Teacher confidence and teaching and learning in data handling

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> Aim

To examine the effect of teacher confidence on pupil confidence and hence achievement in the teaching and learning of mathematics with particular reference to data handling.

> Dimensions of this Case Study

Two contrasting lower schools:

1 St. Swithun's VC Lower School (SLS)
   The Hills Lower School (HLS)
2 Following an initial survey, by questionnaire, of all the teachers at both schools, 6 teachers and their classes were selected to form the basis of this study.

> Summary of Findings for this Case Study

- Previous research that most teachers showed a significant lack of confidence in teaching mathematics was confirmed by the study.

- Difficulty with teaching data handling was revealed as being a substantial issue.

- The teaching of probability was regarded as being particularly difficult.

- Teacher confidence affected pupil confidence and hence pupil achievement in mathematics, especially data handling skills.

- Reliance on a published mathematics scheme adversely affected teacher confidence in teaching data handling and children's achievement in this area.

- INSET on probability as a part of general upgrading of teacher knowledge was ineffective in raising children's achievement in probability.

- Sharply focused support to those identified as being unconfident in data handling was effective in raising teacher confidence.

Background

If we asked you to note down a few words or phrases that came to mind when we said the word 'mathematics', what would you write? Would your jottings include up-beat words like fun, interesting, absorbing? Or would your list have a negative ring to it – hard, can't do maths, forgotten most of it, boring? There is substantial research that indicates most teachers show significant lack of confidence in teaching mathematics. Haylock and Cockburn in their work on the teaching of mathematics to very young children (1989) point out that primary teachers are confused in their thinking about many of the basic concepts in mathematics, which they subsequently teach to children, and that they are very aware of their lack of understanding.

Conversations with our colleagues during 1997 suggested to us that they found themselves lacking in confidence and in need of support at the prospect of teaching to the standards laid down in 'Teaching: High Status, High Standards' (1997). The results of our 1998 Key Stage 1 national tests results and QCA Year 4 mid-Key Stage 2 results showed most mistakes in the data handling questions. We decided to find out if there was a connection.

What happened

We worked in our two contrasting schools, one a high profile county town lower school and the other a small country town Church of England lower school. The same process was followed in both schools. A questionnaire, already piloted, had been designed to give data on our colleagues' perceptions of their confidence in teaching mathematics in general and data handling in particular. This was sent to every teacher in both schools.

From the analysis of the questionnaire, a sample of six teachers was selected for interview and observation. They were chosen because their responses indicated low confidence in teaching mathematics in general and data handling in particular.

Interviewing our colleagues, analysing their responses and assisting them in developing data handling lessons which were subsequently observed, was without doubt the most rewarding period of the study. We were impressed with the dedication and professionalism our colleagues showed in their desire to improve their skills and knowledge, even though it meant being recorded and videoed in the process!

Data was collected from the interviews and from the classroom observations. We decided on a semi-structured format for the interviews but with a focus, namely the teaching of data handling as part of the mathematics curriculum which is assessed nationally at Stage 1 national tests and at the mid-Key Stage 2 tests. Transcripts were made of the interviews which were then studied for themes. The frequency with which these themes occurred was displayed on a bar chart and then analysed.

Each teacher in the sample was observed teaching a lesson generated either by the term's topic or as part of a year group mathematics investigation. The lessons drawn up revolved around sorting water toys or vehicles in the reception classes, a transport survey in Year 1, a Smartie investigation amongst others in Year 2 and food preferences in Year 3. Software used included Dataplot, Junior Pinpoint and My World. Lesson plans were subsequently amended at the request of the individual teachers involved. Our purpose was to gain data on teacher confidence and to gain insight into the children's confidence and general understanding of data handling.

A final questionnaire at the end of the study period allowed us to assess the extent to which the confidence of the teachers had increased as a result of the support programme, relative to that of the remainder of the staff. We were then able to look at the results in the light of the 1999 mid-Key Stage 2 tests.

Analysis and main findings

Analysis of the transcripts of interviews of the six teachers in the sample provided further evidence that confidence and lack of it was a significant issue for this sample.

Coding for Data Analysis (Hycner)

C	Confidence
CA	Child achievement
CL	Confidence lacking
DDH	Difficulty with data handling
DDHP	Difficulty with data handling progression
DHOS	Data handling outside scheme
DM	Difficulty with maths
DMP	Difficulty with maths progression
DODH	Difficulty organising data handling lessons
L	Language
LR	Lateral reinforcement
MS	Maths scheme
SDH	Success with data handling lessons
SDHP	Success with data handling progression
SDHP	Success with maths/progression
TDH	Training in data handling

Analysis of the interview transcripts for the selected sample of teachers, revealed that difficulty with teaching data handling was a substantial issue.

Hycners Analysis of all Responses
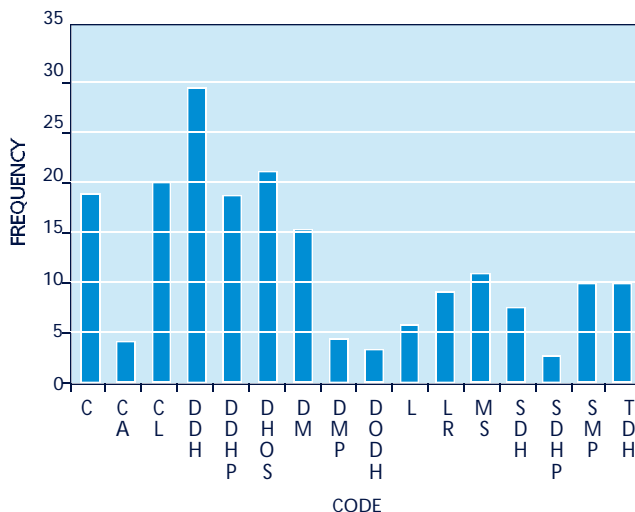
Questionnaire data showed that this was recognised and accepted by all the staff at both schools. INSET was arranged and data handling assumed a high profile at both schools. A second questionnaire explored changes in confidence in the intervening period which included the INSET. The data collected suggested that confidence had increased in the majority of teachers and not just in those being monitored.

Table of results from questionnaires 1 & 2

Research ref no	Frequency Bar		Pictogram		Probability		Discrete Data Graph		Variance
	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2	
HLS/01	4	5	3	5	3	4	3	4	+5
HLS/02	4	5	4	5	2	4	3	5	+6
HLS/03	4	5	4	5	3	4	2	5	+6
HLS/04	4	5	4	4	3	4	4	4	+2
HLS/05	4	4	3	4	3	4	3	4	+3
HLS/06	3	4	2	4	2	3	2	2	+4
HLS/07	5	4	5	4	3	4	4	4	-1
HLS/08	4	5	4	4	4	4	4	4	+1
HLS/09	5	5	4	5	3	5	5	5	+3
HLS/10	4	5	4	5	3	5	4	5	+5
HLS/11	4	5	4	5	3	5	4	5	+5
HLS/12	5	5	5	5	3	5	4	5	+3
HLS/13	5	5	4	5	3	4	4	5	+3
HLS/14	4	5	4	5	2	4	4	5	+5
SLS/01	3	4	3	4	3	4	3	3	+3
SLS/02	3	5	3	4	1	2	1	3	+6
SLS/03	3	4	3	3	2	2	3	3	+1
SLS/04	4	5	4	5	3	5	4	5	+5
SLS/05	3	4	3	4	1	2	2	4	+5
SLS/06	4	4	4	3	3	4	4	4	0
SLS/07	4	5	4	5	4	5	4	5	+5
SLS/08	*	*	*	*	*	*	*	*	*
SLS/09	*	4	*	4	*	4	*	4	*
SLS/10	4	4	4	4	3	3	3	3	0
* indicates missing data									

This table shows the results from both questionnaires. The contents of the first questionnaire were directly comparable with those contained in the data handling section of the first – a frequency table/bar chart, a pictogram, a probability question and a discrete data graph. The increase or

decrease in rating was totalled across the questions and is displayed in the end column. The results of this analysis are as follows:

Two teachers' confidence showed no change.
One teacher's confidence showed a decrease.
The remaining nineteen teachers showed increases in confidence ranging from +1 to +6.

The sample scores were as follows:

Research ref no	Increase in confidence
HLS/02	+6
HLS/03	+6
HLS/06	+4
SLS/02	+6
SLS/03	+1
SLS/05	+5

The average level of increase is +3.4 with the most frequent score being +5. The conclusion to be drawn from the above is that the confidence of the vast majority of all teachers in the schools was increased in the period covered by the research.

For the sample group, the average level of increase was +4.7 and the most frequent score +6. It can be concluded that the additional support given to these teachers caused their increase in confidence above that of the group as a whole.

The knock-on effect of this increased confidence was the greater achievement in data handling of pupils in the 1999 Year 4 QCA tests. Of the three Year 4 teachers, only one, the co-writer of this report, was directly involved in the study.

Between 1998 and 1999 the Year 4 QCA results showed an average improvement in correct responses for data handling questions as follows:

School	%age improvement In data handling
SLS	47%
HLS	35%
Overall	41%

In the classes directly involved in the research, the following observations on children's learning were noted: increased focus on the task, greater ability to ask and answer both closed and open questions and an increased range of questioning leading to the children having a deeper understanding of the issues involved in collecting, representing and analysing data. These observations were confirmed in our subsequent conversations with the children.

Colleagues' responses to the first questionnaire had shown that the teaching of probability was regarded as being particularly difficult. Despite probability forming a significant part of a two-day INSET to upgrade teacher knowledge to meet ITT standards, the probability question in the 1999 Year 4 QCA tests was answered correctly by only 35% of the children at one of the two schools in the study. Clearly further work needs to be undertaken to enhance teaching and learning in this area.

Implications for teachers

Although our results can only be applied with confidence to our two schools, we believe that they will provoke thought and generate discussion amongst other teachers. There are a number of relevant issues arising from the full report, some of which are discussed in this summary. Teachers may wish to consider the following questions in their own situation:

Do you understand the progression in teaching data handling? You need to have a bank of data handling ideas as a basis for developing meaningful hands-on experiences for the children.

Do you understand the concepts behind the teaching of probability? If not, INSET has to be carefully tailored to your needs to raise confidence and children's achievement.

Are you sure that the data handling experiences you offer your children are sufficiently challenging, particularly if you use a published mathematics scheme? Our study revealed that over-reliance on a published mathematics scheme impacted on teacher confidence and pupil achievement.

Are you entering test results onto computer spreadsheets? If you do, trends will be perceived, problem areas isolated and addressed and targets identified.

The future

There is a range of literature on teachers' negative attitudes to mathematics. Likewise, the teaching/learning process including the role of subject knowledge in teacher confidence and pupil achievement has been well documented. However, there is little written on the relationship between teacher confidence and its effect on pupil confidence and hence achievement in the teaching and learning of mathematics. A focus within this project has been data handling. This was found to be a particular issue in the two study schools and could be the case for many others. We have established a clear link between teacher confidence and pupil achievement in our schools. Staff confidence increased significantly and through this pupil achievement, particularly in the data handling aspects of the mathematics curriculum. We are hoping to expand the project and would be delighted to hear from any school interested in carrying out similar research.

Further reading

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