Using National Numeracy Testing to Benefit Indigenous Students: Case Studies of Teachers Taking Back Control of Outcomes

Annette R. Baturo
Queensland University of Technology
<a.baturo@qut.edu.au>

Tom J. Cooper
Queensland University of Technology

Matthew T. Michaelson
Queensland University of Technology

Jessica Stevenson
Queensland University of Technology

This paper focuses on the disempowering nature of Years 3, 5, and 7 *Aspects of Numeracy* testing undertaken by the Queensland Studies Authority, in relation to teachers of Indigenous students. It describes a Deadly Maths project with four far North Queensland regional schools to take back control of outcomes by empowering teachers to undertake their own analyses of the tests and use them for immediate intervention programs. It describes students and teachers' perceptions of the tests and teachers' reactions to the project, indicating difficulties in overcoming teacher resistance and reporting success for teachers who did take back some control.

As in many countries, Australia requires its states and territories to develop and administer a numeracy test for students in Years 3, 5, and 7. The tests are state-specific in content but all tests across Australia are expected to include items from the National Numeracy Benchmarks. The Queensland tests are called *Aspects of Numeracy*. This paper reports on a project to support teachers in four far North Queensland regional schools with Indigenous students use the 2007 *Aspects of Numeracy* results to improve their students' mathematics outcomes.

Background

In Queensland, the *Aspects of Numeracy* tests are administered in August each year. Following strict government guidelines, the Queensland Studies Authority (QSA), a government agency, collects and grades the test papers and provides a report to each school at the end of the school year (late November-early December) and a publicly-available report when it has ministerial approval (usually at least 12 months later). The report provides information on every student for every test item and compares overall students' outcomes with the general state average and a state average for "like" (comparable in terms of size and student background) schools. Schools are then required to report these outcomes to their communities.

Because the reports of student results are not made available to teachers until the end of the year (and the teachers are unlikely to have the same students in the next year), there is little chance, if any, for the reports to provide feedback to teachers that could affect instruction. Furthermore, the reports are in a format that was inaccessible to many teachers. Although teachers are not afforded the opportunity to provide input to the form of the test items, their performance and the performance of their students are judged by the test results in a government-sponsored initiative called "making teachers accountable."

In recent years, the Queensland *Aspects of Numeracy* testing program has tried to accommodate real-life experiences of a variety of students (including Indigenous). However, the test items and strict testing procedures of the past years have not take into consideration the personal attributes of the students, such as their social and racial background, remoteness, the quality of the school staff, facilities and plant, and community support available to them. The only position that appears to be important is comparison with the state average. As a result of this focus on outcomes compared to other schools, school results have generally corresponded to the socioeconomic status of students. Thus, lower socioeconomic schools, particularly those with significant Indigenous populations, have been disempowered, because language, background, and culture made it difficult for their students to understand many of the test items. In particular, Indigenous students' average test performance has lagged two years behind that of non-Indigenous students (QSA, 2004, 2005).

Our, the Deadly Maths group's, solution to the problem of disempowerment, particularly in Indigenous schools, was to work collaboratively with teachers to take back some control of the testing process. The solution recommended that teachers photocopy the test papers, mark their students' answers within a week of the test, and then use a spreadsheet to analyse the results. Based on student results, teachers can then make well-informed decisions about the ways in which they teach numeracy to their students and implement appropriate modifications to the curriculum to more effectively address numeracy outcomes. This paper

describes a collaboration undertaken with four schools, called A, B, C and D, in far North Queensland with Indigenous populations and reports on teachers' and students' perceptions of the *Aspects of Numeracy* tests and teachers' reactions to the Deadly Maths group's solution of taking back control of the tests by marking and analysing photocopies and using the data to improve teaching and students' mathematics outcomes.

Testing and Indigenous Students

Indigenous students' performance on the Aspects of Numeracy tests was largely attributed to a number of factors other than their actual ability and mathematics knowledge. One of these factors was language. English is a second language for most Indigenous students, particularly those in rural areas. Most Indigenous students use a kreol called Aboriginal English outside of the classroom. The numeracy tests covered number, space, and measurement, but, except for a section on mental computation, were based on reading, interpreting, and solving word problems. In fact, many test items were based on a colour magazine with written information, tables, graphs, pictures, and diagrams. Because the language used in the test items and magazine was Standard English, the Indigenous students had difficulty understanding what to do. As a result, in one Indigenous boarding school in another Deadly Maths project, not one student was able to correctly interpret word problems in the 2006 tests.

The second issue affecting the performance of Indigenous students on the Aspects of Numeracy tests was culture and context. The everyday lives of regional and remote Indigenous students are very different to non-Indigenous urban students. Because the real-life applications of test items were designed for experiences typical of non-Indigenous, urban, middle-class students, Indigenous students often could not make a connection to the test items with their own experiences. A principal from another Deadly Maths project stated that the best way for her remote Indigenous students to do better in the tests would be for them to spend six months living in Brisbane. She described a particularly extreme example in which students had been asked a problem about the "rover" pass, a special ticket that allows a day travel on busses, trains, and boats in Brisbane. Her students had interpreted a "rover" pass to have something to do with a dog, as this was the only thing they knew that might have been named "rover". Another teacher in the same project said that the magazine itself was the problem, because her Indigenous students had so little experience with magazines that they spent much of the test time looking at the magazine and not actually answering the questions.

The teaching support received by many Indigenous students was the third issue that influenced their performance on the numeracy tests. Most teachers in Indigenous schools are non-Indigenous, young, newly graduated, and inexperienced in their teaching practice and knowledge and understanding of Indigenous culture. Therefore, many tend to construct Indigenous culture in accordance with western ideals and preconceptions and, instead of integrating learning, they compartmentalise learning using techniques that are unfamiliar to Indigenous students (Christie, 1994, 1995; Grant, 1997; Rothbaum, Weisz, Pott, Miyake, & Morelli, 2000). In particular, these teachers do not attempt to contextualise mathematics into Indigenous culture (Frigo & Simpson, 2000) which has a negative impact on the confidence of Indigenous students in their ability to do mathematics (Howard, 2001; Matthews, Watego, Cooper, & Baturo, 2005). Similarly, because teachers have low expectations of Indigenous students (Raeburn, 1993), Indigenous students' participation and success are marginalised (Sarra, 2003), resulting in limited educational impact on Indigenous student learning (Department of Education, Training and Youth Affairs, 2001). As a result, teachers of Indigenous classes are inclined to focus on algorithm practice with worksheets that do not prepare students for the word problems in the numeracy tests. Many non-Indigenous teachers believe that, because classrooms are places where they are in charge (McFadden, Munns, & Simpson, 1999), they are reluctant to allow Indigenous participation in decision-making (Beresford, 2001). This dominant attitude impacts on teacher-student relationships and results in negative beliefs and feelings (Groome, 1995). As concluded in Warren, Cooper, and Baturo (2007), education in Indigenous schools is socially unjust, particularly in remote communities.

The consequence of these issues is that *Aspects of Numeracy* testing is a very difficult time for Indigenous schools; students strongly disliked the testing regime, actively agitated against the administration conditions, and became very depressed by their inability to understand what to do. For most of our projects, we had avoided attending schools during testing, because it was a period of great disruption. Most teachers in Indigenous schools expect the results that the students achieve on the tests and believe that they are not responsible for the level of the results (Sarra, 2003). They see the test process is not a positive experience but rather one of disempowerment. Therefore, we have advocated that teachers retake control of the testing and

use it for their own purposes and their students' futures. This paper describes our first formal attempts to work with schools to achieve this goal.

Design

The methodology was qualitative and longitudinal (the schools were part of the project for one year), with the researchers collaborating with teachers in action-research case studies (Kemmis & McTaggart, 2001) in which they use the *Aspects of Numeracy* test results to improve the numeracy learning of their classes, particularly their Indigenous students. The participants were the administrators, Years 3, 5, and 7 teachers (13 in all), and their students from four schools in a regional centre in the northern part of Queensland. The four schools were independent, run by religious organisations. Only School A, a boarding school covering Years P to 12, had a totally Indigenous student population. Schools B, C, and D were Years P to 7 day schools that taught both Indigenous (less than 30%) and non-Indigenous students. School B was a catholic primary school and taught students predominantly from its local community. Schools C and D were independent, represented particular religious persuasions and taught students from across the regional city. Schools B and C was middle sized and D was a small school.

The procedure involved five stages. In the first, the Deadly Maths researchers and the Years 3, 5, and 7 teachers had a professional learning day (PL1) on: (i) *Aspects of Numeracy* testing (its form, use, and implications); (ii) interpreting QSA reports; (iii) using spreadsheets to analyse student tests responses; and (iv) translating student performance data into remedial and preventative instruction. In the second stage, the researchers assisted the teachers to: (i) analyse their 2006 Years 3, 5, and 7 test data (using ideas from PL1); (ii) develop a program to use these results to look at their 2007 class; (iii) photocopy and mark their students' 2007 test responses and enter the data on a spreadsheet; and, (iv) analyse this data and determine possible areas for further work with their class. In the third stage, the researchers and teachers had a second personal learning day (PL2) on: (i) implications of teachers' individual 2007 data analyses for numeracy learning; and, (ii) mathematics instructional approaches for Indigenous students. In the fourth stage, the researchers assisted the teachers to develop and implement a teaching program to improve numeracy weaknesses identified in their 2007 test responses. In the final stage, the teachers shared the results of their trials with the other teachers and the researchers.

The data gathering processes used were: (i) observations of the seminars, the sharing and classroom trials; (ii) interviews with administrators and teachers; (iii) interviews with a sample of each teachers' students; (iv) surveys of teachers; and (v) the collection of artefacts (for example, teachers' plans, students' work).

Findings

The video and audio recordings of the observations and interviews were transcribed, organised, and combined with the field notes and descriptions of the artefacts to give a rich description of the project. This paper considers data from observations across the project and interviews in Stage 4 and at the end of the project. Findings cover students' perceptions of testing, teachers' perceptions of testing; and teachers' responses to the Deadly Maths project.

Students' Perceptions of Testing

The students' interviews in the four schools gave rise to the following responses with regard to their feelings about mathematics, the tests, and their success in the tests. Only some of the data is displayed in Table 1. Note that, in Item 7, many students recorded more than one response when explaining strategies employed to solve problems.

Table 1

Yrs 3, 5, & 7 Students' % Responses (N = 38 - Yr 3, N = 38 - Yr 5, N = 64 - Yr 7)

Item	[Form of answer for which % is given]	Yr3	Yr5	Yr7	All
How do you feel about maths generally?	[Students who said "happy"]	61	55	48	54
How did you feel before the test?	[Students who said "happy"]	37	34	23	30
How did you feel when finished the test?	[Students who said "happy"]	84	71	84	81
How did you think you went?	[Students who said "got most right"]	21	29	33	29
	[Students who said "got some right"]	32	37	38	36
You got answers right because?	[Students who said "good at maths"]	50	38	27	28
	[Students who said "tried hard"]	42	55	53	56
Got answers wrong because?	[Students who said "not good at maths"]	25	16	16	19
	[Students who said "did not try hard enough"]	5	30	22	18
How did you work out tricky questions?	[Said "kept working"]	47	50	70	61
	[Said "worked it out wrong"]	8	24	17	16
	[Said "just guessed"]	29	8	17	18
	[Said "gave up" or "didn't do it"]	16	13	16	15

In general, a small majority of students overall (54%) felt happy about mathematics (more younger than older). Before the test, students across all ages (30%) were either unhappy or unsure of their feelings about the tests prior to the test day. However, after the test, most students (81%) indicated they felt happy, but it is uncertain whether their feelings were related to their performance or just that they were relieved to have finished the test. Most students felt that they did not do very well with only 29% indicating that they felt they "got most right" and 36% believing that they "got some right" (older more confident than younger although younger had a more favourable attitude). Whilst overall, only 28% of students believed that they are "good at maths" (more younger than older) some 56% indicated that they had "tried hard" (more older than younger). The older students considered extrinsic factors, such as easy questions or lucky guessing, to have contributed to their correct answers but, unfortunately, they were more likely to blame their failure on themselves or not trying hard enough. There was a propensity for students to believe that they had tried their best in sitting the test. With regard to more complex (or "tricky") questions, the majority of students (61%) identified that they "kept working" until they were confident of their answer, whilst only a small percentage (15%) "gave up" or "didn't do" them. This trend shows that students were inherently motivated to achieve success despite the external factors that were negating their abilities to do well.

As is described in the next section, only 8 of the 13 teachers completed all stages and, particularly, did a complete analysis of students' responses to the tests. However, the teachers that did complete analysis of their students' test responses reported a discrepancy between students' beliefs about their success and their actual success, particularly with respect to problems. One teacher was sufficiently concerned about what she saw as students interpreting problems to be simpler than they were to build her remedial program around this. Overall, in all schools, students' performance was not as high as the students had expected, particularly in School A. However, we need to consider whether the expectations of the students originates from a different individual benchmark, such as an improvement in the students' ability, understanding, and confidence at this point in time compared to at the beginning of the year.

Teachers' Perceptions of Testing

The teachers at School A, the Years P-12 Indigenous boarding school, felt that the tests were unfair for their students, stating that the language and problem contexts used in the tests were unfamiliar to many students (not being in Aboriginal English and not relating to rural/regional Indigenous settings). They stated that the tests were therefore onerous and stressful for the students as the students received poor results despite lots of effort. They were very committed to the education of the students, however, they felt that the tests were unfair to them, arguing that low test results could be interpreted as reflecting poor teaching, rather than a consequence of external factors. They believed that their students started from such a low base that the students' results would still be below average even if they, in their teaching, achieved significant improvements in their students' mathematics outcomes.

The teachers at Schools B, C and D, where Indigenous students made up less than 30% of the population, were not as strong in their dislike of the Years 3, 5, and 7 tests as School A, although some teachers of School B did feel that the testing time was onerous on students and time consuming and that, in their opinion, the tests were a waste of time. Similar to School A, teachers at Schools B, C and D were concerned that the test results may reflect poorly on their individual teaching ability. However, there was no mention of their schools' programs as a contributing to students' results.

Teachers' Perceptions of Deadly Maths Project

Initially all teachers in the four schools seemed enthusiastic about being able to gather and use test data from their students for a relevant purpose. They felt that the time spent administering these test served no real purpose in the everyday running of their classroom and, therefore had little relevance to their individual classrooms. No teachers had previously photocopied, marked and analysed their students' test responses and very few had even used the QSA's reports to determine students' understanding and inform teaching. They had restricted themselves to organising for all their Years 3, 5, and 7 students to complete the tests and then waited for results at the end of the year.

In practice, the teachers' performance did not match their original enthusiasm. One of the major reasons for this was that all participating teachers had very limited knowledge of working with data. None of the teachers had any data entry skills (not even knowing what data was useful and how to find class percentages etc). There were varying levels of skills with using excel (ranging from very limited to moderate – no one was confident using excel for data analysis or to produce graphs). After data had been collated and graphed, teachers could see the trends in the students' understanding. However, none appear able, unsupported, the use these trends to develop remedial programs. Only 8 of the 13 teachers (all 3 from Schools A and C and one each from Schools B and D) completed all five stages of the project.

The schools undertook the data entry and analysis differently. All teachers in School A had their data entered analysed by one teacher who was released for this purpose. Thus, although all the teachers had results, they had not become empowered by the task, and had little data analysis skills at the end of the project. Worse than this, the resulting analyses often had incorrect calculations (e.g., percentages of over 4,000) which were not evident to the teachers because they had not worked with the data. However, the teachers, with support from Deadly Maths researchers, did complete analyses and develop and trial remedial programs, and all presented at the sharing conference. The teachers in School B became reluctant to undertake the task. They became apprehensive about how much time the process of photocopying, marking and analysing would take, clearly giving the impression that they thought it was not really worth the personal time it would take to do it. They employed a casual teacher to mark and enter data but analyses were incomplete. Only one teacher followed through, completed the analysis, and developed and trialled a remedial program. The other teachers seemed to become preoccupied with data entry and analysis becoming system based and undertaken by experts external to their school. The teachers of School C seemed enthusiastic and had good intentions but had little knowledge of how to use test responses to improve teaching. With support (there were many mistakes to correct), they carried out all tasks and were able to develop their own analyses. They all came to see the benefit at the end of the process. Some teachers found that the data simply affirmed what they already understood to be the weaker areas; however, they felt that it was good to have this confirmation. All the teachers from School C followed through the process for the 2007 tests and all presented at the sharing conference. The teachers at School D were initially eager to analyse the results for them selves to find areas that they could improve on. However, their good intentions and enthusiasm for the project did not translate into analyses and remedial

programs. The severe lack of administrative staff at the school made it difficult for the school to carry out the data analysis tasks (teaching principal was the only one really involved with the project) and only one teacher completed all stages (but did not present at the sharing conference because of timetable problems).

Teacher Perception of the Project

In surveys, all teachers marked 4 or 5 out of 5 for usefulness, indicating that they felt that the process was useful in some way. However, although 8 of the 13 participating teachers attempted to complete to Stage 5, in practice, 5 teachers were not willing to spend the out of school time to complete their analyses, some because it was taking too long, others because they felt it should not be their job, and one because it became too difficult. Many of the teachers seemed to be in a mind set of just wanting classroom activities or resources rather than wanting to understand the theories behind the ideas. This made the delivery of some aspects of the project difficult as they seemed to 'tune out' or not really engage with the aspects of the project that they thought they would not directly use in the classroom. Feedback showed teachers giving highest priority to practical hands on activities that they could immediately use in their classrooms.

The teachers who did the work appeared to reap the benefit. All the teachers who completed Stage 5 and attended the sharing conference felt that the process had been worthwhile and beneficial to their teaching and had generated an improvement in the students' outcomes in the selected intervention area. Two teachers did restate the position that the project involved a lot of time just to reaffirm what they already knew about the students' knowledge. They seemed to miss the idea that the test analysis not only indicates areas of weakness and strength, but provides detail for the intensive follow up interventions that enhance students' mathematics outcomes. Some teachers did raise three other considerations. First, they were concerned with the relevance of some items in the tests to what they considered important in their students' mathematical knowledge, and felt their students' responses to these items were unimportant. Second, they repeated their difficulties with test-item language and context not being Indigenous and rural or remote. Third, they felt, at times that the tests contained insufficient questions on specific concepts to determine if students understood the concept, or were those particular questions difficult or not true indicators of the students actual knowledge in that area.

Conclusions

Aspects of Numeracy testing is a difficult time for students and teachers. The students feel stressed and very disappointed when their results do not meet their expectations, a result that was higher in schools with larger Indigenous populations. The teachers feel that they are being judged for results that they believe are largely out of their control, although this may not be as true as they feel. This leads to feelings of disempowerment.

All the 8 teachers who completed all stages (all 3 from Schools A and C and 1 each from Schools B and D) stated that they had gained a lot from the process and so had their students. The 7 who were able to present at the sharing conference showed effective remedial activities and good student progress. However, the support given to these 8 teachers and the resistance showed by the 5 teachers who did not complete showed the difficulty that would be had implementing a program in which teachers mark and analyse their students' government numeracy tests and use the results to undertake immediate remedial programs. The teachers in this project simply did not have the knowledge and skills to do this. On top of this, some teachers felt that doing this analysis was not their job and were reluctant to do any out-of-class and after-school work to achieve it. For 5 of the teachers, these became huge barriers to overcome.

Some teachers gave the impression that they already knew their students' weaknesses and felt that our process was too long and time-consuming and that the data entry and analysis was tedious. These opinions also stemmed from the teachers' lack of skills and familiarity with basic uses in technology, including spreadsheet software, in which simple tasks required a really long time to complete. In particular, teachers tended to demonstrate insufficient skills in each of the following three areas: (i) data entry (having little idea what numbers were important or what numbers to compare and, therefore, not knowing how to lay out the data); (ii) data analysis (not knowing which scores should be combined and averaged to provide an overview of responses that would help interpretation and not having the skills to use a spreadsheet, e.g., to produce graphs easily); and, (iii) interpretation (having little idea what the graphs and tables of data meant in terms of what students know and not know); and (iv) translation (very little idea of how knowledge of what students know and not know can be translated into effective programs for remediation and/or intervention. In particular, teachers were unsure of what strategies to employ to improve students' understanding in the areas of weakness identified in the data analysis.

Notwithstanding, all the teachers who completed the entire process (from data entry to analysis and implementation of an intervention program) achieved improved student outcomes. Those teachers who returned the follow-up survey from the sharing conference indicated that they would follow the process again in the next year. However, the impression was that perhaps they would not comply with the same level of detail due to time constraints. Unfortunately, because the time and effort involved with the process overwhelmed teachers, they did not have an opportunity to feel more empowered about the testing process. Instead, they demonstrated a "tick-box mentality" whereby they felt as though they had accomplished something with the test results if they had merely looked them over, regardless of what the outcomes actually were.

Members of Deadly Maths have unsuccessfully approached QSA in the past with a request that the *Aspects of Numeracy* tests be redesigned so that they are developed in relation to a diagnostic profile and source of remedial activities that can be accessed by teachers when the QSA's analysis comes out or when teachers produce their own analyses. With so much money being spent on testing, it is an utter waste that the tests do not come with accessible diagnostic and remedial material. This, of course, does not even take into account the issue of the tests themselves and their role in social reproduction of Australia – this has to wait for another paper.

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