify any school contextual factors similar to those investigated by Bobis (2001) which are related to improved BST scores. However, we have identified two background factors which may play a role: the proportions of Aboriginal and NESB students.

It is not clear why gains on Year 3 numeracy scores were so much higher in the schools with high Aboriginal enrolments. Perhaps greater access to assistance from support staff, together with the CMIT focus on teacher understanding of individual children's learning, led to a more appropriate teaching environment for Aboriginal students. Qualitative case studies of successful and unsuccessful schools with large Aboriginal enrolments (similar to that conducted by Bobis, 2001) are needed to provide more in-depth information about the specific school factors which could have been responsible for the observed effect.

Over the period of the implementation of CMIT, the schools with low proportions of NESB improved substantially more than schools with high NESB enrolments. It is possible that the diversity of ethnic backgrounds and languages in the latter schools made meeting students' individual needs difficult. It is also possible that the introduction of CMIT has enabled other students to "catch up" with the NESB students.

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