FOUR PIAGETIAN-TYPE CONSERVATION TASKS DONE BY 200 RAROTONGAN CHILDREN AGED 6-10 YEARS

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INTRODUCTION

Testing was carried out to determine the age at which Cook Islands children are able to conserve **substance, weight, length** and **area,** as a basis for curriculum development in primary mathematics and science.

The testing was conducted in four morning sessions of approximately 3 hours each on 2nd, 3rd, 4th and 6th November 1977.

Four Cook Islands educators tested at each session. A fifth person (the report writer) attended to the administrative side. Those who did the testing were: Mrs Kauta Dean, Mr. Ngatoka Rongo, Mrs. Noovai Tyler, Mr. Kauraka Kauraka, Mrs. Akaiti Ama, Mr. Kaoiti Marurai, Mr. Aaron Marsters and Mr. Terepai Moetaua.

SAMPLE OF CHILDREN

5 boys and 5 girls at each age level from 6-10 years were chosen at random from each of the following schools on Rarotonga: Nikao, Arorangi, St. Joseph's and Avarua.

A total of 50 children from each school was tested individually to give a sample size of 40 children at each age level. Each of the 200 children performed each of the four tasks so that 800 test performances in all were recorded.

For the most part, the 6 year olds were Grade 1 children, the 7 year olds were Grade 2 children, and so on up to the 10 year olds who were mostly Grade 5 children.

TESTS

The four tests together with procedures for administering them are outlined

on the Conservation Tasks Sheets in the Appendix. All four are described in Lovell[1].

Two of the tests were modified to make them more culturally relevant, using procedures recommended by Ashton[2].

(a) Dry coral sand was used instead of water to test for conservation of substance since Rarotongan children have more experiences with sand pouring than with water pouring. The children themselves did the pouring to counteract for any magic belief.

(b) 'Lagoons', 'rocks', and 'fish' used in place of 'grass', 'cows', 'houses' for the same reason.

Prior to the test sessions the group of testers met to:

(a) familiarize themselves with the tasks, and

(b) agree on a common translation of instructions into Cook Islands Maori.

Since Cook Islands Maori is the mother tongue of the majority of children, test sessions were conducted in Maori. In a few cases it became evident that the children spoke better English than Maori so instructions and questions were given to these children in English.

RESULTS

TABLE 1

Number and Percentage of Children Conserving

AGE	SUBSTANCE				WEIGHT				LENGTH				AREA			
	B	G	Tot.	%	B	G	Tot.	%	B	G	Tot.	%	B	G	Tot.	%
6	1	1	2	5	3	1	4	10	0	1	1	2.5	2	0	2	5
7	5	4	9	22.5	9	9	18	45	0	5	5	12.5	1	3	4	10
8	6	2	8	20	11	8	19	44.5	3	0	3	7.5	3	4	7	17.5
9	16	6	22	55	15	10	25	62.5	6	7	13	32.5	6	3	9	22.5
10	8	9	17	42.5	14	17	31	77.5	8	8	16	40	3	5	8	20
	36	22			52	45			17	21			15	15		

Table 1 generally shows an increase in conservation ability with age in all task areas. Thus, in the case of conservation of substance, hardly any of the 6 year

olds could conserve, while at the 9-10 year level roughly half of the children could do so. Conservation of weight shows the greatest gain with age — from one-tenth able to conserve at age 6 years the figure increases to threequarters by 10 years. Similarly, by age 10 years 40% of children can conserve length, and 20% can conserve area. The pattern is perhaps more evident in Figure 1.

A Chi Square table was employed to test for sex differences as shown in Table 2.

TABLE 2

Chi Square Results for Sex Differences

	Substance	Weight	Length	Area
	(29)	(48.5)	(19)	(15)
Boys	36	52	17	15
	(29)	(48.5)	(19)	(15)
Girls	22	45	21	15
	58	97	38	30

(Expected frequencies in parentheses)

$X^2 = 3.406$
af = 3
P = n.s.

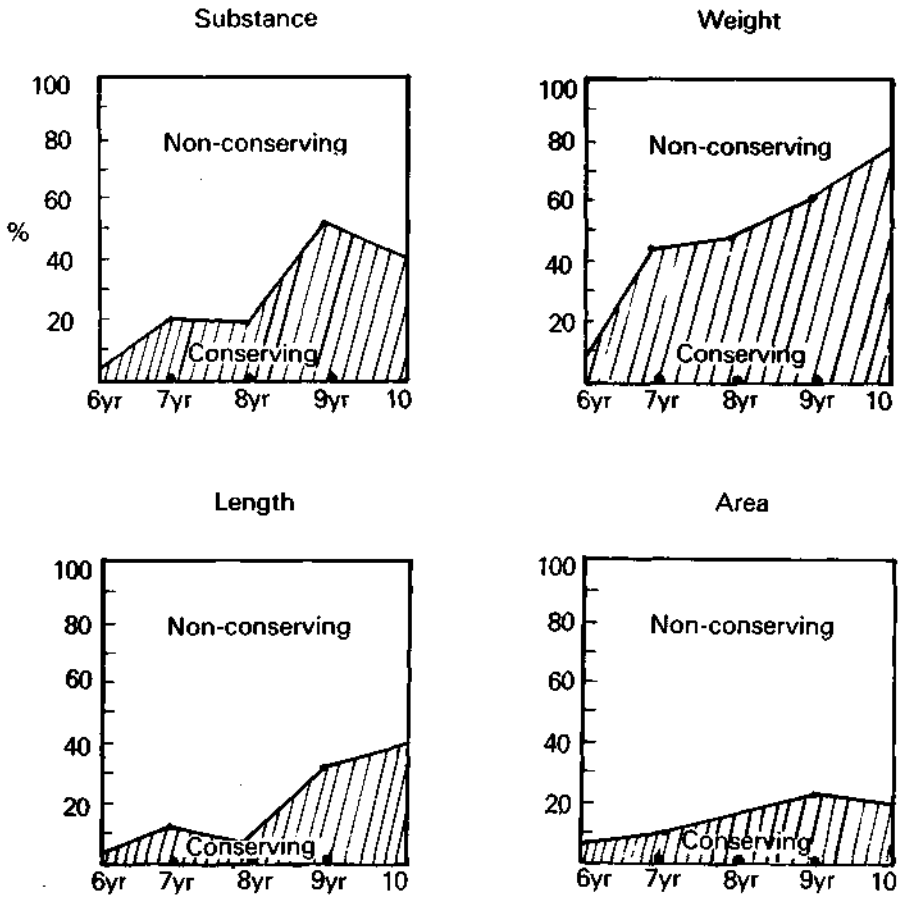
Although the boys appear to have performed slightly better than the girls, at least on the substance and weight tasks, the difference is not significant. It could be due to chance factors. One must therefore conclude that no sex differences exist in conservation ability as measured by the tasks described in this report.

DISCUSSION

The only task area to show a steady or consistent increase in conservation ability with age (as found in number conservation reported previously) is that of weight. Apart from some variation around the 7-8 year level, ability in conservation of length does follow a similar pattern. The same trend occurred with conservation of area up to the 9 year level but then dropped back a few percentage points at the 10 year level. The most marked variation occurred in conservation of substance, where ability apparently drops off at the 8 year level and again at the 10 year level (markedly). These variations are without

FIGURE 1

Percentage of Children Conserving on Four Piagetian-type Tasks



explanation but could be due to limitations of sampling. If it had been possible to double the number of children tested then a much more reliable result could have been obtained, but it would not have been easy to test twice as many children. Despite the number of people potentially available, it took some effort to assemble four testers on any one day.

Although the reliability of the results is questionable, it can probably be tentatively accepted that by age 10 years approximately:

75% of the children can conserve weight,
50% of the children can conserve substance,
40% of the children can conserve length,
25% of the children can conserve area.

Whether they could do so in other task situations relating to weight, substance, length and area is unknown. That is, we do not really know whether the children who conserved on the present tasks have a generalised conservation ability in the areas tested. Also, we do not know whether children who failed to conserve on the particular tasks used could in fact conserve on other tasks.

If children are provided with a richer 'diet' of conceptual experiences at school, then it is likely that a greater percentage of them could conserve in the task situations described in this report. At the present time, however, and for the next few years probably, primary mathematics and primary science curriculum development will need to allow for the restricted (arrested even) conservation ability of children in the primary schools.

The results of the conservation testing reported here seem to raise more questions than they answer. It would appear necessary, for example, to:

(a) carry the testing through to the 12 year level,

(b) test at least 400 children (about 1/10 of the primary school children) in order to be able to generalise to the population of Cook Islands primary school children, and

(c) include a second task in each of the four conservation situations to provide a more valid result.

WHAT THE RESULTS MEAN IN PRACTICE

The most that can be said at this time is that in any one class in the primary schools, teachers can expect to find children of widely differing cognitive ability. To treat all children as if they had the same ability would be a mistake.

It appears that most primary children in the Cook Islands need a considerable amount of concrete manipulative activity in the classroom; that is, they should

be using real objects and real situations to learn from, instead of listening to words and writing words all the time. If teachers merely demonstrate with apparatus, that too is useless. Each child must actively do the things himself if the symbols and words are to have any meaning for him.

From the results so far, it would appear that many children, even at the age of 10 years (or about the Grade 5 level) still cannot conserve substance, weight, length and area. Such children would be unable to use standard units of measurement with any real understanding. The children who cannot conserve length, for example, think that the same length can get bigger or smaller (increase or decrease) depending on the way it is arranged. In other words, it is like a piece of elastic that can be stretched. Meaningful measurement in, say, centimetres would probably be beyond the ability of these children. But this does not mean that the children should not be given measuring activities before they can conserve. On the contrary, they should be given a whole range of activities (using non-standard units) and asked many challenging questions to help them towards conservation.

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REFERENCES

1. Lovell, K. (1962), **The Growth of Basic Mathematical and Scientific Concepts in Children**, London, University of London Press.
2. **Ashton, P.T.**, Cross Cultural Piagetian Research: An Experimental Perspective, **Harvard Educational Review**, 45 (4).