



NAPLAN RESULTS FOR YDM SCHOOLS – MEAN STUDENT GAIN OVER TWO YEARS

Introduction

YuMi Deadly Mathematics has been developed by a group of academics and practitioners at QUT to provide a mathematics pedagogy to address systemic mathematics performance differences that exist between Indigenous and low SES schools and other schools. It is the basis of professional development offered to schools and teachers to improve the quality of mathematics instruction. This paper briefly examines the quantitative evidence of the effectiveness of the YDM pedagogy in primary schools.

NAPLAN testing is standardised testing in literacy and numeracy testing of all Australian students in Years 3, 5, 7 and 9. The results of NAPLAN tests are published for each school in the My School website (ACARA, 2016a). The numeracy data has been used to evaluate the effectiveness of YDM mathematics programs.

Data used

This analysis is based on data obtained from two sources:

- school NAPLAN data published annually in the My School website (ACARA, 2016a), for *YDM schools* (mainly located in Queensland) and their *similar schools*; and
- NAPLAN data for all students across Australia published in the annual national reports of the NAPLAN program (for example, ACARA, 2016b).

For any particular school, the *average gain* over two years is calculated as the difference (usually increase) in the *mean scale score* (MSS) achieved in the NAPLAN numeracy test(s) by a cohort of students in that school with that of the same cohort in that school two years later. The MSS is based on the raw score achieved in the NAPLAN tests in a particular domain (for example, numeracy) that has been:

- normalised across Australia to allow for variations in raw test results from one year to the next (for example, the difficulty of the tests may vary); and
- vertically equated so that a result in a NAPLAN domain in one year (for example, Year 3 in 2014) can be compared with a result in the same domain two years later (for example, Year 5 in 2016).

Nationally, the *average gain* is calculated as the difference in the MSS achieved in the NAPLAN numeracy test(s) by all students in Australia with that of the same cohort two years later.

Similar schools are defined in relation to a particular school (called the *selected school*). They are a group of up to 60 schools with students from statistically similar backgrounds to the students from the selected school. Statistically similar backgrounds are determined by reference to the Index of Community Socio-educational Advantage (ICSEA) (ACARA, 2015) that takes account of students' socio-economic advantage, the school's remoteness and the percentage of Indigenous students enrolled. An average NAPLAN result is calculated for these 60 similar schools to enable comparison with the NAPLAN results of the selected school. The group of schools that are similar to the selected school will vary from year to year as the ICSEA status of the various schools change.

The analysis currently does not include secondary school (Years 7–9) data because most Queensland state schools accepted their first cohort of Year 7 students in 2015. Secondary school results should be available in early 2017 when the results of the 2016 NAPLAN tests are published. For the same reason, the Years 5–7 data comparison ends in 2014.

In analysing the data, the use of data from My School required the following assumptions:

- Given that YDM focuses on mathematics, only the data in the NAPLAN domain of numeracy was considered.
- The calculations of the *mean gain* over two years for YDM schools and for similar schools were based on the average gain for each school, with the result that a small school had the same impact on the mean as a large school. Drawing conclusions based on the mean of data that has already been averaged can be misleading. However, to allow for school size would require data on the number of students in the relevant cohorts in each school. While this data is available in the My School website for individual schools, it is not available for their similar schools.
- In contrast, the Australia-wide data on average gain (labelled *all schools*) is calculated by averaging the result for each student, not for each school. This means that a small school would have a lesser contribution to the mean gain than a large school. Accordingly, the all schools data is useful for analysing trends in the data, but not for direct comparisons. For example, differences in the way that the mean gain is calculated in these two instances would prevent a claim that YDM schools are showing a greater mean gain than schools throughout Australia.

These assumptions have an impact on the validity and reliability of the conclusions. However, given the nature of the data that is available through the My School website, it is not possible to improve on the analysis.

Results of all schools trained in YDM methods

Schools are considered to be trained in YDM methods if their nominated teachers completed a one-year or two-year YDM training program, that is, at least six days of professional development. Their data was included from the year *after* the program was completed. For example, if a school started a two-year YDM program in 2010, their NAPLAN data from 2012 onwards was included in this analysis.

Figures 1 and 2 compare graphically the mean gain in MSS over two years for YDM schools (darkest column) with that of their similar schools (middle column). The Australia-wide average gain (palest column, labelled all schools mean gain) is shown for information, but for the reasons outlined above the palest column should not be compared directly with the other columns. The analysis shows that in every case the mean gain of YDM schools is larger than that of their similar schools, with the extent of the difference shown in the annotations on the graphs.

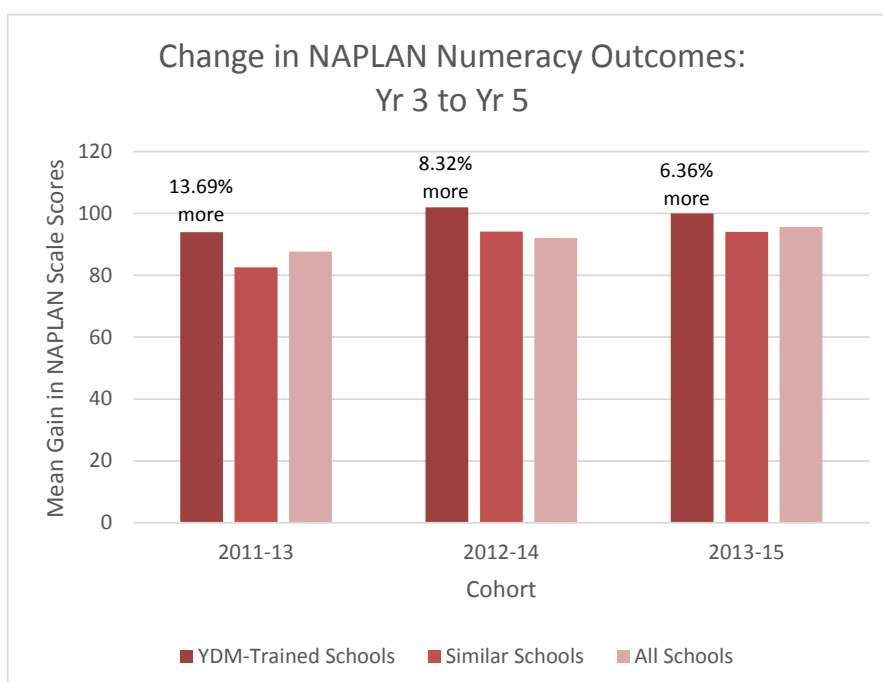


Figure 1: Change in NAPLAN numeracy outcomes of YDM-trained schools – Gains from Year 3 to Year 5.

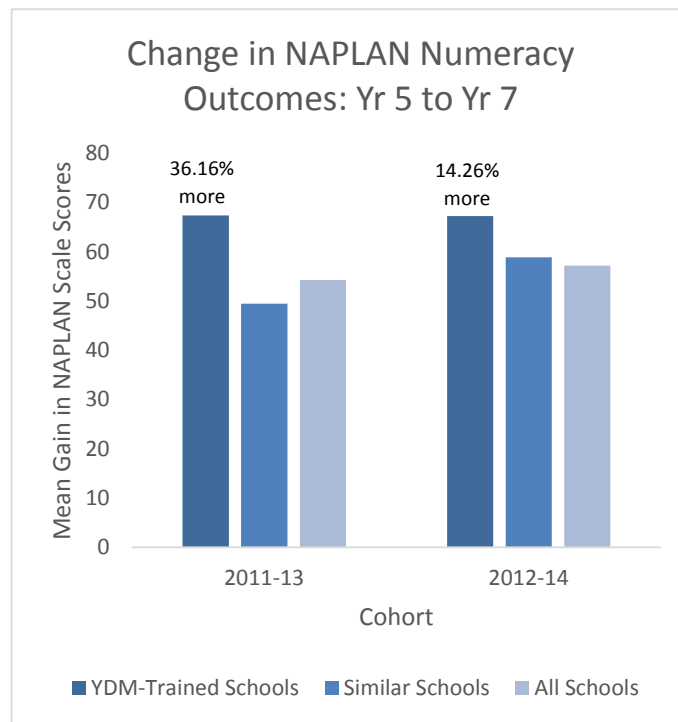


Figure 2: Change in NAPLAN numeracy outcomes of YDM-trained schools – Gains from Year 5 to Year 7.

Source: ACARA. (2016). My School Retrieved May 1, 2016, from <http://www.myschool.edu.au/>

It can be seen that in each of the cohorts analysed, the two-year gain for YDM schools exceeded that of their similar schools.

At present, the data covers a relatively small number of schools, because only schools that completed YDM training between 2010 and 2012 can be included. The analysis covers 10 schools in the 2011–2013 cohort, 17 schools in 2012–14, and 30 in 2013–15. YDM training had a slightly different focus in each year:

- in 2010, YDM training focused on Preschool to Year 3 mathematics;
- in 2011 the training was extended to Years 4 to 7 mathematics, with some schools given the opportunity to repeat the Preschool to Year 3 training; and
- in 2012 the training focused on Years 7 to 9 mathematics, plus catch-up in all year levels for selected schools and teachers.

The timing of the training is reflected in the NAPLAN numeracy results, with the gain of Years 3 to 5 students relative to students in ‘similar schools’ showing a steady decline over time, probably reflecting the gradual loss of YDM-trained staff. The more marked improvement in mean gain in NAPLAN numeracy results amongst the older students (Years 5 to 7) taught by YDM-trained teachers could be caused by one or more factors:

- older students may have longer experience with YDM pedagogy;
- the focus of YDM training on mathematics structure has more effect in the higher year levels;
- YDM requires a major change in mathematics pedagogy that takes time to have effect; or
- changing the way that mathematics structures are presented to students takes time to have powerful effects, requiring accommodation (Piaget, 1997).

As the number of schools undertaking the YDM program is increasing over time, each additional year of NAPLAN data will allow the inclusion of more schools in the analysis, increasing the reliability of the data.

Some schools included in the analysis may no longer be actively using the YDM program. The most likely reason for this is the loss of teachers trained in YDM methods through transfer, retirement or resignation,

although in other cases, schools may have taken a management decision not to adopt YDM methods. Since the data suggests that active engagement in the YDM program increases a school’s average gain in NAPLAN numeracy, the inclusion of data from schools that are not active in YDM is likely to cause an understatement of the mean gain of YDM schools. Nevertheless, to avoid the possibility of influencing the results by strategic selection of schools analysed, once included in this part of the analysis, schools were not removed. The next section of the paper repeats the analysis of mean gain in NAPLAN numeracy scores, but is limited to those schools known to have continued to implement YDM methods.

Results of schools continuing to be active in YDM methods

To better judge the effect of YDM on student results, the above analysis has been repeated for those primary schools that were known to YDC staff as having successfully implemented YDM pedagogy across the school (called, for the purposes of this analysis, YDM-active schools). This included seven schools in 2011–13 and eight schools thereafter. If the analysis of all YDM-trained schools (above) represents baseline data for YDM effectiveness, then this analysis of the YDM successes represents the potential for improvement following the adoption of YDM methods in the recommended manner.

Figures 3 and 4 show that, in general, the results for the YDM-active schools followed the same patterns as for the YDM-trained schools. However, in most cohorts, the difference between the YDM-active schools and their similar schools was even more marked, with students in Years 5 to 7 attending YDM-active schools between 2012 and 2014 outperforming students in other schools with similar socio-economic status by more than 30%.

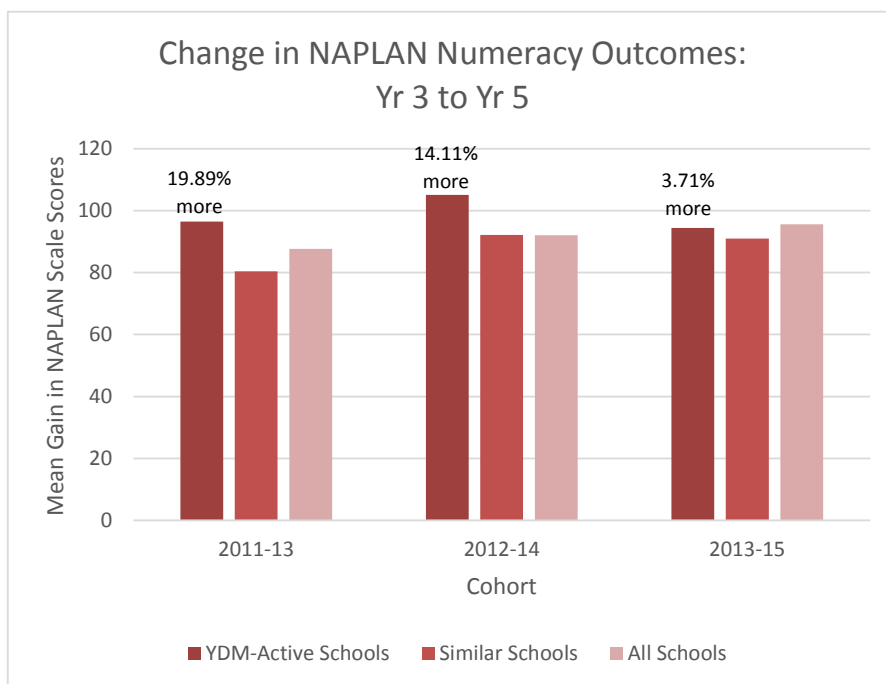


Figure 3: Change in NAPLAN numeracy outcomes of YDM-active schools – Gains from Year 3 to Year 5.

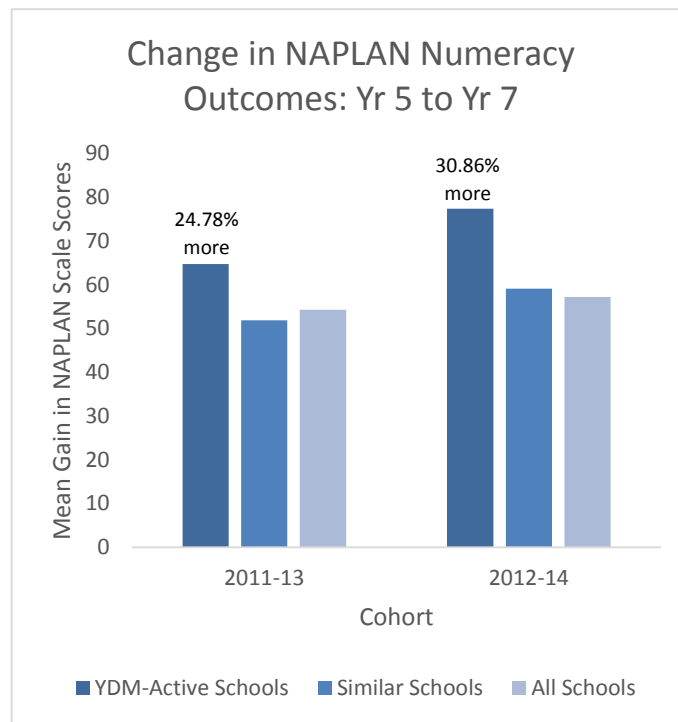


Figure 4: Change in NAPLAN numeracy outcomes of YDM-active schools – Gains from Year 5 to Year 7.

Source: ACARA. (2016). My School. Retrieved May 1, 2016, from <http://www.myschool.edu.au/>

Conclusion

The limitations of the data, including the small numbers of schools involved in some cases, require that caution is exercised in drawing conclusions. However, on the basis of the publicly available NAPLAN data, and given the magnitude and consistency of the difference between YDM schools and their similar schools, the analysis suggests that the YDM programs do enhance students’ aggregated mathematics outcomes, as measured by NAPLAN tests.

References

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