

Mathematics, and other, teaching as a social activity.

Over recent years there has been much debate and a vocal call of the decline in mathematics skills and abilities in New Zealand. In the main, this concern has been identified by national TIMMS and PISA scores and in particular the drop in New Zealand's mathematics ranking. The call for a back to basics approach to mathematics has been loud and long and a refocus and return to rote learning of things like times tables and algorithms promoted by some members of the wider community.

The history:

Mathematics has always been a key component of primary school education in New Zealand and across the world. It is the arithmetic in the three R's. As such, mathematics teaching is often discussed and reviewed and over recent decades there have been many changes and developments in mathematics teaching designed to lift achievement and learning in mathematics. Over the last twenty years or so this has included BSM (an activity based series of tasks designed to be used by teachers to build number and mathematical knowledge alongside rote learning and long established methods for solving number problems), a wide range of different hands on materials, and in some cases working through text book based materials developed with age expected levels of the children using them.

In the early years of this century new ideas around mathematics teaching began to be developed that shifted from the established method of developing the ability to simply develop ways to use mathematical and number knowledge to attempting to promote mathematical understanding and a deeper knowledge of mathematical concepts. This 'Numeracy Project' saw the publishing of a series of booklets which were based on developing number knowledge and concepts through a series of activities which led children from early number ideas to working with number in a broad range of ways which had at its goal building a range of strategies that children could use when considering mathematics problems.

The Numeracy Project was introduced with some in depth training but this was variable in its focus and depth and soon trailed off once the initial tranche of professional development was concluded. Schools had a varying ability to undertake the training, and there was a wide range of ability for schools to build and develop the wide number of resources required to support the projects activities.

In its early stages the Numeracy Project was principally focussed on developing number strategy and less so on developing number knowledge and though this was re balanced over time for the vital initial years teachers spent the larger amount of the time prioritised for mathematics working on strategy ideas often at the exclusion of number knowledge learning. In addition, children's ability to find multiple strategy's for approaching mathematics problems meant that often an inordinate amount of time was spent teaching and re-teaching strategies for a single problem rather than simply finding and teaching a method that would work for the child. This 'multi strategy' approach sometimes added to mathematics confusion rather than minimising it. For example when posed the problem 'If you have 70 apples on your tree and the next day you have 63 how many apples have been picked' rather than simply using subtraction the teacher would often require several possible strategies such as adding 3 to the seventy to get 73 minus the 63 is ten then take the three away from the ten to get 7.

Often this convoluted and multi strategy approach would see children become confused and challenged – sometimes because their basic addition and subtraction knowledge was insufficient to allow them ready access to the strategies that were being taught to them.

Parents and grandparents tasked with helping their children at home found this approach unfamiliar and confusing and also voiced concerns about the inability of their children and grandchildren to solve what they considered basic mathematics even when sometimes they were recognised their children's well developed ability to talk about and consider mathematical problems.

Schools leaders also became concerned and many developed their own approach to mathematics teaching - most a mixture of more traditional mathematics teaching and numeracy project ideas whilst some moved towards the structured mathematics teaching model contained in ideas used overseas in 'mathematics successful countries' such as Singapore (PRIME Maths).

So what happened?

Through all of this a new system was developed which found a happy home in the National Parties key education idea National Standards. National Standards in Reading, Writing and Mathematics were introduced in 2008 with the goal of setting benchmarks for children's progress in key learning areas across the country.

The idea was that teachers would be driven to get their children to these benchmarks or risk their schools being seen as failures during the three yearly ERO visit or when compared to other schools. There was some discussion during the implementation of the Standards that the information that was required to be provided of progress against the National Standards would be used to provide extra assistance and support to teachers and schools but perhaps not surprisingly this aspect of the National Standards policy was never effectively followed through. What did occur, is that schools were driven to focus on children not at the standard in an attempt to raise them to the standard at the exclusion of those students excelling at mathematics and those who were unlikely to reach them, the strands other than number were largely subsumed into mathematics time and mathematics teaching became system and programme based. Rather than lift mathematics achievement mathematics results (and educational achievement in general) plateaued and New Zealand's rankings in global tables declined.

The problem.

One of the many problems with National Standards was that it encouraged a focus on those students that had not reached the standard and in particular those students which fell just below the standard – the children that were seen as those that could effectively be taught to reach the standard and so improve schools 'data' – target students or groups of target students that became a priority in the school and were the focus of school management and ERO and by default the teacher often at the exclusion of other students. Accordingly, teaching was diverting into an individual based learning style just as the development of understandings around the need for learning based quality relationships was being developed.

At the same time the government, in contrast to what was occurring in the National Standards, published a raft of documents that highlighted the need for quality teacher student relationships (including but not limited to Ka Hikitia), which in particular promoted the idea that quality relationships maximised the opportunity for Maori students and those in low decile schools to achieve at school. These groups in particular being ones that were identified as those in the 'tail of underachievement'. Prominent education scholars including Angus Macfarlane and Russell Bishop,

though not directly focused on mathematics, also highlighted the need for positive, relationship based teaching as the core to success at school for Maori and other groups that make up a large proportion of this so called tail of education. This conflict and mismatch of approaches contributed (at least) to the decline in mathematics learning in New Zealand and in similar western countries which have adopted the neo-liberal Global Education Reform (GERM) approach to education.

This is true in particular when considering the needs of those groups in New Zealand that are afflicted by the new levels of growing disparity across New Zealand and the effects of poverty and trauma now evident across New Zealand caused at least in part by poor policy decisions and the implementation of the neo liberal policies in evidence across the world over the last thirty years or so.

Solution

When the Labour led coalition government was elected in 2017 National Standards were quickly abolished in New Zealand schools in recognition that they achieved little, added much to schools workload, narrowed the curriculum and pitted schools against each other as they sought to see themselves placed above other schools in comparisons made available by the National Government through its Education Counts Website and in the media.

This provided an opportunity for schools to re-evaluate and consider other methods of looking at mathematics (and indeed all teaching) using more accepted and academically supported ideas around teaching and learning. For many, and in particular for those working in schools with high levels of children afflicted by the changes in the socio economic make up of New Zealand, this is the domain of building and maintaining deep, positive personal relationships with children and their whanau that naturally lead to building deep learning focussed relationships and in turn a love of learning unfettered by the burden of a National Standards regime.

In the USA a greater acknowledgment of the need for deep relationships between teachers and students has at its core the need to work with what they label as 'Trauma Students' a group that we would likely see as aligned with the children that make up our tail of underachievement – Maori, Pasifika, children in challenging low socio economic circumstances. The work in the United States is based on the need for deep relationships similar to that here in New Zealand which includes in such policy documents as Ka Hikitia and government initiatives such as Te Kohitanga and recently Hurihanginui

But in addition, and importantly, the work has included the need to develop strong and positive relationships *between* children and to actively manage and encourage them to share their mathematics ideas and knowledge with other children. Developing children's ability to talk about, discuss, and carefully and positively dispute and question other children's ideas and mathematical methods is also key.

This has meant that schools have begun to review the process laden procedures of the Numeracy Project and instead seek to develop mathematics learning based on problem solving and mathematical sense using structured opportunities for children to work closely with one another to consider, discuss, investigate and solve mathematical problems as a conduit to developing number and mathematics sense for all students. This approach has been labelled a 'social activity' and aligns itself neatly with the work contained in the literature around relationships being at the core of learning.

Kaeo School

Kaeo School did not engage at any level that was not legislated with regards National Standards. We had and continue to have a very clear understanding of children's progress and ability in mathematics (and indeed in all areas of the curriculum) but we did not actively 'target' children or groups of children in mathematics at our school.

However we did assess children's progress and the progress of our school in mathematics using numeracy project levels against a broad expectation of which level a child would be working near/at/above their year level. We recorded only in the areas of number and proportions and ratios.

Whilst this information suggested that the vast majority of our children were progressing as expected the concern remained as to whether this 'measurement' meant that children were developing mathematical sense and well developed skills when using maths in the real world or if we were simply doing well against a measure that meant little.

We were and continue to be a school that follows the idea that deep, quality relationships are at the core of learning and have for many years used the work of Angus Macfarlane to guide our school. The concepts in the *Educultural Wheel* (Macfarlane, 1999) of Whanaungatanga, Rangatiratanga, Pumanawatanga, Manaakitanga and Kotahitanga are central to our work and key components in the school's Strategy for Maori Achievement. The Strategy has proven to be a successful one both for Maori and for all children in our school however with the goal of further improving the learning in our school and to maximise the opportunity for the overall development of the children in our care we have begun to consider our approach to teaching overall and the needs of our children more closely.

We decided then to investigate the type of teaching undertaken in the United States in trauma schools as mentioned above. The work has begun in mathematics but it is hoped that, should we see the progress that we expect to see, that this approach can and will be used across the school in all curriculum areas.

Our work this year is to introduce the use of:

- Framing teaching around big ideas
- Allowing and encouraging student choice in mathematics
- Using open questions and parallel tasks at maths time.
- Helping students to make sense of mathematical problems and to persevere to solve them.
- Providing opportunities for children to work together to discuss ideas and strategies when solving mathematical problems.
- Teaching that encourages dialogue and also teaches children ways to discuss, disagree and co-construct responses to mathematical problems.

The hope and expectation is that mathematics will become more of a thinking time rather than a solving time (though it is acknowledged that the ultimate goal is that children will become so proficient at mathematics time that maths problems will be able to be solved accurately and quickly).

It will also become a discussion time where children work together to talk about their mathematics ideas (developing oral language skills along the way) and where they develop the skills and willingness to solve problems together and to develop each other and themselves concurrently as they work in the context of mathematics.

There will also be a shift in the manner that teaching occurs in our school. Whilst relationships sit at the core of our work at Kaeo School it is hoped that the power balance in the relationship will shift somewhat – opening up further opportunities for children to teach their peers, develop their skills and knowledge in using oral language and to deepen children’s understanding through discussion, dialogue and debate in the context of mathematics initially but in time across the wider school.

Fundamentally, we believe that schools should be interesting places that are social by design because learning is best achieved through social interaction. Children need the space, encouragement, and teaching that will allow them to learn and experiment in the social aspect of mathematics including the skills to listen to, discuss, and carefully dispute others mathematical thinking and to considerately share their own mathematical ideas in a safe environment.

This essay has no conclusion yet, but as this work continues we expect to see our children’s success in mathematics grow and for this to lead to their success in other areas of their school life and in their lives in general. We expect teachers to become less burdened by policy and programme driven teaching and for the benefits of this new way of looking at mathematics teaching and learning to widen to all aspects of teaching and learning at Kaeo School.

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