

# Students' Attitudes Toward Calculators in the Primary School

Laila Arvonen and Janette Bobis

University of Sydney

*This paper reports on the findings of an investigation into the attitudes of primary students toward calculators and their use in the classroom. Through the use of a questionnaire and semi-structured interviews the attitudes of two groups of children - those for whom the calculator is part of their mathematics instruction and those for whom it is not - were examined. In particular, the findings highlight the need for teachers to be aware of the diverse attitudes children hold toward calculators.*

Even with wide availability and strong departmental support, calculators remain in limited use in primary schools (Educational Testing Service, 1988); and their place in the mathematics curriculum continues to be debated. That calculators have not had the effect on the mathematics curriculum as expected, has been due to the continuing controversy as to whether they should be used at all in schools (Howard, 1992). One thing is clear from the literature, the use of calculators in schools is certainly an emotive issue with strongest opposition being voiced from parents and teachers (Bobis, 1995; Coburn, 1989; Cooper & English, 1985; Williams, 1987). While such opposition is well noted and projects intent on enhancing the use of calculators in schools usually incorporate strategies designed to overcome such opposition, the attitudes of another important group is often overlooked - that of the students. An appreciation of students' attitudes toward calculators is surely necessary before an appropriate approach can be devised toward their use in the classroom.

This report provides a summary of a small-scale investigation into the attitudes of students toward calculators at the primary school level. Of particular importance is the identification and documentation of misconceptions that students have in relation to calculators. Knowing more about what attitudes children bring to mathematics contributes important information which can assist teachers to improve the quality of their decisions about teaching mathematics; enabling them to tailor instruction to students' needs. The study suggests that students can be assisted to reconsider their attitudes toward the use of calculators and to develop expectations and behaviours that are more conducive to success in mathematics. Of particular significance is the information such a study provides teachers in regard to their students' attitudes toward mathematics when calculators are a part of their instruction and when they are not.

## Background

In recent years there has been a growing recognition that understanding the nature of mathematics learning requires exploration of affective as well as cognitive factors (Leder, 1987). What does seem clear is that cognition and affect are interrelated and that affect plays a central role in learning and instruction in mathematics. Focusing on one without the other limits what teachers know about the teaching and learning of mathematics. Accepting this position gives rise to the need for further investigations concerning the impact of calculators on children's attitudes toward mathematics - an area which has received little attention by researchers to

date. The increasing use of technology in the classroom, namely calculators and computers, will invariably be accompanied by changes in attitude toward mathematics. As far as student groups are concerned, research into calculator use has predominantly focused on its effectiveness, particularly on student achievement; few researchers have explicitly examined the attitudes of students toward calculators and their use in the primary classroom (Doig, 1993). Research has provided us with insights into teachers' and parents' views (Blane, 1986; Bobis, 1995), but it is also necessary to investigate the attitudes of students toward calculators and their use in primary schools.

The aim of the present study was to investigate the attitudes of two groups of primary school children - those for whom the calculator is a part of their mathematics instruction at school and those for whom it is not. Through identifying and documenting students' attitudes toward calculators the project hopes to provide important information to teachers about the significance of attending to children's attitudes when planning instruction. While the original investigation also encompassed the attitudes of the classroom teachers toward mathematics, the teaching of mathematics and the use of calculators in the primary classroom, this paper focuses on findings related only to the attitudes of students.

## **The Study**

### **Participants**

Three upper primary school teachers and their classes from a primary school situated in the south-west of Sydney participated in the study. The school, its teachers and their classes were selected on the bases of their willingness to participate in the study and the degree to which calculators were utilised, or not utilised, in their classrooms. While each of the classes comprised students of diverse abilities, mathematics sessions operated daily in which students were

grouped according to their ability. Hence, the extent to which calculators were used varied at the discretion of the particular math teacher each group was assigned. In total 88 students participated in the study; comprising 40 students who regularly used a calculator during mathematics instruction at school and 48 who did not use a calculator at all.

### **Materials**

The study combined both qualitative and quantitative measures with questionnaire and interview as the primary methods of data collection. A questionnaire (The Attitude Toward Calculators Questionnaire) was designed to assess student attitudes toward mathematics in general, and toward calculators, in particular. It contained 24 closed-response items requiring respondents to select from four alternative answers (Yes, No, Sometimes or Don't Know) for each statement; with the exception of one question (Item 5(b)), which required the children to indicate the grade at which they believed calculators should be introduced into schools. A copy of the questionnaire is provided in Appendix A.

As a secondary source of data, semi-structured interviews were conducted on an individual basis with a randomly selected sample of students to provide more extended answers to the statements contained within the questionnaire, as well as providing a means of validating the quantitative data.

### **Procedure**

The research process was articulated in three stages. During stage one, each of the classroom teachers were interviewed to ascertain the degree to which calculators were used in their classrooms, to elicit their own attitudes toward the use of calculators and to gain insight into their perceptions of the attitudes children in the classrooms held toward calculators. Due to length restrictions, results of this stage of the research will not be reported here.

During the second stage of the research, the Attitude Toward

Calculators Questionnaire was administered to each group of children during normal classroom time. Assistance and direct guidance was provided to the children as they completed the questionnaire by the researcher, thus reducing the likelihood that children with poor reading skills would be disadvantaged. The total time for administering the questionnaire was approximately 10-15 minutes for each group.

Stage three consisted of semi-structured interviews with six students randomly selected from the two groups, comprising three students who used calculators in the classroom and three who did not. Interviews were conducted individually, each lasting approximately 15 minutes and were intended to provide opportunities for students to elaborate on the issues contained in the questionnaire, thus enabling the researcher to gain some insight into students' reasons for particular responses. Each interview was audio-taped and transcribed for closer analysis.

## **Results**

To aid the presentation of results, data obtained from the questionnaire will be reported in conjunction with corroborating evidence obtained from the interviews.

### **Attitudes toward mathematics**

The first four items on the questionnaire enabled the researcher to gain some insights into the students' attitudes toward mathematics in general. Overall, a high level of satisfaction with mathematics was noted by students from both groups in the study. The majority of them indicated that they enjoyed mathematics (86.3%), found mathematics to be relatively easy (88.6%), held high perceptions of their mathematical potential (75.0%) and recognised the everyday usefulness of the subject (95.4%). Evidence was also found to suggest that 'liking' and 'difficulty' are not easily attributed to the whole subject, but rather, are associated with specific topics

and forms of presentation. For further discussion of this point see Arvonen (1994).

### **Attitudes toward calculators**

The design of the questionnaire enabled the researcher to gain a general insight into the attitudes of all participants toward calculators, as well as to compare the attitudes of those students using calculators with those not using calculators for mathematics at school.

Attitudes of all students: It is interesting to note that not all students who owned a calculator were making use of it at home. Although the earlier grades were generally considered by the students as 'too young' for the inclusion of calculators, almost all respondents (94.4%) acknowledged the importance of learning to use a calculator and most accepted that calculator use should begin in the primary school years. Years 7, 3, 5, and 6, respectively, were the most frequently cited responses as to the grade at which the students believed calculators should begin to be used in school. Two-thirds of the students reported that 'a calculator can help you learn'. However, the interviews revealed that 'learning' in this sense was often associated with 'memorising' the calculators' answers.

While half of the students 'trusted' their calculator to give correct answers, incorrect answers were often attributed to human error through incorrect keying or machine failure as a result of flat batteries. The interviewees regarded checking a calculator answer as important and were able to offer strategies for checking their work. The children's ideas about what happens inside a calculator encompassed a wide range from 'disk', 'batteries' 'memory' to 'a little brain'. 'Providing answers' was designated as the main use for a calculator but a variety of perceptions were expressed, from 'cheating', 'fun' 'answering big questions', 'mucking around', checking answers' to 'the four operations'.

**Attitudes of students using calculators at school:** Overall, the students for whom a calculator was a part of their mathematics instruction at school, expressed high levels of general satisfaction with calculator use. The majority of the students enjoyed using a calculator (95%), found mathematics learning to be more enjoyable with a calculator (80%), perceived calculator use as relatively easy (67.5%) and considered mathematics to be easier when a calculator is used to solve problems (97.5%). All of the children perceived the calculator as helpful with 55% of students reporting that they 'did not have to think as much when using a calculator'.

**Attitudes of students not using calculators at school:** It is interesting to note that of those students for whom a calculator was not part of the mathematics instruction at school, more than half (59.2%) reported that they would like to use a calculator at school and almost the same proportion (53%) held the view that mathematics would be more enjoyable with a calculator. The majority of students (77.5%) considered that mathematics would be easier with a calculator. Thirty percent of students reported that they would try harder in mathematics if they had a calculator to use. Just over half of the students (53.1%) believed that they 'would not be required to think as much if they used a calculator for mathematics' and a similar number (59.2%) acknowledged the need of still learning to do 'sums' with pencil and paper if they were to use a calculator for mathematics and school.

## **Discussion and Conclusions**

In general, most students at the upper-primary level seem to be strongly in favour of the use of calculators and recognise the application of calculators to everyday life. The majority of the students using a calculator as a part of their mathematics instruction enjoy using a calculator, consider mathematics learning to be more enjoyable with a

calculator, perceive calculator use as relatively easy and consider mathematics to be easier when a calculator is used to solve problems. Additionally, all of the students perceive calculators as being helpful. Furthermore, the high number of students who reported that calculators make maths more fun, suggest a better attitude toward mathematics resulting from calculator use, a finding that is supported by other studies (Hembree & Dessart, 1986). The majority of students for whom a calculator is not a part of their mathematics instruction indicated that mathematics would be easier with a calculator. This comment may reflect the attitude indicated by Item 24 of the questionnaire, where more than half the children surveyed believed that they 'would not have to think as much' if they could use a calculator because the calculator would do all the 'hard work' - a common misconception expressed by parent and teacher groups (Williams, 1987). Furthermore, more than half of these students indicated that they would like to use a calculator at school, while almost the same number believed that the use of a calculator would increase mathematical enjoyment. A number of these students even reported that they would 'try harder' in mathematics if they had a calculator to use.

Although calculators were generally perceived by the children as being 'fun' and 'helpful', it seems that many students are unsure about the legitimacy of using a calculator, many expressed the notion that using a calculator in school was somehow 'cheating'. These children felt that the calculator would inhibit their mathematical skills, fearing that they would become over-dependent on them and therefore not learn their basic facts. Such concerns seem to be more a reflection of attitudes expressed by the general community and parent groups rather than evolving from the children's own experiences.

A further concern expressed by the children was that calculators 'only give

answers' and hence are simply a replacement for computation. This reflects the way they are used in schools and highlights the need to educate further teachers and the general community concerning the varied uses of calculators.

The results of the investigation indicate that a range of attitudes are being developed by children in relation to calculators and their use in primary school, with conflicting views on almost every aspect investigated. Although a small-scale study, findings from the present investigation support the suggestion that technology can have an impact on children's attitudes toward mathematics and possibly even play a role in improving attitudes toward the subject. Of particular importance, however, is the necessity for teachers to be aware of the diverse attitudes students hold toward the use of calculators - many of which may contribute to impeding the effective integration of calculators into a teacher's mathematics instruction. Any teacher implementing calculators into their mathematics program will have to deal with the impact the new experiences are likely to have on students' affective states. Research into children's attitudes toward calculators can prepare teachers with strategies for introducing calculators into their classrooms while avoiding possible impediments identified in the literature.

## References

- Arvonen, L. (1994). An investigation into students' attitudes toward calculators in the Primary School. Unpublished Bachelor of Education Honours thesis. University of Sydney.
- Blane, D. (1986). Guidelines for the use of calculators in mathematics teaching in Australia. In N. Ellerton (Ed.), Mathematics: Who Needs What? pp.234-239. Melbourne: The Mathematical Association of Victoria.
- Bobis, J. (1995). Institutional collaboration and the professional development of teachers. In R. Hunting, G. Fitzsimons, P. Clarkson & A. Bishop (Eds.), Regional Collaboration in Mathematics Education 1995. Monash University: ICMI.
- Coburn, T. (1989). The role of computation in the changing mathematics curriculum. In P. Trafton (Ed.), New Directions for Elementary School Mathematics, pp. 43-56. Reston, Virginia: NCTM.
- Cooper, T. & English, L. (1985). Calculators do more than just compute: Using the calculator to teach an understanding of concepts and processes. In P. Sullivan (Ed.), Mathematical Association of Victoria Twenty-Second Annual Conference, pp.31-36. Melbourne: MAV.
- Doig, B. (1993). What do children believe about calculators? In Contexts in Mathematics Education. Proceedings of the sixteenth annual conference of the Mathematics Education Research Group of Australasia. The Australian Council for Educational Research, Brisbane.
- Educational Testing Service (1988). The Mathematics Report Card: Are we measuring up? Trends and achievements based on the 1986 National Assessment. Princeton, NJ: Author.
- Hembree, R. & Dessart, D. (1986). Effects of hand-held calculators in precollege mathematics education: A meta-analysis. Journal for Research in Mathematics Education, 17, 83-99.
- Howard, P. (1992). The Calculator Issue: A literature review 1965-1991. Primary Association for Mathematics, Sydney: University of Western Sydney, Nepean.
- Leder, G. (1987). Attitudes toward mathematics. In T. Romberg & D. Stewart (Eds.), The Monitoring of School Mathematics, (Vol. 2). pp.261-277. Madison: Wisconsin Centre for Education Research.
- Williams, D. (1987). A calculator-integrated curriculum: The time is now. Arithmetic Teacher, 34, 8-9.

**Appendix A: Attitude Toward Calculators Questionnaire**

Q		Yes	No	Some- times	Don't know
1	I like maths	44.3%	11.4%	42.0%	2.3%
2	Maths is easy	12.5%	11.4%	76.1%	0.0%
3	I'm good at maths	31.8%	15.9%	43.2%	9.1%
4	Maths is important / useful to everyday life	92.0%	3.4%	3.4%	1.1%
5a	Students should use calculators in primary school (K-6)	23.9%	36.4%	36.4%	3.4%
5b	I think that students should begin using calculators in grade _____				
6	I use a calculator at home	9.1%	52.3%	38.6%	0.0%
7	I own my own calculator	58.0%	42.0%	0.0%	0.0%
8	It is important that everyone learn to use a calculator	89.8%	3.4%	4.5%	2.3%
9	A calculator will always give the correct answer	50.0%	25.0%	23.9%	1.1%
10	A calculator can help you learn	45.5%	34.1%	20.5%	0.0%
11	All calculators will give the same answer to a question	63.6%	21.6%	9.1%	5.0%
12	I use a calculator at school If 'Yes' answer questions 13-18 If 'No' answer questions 19-24	45.5% <i>n</i> =40	54.5% <i>n</i> =48	XXXX	XXXX
13	I enjoy using a calculator	75.0%	5.0%	20.0%	0.0%
14	Using a calculator is difficult	12.5%	67.5%	20.0%	0.0%
15	Calculators make maths fun	67.5%	20.0%	12.5%	0.0%
16	Maths is easier if a calculator is used to solve problems	85.0%	2.5%	12.5%	0.0%
17	Calculators are helpful	82.5%	0.0%	17.5%	0.0%
18	Because I use a calculator I don't have to think as much	27.5%	45.0%	27.5%	0.0%
19	I would like to use a calculator for maths	24.5%	40.8%	34.7%	0.0%
20	Maths would be more fun with a calculator	30.6%	44.9%	22.4%	2.0%
21	Maths would be easier with a calculator	65.3%	20.4%	12.2%	2.0%
22	I would try harder in maths if I had a calculator to use	24.5%	69.4%	6.1%	0.0%
23	If I used a calculator I would not need to learn how to do sums with pencil and paper	36.7%	59.2%	4.1%	0.0%
24	If I used a calculator I would not have to think as much	53.1%	38.8%	6.1%	2.0%