

A Whole School Approach to the Provision of Mathematics for Low-Achieving Girls in a Secondary School

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As part of a wider evaluation of the *Counting On* mathematics program in NSW government primary and secondary schools, the authors conducted a case study at Bankstown Girls High School which specifically considered the structural arrangements needed to maintain the program when its specific funding from the NSW Department of Education and Training was withdrawn. The effects of these arrangements on the staff and students in the school are discussed and the success of the arrangements in terms of enhanced cross-faculty teacher interaction and respect, and increased student achievement in mathematics are celebrated.

Background: *Counting On*

Counting On is a mathematics program that targets low-achieving students in Year 7, the first year of secondary school in NSW. The program focuses on the professional development of teachers in identifying and addressing the student's learning needs. It usually operates on a team approach involving, in each secondary school, the Head Teacher, Mathematics, the Year 7 Classroom Teacher, the Support Teacher Learning Difficulties and the District Mathematics Consultant. Key features of *Counting On* include individual assessment, tailored programs and team-taught lessons based on the *Counting On* Numeracy Framework (Thomas, 1999) which is an extension of work by Cobb and Wheatley (1988) and Jones et al. (1996).

Reports on the statewide efficacy of the *Counting On* program have been presented in previous years (Perry & Howard, 2000; 2001a; 2001b; 2002). In terms of student achievement and the professional development of teachers, *Counting On* has been shown to be successful.

Study Methodology

The overall *Counting On* evaluation in 2002 employed a case study methodology (Cohen, Manion, & Morrison, 2000) in seven schools—four secondary, two primary and one central—across NSW. It was designed to:

- track students who completed *Counting On* in 2001 as Year 6 students and who attended Year 7 in secondary schools that were implementing *Counting On* in 2002;
- consider the ongoing development of links between primary and secondary schools and how these can be facilitated by *Counting On* through continued implementation over two years;
- investigate how the various components of *Counting On* were implemented in both primary and secondary school settings which are no longer funded by the program.

This paper concentrates on one of the secondary schools and the third of these investigations. Data was collected through interviews with the Head Teacher, Mathematics (HTM), Head Teacher, Support (HTS), the current *Counting On* teacher, two Science

teachers involved in the implementation of *Counting On* and five Year 7 students who were undertaking *Counting On* during 2002. As well, quantitative data on the *Counting On* students' numeracy achievement during 2002 was made available.

The School

Bankstown Girls High School is situated in the south western suburbs of Sydney. Approximately 670 girls attend the school, with 98% coming from a non-English speaking background. There are 32 different cultural backgrounds among the student population with the major language groups being Arabic (55%), Vietnamese (20%) and Pacific Islander (15%). There are 70.6 staff (61.6 teaching) employed at the school.

The mathematics staff consists of five mathematics-trained teachers. In the words of the HTM:

Many of the mathematics teachers have come here as beginning teachers and are still here. They like being here, I think because they see a group of students who really as a whole like being at school. Even though the parents might have views at odds to ours in many ways...overall the kids generally want to learn and what we have here I think is a bit unique as far as the combination of staff goes. I think that is why many of the staff stay. At this stage now, there would be out of that 5, I think all but one of them are here up to 10 years and that one has been here only 5 or 6.

I think three had been appointed here as their first school as mathematics teachers. They have had their families and gone and come back. I think as a team they are very, very willing...it certainly makes my job very easy because I know that I can rely on the group to put their heads together.

Counting On at Bankstown Girls High School—2001

Counting On commenced in Bankstown Girls in 2001 with initial funding and training supplied by the NSW Department of Education and Training. One class in Year 7 was chosen to be involved in the program. It was taught by a mathematics teacher with the assistance of the HTS. The class was chosen because it was the targeted class formed as a result of the literacy- and numeracy-based assessment used in the Year 7 orientation. In the words of the HTM:

So we told them that they were special and we wanted to video them for a special program and gave out the permission notes to anyone in the class. Basically we just took whoever brought the notes in. The kids loved that because they were getting a bit of attention, one-to-one, and they were getting to see themselves on TV. That really got them interested.

Fifteen students from the class were videotaped as they completed the *Counting On* assessment. Each of the three teachers involved in the 2001 implementation—HTM, HTS and classroom mathematics teacher—interviewed five students. “*Then we came together with the mathematics consultant to look at what was going on so we could make a judgement about what particular level they were at*” (HTM). The value of this assessment procedure was clearly expressed by the teachers. However, it was stressed that the teacher relief days which had been provided by the *Counting On* program were essential for this value to be realised: “*Without those days we wouldn't have been able to do the videoing or the analysis*” (HTM).

Counting On was implemented in this Year 7 class with some fanfare and with the acceptance that the normal curriculum might have to be varied to accommodate the program. “*We went to the kids and made a big deal about it being a Counting On lesson.*”

We didn't stop everything but we certainly slowed it down because we wanted to make it work" (HTM). This was then taken up by the *Counting On* teacher and the HTS:

In the classroom I supported the mathematics teacher and we very deliberately and extensively went through the *Counting On* activities. She would continually come back to them. We systematically worked through a lot of the strategies though the course of the year. I think one of the biggest things in terms of implementation was that we negotiated a lot with the HTM to suspend some of the normal things in the Year 7 curriculum.

What we ended up doing was spending a lot of time with those kids and part of the time was spent with actually getting the kids to justify their answers and to talk through their answers. That meant a lot of liasing and support from the HTM and so we worked with that through a lot of the year. It was a busy, doing year with the kids but we did start to see improvement with the results.(HTS)

However, one class was not enough for Bankstown Girls! The HTS provided professional development for another of the support teachers who, in turn, provided professional development to another of the mathematics teachers. They then proceeded with a full implementation of *Counting On* in a second Year 7 class. Funds for this professional development, and the assessment and analysis days for this class, came from the school.

Moreover, all of the mathematics staff participated in a one day professional development course run by the initially-trained mathematics teacher and the HTS. This was done in Term 4, 2001, again with funds from the school.

There are two measures which have been used by the school to evaluate the effect of *Counting On* on the achievements of students in the two 2001 classes. The first deals with grading for the five Year 8 mathematics classes. This grading uses a series of common tests throughout Year 7. Of the 15 students who were assessed for *Counting On* in the first Year 7 class to be chosen in 2001, two were graded into the highest Year 8 class, six into the second highest and another four into the third highest. The second measure is based on improvements in numeracy achievement from Year 7 to Year 8 based on statewide Secondary Numeracy Assessment Program. Of the 32 targeted *Counting On* students from the two Year 7 classes in 2001, 20 have shown improvements in their numeracy levels. "What we did in 2001 seemed to work" (HTM).

Counting On at Bankstown Girls High School—2002

In 2002, the initial funding for *Counting On* was exhausted and the school set about determining how it could continue to run the program. This has resulted in a very interesting, innovative solution. Once again, there are two *Counting On* classes in Year 7 and *Counting On* activities are used in one period per week in each of these classes. The HTM explained the genesis of the current practice:

Coming to this year the organisation was really supported by [the Principal] in giving periods to make it happen. We had two extra periods in mathematics that we were able to give to [the *Counting On* teacher] and she went into those with a support person. As it turned out the support staff that were available didn't mesh with the times that were there so we looked for an alternative situation and as it turned out those that were available were the science staff. In those science classes they do numeracy work and so I guess that science has come to the party for those periods because they can see the benefits. So as it turns out we have *Counting On* with science classes and science teachers.

An added dimension to this arrangement was that the originally trained *Counting On* teacher started maternity leave in mid-Term 2 and was replaced by another mathematics teacher who was away from the school in 2001 when the mathematics staff were trained in the program. Hence, she had to be trained in 2002 by her colleagues.

From the perspective of the *Counting On* teacher, the fact that the lessons are given in science time with science teachers supporting does not affect what is done. However, from the science teachers' perspective, the development of numeracy skills and the students' overall confidence has been spectacular.

Counting On is such a wonderful program because unfortunately the Stage 4 syllabus has such high expectations of the students. It assumes that the students come in and will be able to grasp these things. One of the things that we do early on in Science is to boil water and they have to be able not only to graph but they have to be able to read a thermometer. They have to record that into a table form and from that they have to be able to graph. It is little things like the number line and the *Counting On* strategies have been wonderful for the girls. You know, all the arrays that we have been doing, and just getting them used to table form. It just starts to boost their confidence up a little bit more.

For the skills that the students gain from the *Counting On* program—giving up that one period a week is far more valuable than the time that we would have with them in the class—not just in Year 7 but for life skills generally, and generally for their skills in Science. (Science teacher)

Further, the development of the science teachers' own skills and knowledge of numeracy ideas has been substantial.

I've learned heaps. The Science knowledge that the kids are meant to know, drawing graphs and interpreting tables and putting information into tables, I think in the past I just assumed that they knew that by the time they get to Year 7. Maybe not know it totally but have some idea about what to do. All of these strategies that [the *Counting On* teacher] has gone through made me think, 'Wow, they are just fantastic for our children'. (Science teacher)

The science teachers have integrated numeracy ideas into their Year 7 program as a result of the work being undertaken in *Counting On*. For example, they have correlated the Year 7 Science skills with their numeracy demands and linked these directly to the *Counting On* strategies. Neither of the science teachers saw *Counting On* in 'their' science periods as an impediment. Rather, they were very enthusiastic and gave several examples of where the increased numeracy skills of the students saved time in their science lesson. For example, in their written report on the project in 2002, they suggested that:

There was a significant improvement shown in the girls' graphing and tabling skills. They were able to draw scales on the axes by dividing the lines into equal sections as well as plotting the numbers.

There was a significant improvement shown in the relationship between numbers such as adding by tens.

The girls multiplying skills showed significant improvement. They were answering the questions correctly and answering more quickly.

The Arrays (one of the *Counting On* activities) helped to develop times tables skills to the point where most students had a good grasp of their times tables.

Evidence for this increase in the skills of the students was made available in the form of the results from the Science numeracy tests undertaken by one of the *Counting On* classes in February and November, 2002. From a class of 24 students for whom complete data is

available, 23 improved their scores on the test and one student remained on the same, relatively high, score (see Table 1). The mean score for the group on the pre-test was 48.5% and on the post-test was 81.5%.

Table 1
Science Numeracy Test Scores (Percentage) in One Counting on Class

Student Code	Initial test—February, 2002	Final test—November, 2002
1	55	94
2	58	84
3	48	87
4	52	87
5	45	74
6	42	85
7	55	97
8	48	87
9	42	87
10	55	77
11	58	77
12	29	74
13	48	77
14	58	68
15	48	81
16	55	97
17	61	90
18	19	58
19	32	68
20	23	68
21	48	94
22	87	87
23	32	66
24	65	100

Perhaps not surprisingly, given the dramatic improvements in their numeracy results, all the students interviewed at Bankstown Girls were enthusiastic about their *Counting On* experiences in Year 7. They enjoyed the activities, thought having a mathematics and a science teacher working together was great and could see the reason why you might learn mathematics in science classes, especially in terms of the various ways in which number lines are used in science lessons—measuring instruments such as beakers, thermometers and rules, tables and graphs. The following is a selection of comments from these students about their *Counting On* lessons.

Maths is my favourite subject.

It's challenging. You have to use your brain and sometimes you get stuck in the middle of answers.

Some subjects they just give you work and you just have to do it. In maths they usually give you new work.

It's fun to learn. It's challenging. Some of the questions I've seen are very hard.

Discussion

The initial experience with *Counting On* in 2001 at Bankstown Girls was so positive that the school has decided not only to continue the program in the innovative fashion it has in 2002 but also to use individual assessment of numeracy skills and knowledge as part of overall assessment of students in Year 7. Each student undertakes a written numeracy test as part of their mathematics and science assessments. As well, in 2002, every student in Year 7 was assessed individually using a modified *Counting On* assessment schedule, consisting of 11 of the 17 *Counting On* questions. Time was allocated from school funds for the *Counting On* teacher to conduct these individual assessments in the first four weeks of Term 1. These were not videotaped and were analysed by the teacher. In spite of this, they gave a great deal of information about the students' performance and their likely needs during Year 7.

Bankstown Girls High School has made a commitment to the development of their students' numeracy knowledge and skills and has allocated funds for the continuation of *Counting On* as part of that commitment. However, perhaps more spectacular than funds are the organisational initiatives which have encouraged the use of time and staff from other than the mathematics faculty in order to implement the program. These feelings were reiterated by the HTS:

I think we can see that numeracy is obviously important and valuable for these kids and the need is just as great (as literacy). I think secondly the work across the school is only possible—and where we might be different from other places—because it is a very collegial and supportive school so that [the HTM] and I could approach [the Head Teacher, Science] about the arrangements.

It's all about a very strong network across the school and support. There are other issues but I think in a nutshell for us everything you see is basically because of the very holistic, integrated approach, where we do use our money as well as we can to do as many things as possible.

Counting On is designed to be an active and engaging program of mathematics learning and teaching for low-achieving students in Years 6 and 7 (NSW Department of Education and Training, 2002). It is based on a sound knowledge framework and uses many positive pedagogical tools in its implementation. At the same time as Bankstown Girls High School was introducing *Counting On*, it was also exploring the relevance of Productive Pedagogies (Gore, Griffiths & Ladwig, 2002) to its learning and teaching programs. In an excellent example of how two initiatives can be realised simultaneously, there are notable similarities between the implementation of *Counting On* at Bankstown Girls and Productive Pedagogies.

The four Productive pedagogy dimensions are intellectual quality; relevance; supportive classroom environment and recognition of difference (Gore, et al., 2002). Each of these is broken into several items, many of which can be discerned in the approach taken with *Counting On*.

For example, one key item is substantive conversation in which classroom talk leads to sustained dialogue among the students and between teachers and students as the students

strive to understand the material being studied. While this is important to all learners, there is evidence that it is of particular importance to female students (Leder & Forgasz, 2000). In *Counting On*, students engage in such sustained talk as they justify their answers, explain their methods and develop their arguments. Students' higher order thinking skills of justifying, analysing and applying are very much in evidence through this sustained talk.

Counting On classrooms at Bankstown Girls are very supportive of the students in them. The activities encourage students' visualisation of mathematical problems. Through excellent modelling by both the mathematics and science teachers in the classroom, scaffolding provided through the Learning Framework and the collaborative nature of the classroom pedagogy, students have improved their confidence in their own mathematical ability as they experience success as learners.

An important item under the Relevance dimension of Productive Pedagogies is connectedness – connection to the world beyond the classroom. Traditionally, mathematics classrooms have tended to be relatively disconnected with this world. However, there have been many calls for this to be rectified (e.g., National Council of Teachers of Mathematics, 2000). The choice of undertaking *Counting On* as part of the science program in Year 7 at Bankstown Girls has brought immediate connection with another major area of the curriculum and has shown the students that their mathematics has immediate relevance to another part of their lives.

Munns, McFadden and Koletti (2002, pp. 5-6) suggest that “It is arguably the case that for students to be strongly engaged in their learning then their classroom should be characterised by purposeful experiences in a supportive classroom environment offering intellectual quality, relevance and recognition of learner difference”. *Counting On* at Bankstown Girls has sought to achieve this and seems to have succeeded.

Counting On at Bankstown Girls High School—2003

The *Counting On* program at Bankstown Girls has been expanded in 2003. As in 2002, all Year 7 students were assessed using a modified *Counting On* schedule, implemented by two mathematics teachers. Support staff provided relief for these teachers as they conducted the assessment. This assessment revealed that the 2003 Year 7 had much higher numbers of students in need of the program and many of these had quite severe needs. For example, some students were unable to even use their fingers to count on; there was poor understanding of mathematical terminology and many of the students lacked self-confidence in mathematics. Forty-three of the approximately 90 Year 7 students are undertaking the *Counting On* program. These are divided into two classes one of which is taught by a mathematics teacher and a support teacher while the other is taught by a mathematics and a science teacher. The school plans to compare student performance across the two classes as well as to monitor the professional development of all the teachers involved. The number of teaching periods per week for each class has doubled—from 2002—to two.

Conclusion

Bankstown Girls High School has used the *Counting On* program as a central plank for its whole school numeracy initiatives. As a result, the implementation of numeracy

initiatives are now seen by the school staff as important as the well-established literacy initiatives across the school. Similarly, *Counting On* is a central feature of the school's linkages initiatives with its feeder primary schools. The program has been implemented in an innovative and very successful manner at Bankstown Girls High School. The support of the staff—in particular, the Principal—is very much in evidence and the result is a much-enhanced mathematical learning experience for a group of young women who have struggled to learn mathematics in the past. The experience of *Counting On* at Bankstown Girls High School provides an exemplar for other schools but, most of all, it has provided an inspired experience for the students.

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