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Purpose of the Research

The new Primary Maths Curriculum expects all children to have secure knowledge of times tables facts up to 12 x 12 by the end of Year 4. From 2017, as part of a new government initiative all Year 6 children will be assessed. Quick recall of multiplication facts is essential to access the maths curriculum however; many children struggle to reach the national expectation in this area despite teachers devoting a significant amount of lesson time to achieve this outcome. The purpose of this research was to determine the most effective way for children to learn times tables which could help teachers to raise standards and attainment in this area. We taught three times tables using different approaches and measured how much progress children made during each unit of work. This enabled us to determine which method yielded the highest results. In one school, the children's enjoyment and confidence at the end of each unit was rated on a 7 point Likert scale, in order to show which method of learning the children preferred.

The Research Design

A within-subject design was used with a pre-and post-test. The independent variable (method of learning times tables) was operationally defined by the creations of three counterbalanced conditions:

IV Level I – Control condition – Three ten minute sessions each week for two weeks in which children learnt through a teacher led session using a counting stick

IV Level II – Active control – Three ten minute sessions each week for two weeks in which children learnt through writing times table facts out in rote and completing practise questions.

IV Level III – Experimental condition – Three ten minute sessions each week for two weeks in which children learnt independently through use of an ICT program.



Look, Cover, Write, Check

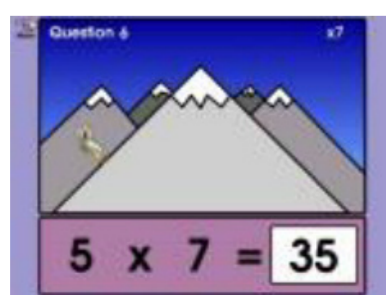


Table Mountain ICT game



Counting Stick Method

Method

Participants, sample size and randomisation

Three Key Stage 2 classes each from different primary schools took part in this research. All children completed a unit using each method of teaching therefore randomisation was not required. The sample comprised of 34 girls and 36 boys.

Procedures

Each class completed a two week unit on each of the 6, 7 and 8 times tables. During each unit, there were three ten minute sessions per week for two weeks. For each unit, the children used a different method to learn the times table. The three methods were:

1. Writing times tables facts out using a 'Look, Cover, Write, Check' system and practise questions. Children marked their own work to ensure that misconceptions were not reinforced.
2. A teacher led session using a counting stick.
3. Independent practise using an ICT program (Table Mountain).

To ensure consistency in the teacher led group, a lesson plan was written and agreed.

The schools used different methods during each unit, the order of which had been randomly assigned. A pre- test and post-test were applied at the beginning and end of each unit and used to assess progress.

Materials (and apparatus)

A pre- and post-test for each unit comprising of 12 questions presented in a mixed order.

A rating sheet for the children to rate their enjoyment and confidence from 1-7 on a Likert Scale.

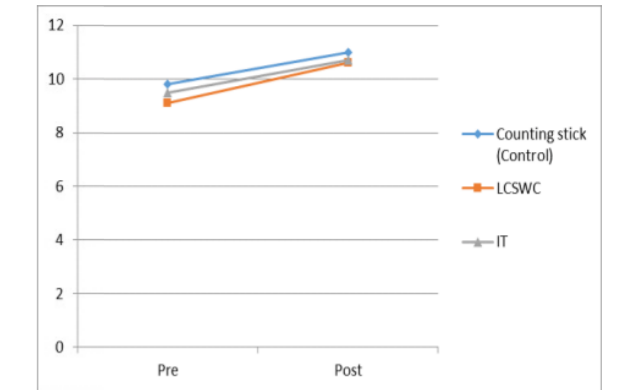
- Laptops loaded with the ICT program, Table Mountain.
- Look/Cover/Write/Check sheets for practising each times table.
- A lesson plan for the teacher led session using a counting stick.

Results

Gain scores were analysed using the pre-post test data in the graph below. A Friedman test showed a non-significant difference across all conditions ($p < 0.769$). Separate Wilcoxon signed-rank tests were used to compare the three conditions to one another. Because the analysis used multiple tests, a more stringent significance level (Bonferroni adjustment) was set (0.017). These results can be found in the table below.

This shows that there is a significant difference between the conditions. Intervention B (ICT) was significantly better than the control (counting stick) and intervention A (Look, Cover, Write, Check) was significantly better than both conditions, but only by a very small amount.

	Condition 1	Condition 2	Condition 3
Condition 1		$r = -0.06$ $p < 0.001$ (two-tailed)	$r = -0.01$ $p < 0.001$ (two-tailed)
Condition 2	$r = 0.06$ $p < 0.001$ (one-tailed)		$r = 0.06$ $p < 0.001$ (two-tailed)
Condition 3	$r = 0.01$ $p < 0.001$ (two-tailed)	$r = -0.06$ $p < 0.001$ (two-tailed)	



Limitations

This was preliminary evidence from a small scale randomised control trial, and further research would be necessary in order to eliminate some of the limitations present:

- Different teachers taught at each school; therefore the counting stick session could have been delivered differently despite all teachers using the same plan.
- The number of attendees for each teaching session was not recorded.
- Data from the children who were not present for either the pre or post-test was withdrawn from the study.
- There were different abilities of children included dependent on whether the children were streamed or not.
- Likert Scales for pupils to self-assess their progress and enjoyment were only recorded in 1 of the schools, therefore conclusions are limited.

Conclusions and Recommendations for Future Research

From the identified methods of teaching timetables, our study suggests that all 3 methods are equally valid and lead to a similar rate of progress. Whilst 'Look, Cover, Write, Check' was marginally better, all 3 methods increased progress made. One school trialled the use of an 'enjoyment and confidence rating sheet.' It suggested that a large percentage of children enjoyed the ICT method the most, but they felt that it didn't help them make the most progress. All 3 methods led to progress being made across a range of schools; therefore we conclude that 10 minutes of daily practise using a range of methods aids children to make good progress in learning and retaining times table facts. Prior teacher-led RCT research (Morris, 2015) has indicated LCWC to be more effective than normal practice and kinaesthetic approaches when used with spelling. In contrast, and in the case of the automatic recall of timetable (present study) it appears to be an alternative treatment to current practice.

If the research were to be repeated, it could be conducted using a group of younger children who have less previous knowledge, to determine whether the initial method of learning times tables impacts on progress and retention of times table facts.