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Numeracy improvement at Wallaroo Mines Primary School

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Summary

This strategy used a coaching model along with the Big Ideas in Number program to bring about change in pedagogy and improved outcomes for students from Foundation to year 7 at Wallaroo Mines Primary School. The Big Ideas in Number professional development project identified a sequence of ideas and concepts fundamental to developing a deep understanding of Number in primary years students. The Big Ideas in Number resource provided numeracy coaches and teachers with a consistent language for numeracy and a common thread in the development of highly numerate students.

Through the implementation of the diagnostic tools and the professional development, teachers were able to take a closer look at their programming and context knowledge. Teachers evolved their pedagogies and focused on individual student numeracy learning, while improving their own understandings and abilities to explicitly teach mathematics concepts.

Evidence that this initiative has contributed to the improvement in numeracy outcomes can be seen across a significant portion of the data sets. A significant improvement can be seen in the formal data collected using NAPLAN and Online Placement Instrument (OPI) (Australian Council for Educational Research) tests, with students achieving as much as 213.4 points individual growth in NAPLAN. Continuous improvement has been recorded in year levels 3–7 using OPI. Assessments measuring cohort growth across the last two years have seen significant improvement in all year levels. The analysis of year-level growth recorded between different cohorts has also shown significant improvement with increases of up to 22% in mean scores.

Target student group

Wallaroo Mines Primary School is a small regional school in the town of Kadina in South Australia. The school context is one of significant socio-economic disadvantage. The school has 90 students from Foundation to year 7.



Method

Aims of the strategy

The main objectives of this strategy were:

- to improve the conceptual development of numeracy in all students, Foundation to Year 7. The inclusion of every child was paramount.
- to support students and the wider school community to change the culture of learning and attitudes towards numeracy
- to build consistency in numeracy learning across the year levels
- to improve engagement and student learning outcomes in numeracy through the use of innovative digital learning devices (13 iPods, 4 iPad 1s and 20 iPad 2s per class)
- to improve the effective use of data to inform teacher practice.

The diagnostic tools associated with the 'Big Ideas in Number' resource were used in this initiative. While standardised tests, like NAPLAN and OPI, gave a snapshot of the student's skills and understanding, the diagnostic tools provided a deeper, more authentic assessment of the child's knowledge. Students identified as requiring additional support in numeracy received specific intervention designed specifically to build on students' numeracy knowledge and encourage deeper conceptual development in Number.

The strategy

This project was a whole-school project including approximately 90 students, 10 teachers (across the two years), 5 support staff and 1 principal. It was implemented across all five classes.

Underlying the project were the beliefs that:

- students need to be able to relate their learning to the world around them
- learning needs to be engaging and relevant for it to be successful
- teachers need to share similar expectations of numeracy learning with their students
- consistent use of mathematical language and conceptual understandings across the school allows for deeper understanding and increased success in building on prior knowledge.

A journey of strategic review was initiated in the areas of student achievement data, teacher practices and whole-school policies and targets. A numeracy improvement team was developed, consisting of four teachers and the numeracy coach. The team identified the main areas for improvement. These included the deprivatisation of classroom practices, improving the culture of learning and attitude towards numeracy and developing



consistency in language and conceptual development of Number across the year levels. The numeracy improvement team then developed a learning outcomes action plan that included improvement in specific data collection, SMARTA targets (Specific, Measurable, Achievable, Relevant/ Resourced, Timed, Agreed – a planning strategy to ensure that targets that are set lead to actual improvements), key strategies for achieving the targets and methods for measuring evidence.

A second action plan was also developed, aimed at improving student engagement and community attitudes towards numeracy. Some of the strategies outlined in the document included the incorporation of digital technologies into numeracy; the creation of the Wallaroo Mines Primary School numeracy blog to open a direct line of communication to the community; numeracy assemblies to promote positive learning events in the classrooms, and family mathematics mornings where families were invited into classrooms to take part in the innovative and engaging learning in numeracy.

The numeracy improvement team also worked with other staff members to draft and implement a 'negotiable and non-negotiable' document that outlined the self-imposed expectations that the staff developed for themselves and for others in the teaching of numeracy. The document set expectations that numeracy would be programmed every day, for a minimum of 300 minutes per week, and that it would reflect the curriculum and differentiated learning while giving teachers the flexibility to creatively implement their own methodologies.

Data was collected at an individual student, cohort, class and whole-school level, and was then triangulated to identify student's strengths and support for learning. This data was also used to inform intervention strategies and teaching practices.

Every child from Foundation (Reception) to year 7 was assessed using the Big Ideas in Number diagnostic tools. These assessment tools provided a detailed and authentic insight into the varying stages of conceptual understandings evident in every classroom. The OPI is a NAPLAN-style standardised assessment. The students sat for this assessment twice a year in March and November. The data was also used to measure individual growth, identify gaps in students' learning and inform teaching. Data was also compared to NAPLAN results for students in years 3, 5 and 7.

The comprehensive review of students' ability levels provided clear direction, identified students requiring immediate intervention, informed teaching practices and gave a starting point from which growth in learning could be measured. Students from all student groups who were at or below the national minimum standard in numeracy were selected for intervention. A learner intervention program was developed by the numeracy coach based on the Big Ideas in Number program. School support officers were trained in the effective



implementation of this resource. Students identified as requiring intervention were given access to specifically designed lessons building on their current knowledge to deepen their understanding and skills.

Use of technology

Some iPods and a newly purchased class set of iPad 2s were provided for each classroom. These devices hold approximately 140 educational apps designed to challenge student learning and support the implementation of a differentiated curriculum. Whole class, small group and individual learning contexts made extensive use of technologies. iPods and iPads were used in every area of the curriculum. They were embedded into pedagogies and supported the inclusion of students with special needs, and were also used to extend learning beyond what was expected for the year level.

These devices helped to remove the stigma for students with special needs. While they were working on a completely individual task, to them and to everyone else, they appeared to be doing the same thing as their peers. This is a truly inclusive approach.

In mathematics, the iPads allowed students to develop new skills independently. While the teacher worked explicitly with a small group, other students were extending their knowledge. These small groups were rotated, ensuring that the teaching was specific to each child and not a one-size-fits-all lesson. Students engaged with these devices during non-class times: before school, breaks, and also during free time. These times were previously wasted minutes, but now are some of the most powerful minutes of the day.

Professional learning

Teachers and support staff volunteered time to attend professional development sessions vital to the implementation and sustainability of the project. This approach ensured consistency of professional content knowledge, understandings and expectations for numeracy improvement. Time was also volunteered to support the development of resources across the school. Without these contributions by staff, the success of the project may not have been as significant or sustainable.



Results

What data was used?

Data was used effectively to identify an accurate and authentic measure of students' numeracy abilities. It was vital that assessment was measured formally and informally and triangulated to ensure that the learning program met the individual needs of every student and improved numeracy learning. Assessment was used as a measure for learning, and not just as measure of learning.

Achievement data from Foundation (Reception) to year 2 was collected using the I Can Do Maths assessment tool (Doig & De Lemos 2000). This is a junior primary assessment tool that was used to collect baseline data in the early years. OPI and NAPLAN data were used in years 3, 5 and 7. Students from Foundation (Reception) to year 7 were also assessed using the Big Ideas in Number diagnostic tools. For the students in years 4 and 6, data were gathered from the OPI, Big Ideas in Number diagnostic tools, as well as NAPLAN assessment data from the previous year. Teachers also provided informal, class-based assessments and data were collected on a regular basis (eg mental mathematics tests and one-minute mathematics tests).

To support teachers in the analysis of their data, the numeracy coach developed some resources including an individual student learning profile that collated all forms of data onto an A4 page for each student; a NAPLAN band chart; and a Big Ideas in Number chart that displayed students' names based on their current level of conceptual development. Before and after comparisons for each year level were made to assess the contribution of the initiative in improving numeracy outcomes.

Improvement

Evidence that this initiative has contributed to the improvement in numeracy outcomes can be seen across a significant portion of the data sets. In comparison to 2010 data, an increase of 9.2 per cent in year 3, 20.5 per cent in year 5 and 10.5 per cent in year 7 was identified for 2011. There was also an improvement recorded in the individual growth of students. On average, students achieved a growth of 99.71 in NAPLAN between year 3 and year 5 in 2010. This increased to an average growth of 135.9 in 2011.

In 2010, the average growth of students from year 5 to year 7 was 68.9, which improved to 86.2 in 2011. Student improvement in learning outcomes was also recorded using OPI, with an improvement in mean score from 2010 to 2011 of between 10 and 22 per cent. One hundred per cent of students who attended Wallaroo Mines Primary School over the past two years of this initiative have also shown growth in their conceptual understandings using the Big Ideas in Number diagnostic tools.



Lessons learned

There was a major improvement in numeracy outcomes as the result of student involvement in this project. The use of digital learning tools to engage students and improve learning outcomes has been a major factor. The implementation of the devices allowed staff, students and the wider school community to begin to see that mathematics does not have to be restrained by a textbook or work sheet. Learning can occur in many different ways. The iPods and iPads not only engaged the students from the moment they walked in the door, but also changed the culture of learning. The iPads and iPods have been used extensively across all learning areas, which was an unexpected outcome of the initiative.

‘During 2011, the school participated in the DECS site validation process receiving commendations for:

- triangulating data to demonstrate improvement
- staff professional development including evidence of professional learning communities that focus on learning improvement
- confidence in the use of data.’

From a leadership perspective, one of the main factors that contributed to the success of this initiative was the development of the whole-school agreement around the teaching and learning of numeracy. This document ensured that high and achievable expectations were being set for staff and students, as well as ensuring that there was consistency in teaching practices. Developed by the teaching staff, it opened a line of communication between teachers around the pedagogies and methodologies that were taking place, therefore breaking down the walls of the privatised classrooms.

Feedback from staff indicated that one of the greatest contributing factors included the ongoing support from, and access to the numeracy coach. The regular professional development and the support provided improved pedagogies and curriculum content knowledge, enabling teachers to develop confidence and improve their teaching practices.

Early intervention programs and support for students at risk have continued and evidence of the benefits of this can be seen in the data collected. One hundred per cent of students have made improvements in their numeracy outcomes measured using the Big Ideas in Number diagnostic tools. Fewer students are requiring learning intervention as teachers are more skilled in providing a differentiated curriculum that accurately supports the learning of all students.

A significant improvement can be seen in the formal data collected using NAPLAN and OPI with students achieving as much as 213.4 points individual growth in NAPLAN.



Continuous improvement has been recorded in year levels 3–7 using OPI. Assessments measuring cohort growth across the last two years have seen significant improvement in all year levels. The analysis of year level growth recorded between different cohorts has also shown significant improvement with growth of up to 22 per cent in mean scores.

‘Numeracy was once a time of the day that students resented and groaned about. It is now a time that students love and they are excited about their numeracy learning. The one true testament of this is that students are choosing to engage with the numeracy apps on the iPads and iPods outside of class time. Children are walking in the door excited about achieving the next level in their favourite app or challenging another student to achieve a new high score. Students are actively using their own time to improve their learning. The students have written reviews for some of the apps on the school blog. This in itself signifies a major success.’

Evidence of sustainability in this initiative can be seen in continual improvement of teacher practices after the conclusion of the coaching role in term 1, 2011. All staff, including school services officers, have been given opportunities to develop their knowledge and skills in the area of quality assessment and data analysis, allowing them to independently review practices and effectively plan for student improvement.

One of the challenges that could have been faced during the implementation of this initiative was dealing with ‘blocking’ behaviours, either passive or active, of individual staff members. While some staff can appear to be supportive, what occurs in the classroom may be different from what is said to have been done. To resolve this, the leadership team worked together to promote the initiative as a whole-school project and ensured that all staff shared the same appreciation of continual improvement.

Next steps

The principal ensured that time was allocated throughout the term to maintain professional learning outcomes, sharing of programs and collaboration.


Technology resources have been increased to 30 iPad 2s, which ensures 1:1 access during the class rostered rotation, as well as providing 1:1 full-time to high risk or special needs students. Twenty-eight MacBook Pros that are used in conjunction with the iPads have also been purchased. A Mac server has just been installed to manage the backup of the devices. ‘App recommendation’ sheets have been placed around the school. These posters allow students and parents to recommend an app to be put on the iPads and iPods.



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In 2012 Big Ideas in Number groups were implemented across the whole school. The staff work explicitly to the developmental level of every group, ensuring that each and every student is developing the skills and understandings that they require.

After reviewing the success of the numeracy coach role in the school, the principal suggested that our staff and students could benefit from similar practices in literacy. School funding is being used to provide a literacy focus teacher to improve the literacy practices across the school.

‘Discussions about numeracy assembly can be located at [Wallaroo Mines Primary School numeracy blog](#) .

Research base

There is growing recognition that professional learning models reliant on traditional ‘one off’ teacher workshops have little impact on teacher practice. While teachers may gain new knowledge about teaching practices, this knowledge does not in itself lead to changed practice in the classroom.

Cornett and Knight (2008) suggest that coaching improves teachers’ attitudes and job satisfaction. It impacts on teaching practices by increasing the rate of transfer of new learning to classroom practice and improves teachers’ efficacy. Vanderburg and Stephens (2009) found that coaching led to teachers:

- being more willing to try new practices
- using more authentic assessments
- being more able to modify teaching to meet student learning needs
- changing their beliefs and educational theories.

The coaching model was used in this project. A coach worked with teachers to plan, implement and evaluate the impact of new teaching practices on student engagement and achievement.

The implementation of ‘Big Ideas in Number’ program (Siemon 2006) has been central to the success of this initiative.



Further reading and links

Australian Council for Educational Research, [iachieve](#) website, (accessed May 2012).

Cornett, J & Knight, J 2008, '[Studying the impact of instructional coaching](#)' (accessed May 2012).

Doig, B & De Lemos, M 2000, *I can do maths*, ACER Press, Camberwell, Vic.

Siemon, D 2006, (RMIT University, Melbourne), Victorian Department of Education and Early Childhood Development website, '[Assessment for common misunderstandings: an introduction to the Big Ideas](#)' (accessed May 2012).

Siemon, D 2006, (RMIT University, Melbourne), Victorian Department of Education and Early Childhood Development website (link defunct).

Vanderburg, M & Stephens, D 2009, 'What teachers say they changed because of their coach and how they think their coach helped them', (Literacy Coaching Clearinghouse, University of South Carolina), (accessed May 2012).

Contacts

Please contact the [Wallaroo Mines Primary School](#) if you wish to access resources such as:

- school-developed NAPLAN band chart (2009)
- triangulation summary
- Big Ideas in Number chart
- student learning profile (2010).