

Calculator use in the Primary School

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In levels 1-4 of the curriculum document the Number and Algebra strands recommend the use of calculators in some of the 'Suggested Learning Experiences'.

Mathematics in New Zealand Curriculum (1992) gives guidelines to teachers about the use of calculators:

Calculators....are learning tools which students can use to discover and reinforce new ideas. Calculators are powerful tools for helping students to discover numerical facts and patterns, and helping them to make generalisations about, for example, repeated operations. (p14)

Develop accuracy, efficiency, and confidence in calculating - mentally, on paper, and with a calculator. (p31)

In levels 1-4 of the curriculum

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document the Number and Algebra strands recommend the use of calculators in some of the 'Suggested Learning Experiences'. This is new for Year 1-5 students and their teachers as the previous syllabus (Department of Education, 1985) had no particular requirements for using calculators.

Biddulph (1996) considered how to convince preservice teachers of the merits of integrating calculators into primary mathematics programmes. Twenty-four student primary teachers in a 300 level mathematics course were exposed to

research on calculator use and possible calculator activities. The students proceeded to teach groups of approximately three children aged 7-8 years using prepared calculator learning tasks. His results suggest that preservice teachers' beliefs can be changed in a positive direction by being exposed to research and having the opportunity to work with children. Results from this study highlight the value of research awareness and the use of a wide range of calculator activities. Of the twenty-four student teachers surveyed, all appeared to change their ideas about the place of calculators in junior primary school mathematics programmes and now saw them as essential.

Much of the literature reviewed made reference to the Calculator Awareness Programme Project (CAN, 1986) conducted in Britain more than a decade ago. Lindale and Biddulph (1991) summarised the key results from the CAN project:

1. Children are able to understand relatively large numbers, and this has allowed them to develop understanding of the ideas and processes associated with number;
2. Children have a greater sense of control over their own learning and can talk freely about what they are investigating;
3. The children develop very positive attitudes towards learning in mathematics;
4. Teachers have appreciated the opportunities afforded by the investigative-type approach to observe more closely their children's thinking and intellectual skills. (p138)

Groves and Cheeseman (1995) stated that the CAN Project found



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that the calculator's full potential could not be realised without a change in teaching style. McChesney (1995) made reference to adults' perception of the use of calculators. She stated that adults perceive the calculator as a computation tool. In her reference to the CAN Project, she said,

Adults use calculators to 'get out of mathematics' while children use calculators to 'get into mathematics'. (p8)

SET (1982) lists ways of using calculators in the primary mathematics classroom compiled by the Shell Centre for Mathematical Education at Nottingham University (1978). They can help develop children's:

1. Early number concepts, symbols and notation.
2. Number facts
3. Grouping, place value and notation ideas
4. Extension to fractions
5. Negative number ideas
6. Computational skills (p4)

Bell et al (1977) summarise three frequently expressed concerns about the impact of calculators on children's learning in mathematics:

1. Children may not learn their tables or basic facts.
2. Children may gain a false impression of mathematics, develop mental laziness and a lack of understanding of mathematics, and come to depend on the calculator.
3. Some children will be disadvantaged since calculators are not available to all children. (p130)

On the other hand, Biddulph (1991) lists benefits of calculator use by primary school children.

These include:

1. The calculator provides a bridge between the concrete and abstract.
2. Children are able to deal with large numbers in a computational sense.
3. Children are able to develop their thinking and number sense.
4. Children have a greater feeling of control over their own learning.

5. Children's attitudes toward learning mathematics become more positive.

6. Children are able to devise ingenious ways of checking solutions.

7. The learning is enhanced of slower-achieving children and those suffering physical and learning disabilities.

8. Teachers have a greater opportunity to observe children and their thinking. (p131)

Whether the curriculum document requirements with respect to calculators, and the benefits to children revealed in the various calculator development projects, are generally recognised by primary teachers and translated into classroom practice in New Zealand is another matter. This small-scale investigation set out to explore this issue.

What We Did

Approximately 60 course participants from four 'Advanced Studies for Teachers' courses (not mathematics related) at the Christchurch College of Education were asked to complete a questionnaire. This convenience sample was chosen because it would provide an immediate response and it was believed that AST course participants would be a reasonable representation of the Christchurch region's primary teacher population. Thirty-six responses were received, some course participants being

absent on the day the questionnaires were collected, and a few others preferring not to participate. The teachers sampled were from the Christchurch area. Each participant completed the questionnaire in less than ten minutes.

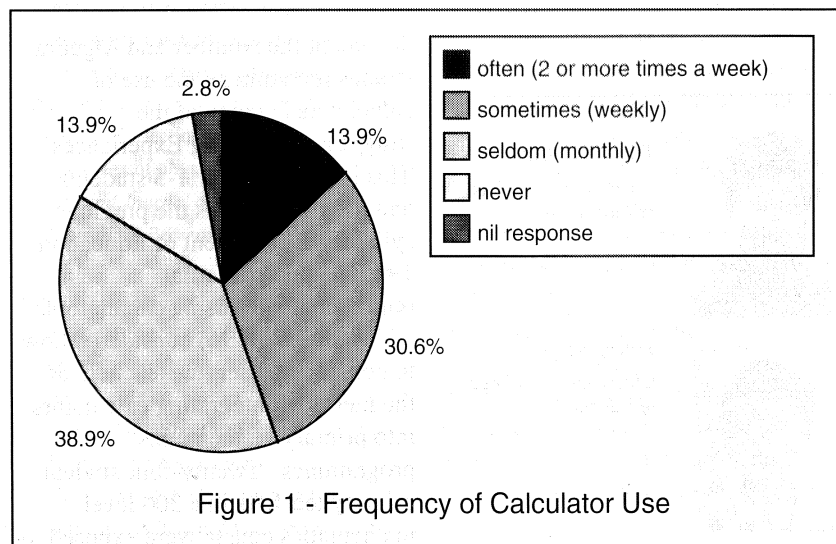
The initial questions sought information about the teachers' backgrounds and the frequency of calculator use in their mathematics programmes. Participants were asked whether and how calculators were being used in their programmes and to state what they considered were the benefits and concerns related to calculator use. Teacher and pupil enjoyment of calculator use was also queried. Questions relating to resource access and teacher training were asked.

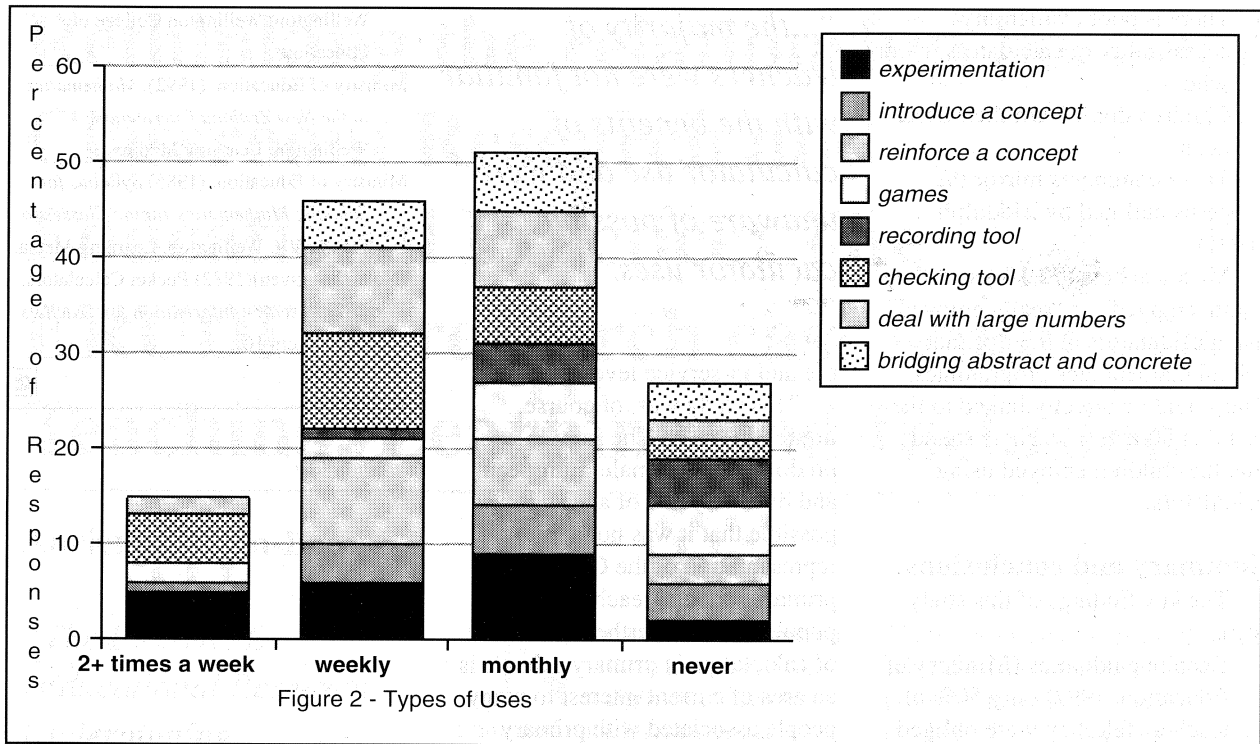
Results and Discussion

1. The teachers

The 36 teachers represented all class levels from Years 0-8; Junior School (41.6%), Middle School (36.1%) and Upper School (22.2%). This gave a good coverage across the different areas of the school. Most teachers surveyed (83.3%) had 5 or more years of teaching experience. More than three-quarters of the teachers (77%) taught in state primary schools. The majority of the teachers were over 40 years of age (58.3%), female (75%) and European (72.2%).

Approximately 10-15% of teachers surveyed did not respond to





the age, gender and ethnicity questions and some participants verbally objected to being asked for this information.

2. Accessibility of Calculators

The most frequent comments made by the teachers about accessibility to calculators in their schools were:

1. there are class sets (20%)
2. children have their own (8%)
3. they are stored in central storage areas (23.4%)
4. there are a small number (eg. 5-15) stored in classroom (24%)

Half of the sample stated they would use calculators more in the future if they had improved accessibility to calculators.

3. Frequency of Calculator Use

Figure 1 shows how often calculators were reportedly used by the sample group in primary school mathematics programmes.

Figure 2 shows the most frequent uses of calculators reported by the teachers were as a checking tool, to deal with large numbers and for free play and experimentation.

Figure 2 also shows the least frequent use of calculators were to introduce a concept and to use as a recording device.

This is somewhat at odds with

the conclusion of Groves and Cheeseman (1995) and McChesney (1995) that calculators are not just computational tools but are highly versatile teaching aids.

“Half of the sample stated they would use calculators more in the future if they received more teacher training..”

4. Training in Calculator Use

Because the majority of teachers sampled had taught for five or more years it is likely that they had not been exposed to current preservice training that supports the use of calculators in primary school mathematics classroom. They are likely to be less aware of the promotion of the use of calculators in *Mathematics in New Zealand Curriculum*, (1992).

This was reflected by 50% of the teachers stating that they did not feel obligated to use calculators in their current mathematics programmes, and 5.6% not responding to the question about this matter.

Of the teachers surveyed 55.6% had received no training in the use

of calculators in the mathematics programme.

Half of the sample stated they would use calculators more in the future if they received more teacher training.

5. Benefits and Concerns of Using Calculators

Three or more benefits from using calculators in their mathematics programmes were stated by 44.1%.

Those most frequently stated included:

1. It is a good checking tool.
2. It helps children gain familiarity with calculators.
3. They enable calculations to be done faster.
4. They can reinforce number patterns.
5. They provide children with the ability to deal with larger numbers.

Only 2.7% stated three or more concerns about using calculators in their mathematics programmes. 41.7% stated only one concern.

The most common concerns were:

1. Children become reliant on calculators for all work.
2. Children don't learn the processes.

3. There is poor availability/ accessibility of calculators in our schools.
4. Children don't learn their basic facts.

These comments mirror the concerns outlined by Biddulph (1991).

Most teachers (72.1%) said they "quite enjoyed" or "really enjoyed" using calculators in their primary school mathematics programmes. This could be directly linked to the fact that 80.6% of teachers stated that the children enjoyed using calculators.

Summary and conclusions

The key findings of this study were:

1. Despite guidelines (Ministry of Education, 1992) only 50% of teachers felt they were obliged to use calculators in their mathematics programmes.
2. Of the teachers surveyed, 50% stated that they would use calculators more in the future if they received more teacher training or had improved accessibility to calculators.
3. Only 44.3% of teachers use calculators on a daily or weekly basis.

The findings show that calculators are being used across all levels of the primary school, but to varying degrees.

It is concerning that the majority of teachers were not familiar with the benefits of calculator use and were unaware of possible calculator uses.

Despite requirements in the *Mathematics in New Zealand Curriculum* (1992) many teachers did not feel obligated to use calculators. The sample group were teachers without responsibility for mathematics in their schools. The results suggest that this is a segment of the teaching population who would benefit from greater assistance with calculator use in the mathematics programme. Many teachers stated that improved accessibility and teacher training would lead to greater use in the future. This teacher development almost surely needs to occur at both

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pre and in-service levels.

This study was, of course, limited in scale. The sample was predominantly female, European and over 40 years of age so it was possible that it was not a fair representation of the Christchurch primary schools' teaching population. Nevertheless, the use of calculators in primary schools is an area of current interest to many people associated with primary school mathematics education.

Future studies in this area seem to be needed, and may include observation and work with children developing a variety of calculator uses.

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