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CHILDREN'S NUMERACY SKILLS AND THE USE OF EDUCATIONAL TELEVISION PROGRAMMES

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Abstract.
Four year 1 classes in different schools watched a series of programmes from one of two television series designed to support numeracy needs. In each school another year 1 group was identified as a control. The control group had lessons with the same learning objectives and similar worksheets and resources but did not use the television programmes. Pre- and post- tasks were used to assess the children's progress in numeracy skills. The average gain from pre- to post- test results was higher for the television groups than the control in two schools and lower in one school. For all the television groups it was possible to identify small groups of children with low pre-test scores who made substantial improvement. This feature was not present in the control groups. In the control groups gains were focused on one or two assessment items. In the television groups gains were more evenly spread across the test items for children of all achievement levels.

1. Introduction

This research project was commissioned jointly by the BBC and Channel 4 to evaluate the effectiveness of television in developing numeracy skills. The two television series used were Numbertime by the BBC and Number Crew by Channel 4. There are studies of the effectiveness of educational television for various ages and subjects (Clifford, Gunter & McAleer, 1997; Bage 1997) but there has been little recent study of mathematics and television. In the UK the introduction of the National Numeracy Framework for schools from September 1999 has stimulated interest in whole class teaching methods and it would be possible, if it were shown to be effective, that the use of educational television could form part of whole class teaching. Positive effects on pupil motivation

(Sumner 1991) are reported for television programmes on a variety of subjects but this study focuses on the effect on children's learning.

2. Methodology

2.1 Design

In each of four schools a television and a control class of year 1 pupils (5 to 6 year-olds) were identified. The class teacher administered the assessment activities as a pre-

test. After a two-week period of study, the same activities were administered, by the class teacher, as a post-test.

2.2 Materials

The children in the television group watched 5 programmes from the series (average length 10 minutes) over a two-week period. In each school the two class teachers planned lessons with the same learning objectives and children, in both the television group and the control, used worksheets provided as support material for the programmes and other materials. The skill of the teacher in using the television programmes and the follow-up activities has been identified (Convery, 1990) as a factor in the effectiveness of the use of television.

2.3 Subjects

157 children participated in this study. There were 88 boys and 69 girls.

The phrase 'control group ' is used to describe the group that did not watch the television programmes. The classes involved in the project were existing year 1 classes set up by the schools at the beginning of the academic year according to a variety of criteria. Year 1 groups in schools are seldom evenly matched and their teachers have different experiences and skills. The teachers identified certain differences in the way children were assigned to the year 1 classes. (Appendix 1)

2.4 Procedure

The teachers were briefed on the structure of the research project. They were provided with the programmes and support materials, and given guidance on the teaching period, the assessment and the role of the control group. The teachers, in both television and control groups, administered the pre-assessment activities, taught for two weeks and then administered the same activities as a post-test. A researcher visited each classroom during the period of the project to gather background information. In addition to the test results the work of each child, in both the television and the control group, on a selection of worksheets was collected together with a diary kept by the teacher over the period to record observations on pupil progress. These materials provided additional information on pupils whose test scores were in some way distinctive.

2.5 Developing the Assessment Activities

The content of the programmes, and of the associated activities was examined. The content which was common to both programmes and reflected the National Numeracy Strategy (1999) key objectives included: counting, reciting the number words(Item

1A); counting groups of objects, singly and in groups of 2, 10 and 5 (Item 1B); writing numbers (Item 1C); matching number symbols with spoken numbers (Item 2A); ordering numbers (Item 2B); odds and evens (Item 2C).

The assessment tasks were designed to cover the above areas (task items are referred to in italics), whilst ensuring manageability for the teachers. It was assumed that teachers were familiar with the statutory assessment tasks for Key Stage 1. The tasks were based on Key Stage Assessment Tasks, which are designed for low attainers in Year 2, and on the work of Shirley Clarke (1995). Two of the assessment tasks were designed to be undertaken by the teacher with small groups of up to four children. Attainment is given a numerical score depending on the outcome of the tasks. These scores are roughly equivalent across the tasks, and are arranged hierarchically. The initial assessment tasks were piloted with an experienced teacher. In the light of the pilot the assessment outcomes were modified and the detail given to assist in administration of the tasks was refined.

3 Results

3.1 Visits to school

In all classes visited the children were generally well motivated and enthusiastic about the mathematics they were doing. The teachers presented the work in an engaging way and managed the pace of the lesson well. The schools are designated A, B, C and D. In classes that were using the TV programmes the children showed enthusiasm for the programmes and knowledge of the characters and story lines. In one class (A with TV) the children watched each programme twice: the first time the teacher stopped the tape whenever a question or problem was posed and a brief class discussion ensued, the second time the programme was watched all the way through. The children were active watchers of the programme, joining in with the songs and counting and speaking answers to questions and problems quietly as they arose. The follow up work used ideas and resources from the materials produced to support the TV programmes. In all classes, these were supplemented by additional work in some instances to extend high attainers (school D) and to provide appropriate work for lower attainers (all schools). The joint planning was reflected in the similarity of the work seen in both the class using TV and the control class.

3.2 Overview of assessment outcomes

Post-test results were not available for all children involved in the project due to absence from school. Unfortunately the teacher of one of the control classes was unable to complete the post- task assessments due to ill health. The remaining seven classes showed an average increase in the child's performance on the first two assessment tasks, regardless of their prior attainment. The improvement in

performance was greater for the class that had used the TV programmes when compared with the control class in the same school, in at least two of the four schools. The difference in average gain per child was statistically significant in schools A and B (determined using a t-test), in school A the increased gain was by the class who used TV, whereas in school B the class not using TV made the most gain. It is worth noting that class B with TV was a mixed age class of lower attaining children. Analyses were undertaken to explore whether or not age or sex had any bearing on the progress made. There was no difference between the progress made by boys or girls within each class, and there was no correlation between the gain in progress and the child's age.

Score gain/ child represents the total increase in score for the group per number of children tested (number who took the pre-test minus the number who were absent for the post test).
Average test results are based on the number of children who took the tests.

Class	(Size)	Pre-test class average	Post-test class average	Score gain/child	Standard deviation
A+	(26)	16.96	20.58	3.62	3.49
A-	(24)	22.33	24.33	2	2
B+	(22)	19.5	22.32	2.82	3.23
B-	(28)	15.75	19.93	4.18	2.44
C+	(20)	14.3	16.7	2.4	3.00
C-	(19)	22.89	24.10	1.21	2.01
D+	(18)	18.94	22.83	3.89	2.42

The pre-test and post-test results were entered on scatterplots which clearly demonstrate that few children in any class failed to make progress on the areas of content assessed by the tasks. Classes in each school followed similar programmes of teaching, although only one class used the TV programmes. Typically this meant that the same activities and worksheets were used in each class. The scatterplots also showed that small groups of children with low pre-test results made considerably further progress in the classes which had used the TV programmes.

Whilst all classes showed an improvement in overall performance on the assessment items, the standard deviation indicates that there was considerable individual variation. All the classes which used TV have a higher standard deviation than those classes that did not use TV. An analysis of the individual items (see below) suggests that in classes which used TV progress was made on more of the assessment items.

3.3 Particular Test Items

The table below shows the improvement in performance on the assessment items, labelled as per 2.5. The values in the table show the sum of gains and losses for all the

children in the class by item 1A, 1B etc.e.g. in school with TV (A+) the overall gain on assessment item 1A was 16.

Class	(Size)	1A	1B	1C	2A	2B	2C	Average gain per child per item
A+	(26)	16	17	6	8	24	23	.603
A-	(24)	3	8	6	-2	-2	35	.333
B+	(22)	7	23	-2	11	11	12	.470
B-	(28)	13	35	14	18	18	19	.696
C+	(20)	7	2	15	19	4	15	.400
C-	(19)	0	1	-2	0	6	18	.246
D+	(18)	7	15	4	19	10	15	.648

Class A+ means class using TV in School A, class B- means class not using TV in School B.
Average gives the average gain per item per child (to 3.d.p.)

The improvement in performance across the items is variable. In school A both classes made considerable gains on item 2C (recognising odds and evens), in addition the class using TV gained on item 2B (ordering numbers) and to a lesser extent on items 1A (counting/ reciting number words) and 1B (counting in groups). In schools C and D impressive gains were made on item 2C (recognising odds and evens) and for the classes using TV on item 2A (matching number words and symbols). The two schools differ slightly in the other effects of TV which may be a reflection of their different teaching programmes. The class in school C with TV showed gains on item 1C (effective recording whilst playing the counting game), and the class in school D with TV showed gains on item 1B (counting in groups). Apart from item 1A for one class, the classes using TV showed gains across all the assessment items, whereas the classes not using TV gained in certain areas only. A possible interpretation of these results is that these were the areas targeted by the teachers in the non-TV classes. The number line activity showed an interesting development over the 2 weeks. The post test number lines generally included 0 as the starting point and made greater use of colour and shapes: in some the numbers were written in snakes or spirals. This may be due to the images used on the worksheets. For many children more numbers were used in the post test and there was increased accuracy. The pre and post test number lines were not available from schools B and C.

4. Conclusions

This research project set out to establish if improvement in pupil performance, as assessed by their class teacher, was greater with or without the use of television programmes in teaching. To try to ensure that the television programmes were a clear factor in the progress of the children a short period of two weeks was considered. Teachers in both the TV and control classes integrated written materials and activities

related to the TV programmes in their teaching, The results overall are inconclusive. The difference between a formal control group with pairwise matching of children and a control group taken as another class in the same school with a different teacher are clearly substantial. In the school where the two classes were reported by the school to be most closely matched the TV group showed an increase over the non-TV group. Analysis of the scores in detail suggests two interesting hypotheses:

- use of television may enable some low-achieving children to make gains above the average for their class

- television programmes may enable children to make gains across a wide spectrum of assessment items whilst the teacher input produces specific gains in a narrower range of items. (Note: In this study the children watched several programmes from the series over a two week period)

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Appendix 1 Descriptions of schools and classes

School A 383 pupils. A Roman Catholic school in an area of mixed social housing and owner occupied housing. 7% of children have free school dinners.

The TV and the control group are of mixed ability with a small strong core group and approximately 50% of the children have extra remedial support, predominantly for English

School B 352 pupils. On large council high rise estate .60% free school dinners

TV class is a mixed age year 1 and year 2 with a high proportion of children on the SEN register. Control is a year 1 class, with all of the children perceived to have average, to above average ability.

School C A large primary school (600 pupils) Housing is a mix of owner occupied and social housing provision. 25% free school dinners.

TV group had children who scored below 12 on their final baseline scores. Control group had children who scored above 12 on their final baseline scores.

School D A small First school.(272 pupils) Housing is mainly owner occupied and expensive. 1% of children have free school dinners. TV class made up of spring birthday children with a few summer birthdays. Control class made up of autumn birthday children with a few summer birthdays.