AN INVESTIGATION ON THE EFFECT OF HOMEWORK ON PUPIL GAINS IN AN ASSESSMENT OF NUMERACY IN THE FIRST YEAR OF THE LEVERHULME NUMERACY RESEARCH PROGRAMME

Hazel Denvir, Valerie Rhodes, Margaret Brown,
Mike Askew, Dylan Wiliam and Esther Ranson

School of Education, King's College London

Abstract: A range of data was collected from the 73 Y4 classes which participated in the first year of the Leverhulme study (1997-1998). This included teacher questionnaire, pupil data, classroom observation and teacher interview. These data are being matched to the mean class gains which pupils made between October and June in an assessment of numeracy. In this paper we report our findings relating to one aspect, homework, explored in the Teacher Questionnaire and match these to class mean gains in the assessment.

Background and Context

The five year Leverhulme Numeracy Research Programme focuses on attainment in primary numeracy and on ways of improving numeracy standards. The Programme contains five Focus Projects and a Core Project. The Core Project, which provides the data for this paper, sets out to obtain large scale longitudinal value-added data on numeracy in order to:

-inform knowledge about progression in primary school pupils' learning of numeracy.

-assess relative contributions to gains in numeracy of the different factors investigated in the programme.

Shortly after the beginning of this research programme the government published the final report of the Numeracy Task Force (DfEE 1998) outlining proposals for a National Numeracy Strategy (NNS) to be implemented in 1999/2000. As a consequence of this timing, this Programme will be well positioned to provide some degree of independent evaluation of the Strategy.

The NNS (DfEE, 1999) asserts:

> *'better numeracy standards occur when.. .there is a daily, dedicated mathematics lesson in every class, with lesson time extended through out-of-class activities and regular homework;'*

There are also suggestions about the range of activities homework should cover, including:

> *'play a number game or work on a number puzzle'*
> *'learn some number facts or multiplication tables by heart'*
> *'think about how they might solve a problem'*

and stating that :

> *'out of class activities need to be frequent, short and focused"*

Current advice to parents from the DfEE (DfEE, 1999b) suggest that children in year 1, 2 and 3 do one hour of homework per week and that this should increase to 2.5 hours in Years 5 and 6. The need for parental support is stressed, also the importance of feedback from teachers.

In a comprehensive review of research on homework Hallam and Cowan (unpublished paper) note that whilst much of the research on homework generally has been concerned with its effect on academic attainment, little work had been done at the primary level. Whilst the value of homework at secondary level is well established the situation at primary level is less clear. Analysis of the Third International Mathematics and Science Study carried out by the IEA in 1994 (Mullis et al., 1997), (Keys et al., unpublished paper) found that teachers set homework more frequently to Year 4 classes with above average mean scores on the mathematics test and with above average NC levels in mathematics. However a recent study of Year 6 pupils, relating to progress in mathematics and reading which draws on data from a large national project on performance indicators, has indicated that primary pupils who did very regular homework made less progress than pupils who did homework infrequently (Farrow, Tymms and Henderson, 1999). Research in the UK has suggested that there is a consensus amongst teachers that the setting of homework is worthwhile (Hallam and Cowan, unpublished paper). In primary schools children are often expected to 'do sums' and 'learn tables'. MacBeath and Turner (1990) suggest that the four most common types of homework are finishing off class work, self-contained homework, project related work and preparation in advance of a lesson.

Sample and Data Collection

Ten schools were selected in each of four LEAs: two of these are London Boroughs which include both inner city and prosperous suburban areas, and two are large county authorities, one in the north of England, which each include urban, suburban and rural areas. Three of the LEAs have significant ethnic populations. The ten schools were selected to represent the variations within each authority on the basis of the school size, the socio-economic nature and mathematical level of pupil intake, religious affiliation, and value-added performance. Of the 38 out of the original 40 schools which have provided full data, seven are linked Junior and Infant schools, the other 31 are Primary schools.

The progress of two cohorts of pupils is being monitored: cohort 1 children (n >1500) were at Reception stage in 1997/8 and will be followed to Year 4 (2001/2). Children in cohort 2 (n >1600) were in Year 4 in 1997/8 and will be followed to Year 6, with some tracking of students into KS3. While numerous data are being collected this paper focuses on just two data sets which have been matched: the gains that Y4 pupils (cohort 2) made in the first year of the study and those gathered from a Teachers Questionnaire.

The items in the Teacher Questionnaire were adapted, with permission, from those used in the Third International Mathematics and Science Study carried out by the

IEA in 1994 (Mullis et al., 1997). Most of them were used in the Effective Teachers of Numeracy Study (Askew et al., 1997a). They are designed to gather data about beliefs and practices in teaching mathematics as well as teacher characteristics such as age, gender, and qualifications.

The assessments set out to assess children's grasp of numeracy. Their development and administration is described in Rhodes (1998) and Wiliam (1998). Scripts from the assessments were returned by 1723 pupils in October '97 and 1655 in June '98. The results reported here are for the 1467 pupils who could be matched for both administrations of the test.

Homework Factors Relating to Mean Class Gains: Results and Discussion

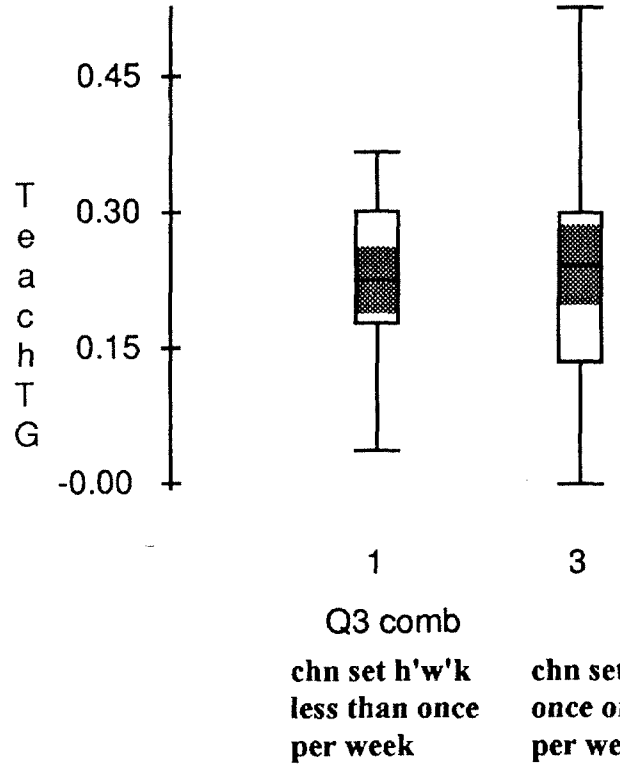
The adjusted class gains were matched to the data from the teacher questionnaire relating to the frequency and nature of homework .

In interpreting these results it should be noted that the numbers of teachers in some categories were small, and that the total sample was around 65 teachers in most cases, since ten did not complete the questionnaire. It is particularly important to note that caution must be exercised in interpreting these statistical associations: these do not necessarily imply causality.

In our study teachers were asked to indicate how often they set mathematics homework for their class. Although the children in classes of teachers who set homework once or twice a week had very slightly higher mean class gains in attainment than teachers who set homework less than once a week the difference was not at all significant ($p>0.1$; effect size<0.2 (fig. 1). Teachers were also asked to indicate the purpose of the homework. Doing more class work, finishing of work set in class and learning tables did not have a significant effect on class gains (effect size<0.2 and $p>0.1$ for each of these factors). Classes who were set problem solving activities or investigations gained slightly less on average than classes who were not set these tasks, although again the differences were not significant (effect size -0.36, $p>0.1$)

In contrast classes where homework was focused on family activities, such as IMPACT, did significantly better than those which did not (effect size = 0.89, $p=0.07$) (fig. 2). However it should be noted that the number of classes involved in IMPACT type activities was small, only 5 out of 64 classes in all. Great care must be made in making interpretations about the effect of IMPACT: only schools with effective organisation, communication and co-operation with parents could be effective in implementing an IMPACT scheme and these factors could be the crucial element rather than the types of homework children are given. The five classes, three in one school and separate classes in two other schools were all in the same LEA and were in schools with well structured policy and organisation for mathematics. All three schools also had mathematics co-ordinators with considerable experience who had implemented the schemes.

Figure 1: adjusted teacher gains by frequency of setting homework



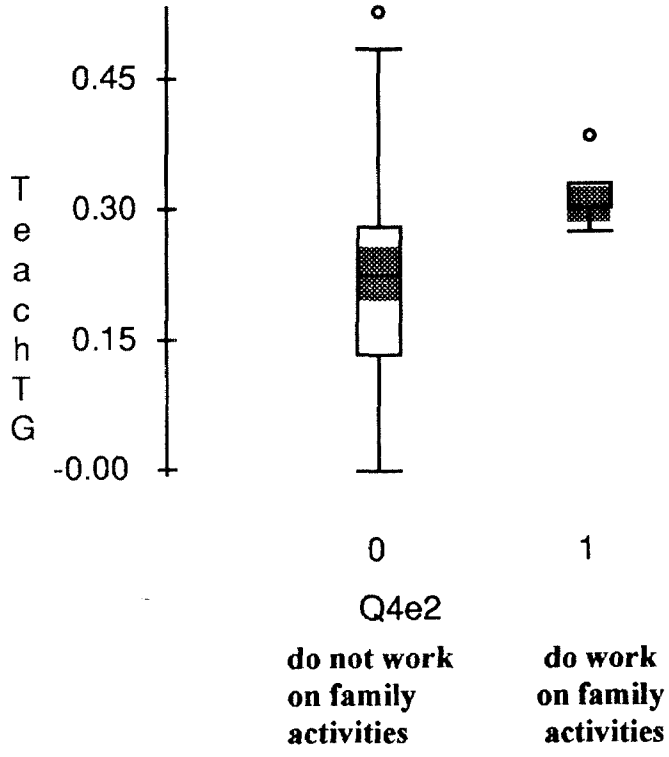
Summary of **TeachTG**
For categories in **Q3 comb**
No Selector
65 total cases of which 1 is missing

Group	Count	Mean	StdDev	PopStdv
1	29	0.223938	0.094136	0.092499
3	35	0.235175	0.122034	0.120278

Analysis of Variance For **TeachTG**
No Selector
65 total cases of which 1 is missing

Source	df	Sums of Squares	Mean Square	F-ratio	Prob
Const	1	3.38804	3.38804	278.42	≤ 0.0001
Q3c	1	0.002002	0.002002	0.16455	0.6864
Error	62	0.754460	0.012169		
Total	63	0.756463			

Figure 2: Adjusted teacher gains against working on family activities, e.g. IMPACT



Summary of **TeachTG**
For categories in **Q4e2**
No Selector
65 total cases of which 1 is missing

Group	Count	Mean	StdDev	PopStdv
0	59	0.222637	0.110472	0.109532
1	5	0.317947	0.041108	0.036768

Analysis of Variance For **TeachTG**
No Selector
65 total cases of which 1 is missing

Source	df	Sums of Squares	Mean Square	F-ratio	Prob
Const	1	3.38804	3.38804	293.96	≤ 0.0001
Q42	1	0.041871	0.041871	3.6329	0.0613
Error	62	0.714591	0.011526		
Total	63	0.756463			

It is apparent that these findings do not support the latest Government advice that frequent focused homework leads to better numeracy learning but does support the findings of Farrow et al. (1999) that more homework is not necessarily better.

Summary

Homework variables from the teachers' questionnaire, were on the whole unrelated to the mean class gains that pupils made in the assessments. We believe that determining 'what works' is not an easy: most easily measurable and apparently 'obvious' factors, like the 'homework' factors seemed unconnected to gains in numeracy.

Along with other researchers, we believe that the differences between effective and less effective teachers are subtle and relate rather to characteristics of teachers' integrated knowledge, beliefs and practices in mathematics teaching. We hope to be able to report further on this in future years.

References

Askew, M., Brown, M., Rhodes, V., Wiliam, D. and Johnson, D. (1997a) *Effective Teachers of Numeracy*. London: King's College London.

Department for Education and Employment (DfEE) (1998) *The Implementation of the National Numeracy Strategy: The final report of the Numeracy Task Force.* London: DfEE.

Department for Education and Employment (DfEE) (1999a) *The National Numeracy Strategy*. London: DfEE.

Department for Education and Employment (DfEE) (1999b) *THomework: Guidelines for Primary and Secondary Schools*. London: DfEE.

Farrow, S., Tymms, P. & Henderson, B. (1999) Homework and attainment in primary schools. *British Educational Research Journal,* 25 (3), 323-341.

Hallam, S. & Cowan, R. *Is homework important for increasing educational attainment?* Unpublished paper, Institute of Education, University of London.

Keys, W., Fernandes, C. & Harris, S. *Third International Mathematics and Science Study, Second National Report, Part 3: Factors associated with differences in students' performance on the mathematics tests in England.* Unpublished paper, Slough: NFER.

MacBeath, J. & Turner, M. (1990). *Learning out of school: Homework policy and practice.* A research study commissioned by the Scottish Education Department. Glasgow: Jordanhill College.

Mullis, I. V. S, Martin, M. O., Beaton, A. E., Gonzalez, E. J., Kelly, D. L. & Smith, T. A. (1997) *Mathematics Achievement in the Primary School Years: IEA's Third Mathematics and Science Study*. Chestnut Hill, Massachusetts: Boston College.

Rhodes, V. et al. (1998) *Designing valid numeracy tests for the primary age range.* BERA 1998 paper (BERA Educati*on-line*) August 1998.

Wiliam, D. et al. (1998) *Analysing numeracy attainment and progress in a Year 4 cohort.* BERA 1998 paper (BERA Educati*on-line*) August 1998.