



Using a range of evidence to support decision making and to effectively
develop and deliver the mathematics curriculum for students

Evidence-based decision making for Pasifika success in mathematics: An Exemplar

Judy Oakden, Dr Ruth Toumu'a, Pale Sauni and Kellie Spee



Evidence, Data and Knowledge Group
Ministry of Education
PO Box 1666
Wellington 6140
New Zealand

Email: research.info@minedu.govt.nz
Phone: 64-4-463 8000
Fax: 64-4-463 8312

ISBN: 978-0-478-42242-9
ISBN: 978-0-478-42243-6 (web)
RMR-1035

© **Ministry of Education, New Zealand: 2016**

Opinions expressed in this report are those of the authors and do not necessarily coincide with those of the Ministry of Education.

Any text, tables or diagrams reproduced from this report should be cited as follows: Oakden, J., Toumu'a, R., Sauni, P., & Spee, K. (2014). *Evidence-based decision making for Pasifika success in mathematics*. Ministry of Education: Wellington.



Contents

| | |
|--|-----------|
| Introduction | 5 |
| Understanding the context and challenges | 8 |
| Theory of practice — the values and principles | 10 |
| Range of initiatives undertaken | 11 |
| Effective use of data | 13 |
| Using data to identify student needs on entry to the school..... | 13 |
| Using data to set high expectations in mathematics for Pasifika students..... | 14 |
| Using data to communicate with parents about Pasifika students' mathematics progress | 15 |
| Using data to analyse class results and inform teaching practice..... | 17 |
| Using data to access resources that support learning in mathematics | 17 |
| Sophisticated use of data for decision-making..... | 17 |
| Responding to what the data say about student progress and needs | 18 |
| Ongoing curriculum development | 21 |
| Conclusion | 22 |
| When students believe in themselves, significant changes can occur..... | 22 |
| Building reciprocal relationships and trust support Pasifika student achievement | 23 |
| Strong leadership and vision is important for driving change..... | 23 |
| Some final comments | 24 |
| Acknowledgements | 25 |
| Research team | 25 |
| List of case study and exemplar reports in the series | 26 |
| Works Cited | 26 |

Contents continued ...

Figures

Figure 1: Pass rates in NCEA level 2 mathematics external achievement standards from 2009 to 2011: a comparison of McAuley High School (MHS) Pasifika students with Pasifika girls in other decile 1 schools and girls' schools nationally 6

Figure 2: Pass rates in NCEA level 2 mathematics internal and external achievement standards 2012: a comparison of McAuley High School students with students in other decile 1 schools and girls' schools nationally..... 6

Figure 3: Information sheet developed by McAuley High School to help parents interpret mathematics progress . 16

Tables

Table 1: Year 12 Pasifika student achievement in NCEA level 2 mathematics at McAuley High School, 2011 and 2012..... 7

Table 2: Challenges in raising mathematics achievement identified by McAuley High School 9

Table 3: Summary of key strategies used to lift Pasifika student achievement in mathematics at McAuley High School..... 12

Table 4: Percentage of Year 9 students at McAuley High School below New Zealand Curriculum level 3 for different areas of mathematics at the start of 2011 13

Table 5: Percentage of Year 9 students at McAuley High School below New Zealand Curriculum levels 3 and 4 for different areas of mathematics at the end of 2011 14



Introduction

How do schools lift Pasifika achievement in mathematics? What does it look like in a school where there is a strong culture of success in mathematics for Pasifika students?

The exemplar featured in this report¹ shows the journey McAuley High School² has made to lift Pasifika (and other) students' achievement in mathematics, using data to inform and change practice. This is in a school where, on entry, there are 'approximately double the number of Very Low and Below Average students [for literacy and numeracy]³ than we would expect if this were an average cohort'. (McAuley High School, n.d., p.18)

The principal, senior leadership team, and teaching staff all speak of how the school strives to support Pasifika students' aspirations across a wide range of tertiary and vocational pathways. Students achieving NCEA level 2 mathematics is considered particularly important, as this qualification opens doors to so many future options. The principal and parents who took part in interviews for this project report that students are meeting the prerequisites for academic and vocational pathways which include mathematics, and that the mathematics courses continue to evolve.

This exemplar report describes how McAuley High School raised Pasifika student achievement in mathematics over a number of years, so that in 2011:

- 98% of year 11 students achieved NCEA level 1 numeracy, and 79% had gained enough numeracy credits for university entrance
- 97% of year 12 students had achieved NCEA level 1 numeracy and 95% had gained enough numeracy credits for university entrance
- 99% of year 13 students leaving the school had achieved NCEA level 1 and sufficient numeracy credits for university entrance.

McAuley High School's Pasifika students' achievement levels in NCEA level 2 mathematics are now⁴ consistently high and compare favourably with all other schools in New Zealand (Figures 1 and 2 on the next page).

Figure 1 shows the improvement in the percentage of the school's Pasifika students achieving NCEA level 2 mathematics external achievement standards from 2009 to 2011. The graph also compares McAuley High School (MHS) results with Pasifika girls' results in all girls schools nationally and in all other decile 1 schools.

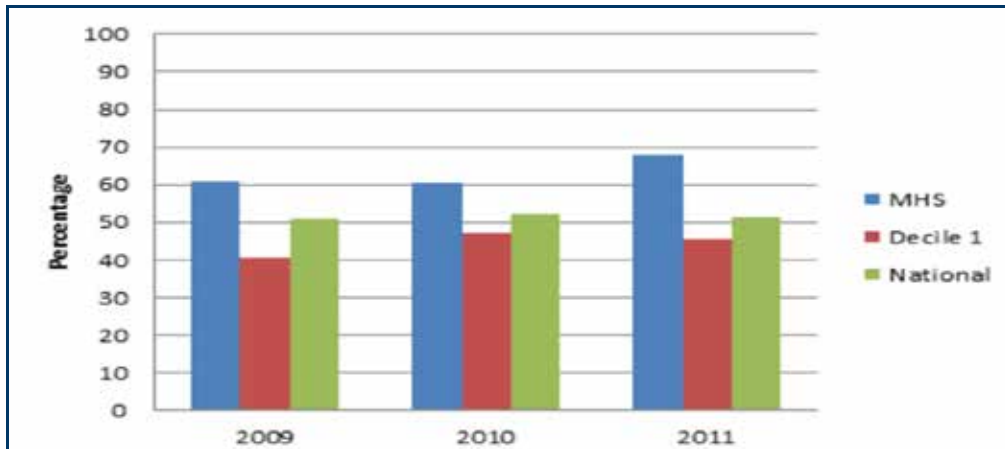
¹ This report is one in a series of three exemplar and three case study reports with a focus on school leadership practices supporting Pasifika student achievement and success. (One of the case studies features McAuley High School). All six reports are listed at the end of this document (on page 26).

² McAuley High School is a state-integrated decile 1 secondary school for girls located in Otahuhu, Auckland. The school has 679 years 9–13 students. Pasifika students have a strong presence in the school, making up 88% of the school population: 58% of the school roll are Samoan, 24% Tongan, 6% are from other Pacific communities, 4% are Māori, 4% Asian, and 4% are from other ethnic groups.

³ Based on Middle Years Ability Test (MYAT) entrance data at year 9.

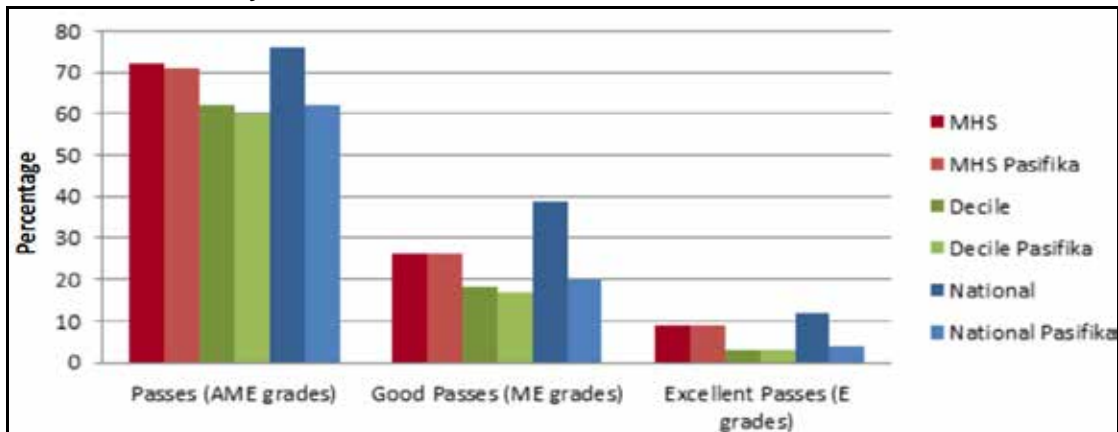
⁴ Most of the information for this exemplar report was gathered between September and October 2012, with some follow-up information obtained in the period to May 2013.

Figure 1: Pass rates in NCEA level 2 mathematics external achievement standards from 2009 to 2011: a comparison of McAuley High School (MHS) Pasifika students with Pasifika girls in other decile 1 schools and girls' schools nationally



The school's 2012 pass rates for NCEA level 2 mathematics achievement standards (both internal and external) are shown in Figure 2. As in the previous figure, the school's results are compared with results for all decile 1 schools and for all girls' schools except that this time comparisons are made both across all students and for Pasifika students only. The data are also presented firstly for the total number of students in each grouping who gained a 'passing' grade (whether 'Achieved', 'Merit' or 'Excellence'), followed by separate presentation of data for students who achieved a mix of merit and excellence passes, and students who achieved overall 'Excellence'.

Figure 2: Pass rates in NCEA level 2 mathematics internal and external achievement standards 2012: a comparison of McAuley High School students with students in other decile 1 schools and girls' schools nationally



Note: Decile data relates to decile 1 schools only.



As well as working to achieve consistently high levels in the numbers of students gaining NCEA level 2 qualifications, the school is now also building an increase in the proportion achieving Merit and Excellence grades. The data in Table 1 show that more students achieved Merit and Excellence ratings in 2012 than in 2011.

Table 1: Year 12 Pasifika student achievement in NCEA level 2 mathematics at McAuley High School, 2011 and 2012

| Course details | | | | Pasifika students' results | | |
|--------------------------|---------------------------|-----------------|-----------------------------|--|--|---|
| Course | Maximum credits available | No. of students | Average credits per student | 'Achieved' (Pass) | 'Merit' | 'Excellence' |
| | | | | (Percentage students getting 14+ credits) % | (Percentage students getting 14+ Merit credits) % | (Percentage students getting 14+ Excellence credits) % |
| NCEA level 2 maths, 2011 | 20 | 35 | 15.8 | 66 | 11 | 0 |
| NCEA level 2 maths, 2012 | 22 | 42 | 17 | 62 | 19 | 5 |

Now that the school has consistently high levels of Pasifika student achievement for mathematics in NCEA levels 1 and 2, it is focused on raising NCEA level 3 achievement rates. What is more, the principal confirms that mathematics has become one of the most popular option choices for girls in their senior years at the school.

I think one of the things you don't realise as you are travelling the journey is how big the difference that you are making is, until you look back. It's little steps all the time ... then you realise, wow, there is a big difference and a big change has happened! [Principal]

Understanding the context and challenges

Students arrive at McAuley High School from over 30 feeder schools with wide variation in numeracy foundation skills. The principal, deputy principal (DP) Curriculum and head of department (HOD) for Mathematics, along with the teaching staff, identified that there were large gaps in mathematics knowledge that needed to be addressed. These gaps occurred in a wide range of areas, and because gaps were often specific to individuals they were not as easy to target as in a situation where a large number of students are found to have similar gaps on entry (eg, in fractions), indicating a need for a larger class focus on those particular areas.

According to the principal, one of the initial challenges was to identify appropriate tools to assess students' mathematical knowledge and skills at entry. They first trialled e-asTTle⁵ but found that the online delivery did not work well in this school. The school then engaged in the Secondary Numeracy Project (Ministry of Education). This helped the mathematics department to develop key understandings about learning progression in mathematics that could be used for diagnostic assessment. They also used the Middle Years Ability Test (MYAT) which is 'designed to assess students' general reasoning ability in the areas of literacy, numeracy and non-verbal reasoning, three important areas contributing to general scholastic ability' (McAuley High School, n.d., p.18). This significantly helped the school to identify students' learning needs upon entry and establish ways to accelerate their learning.

I can check by the entrance test which students have not been exposed to decimal fractions. I can tell you which ones have [skimmed] over fractions. So, really, we do collect a lot of data during years 9 and 10. It takes these two years to ensure that all students have had exposure to the necessary mathematics concepts for future success. [HOD Mathematics]

While girls at McAuley High School always saw the importance of mathematics and enjoyed it as a subject (as measured by the e-asTTle attitude questions), this did not always translate into academic success. A key focus was to encourage students to talk about their mathematics learning so that they better understood the important factors that lead to academic success and could take ownership of their own learning.

The principal and board of trustees (BOT) understood that lifting student achievement would take a concerted and orchestrated approach, and would require additional resourcing, both to support student learning and to provide ongoing professional development for teachers. They wanted to ensure that Pasifika students' socio-economic background was not a barrier to learning, that all students were physically and emotionally well, and that they had access to necessary teaching and learning resources.

The need for parental involvement and support was also acknowledged. Originally, parent-teacher communications were characterised by discussions about behaviour, rather than about progress and achievement in mathematics and numeracy. The HOD Mathematics wanted to find ways to communicate constructively with Pasifika parents about the current levels of their daughters' understanding, even when this was well below what might be expected for their year level.

⁵ An online assessment tool first developed by Auckland Uniservices to assist schools and teachers to assess student achievement and progress in reading, mathematics and writing.



As part of ensuring that the school's courses offered valid pathways for Pasifika students taking mathematics to higher levels of study, the senior leadership team needed to take into account changes in the national NCEA environment, as well as in entry requirements of a range of tertiary institutions.

Table 2 sets out the challenges for the school in its quest to raise student achievement in mathematics.

Table 2: Challenges in raising mathematics achievement identified by McAuley High School

In summary, the challenges facing the school in raising Pasifika (and all) students' achievement in mathematics were multifaceted and included the need to:

- set high expectations for student success in mathematics and demonstrate to both students and teachers that these expectations were realistic
- identify areas of mathematics strength and weakness for Pasifika (and all) students on entry to the school, and coordinate a plan to accelerate strengths and minimise areas of weakness with highly effective teaching
- effectively resource mathematics to support teaching and learning for all students
- build relationships with Pasifika parents about student progress in mathematics
- build the capability of students to have learning conversations about their mathematics understanding
- ensure students' educational pathways are optimised by a clear understanding of developments in NCEA, as well as university and tertiary requirements.

Theory of practice — the values and principles

The underlying values and principles that guided McAuley High School's improved Pasifika student achievement rates in mathematics were as follows.

- A concerted, whole-school, holistic approach to working with Pasifika students.
- High expectations of Pasifika students and a real belief that all Pasifika students can succeed in mathematics.
- Constantly working to develop a deep understanding of how to teach mathematics, including collecting, analysing and utilising diagnostic data to determine where students' understanding is currently and what next learning steps should be.
- Placing a high value and emphasis on having students' develop a deep understanding of mathematical concepts and principles, rather than the more surface memorisation of formulae or rote learning.
- A clear focus on course and task design to meet student needs and facilitate their learning through applying mathematical concepts in real life scenarios.



Range of initiatives undertaken

The principal maintains *"It's not one particular thing, it's a combination of everything"* that helped raise Pasifika student achievement in mathematics. The school implemented a number of initiatives to support higher levels of achievement in mathematics. At the heart of this approach was the principal's belief that:

It's a case of aiming high; not having low expectations.

The interwoven strategies used to lift Pasifika student achievement in mathematics are outlined in Table 3. While acknowledging the importance of this multifaceted approach, this exemplar focuses on the use of data to raise student achievement.

Table 3: Summary of key strategies used to lift Pasifika student achievement in mathematics at McAuley High School

Strategies undertaken to lift Pasifika achievement in mathematics are set out below.

1. Understand Pasifika student needs by:
 - screening students on entry both for medical issues (such as eyesight and hearing) and for pastoral care issues
 - using clear diagnostic testing in literacy, numeracy and reasoning
 - offering streamed classes in the junior years that enable a focus on areas where understanding is below the required level
 - focusing on the curriculum level/s at which students are achieving and finding ways to accelerate their learning
 - knowing the student and their family, and helping them to explore their career or study aspirations via extended form-time sessions, careers evenings, and individual and family interviews with the careers advisor, and using this information to guide student course choice.
2. Involve Pasifika parents through twice-yearly meetings (with parents and students together), as well as through other, informal means both within the school and in the community.
3. Ensure staff professional development and practice encourages and supports sophisticated pedagogical innovation in the delivery of the curriculum. For example, by:
 - participating in the Secondary Numeracy Project (2008–2010)
 - operating a collaborative professional learning approach using a model of ongoing cycles of teaching as inquiry
 - using evidence-based practice, including student feedback, for professional learning opportunities and staff appraisals
 - designing courses that support student achievement and future pathways, including removing Unit Standards (that did not support future pathways well) at all levels in mathematics
 - have a strong focus on development of appropriate assessment tasks that enable students to achieve at the highest possible levels and expose them to a wide range of mathematical contexts.
4. Provide additional support to students in need by: timetabling students to attend the regular homework centre if they need numeracy credits; offering a maths club for those with a particular interest and ability in mathematics or those seeking extra support.
5. Undertake sophisticated and in-depth data analysis using Fathom software (for exploring and analysing data) to track how effectively students learn the material presented to them, including both test results and student feedback about teaching.
6. Obtain resource approval and establish a mathematics computing suite that enables courses to be taught using the most appropriate technology, so that students can develop a conceptual understanding of mathematics and statistics through hands-on learning.



Effective use of data

The school uses data in a number of effective ways to unlock Pasifika students' mathematics potential and better understand and respond to each student. Data are used to:

- identify student needs and plan realistic pathways for progress based on a deep understanding of (1) what they currently know, understand and can do, and (2) the mathematics curriculum
- set ambitious targets for potential achievement and articulate high expectations of both Pasifika students and the teachers, with regard to student engagement and possible learning trajectories in mathematics
- communicate effectively with parents regarding their daughters' success in mathematics
- report to the BOT and make proposals for mathematics teaching and learning resources
- support mathematics teachers in cycles of teaching as inquiry that are linked to the appraisal process
- develop the curriculum.

Using data to identify student needs on entry to the school

In order to achieve their targets in mathematics, the school uses diagnostic data to unpack students' wide range of mathematics abilities upon entry to the school. These data are also able to be disaggregated by ethnicity to enable a closer and more thorough analysis of trends within the Pasifika student data.

The school found, at the start of each year, that a high proportion of the year 9 cohort had not mastered mathematics at level 3 of the New Zealand Curriculum, the expected level for year 9.

At the beginning of the 2011 school year, for example, sizeable proportions of incoming students (Table 4) were below New Zealand Curriculum level 3 in a wide range of mathematical knowledge areas, including proportions and ratios, fractions, number sequence order, addition and subtraction, and place values. Some of these students were well below expected levels: at the start of 2011 nearly 30 incoming students were operating at level 1 of the curriculum in the addition and subtraction domain.

Table 4: Percentage of Year 9 students at McAuley High School below New Zealand Curriculum level 3 for different areas of mathematics at the start of 2011

| Domain | Students <i>below</i> curriculum level 3 at start of 2011 |
|-----------------------------|--|
| | % |
| Proportion and ratios | 59 |
| Fractions | 53 |
| Number sequence and order | 49 |
| Addition and subtraction | 47 |
| Place value | 45 |
| Multiplication and division | 35 |
| Basic facts | 30 |

One way the mathematics department addressed this disparity was by ensuring all relevant staff were very clear about where the new students' knowledge gaps were, and that they then participated in planning for and responding to the students' needs accordingly.

Based on student achievement records, students were placed in mathematics classes with other students likely to work at a similar pace. The HOD Mathematics identified a core group of essential units that all classes were to cover, but each teacher had the flexibility and responsibility to work with the data on their particular students' needs to design the year's syllabus to reflect those needs. While each class worked at their own rate, the overall aim was to bring all groups to the threshold of readiness to sit NCEA level 1 — no matter what level students in each group were at when they entered the school.

In addition, the school offered a range of extra ways to accelerate students' progress, for example, an after-school mathematics club, support in completing homework, or catch-up sessions. Parents showed excellent support for this, in encouraging their daughters to take up these options.

The HOD Mathematics set common assessment tasks to cover areas taught during the year. Students were tracked individually and assigned curriculum levels as they progressed: the ultimate goal was to have all students achieving at level 4 or 5 of the curriculum by the end of year 10.

By the end of 2011 the year 9 cohort — whose early 2011 data are shown in Table 4 — had made significant progress (Table 5), although around a quarter were still operating at below level 3 of the curriculum, and over half had not yet reached level 4 (Williams, 2011, pp.83–84).

Table 5: Percentage of Year 9 students at McAuley High School below New Zealand Curriculum levels 3 and 4 for different areas of mathematics at the end of 2011

| Domain | Students <i>below</i> curriculum level 3 by the end of 2011 | Students <i>below</i> curriculum level 4 by the end of 2011 |
|-----------------------------|--|--|
| | % | % |
| Addition and subtraction | 23 | 93 |
| Multiplication and division | 19 | 42 |
| Integers | 20 | 58 |
| Algebra | 29 | 66 |

The results in Table 5 show that students still had a lot of ground to make up in year 10 if they were to successfully achieve NCEA levels 1, 2 and 3 mathematics. Despite this, the HOD Mathematics firmly believed NCEA achievement was possible for this cohort:

Years 9 and 10 can be a huge struggle, and then in year 11 suddenly things just click. What we want is to allow for accelerated progress at any stage. So you are not destined to fail because you are in a support class in year 9 which means you don't learn the required skills for NCEA level 1. [HOD Mathematics]

Using data to set high expectations in mathematics for Pasifika students

The principal, DP Curriculum, HOD Mathematics, and teachers at McAuley High School all believe that a key way to accelerate student learning in mathematics is to set high expectations — to clearly communicate that Pasifika students can and will achieve. School leadership also believe that in years 9 and 10 there are often Pasifika students in the lowest achieving classes who in fact possess a great deal of academic potential, and the HOD Mathematics considers it very important to identify and respond to the needs of these students.



The senior leadership team ensures that ongoing monitoring of progress is recorded in the student management database (KAMAR) so that all teachers can make use of this information. Once teachers have a good understanding of student progress, the school looks for effective ways to clearly communicate this information to both the Pasifika students and their parents. A great deal of time, effort and attention is paid to the way in which feedback is given to Pasifika students, and how this is framed — particularly in the junior school.

We are very careful about how we articulate information to students. We focus on showing what learning has occurred rather than just showing what they can't do. [HOD Mathematics]

Junior students are now no longer seen as passing or failing, and instead they are seen as being on a journey. This approach has brought about positive change in the junior school. The HOD Mathematics recalled overhearing a gratifying playground conversation in which a student asked her friend what she scored on a mathematics test. Her friend answered that she had “failed”. The girl immediately corrected her friend, by saying: *"It's not about failing. ... It's about where you are at, at the moment!"*

Teaching and assessment are undertaken with the explicit cultural understanding of how to minimise loss of face for Pasifika students within the classroom. The DP Curriculum reflected:

This is about building trust between teachers and students so that when students say they don't understand or get an answer wrong it is part of the learning process and further teaching and learning can occur, rather than being shameful.

Senior students are also encouraged to have a greater understanding of the progress they are making, and this is communicated to them in clear, concrete and affirming ways. Particularly at NCEA level, students are encouraged to use data to track and discuss their own progress in mathematics. Furthermore, by reporting to students on the school's overall achievement patterns, the school harnesses and encourages the natural competition between student year groups to improve student achievement rates in all subjects, including mathematics, each year.

Using data to communicate with parents about Pasifika students' mathematics progress

School leadership works collectively with staff, and with parents, to make the reporting system more understandable and affirming for Pasifika parents and students, ensuring ‘a more honest way of reporting to the parents’. For instance, the HOD Mathematics altered the way in which the school reported junior student progress in mathematics to parents. This was motivated by the desire to make it easier for Pasifika parents to know where their children were at, and partly to assist students themselves to better understand and take ownership of their own progress.

So in the report comment I will put something like 'They are working at level 3 [of the curriculum] in algebra, but they could do this, this, and this at [the next level] to get [them] to their level 4'. This level of detail is important if they are to continue to improve. [HOD Mathematics]

When this new reporting was introduced, the HOD Mathematics produced an information sheet entitled ‘Interpreting your daughter's mathematics report’ — as shown in Figure 3 — to accompany the changes. This sheet showed parents and families how each student's progress is aligned with year levels and curriculum levels, as outlined in *The New Zealand Curriculum for English-medium Teaching and Learning in Years 1–13* (Ministry of Education, 2007, p.45).

Figure 3: Information sheet developed by McAuley High School to help parents interpret mathematics progress

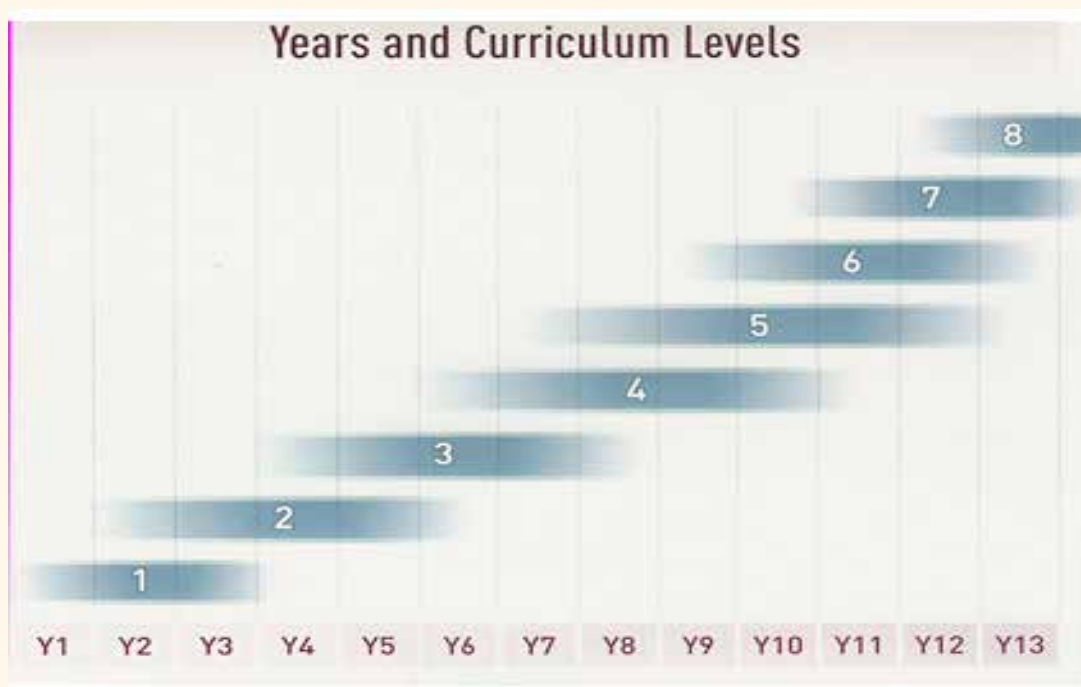
'Interpreting your daughter's mathematics report'

In mathematics we are reporting curriculum levels for each topic we have covered in class. The New Zealand mathematics curriculum ranges from level 1 to level 8.

Assessment is done for each topic several times a year and in various ways. The purpose of this assessment is to improve students' learning and teachers' teaching; both teachers and students need to use the information that assessment provides.

Each student is an individual and therefore will learn and develop her skills at differing rates. However, NCEA level 1 is set at level 6 in the curriculum. Working back from there, year 10 students should aim to be at level 5 of the curriculum *by the end* of year 9.

The diagram shows roughly how the curriculum levels relate to the number of years at school.



On parent interview evening, the mathematics department will be running two sessions to explain or go over the mathematics report. The first session will be at 4pm and the second session will be at 6pm. Both sessions will be held in the Cecilia Block (next to the GYM).

If you are unable to make either session and have questions about your daughter's mathematics report then please feel free to speak to any member of the Mathematics Department.

Curriculum level reporting was extended to all subjects in 2013, following the lead of the mathematics department.

For students sitting NCEA, the school develops credit snapshots to provide assessment information for the student, their parents and teachers, as well as the BOT.



Using data to analyse class results and inform teaching practice

Clear systems were developed over time for teachers to assess students and record results so that there would be easy access for further analysis. The DP Curriculum and the HOD Mathematics were, and continue to be, responsible for compiling and disseminating assessment data to teachers so that they can analyse their class results.

The head of maths and myself work together to produce appropriate graphs, tables and statistics for professional learning and reporting procedures. The focus for staff is on analysing this data — ‘What does it mean? So what? Now what?’ — rather than data manipulation. [DP Curriculum].

The senior leadership team also use these data to inform teaching practice. They maintain that teachers in the school take very seriously their responsibility for student success and are very willing to take action as appropriate.

The senior leadership team considers it is important for teachers to have in-depth knowledge of the students, and to use data to provide appropriate pedagogical responses, identify where to focus, and to develop suitable teaching resources in a collaborative way. A statistical data analysis package helps identify how targeted support might raise student achievement. Teachers are encouraged to respond to what they learn from the data in a timely way that addresses student needs, and over the last few years they have used the data to help them develop new approaches to delivering the curriculum to best suit the needs of their NCEA level students.

Using data to access resources that support learning in mathematics

The school provides regular information to the BOT on student progress to help identify areas where further resourcing is required. The board is provided with information on student progress throughout the year. Reports to the board also include statement of goals, an analysis of progress to date, and note planned action for the future. Over the past few years, the BOT has prioritised resourcing to improve student achievement in mathematics in a number of ways. The BOT has supported:

- the establishment of a new computing suite for teaching mathematics and statistics, which was essential for responding to and meeting the requirements of the New Zealand Curriculum and to changes in NCEA requirements
- the purchase of software packages, such as Fathom for exploring and analysing data, to support teaching and learning (the benefits of which included enabling students to use specialised online calculators rather than having to purchase them physically)
- the purchase of sets of graphic calculators for lease by students for the academic year
- additional teaching time for students, through programmes such as the homework centre, maths club and holiday classes
- a wider differentiation of mathematics courses on offer in the senior school
- the provision of sufficient staff to enable English and mathematics class sizes to be minimised.

Sophisticated use of data for decision-making

Fathom, a statistical data analysis package, proved to be a powerful tool for analysing student performance data. The principal credits the current HOD Mathematics with introducing Fathom and learning how to use it. The HOD Mathematics convinced the school's management and staff of its usefulness to them as a tool for tracking and

pinpointing trends in student data, as well as for isolating and tracking the relationships between a wide range of other factors that might impact on student achievement (such as absences, and pastoral and health care visits). The DP Curriculum also uses this package extensively in her school-wide analysis of student achievement patterns.

A particularly important milestone and turning point for staff was analysis by the DP Curriculum that showed how targeted support of particular students had significantly raised Pasifika (and overall) student achievement rates in the school.

This analysis also highlighted that students were achieving success in both internal and external standards, and that the school's focus on using achievement, rather than unit, standards⁶ where possible had led to a substantial improvement in Merit and Excellence grades. This was particularly important in challenging the myth that decile 1 schools that achieve success do so with easy standards that may not support future academic endeavours.

Responding to what the data say about student progress and needs

As discussed further below, the senior leadership team was unequivocal in its belief that the most important aspect of having data is being able to respond in a timely and appropriate way to students' needs and provide effective teaching.

Amongst other things, knowing more about students' prior experience of and progress in mathematics through effective gathering and analysis of data helps teachers to more effectively engage students in mathematics learning. It also helps in promoting understanding of why practice in the classroom needs to be more focused on teaching mathematical concepts rather than on rote learning, and on building students' wider, everyday vocabulary and understanding of context, rather than a focus on maths-specific language in the first instance.

- **In-depth knowledge of students:** In addition to the sophisticated use of data, the DP Curriculum and HOD Mathematics both stress the importance of developing teachers' knowledge of Pasifika students' needs and strengths, and identifying appropriate pedagogical responses. The DP Curriculum (who continues to teach one maths class) noted that: *"Feedback and feed forward are particularly important for student success. In marking student work and assessing their current ways of thinking, next teaching steps can be identified."* School-wide professional development in understanding students' learning needs was provided and continues to be a focus for professional learning.

There is a strong focus on cycles of teacher reflection to improve delivery of the curriculum. Teachers analyse student assessments to identify specific areas of the curriculum where Pasifika (and other) students have gaps or only partial knowledge of specific mathematical concepts. For instance, the HOD Mathematics analysed tests belonging to the subset of students who had not achieved the required standards in a specific year. This revealed that, for one of the measurement units, roughly 17 out of 20 students had mastered the questions relating to volume and area but were unable to successfully complete the perimeter questions. Therefore perimeter became a topic for further learning.

- **Identifying where to focus:** The DP Curriculum believes that year 11 is a key period to focus on when planning for improvement in mathematics. Analysing results for year 11 students enabled the staff to look back to years 9 and 10 and continually improve teaching practice and course design at those year levels. The HOD Mathematics noted that: *"You can then identify what students needed to have been doing back in [years] 9 and 10, so we can address that in our course planning."*

⁶ Achievement standards count towards University Entrance and provide pathways to tertiary education. Students can achieve a grade for these standards. Unit standards do not provide a pathway to University Entrance and are only shown as 'achieved' — there is no grading (eg, Merit or Excellence) for these unit standards.



- **Using evaluative and student progress data to develop, refine and share teaching resources that work for students:** The HOD Mathematics and classroom teachers also regularly collaborate to develop and share resources. There is a clear process for teachers in the mathematics department to develop, test and evaluate teaching and learning resources. Teachers willingly share resources with each other, feedback is obtained and adaptations made. After teaching tools are used in the classroom, teachers reflect on how successful they were (particularly for the Pasifika students), whether further adaptations are necessary, and whether they would be useful to share with other staff and, if so, when. This intensive process is characterised by a no-blame approach, a willingness to try new things out, and a commitment to improving practice each time in order to achieve success for Pasifika and all students at the school.

They [colleagues] don't hide anything but are really keen to share for the benefit of the students. ... We see what we can share to help everyone. [Teacher]

- **Making mathematics more engaging and manageable for students:** Using student progress and achievement data to inform the process, mathematics topics are broken down into manageable chunks for students, with “lots of visuals” to aid teaching and learning. In addition to this, a great deal of scaffolding is provided, and extra time allowed to enable students to prepare for a piece of assessment — to practise and reflect on their performance before it is formally assessed.

To make mathematics more relevant and engaging for Pasifika students, teachers try to convey that it is not simply about numbers. There is a commitment to enabling all students to engage with mathematical concepts in a deep and meaningful way to gain real understanding, rather than to simply memorise and use formulae or rules in a prescribed or mechanical fashion.

We focus on the main ideas and get them interested in the real mathematics — the nuts and bolts of mathematics. [Teacher]

Real-life and topical examples are used to work through mathematical concepts and exercises. For instance, the price of petrol was one successful example. Given the petrol unit price, and usage rates and distances, students calculated the amount of petrol needed to cover certain distances and the costs associated with that. Pasifika students were able to relate to this, since meeting petrol costs and transport costs are an everyday reality for their families.

Similarly, with the school being situated near the airport and flight paths, a topic used to teach angles that the students would easily relate to was that of airports and aircraft. However, the DP Curriculum and HOD Mathematics also believe it is important that students are not limited to engaging only with the familiar: both senior leaders are committed to stretching students by helping them engage with new and culturally unfamiliar subjects.

They encourage and push us to try the things that we like to do and don't like to do in maths. They focus on the things that we find hard to understand and they try and make us understand. [Student]

- **Building student vocabulary and understanding of context:** Using student data and other relevant information the mathematics teaching staff actively work to identify vocabulary within teaching resources or assessments which might be unknown or problematic for Pasifika students. They also work to integrate opportunities for learning specialised mathematics vocabulary into everyday teaching so that it is in a more readily understandable context. The mathematics department's current focus, at the time of this research, was

on assisting Pasifika students to respond to the challenges they encounter in understanding or interpreting the more everyday language used in external assessments rather than simply relying on teaching them the 'maths-specific language' only.

Mathematics teachers in the school actively encourage Pasifika students to ask questions when they do not understand a context or particular content. At the same time, the teachers remain aware of the potential cultural barriers for the students in asking questions or asking for assistance, and act to minimise these. Staff experienced in working with Pasifika students work hard to ensure the necessary trust and rapport exists with and between students, and that there is a supportive, non-threatening learning environment so that students feel more able to seek and accept help.

So it's about recognising, and it's also about training the students so that they feel confident to actually put up their hand and ask [for help], and actually say, 'I don't know what this means'. [HOD Mathematics]

The teacher walks around while we are working, and asks if we are stuck on something individually, because students don't say anything in front of the class. [Student]

The DP Curriculum also engages students in conversations in the classroom about topics such as money management, wages and lending, and uses this for meaningful discussions about relevant mathematical concepts, at the same time giving the girls opportunities to exercise critical thinking about financial issues observed in their own families and communities. The DP maintains that the pedagogical content of these conversations is critical to her own professional development and to the professional development of the mathematics department as a whole. Through each such interaction, insight and understanding is gained not only about the topic and subject, but also about how to teach that topic more effectively for Pasifika students.

*Effective maths pedagogy is essential to developing students' conceptual understanding of mathematics. An example of this is **not** beginning a topic with definitions of all the vocabulary to be taught, or a list of procedures to be learned. Instead, I try to give a problem or context for them to explore the situation, and when students are able to discern the need for correct notation or vocabulary I then share the correct mathematical term or representation [with them]. [DP Curriculum]*

Data use is discussed as part of appraisals, to build teacher skills in identifying student needs: Staff appraisals represent opportunities for appraisers, including the DP Curriculum and HOD Mathematics, to have in-depth conversations with teachers about how they successfully teach Pasifika students and how they go about continually enhancing their practice. There is an expectation that teachers are closely observing their students and using data from assessments to determine student progress. In working with teachers during the appraisal process, the DP Curriculum looks for three key criteria:

- Did teachers notice when students did or didn't get it?
- What actions did they take (or could they have taken) to address these learning strengths or needs?
- What content knowledge and pedagogical content knowledge was necessary to support these actions?

The DP Curriculum observed that many students enter the school expecting mathematics to be a subject they rote learn rather than a subject that requires critical thinking, and that it often takes time for students to adjust to the school's expectations.

The DP Curriculum and the HOD Mathematics consider an important question for teachers to reflect on is 'Who is doing the thinking in your classroom?' This question has been used during appraisals and other meetings to encourage teachers to realise that it is important to explore multiple ways of solving problems, and for students to be able to reason from different points of view rather than just being told what to do.



While recognising that rote learning might help to achieve high pass rates in some instances, the school's way involves aiming for a 'relational understanding of maths' rather than a 'procedural understanding'. The mathematics department belief is that rote learning does not support the kind of thinking required for Merit and Excellence grades — that is, it does not assist students to independently transfer knowledge and processes into different contexts.

My teacher doesn't expect us to give the right answer all the time. If we get it wrong we correct our mistakes with the help of our teachers. It's fun and our teacher is always entertaining. My teacher explains different strategies, and we decide which one we work best with. [Student]

The teacher goes around checking what strategies we are using for certain problems and tells us [if] there is an easier way. The teacher also checks what we are doing, and if we are doing something wrong she writes it on the board just in case there are other students stuck on the same issue. [Student]

Ongoing curriculum development

The introduction of new approaches to delivering the curriculum for students undertaking NCEA levels 1–3 over the past three to four years has seen a significant change within McAuley High School's mathematics department, both in what is taught and how. The school's focus on what is taught has been carefully considered in conjunction with how that learning would be assessed. The school wanted to enable Pasifika (and all) students to experience success in achievement standards that kept viable future pathways open. The HOD Mathematics reflected that while some of the achievement standards are hard and the school initially risked having a lower pass rate, these standards nevertheless still need to be offered and taught well.

I think that pathways, in terms of planning, are absolutely vital. ... The big thing is leaving pathways open, so not taking out those real crunch standards that you need. So I guess what I am trying to say is, don't dumb them down. You actually need your students to aim to go into engineering school and medical school [etc]. [HOD Mathematics]

Three bands of mathematics courses were created for year 11 students. The first of these, maths applied (MAP), is for students who struggle in mathematics. In the past the course of study for these students did not necessarily lead on to year 12, but in 2011 a course assessed by achievement standards (rather than unit standards) was introduced to help keep pathways open. Of the 44 students taking the new MAP course in 2011, 21 met the requirements for entry into year 12 statistics. The other two bands are the middle band (MAT) and upper band (MAA) courses, both of which offer students access to year 12 mathematics and statistics courses in the following year.

Data analysis also informs decisions on how many credits to offer in each course, which standards to offer and why, as well as informing the development of new mathematics courses at McAuley High School. For instance, with the increased uptake of mathematics and the high retention of students taking this subject up to year 13, the school planned to offer mathematics, calculus and statistics courses in 2013.

Conclusion

When students believe in themselves, significant changes can occur

Obvious changes have occurred in the school. The principal, senior management team, board of trustees, students and parents all report that over the past decade a significant shift has occurred in the attitude of students in all year groups; this is linked with a clear change in school culture. The principal and several senior management team members observed that there was a stage when the attitudes of Pasifika students in the school reached a tipping point and they began to see and enjoy the intellectual challenge of mathematics: the students now see mathematics as not just important for their future but also as a subject they can understand.

I enjoy the work that has been set because I understand and get it and that makes me feel good [smiley face].
[Student]

I enjoy this class because I 'get' maths now; all the teachers are great but [my teacher] just explains in ways you would understand. [Student]

The principal, senior management team and teachers all mentioned that as change has occurred, more and more Pasifika students have started to believe that they can do mathematics, and do it well. Students have also gained greater understanding of the level they are working at and what they need to do next. The school's approach offers a progressive framework as opposed to a pass/fail framework. This shift has involved a whole culture change and a new and more honest way of reporting to Pasifika parents.

The teacher, she explains in ways that us Islanders could understand. [Student]

Mathematics has become one of the most popular options, with many Pasifika students taking this subject right through to NCEA level 3, and doing well.

Isn't it incredible that when we look at the subject choice options for next year, mathematics is one of the most popular options that the kids are choosing! [Principal]

There is now strong uptake of any extra support offered to students by the school, not only for those who struggle and seek extra support to achieve the standards, but also amongst students seeking Merit and Excellence endorsements. Pasifika students, staff, and Pasifika parents and families all have high expectations, and the students willingly strive to fulfil these. High achievement amongst Pasifika students is now the norm, and excellence is aspired to.

In this school maths is a very important subject. Striving for excellence is the main key. Our teachers go over things we don't understand and need to improve on. [Student]

Pasifika and all students are constantly challenged to better the results of earlier cohorts. The principal and senior leadership team believe in harnessing the positive competition that has been observed between year groups, and in always building on success. Thus the girls at the school buy into this early on, and in their senior year levels strive to outperform the year before.

You need to use the competitive spirit ... that exists amongst them. They want to beat the previous year. That is their goal. [Principal]

More Pasifika girls at the school are achieving academic success in mathematics and in all subjects. Destination data kept by the school's careers advisor indicates there are good pathways available to school leavers, and that there is an



increasing rate of university participation. Tertiary study programmes that rely on strong achievement in secondary school level mathematics, and which were previously out of reach for many Pasifika students, are now a viable option for students graduating from McAuley High School.

Building reciprocal relationships and trust supports Pasifika student achievement

The development of strong reciprocal relationships and trust is at the heart of the school's initiative to use student assessment data to support Pasifika achievement and success. Mutual respect and gratitude are behind the willingness and goodwill of all involved to contribute towards the school's shared success by giving of their time and expertise. Members of the McAuley High School community work cohesively towards continued growth in Pasifika achievement in mathematics and in all areas.

Pasifika students respect their teachers' teaching ability and their willingness to provide additional support. Teachers are grateful that Pasifika students care about their study and make good use of learning time. At the same time, teachers recognise and respect that Pasifika students do still vary in their ability and confidence to have open dialogues with them about issues to do with their learning: sometimes the students may need help to develop the language and confidence to take care of an issue themselves, while at other times students may require the direct advocacy of the dean or another trusted person in order to approach the teacher or another staff member on their behalf.

Pasifika families value the school's ongoing improvements for encouraging and fostering student achievement. They also value and appreciate that the school provides a safe place for their girls and the opportunity to belong and succeed. The school in turn welcomes the support and responsiveness of Pasifika parents.

Staff members acknowledge the consistent and strong leadership and vision that has driven the successful approach to raising Pasifika achievement in mathematics within the school, and the school leadership team is genuinely grateful for the high calibre, commitment, and output of the school's staff and for the loyalty, commitment, and support of its board of trustees.

Strong leadership and vision is important for driving change

The principal believes that the first important step in McAuley High School's journey to lifting Pasifika achievement in mathematics was the appointment and retention of dedicated and committed staff to support the school's vision for successful students. The principal worked hard on this, and maintains that the current HOD Mathematics is an "awesome asset" to the school. More recently, the appointment of the current DP Curriculum built on the excellent foundation laid by her predecessor and helped gather further momentum to drive positive changes through.

We are very fortunate with the mathematics staff that we have at McAuley and their willingness to respond to student needs. ... A large proportion of the success goes to the HOD for her work and her initiatives, her enthusiasm and her total commitment to the students. [Principal]

A learning culture has been built within the school. The principal believes it is important to look critically at what works and what does not, in order to better understand why some initiatives are not successful and what needs to change.

[Success is not just occurring] in mathematics. The Eureka moments are happening every day in the school in different areas, in different ways. There are also failures happening every day in different areas. It's building on the positives. It's giving praise to achievement and to teachers' hard work. [Principal]

The principal, senior management team, and teachers all reflected that the school now has a strong system of teaching, assessment, reflection and improvement, and an institutional culture that provides an exciting and innovative workplace for teachers, which in turn supports staff retention. Teachers also model learning behaviour for students, and a more collaborative approach enables Pasifika students to learn in ways that are appropriate and meaningful for them.

The principal and board of trustees appreciate the need to provide adequate resources, equipment and support. They look for high-quality teaching staff and provide effective professional learning opportunities. Funding is available for staff to become members of the Mathematics Association and to draw on the support of mathematics advisors when needed. The school also strongly supports the mathematics department in providing resources that enable success in mathematics.

Some final comments

This exemplar demonstrates how a focus on evidence-based decision-making in mathematics has had a far-reaching effect that has supported McAuley High School to consistently accelerate student progress over a number of years. The principal, senior management team, and board of trustees maintain that, increasingly, Pasifika and all students with ability and potential in mathematics are identified early and given a programme of study that builds on their abilities and provides extension. Likewise, those struggling in mathematics are identified and responded to in a sustained, informed and holistic way throughout their time at the school.

This type of focus now occurs not only in mathematics but in other subjects as well. While acknowledging that students mature at different times or rates, and that challenges from outside of school will always affect development and academic success, the school seeks to consistently demonstrate that Pasifika (and all) students are capable of doing anything and doing it well. The school has legitimised the need for time, space, and teacher attention so that current and future Pasifika students can achieve to their highest potential.

At times there are challenges, but overall, Pasifika girls at the school are responding well to the support, care, and well-resourced learning environment provided to ensure their success.

You do have some very difficult times, because that's the nature of life. But your prime purpose for being here is the girls! And if you asked us what is our prime asset? It is our girls ... and it's such a privilege to work here.

[Principal]



Acknowledgements

This exemplar was developed from the knowledge and expertise of many people both now and from the past. The research team would like to acknowledge all those who have been involved in various stages of writing and production.

The first acknowledgement is to McAuley High School and its community of staff members, board of trustees members, families, and students who participated enthusiastically and candidly in the research. Throughout the process, the school principal and senior leadership team worked alongside the research team to share their journey of raising Pasifika achievement. Without their support and willingness to work with the researchers, it would not have been possible to develop this exemplar.

The research team is grateful for the time and contribution of Pasifika students and their families who spoke with them and trusted that their experiences within the school would be represented accurately. Students engaged in the research process with maturity and expressed their hope that their own successful experiences would improve education for Pasifika throughout New Zealand.

We would also like to acknowledge the support of the team from the Ministry of Education — in particular Dr Lesieli Tongati'o (then Pule Ma'ata Pasifika), Fatulatetele Tolo, Gabrielle-Sisifo Makisi, Jo MacDonald and Shelley Kennedy.

Research team

Based on the success of the *Rangiātea Case Studies and Exemplars* (Ministry of Education, 2011), Judy Oakden was selected by the Ministry to lead the project with the support of Kellie Spee. Pasifika cultural and research competence was then built into the project through the selection of experienced Pasifika team members — Pale Sauni, Dr Ruth Toumu'a, and Clark Tuagalu — whose input, involvement and presence in all key stages throughout the project provided the Pasifika lens required to ensure the project planning, data collection, analysis and reporting were framed appropriately for Pasifika.

Judy Oakden, with the support of Dr Ruth Toumu'a, Pale Sauni and Kellie Spee, co-constructed this particular exemplar.

List of case study and exemplar reports in the series

Case Studies

- *Leadership practices supporting Pasifika student success: De La Salle College Case Study* (Spee, K., Oakden, J., Toumu'a, R., Sauni, P., & Tuagalu, C.: 2014)
- *Leadership practices supporting Pasifika student success: McAuley High School Case Study* (Toumu'a, R., Oakden, J. & Sauni, P.: 2014)
- *Leadership practices supporting Pasifika student success: Otahuhu College Case Study* (Spee, K., Toumu'a, R., Oakden, J., Sauni, P., & Tuagalu, C.: 2014)

Exemplars

- *Teacher coaching to upskill teachers and support Pasifika student achievement: An exemplar* [De la Salle College] (Spee, K., Oakden, J., Toumu'a, R., Sauni, P., & Tuagalu, C.: 2014)
- *Evidence-based decision making for Pasifika success in mathematics: An exemplar* [McAuley High school] (Oakden, J., Toumu'a, R., Sauni, P., & Spee, K.: 2014)
- *A model of academic mentoring to support Pasifika achievement: An exemplar* [Otahuhu College] (Spee, K., Oakden, J., Toumu'a, R. & Tuagalu, C.: 2014)

All six reports are published by the Ministry of Education, Wellington, and are available from the Education Counts website at: www.educationcounts.govt.nz/publications (under Pasifika). Some hard copies may also be available: to request copies, please email research.info@minedu.govt.nz

Works Cited

- McAuley High School. (n.d.). *What do we know about the engagement, progress and achievement of students at McAuley High School?* Auckland: McAuley High School.
- Ministry of Education. (2007). *The New Zealand Curriculum for English-medium teaching and learning in years 1-13*. Wellington : Ministry of Education .
- Ministry of Education. (2012). *Pasifika Education Plan 2013–2017*. Wellington: Ministry of Education.
- Ministry of Education. (2011). *Rangiātea Case Studies and Exemplars*. Wellington: Ministry of Education. Retrieved August 29, 2013 from www.educationalleaders.govt.nz/Leading-change/Maori-education-success/Rangiataea-case-studies-and-exemplars
- Team Solutions. (2010). *Effective practice in Education: Enhancing achievement and student education in statistics*. Auckland: The University of Auckland.
- Williams, R. (2011). Mathematics Department: Report to Board of Trustees 2011. In McAuley High School's 2011 *Departmental Reports*.