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THE KEY STAGE 3 STRATEGY FOR MATHEMATICS: YEAR 8 PUPILS' AFFECTIVE RESPONSES

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This is an account of research conducted before and after the implementation of the National Key Stage 3 Strategy, exploring Year 8 pupils' affective responses to mathematics. The results suggest that the teaching styles recommended for the Strategy did not have an adverse affect on pupils' attitudes. The responses highlight some issues concerning social acknowledgement of the personal importance of mathematics and how teachers' difficulties may have an adverse affect on pupils' feelings about mathematics.

INTRODUCTION

Around the time of its introduction, commentators expressed concern that some of the teaching approaches recommended for the Key Stage 3 Strategy could have an adverse affect on pupils' affective responses to mathematics (Costello (2000); Ruffell et al (1998) and Brown et al (1998)). To investigate this, I collected data from Y8 pupils from a very large southern English comprehensive school, before and after the introduction of the Strategy. This was repeated with another group of Y8 pupils in 2004. In all, results were obtained from 380 (out of 430) pupils in 2001, 331 (out of 380) pupils in 2002 and 365 (out of 435) pupils in 2004. Although the lack of data for absentees is a possible source of bias in the sample, all three samples were affected in the same way, permitting comparison between the data from the different cohorts. This opportunity sample was not specially constructed to be representative of Key Stage 3 students nationally, nevertheless I hope that the results of the investigation will offer some illumination and evaluative insights into the implementation of the Strategy.

The data were collected using a questionnaire consisting of 18 items from the 1995 Third International Mathematics and Science Study, or TIMSS, (Keys et al, 1997). As in TIMSS, the respondents chose between the Likert responses *Strongly agree*, *Agree*, *Disagree*, *Strongly disagree*, with the options to item 1 adjusted to *Like a lot* etc. This allowed me to use trialled items and permitted comparisons to be made with national and international results. The items are listed below.

1. How much do you like mathematics?
2. I need to do well in mathematics to please my parent(s).
3. To do well in mathematics at school you need lots of hard work studying at home.
4. To do well in mathematics at school you need to memorise the textbook or notes.
5. I enjoy learning maths.
6. My parents/carers think it is important for me to do well in mathematics at school.

7. I need to do well in mathematics to please myself.
8. Maths is an easy subject.
9. Maths is important in everyone's life.
10. I need to do well in mathematics to get into the college or university I prefer.
11. I would like a job involving maths.
12. Most of my friends think it is important to do well in mathematics at school.
13. Maths is boring.
14. To do well in mathematics at school you need lots of natural talent.
15. I think it is important to do well in mathematics at school.
16. To do well in mathematics at school you need good luck.
17. I need to do well in mathematics to get the job I want.
18. I usually do well in mathematics at school.

The following table shows the percentage of respondents in agreement (*Agree* or *Strongly agree*) with each statement. The analysis was based on the differences in these proportions (throughout, significance is cited at the 5% level). The 2004 data are presented in three forms: for the whole cohort (*2004*), for the classes taught by Newly Qualified Teachers (*NQT*) and for the classes taught by more experienced teachers (*EXP*). The TIMSS data are in the final row. Note that items 13, 14 and 16 (underscored in the table) may be considered to have opposite *charges* to the other items (where a positive response may indicate a negative attitude).

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
2001	65	57	52	47	63	90	71	37	84	83	37	36	52	23	88	14	68	78
2002	68	61	59	46	65	92	79	42	88	90	39	48	52	31	92	12	72	80
2004	52	64	49	46	49	92	70	36	87	85	33	36	57	25	88	14	62	74
NQT	31	58	40	38	36	87	62	32	80	83	24	33	78	24	79	10	54	63
EXP	60	66	53	50	54	94	74	37	90	86	36	38	49	25	92	16	65	78
TIM	79	71	92	49	81	98	91	30	91	86	49	85	30	51	98	29	80	93

Table 1: comparison of percentages agreeing or strongly agreeing with each item

DIFFERENCES BETWEEN 2001 AND 2002

When the results for the 2001 and 2002 samples were compared, there was a significant difference (at the 5% level) between the proportions agreeing for four of the items, 7, 10, 12 and 14. Apart from items 4, 13 and 16, the proportions in agreement for each item for the 2002 sample were higher than those for the 2001 sample. Although, it is not safe to infer from the evidence of this study that the pupils' attitudes to mathematics were better in 2002 than in 2001, there is certainly no evidence that they had deteriorated over this period.

For both years there is a striking discrepancy between the responses to items 12 and 15. These responses suggest that pupils believed that they personally attached more

importance to success in mathematics than did their friends. Since this is the only secondary school in the town, attended by the vast majority of the local children, it follows that most of the pupils' friends would also have been pupils of the school. One would have expected the agreement rates for the two items to be consistent. The inconsistency of these results may arise from pupils conforming to peer influence and masking from their friends the extent of their personal concern about doing well in mathematics. It must be noted that, although the responses were anonymous, there is a possibility that some pupils may have diplomatically overplayed their liking of mathematics in what they perceived to be an official school document.

DIFFERENCES BETWEEN THE GENDERS

An analysis by gender revealed that in 2001 the boys' responses were more positive than the girls' for all but four of the items (significantly so for items 1, 2, 3, 4, 8 and 16). No such difference between the boys and girls was apparent in the 2002 sample. Similarly, the girls' responses in 2002 were much more positive than the girls' responses in 2001 (with significant differences in the responses to items 4, 8, 10, 12 and 14). It is impossible to identify from this study whether the teaching approaches associated with the Strategy had a positive affect on the girls' attitudes to mathematics or whether the 2001 results reflect the disaffection of a particular group of girls in this school.

COMPARISON WITH TIMSS 1995

The results were compared with those from TIMSS in 1995 (Keys, 1997), from which the questionnaire was developed. As can be seen in table 1, the pupils in the samples gave consistently less positive responses to the items than those in the English TIMSS sample. In particular, the evidence from the responses to those items in the TIMSS cluster addressing attitudes (items 5, 8, 9, 11 and 13) suggests that the proportions of pupils in this study with positive attitudes to mathematics were relatively low (56% in 2001 and 59% in 2002), compared with 82% for the English TIMSS results. Analysis of the TIMSS results also reveals the tendency for respondents to believe that their friends attach less importance to success in maths than they do.

THE 2004 SAMPLE

By 2004, the departmental timetable had changed, resulting in the regular movement of mathematics teachers between two sites, several hundred metres apart. This caused difficulties for mathematics teachers, especially three NQTs who taught four of the fifteen sets in Year 8. These difficulties may have had a major influence on the classroom experiences of a number of pupils, and hence their responses to the questions. Therefore, great caution must be exercised when these data are compared with those from the earlier surveys.

Compared with the 2001 results, six items had a higher proportion of positive responses (two of these with a negative charge) and nine lower. Two of these (1 and 5) were significantly lower. When compared with the 2002 results, three items had a

higher proportion of positive responses (again, two of these with a negative charge) and 13 lower. Seven of these were significantly lower (items 1, 3, 5, 7, 12, 17 and 18). The responses suggest that the 2004 pupils had less positive attitudes towards mathematics than those in 2002 and that there was little evidence to suggest that their attitudes were more positive than the pupils in the 2001 sample.

When the responses from the 103 pupils taught by NQTs were removed from the analysis, the differences between the remaining results and those from previous years were much less pronounced. When the responses for classes taught by NQTs and more experienced teachers were compared there were higher agreement rates for every item (except question 13 "Maths is boring") from those classes taught by the more experienced teachers. Eleven of the differences in responses were significant.

Because of problems of comparability between the samples, it is unsafe to infer from these data that the pupils in 2004 had less positive attitudes to mathematics than those in 2002. However, these results support two of the previous findings:

1. The results are much less positive those from TIMSS
2. There is an indication that pupils were more likely to believe that they personally attached more importance to success in mathematics than did their friends.

RESULTS

The main findings of this study indicate that, for the pupils in these samples:

1. There is no evidence to suggest that pupils had a more negative affective response to mathematics after the first year of the implementation of the Strategy in this school. In fact, the proportion of pupils with positive attitude scores increased by 3% over the year (however, this increase was statistically insignificant).
2. The survey responses were consistently and considerably less positive than those in the 1995 English TIMSS sample.
3. Pupils appeared to believe that they personally attached more importance to success in mathematics than did their friends. This is also evident in TIMSS data throughout the world and may not be a uniquely English phenomenon.
4. Being taught by inexperienced teachers, or those experiencing difficulties (in this case associated with split sites and timetabling difficulties), appears to have had a negative affect on pupils' attitudes to mathematics.

IMPLICATIONS FOR FURTHER RESEARCH

As a result of this project, a number of areas can be identified where further research might be profitable. These include the following.

1. The results indicate relatively poor attitudes to mathematics amongst Year 8 pupils of this particular school, compared with the English 1995 TIMSS results. Are these attitudes reflected across other schools and other subjects?
2. If relatively poor attitudes to mathematics are common at this stage of education, is it a consequence of the curriculum or developmental factors (physical, emotional and intellectual), or does it have a broader social base (in school organisation, or in youth culture for instance)?
3. How prevalent is the tendency for peers to understate or deny their interest in studying mathematics (or any other subject)? This might this contribute to a vicious circle, propagating a negative image of mathematics and a consequent lack of engagement with mathematics. How might this be redressed?
4. Do the direct teaching approaches recommended for the Strategy result in individual cases of increased anxiety?
5. To what extent do teachers' difficulties and inexperience affect the pupils' response to mathematics?
6. Is the disparity between the 1995 national TIMSS attitudes results and those for the sample a characteristic of this school, or is it more widespread? Were the original English TIMSS results representative? Have there been increased general levels of disaffection with mathematics since 1995?

IMPLICATIONS FOR TEACHING

1. Using the teaching approaches recommended for the Strategy does not appear to have an adverse affect on pupils' general affective responses to mathematics. However, it is possible that individual pupils may be disadvantaged by, or uncomfortable with, some of the interactive approaches. Teachers should be sensitive to the feelings of those pupils for whom such approaches may produce feelings of exposure or potential ridicule.
2. The development of strategies to make success in mathematics more socially acceptable may lead to greater pupil engagement and will help to break down peer influence which militates against pupils' engagement in mathematics. The consideration of pupils' beliefs, motivations, emotions and personal engagement with mathematics is important in promoting the learning of mathematics and should be treated with some of the seriousness that is accorded to success in tests.
3. Schools and teachers may wish to determine whether a lack of personal engagement with mathematics amongst Year 8 pupils applies to them, whether it applies to other subjects and what strategies they may use to address this issue.

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