A COURSEWORK TASK IN A LEVEL MATHEMATICS – A SURVEY OF STUDENT OPINION

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The use of coursework assessment in English and Welsh high stakes mathematics examinations is rapidly declining. This paper reports the results of a survey of student opinions towards a compulsory piece of coursework for A level mathematics. Girls estimated they spent on average 29% longer on the task than boys. Using an aggregated measure of 'positivity', 77% of females and 64% of males were on balance positive towards the coursework; 14% of females and 29% of males were on balance negative towards it. 24% of open responses which were classed as 'positive', and 44% 'negative'. These results suggest that these students overall were positive about doing this coursework, with girls significantly more in favour than boys.

INTRODUCTION

Coursework in the UK is generally taken to mean work done by candidates outside the formal timed written examination which counts towards their grading for high stakes qualifications. Following the Cockcroft report 'Mathematics Counts'(Cockcroft, 1982), which argued for the inclusion of the assessment of practical and investigational work in mathematics (para 243), considerable development work went into coursework assessment for the new GCSE examination (Brown, 1993, Jennings, 1992, Little, 1993), . This was followed by developments in GCE A level, with popular mainstream syllabuses such as MEI Structured Mathematics (Oxford Cambridge and RSA Examinations, 2004) and SMP 16-19 (Dolan, 1994) integrating coursework elements into their assessment schemes.

However, the use of coursework in GCSE and A level has diminished dramatically recently. Following a Qualifications and Curriculum Authority review in 2005, GCSE Mathematics coursework has been scrapped from summer 2008, and only two current A/AS Mathematics specifications (AQA and MEI), offer coursework. An MEI discussion paper published in 2006 (Porkess, 2006) offered an analysis of the reasons for this decline, including difficulties of consistent interpretation of marking schemes, teacher attitudes to guiding pupils in a high stakes culture, teacher and student overload, and plagiarism.

What do students think about coursework? Do they believe that it should be part of formal assessment of mathematics qualifications? Research on student attitudes is hard to come by, though a small –scale study by Price reported positive attitudes (Price, 1995) There is also evidence (Goulding, 1995) that girls outperform boys on coursework.

As the coursework in the AQA A/AS specification (Assessment and Qualifications Alliance, 2007) is optional and attracts only 5% of candidates, the only compulsory coursework currently being completed by a substantial number of A level Mathematics candidates is a piece on Numerical Methods, which comprises 20% of a

compulsory MEI Pure Mathematics unit (Oxford Cambridge and RSA Examinations, 2004). The task requires students to utilise and compare three techniques for searching for roots of equations, change of sign, Newton-Raphson and rearrangement in the form $x = g(x)$. This paper reports on a larger survey of student attitudes and opinions about this piece of coursework.

THE SURVEY

The survey is reprinted as Figure 1. Questions 1 and 2 concerned the time spent on the task, and the use of technology. Questions 3 – 12 asked for students' degree of agreement with statements for and against the coursework, on a scale from strongly agree to strongly disagree. Question 13 gave students the opportunity to comment generally on their experience with the coursework.

The survey was completed by 228 students (138 males, 90 females) from a sixth form college in Hampshire The survey was completed in mathematics lessons in September 2007, at the start of their second year of mathematics A level, the students having completed the coursework the previous July, at the end of their first year.

Responses to questions 3 – 13 were aggregated to provide a summary measure of their degree of support for the task. The questions were also analysed by gender, to assess differences in responses from males and females. The comments made in question 13 were scrutinised for issues repeatedly raised by a number of students.

Questionnaire on MEI C3 Numerical Methods Coursework

Name…… Gender Male / Female

1. Roughly how long did you spend in total on your coursework?	less than 5 hours	between 5 to 10 hours	between 10 to 15 hours	between 15 to 20 hours	over 20 hours

2. Tick which of these technologies you used in your coursework	Autograph	Derive	Graphics calculator	Spreadsheet	Other (please specify)

Consider the following statements, and tick which option best fits your views	strongly agree	agree	neither agree nor disagree	don't agree	strongly disagree
3. The coursework I did was worthwhile.					
4. I found the coursework difficult.					
5. I found the coursework interesting.					
6. The coursework was unfair because some get more help than others.					
7. The coursework gave me a chance to show what I can do outside the exam room.					
8. It would be fairer if A/AS maths was assessed by exam only.					
9. I feel positive about doing this piece of coursework.					
10. I would prefer to do an A level maths course without any coursework.					
11. The coursework helped me to understand how numerical methods can be used.					
12. The GCSE maths coursework I did was more worthwhile than this numerical methods coursework.					

13. Please comment generally on your experience of doing this coursework (continue overleaf if you need more space!)

……

Fig. 1

RESULTS

Time spent on the coursework task.

Estimated means and standard deviations for males, females and all students (taking the last open-ended class as 20 – 25 hours) are as follows:

	n	mean (hrs)	standard deviation (hrs)
Males	137	7.28	4.56
Females	89	9.41	4.71
all	226	8.12	4.73

Female students estimated spending an average of 2.1 hours or 29% longer on the task than male students (95% CI = (0.89, 3.37), $p < 0.001$). Unless female students' estimates differ from males, it suggests that on average they spent over 2 hours more, on the task.

Technology used

This question was not analysed in detail, as virtually all the students used Autograph and a Spreadsheet to complete the task.

Statements about the coursework (Questions 3 – 12)

Some key results were as follows:

- 53% thought the coursework was worthwhile; only 14% disagreed;
- Only 10% of students felt that the coursework was unfair due to varying degrees of help being available;
- Nearly half felt the experience was positive; only 17% disagreed;
- One third of those surveyed would prefer an A level without coursework;
- Nearly 80% felt that they learned how to use numerical methods.

Tables 2a and 2b show the results for questions which were respectively positive and negative towards the coursework, analysed by gender.

Statements positive towards coursework		Agree	Indifferent	Disagree	χ^2	p
Q3 The coursework I did was worthwhile.	M	47.1	34.1	18.8	7.2	0.07
	F	62.2	30.0	7.8		
Q5 I found the coursework interesting.	M	24.1	35.8	40.1	3.7	0.3
	F	33.3	37.8	28.9		
Q7 The coursework gave me a chance to show what I can do outside the exam room.	M	40.7	36.3	23.0	2.9	0.41
	F	52.2	30.0	17.8		
Q9 I feel positive about doing this piece of coursework.	M	46.7	32.1	21.2	3.8	0.28
	F	50.6	38.2	11.2		
Q11 The coursework helped me to understand how numerical methods can be used.	M	75.7	17.6	6.6	2.6	0.46
	F	83.3	10.0	6.7		

Table 2a

From Table 2a, it is apparent that in all the statements which were positive about coursework, a larger percentage of females than males agreed, and a larger percentage of males than females disagreed. This approached a 5% level of significance in question 3, which stated that the coursework was worthwhile.

Statements negative towards coursework		Agree	Indifferent	Disagree	χ^2	p
Q4 I found the coursework difficult.	M	21.0	37.0	42.0	2.5	0.47
	F	30.0	31.1	38.9		
Q6 The coursework was unfair because some get more help than others.	M	8.0	29.7	62.3	1.4	0.7
	F	12.4	25.8	61.8		
Q8 It would be fairer if A/AS maths was assessed by exam only.	M	30.7	29.2	40.1	8.7	0.03
	F	14.4	30.0	55.6		
Q10 I would prefer to do an A level maths course without any coursework.	M	37.2	21.2	41.6	2.2	0.53
	F	27.8	23.3	48.9		
Q12 The GCSE maths coursework I did was more worthwhile	M	22.6	40.1	37.2	2.3	0.51
	F	16.3	37.2	46.5		

Table 2b

From Table 2b, the reverse pattern is apparent in questions 6, 8 and 10, with a result significant at 5% for question 8. The responses to question Q4 suggest that girls perceived the task as more difficult. One could argue that this does not necessarily reflect a negative perception of coursework, but rather that the girls engaged with the task more persistently, an interpretation born out by the estimated length of time spent on the task by each gender (Q1).

In order to achieve an aggregated measure of 'positivity' to coursework, replies were scored on a scale from 1 (strongly agree) to 5 (strongly disagree), and an aggregate score *s* calculated over 'positive' questions 3, 5, 7, 9 and 11, and 'negative' questions 6, 8 and 10. The formula for *s* was

$$s = (3 - s_3) + (3 - s_5) + (3 - s_7) + (3 - s_9) + (3 - s_{11}) + (s_6 - 3) + (s_8 - 3) + (s_{10} - 3).$$

A 'neutral' score for *s* could be considered to be zero. Positive scores might be taken to indicate that the respondent was on balance in favour of coursework, negative scores would suggest on balance negative feelings about this coursework. 77% of females and 64% of males scored over zero; 14% of females and 29% of males scored under zero. Fig. 5 shows a box plot of the *s* scores for males and females, which confirms the lower median and higher spread in boys' *s*-scores.

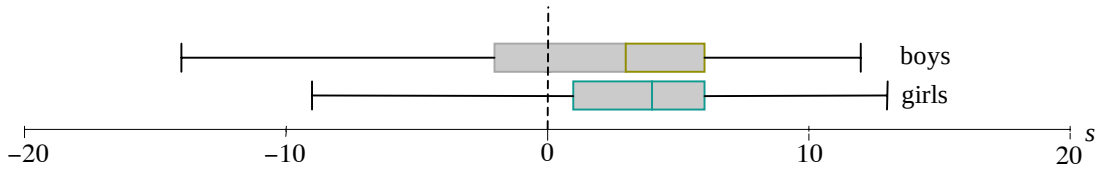

Fig. 5

The mean and standard deviation for *s* by gender were as follows:

- Males: mean 2.06, standard deviation 4.88
- Females: mean 3.73, standard deviation 4.13

A large sample difference of two means test using these values produces a highly significant result ($z = 2.80$, $p = 0.003$).

Comments on the coursework

Two thirds of the respondents made additional comments, ranging from one-word (e.g. ‘fine’) to quite detailed responses. 44% of the comments were assessed as ‘negative’, 30% as ‘balanced’, i.e. including some positive and some negative points, and 24% as ‘positive’.

Some comments were very positive about the experience, for example:

‘I enjoyed doing the coursework and learnt a lot from it. I think that it also takes some pressure off the exam.’

‘This coursework was interesting and good fun. It was a welcome break from drab theories and it was cool to find points so easily.’

‘I think a coursework module is important in maths as it focuses more time on a subject, and many perform better in coursework.’

On the other hand, here are some examples at the negative extreme:

‘I hated it. The only point in numerical methods with any relevance is to figure out how to make a computer do it for you. Time could be spent on much more productive things, imaginary numbers, matrices etc.’

‘I think coursework in maths is pointless. It does not assess fairly a pupil’s ability to apply mathematical knowledge to problems. I felt it was a waste of time.’

‘I would have rather spent the time learning the numerical methods in class. The coursework was a waste of time.’

Seventeen students commented that the task was not worth enough credit towards the total assessment. On the other hand, eight students complained that the coursework was rushed, and they did not have enough time. Ten students felt that the highly structured form of the assessment sheet did not encourage true investigation. On the other hand, six students felt that they needed more structure and support.

SUMMARY

The evidence of this survey suggests that most of these students thought that this coursework task was worthwhile and straightforward. Few expressed the view that coursework was unfair. Aggregated results suggest that 77% of females and 64% of males were on balance positive towards coursework; 14% of females and 29% of males were on balance negative towards it. However, this evidence needs to be

weighed against the comments made about the experience of the task, 24% of which were classed as ‘positive’, and 44% ‘negative’.

The results support the generally held belief that girls are more favourably disposed to coursework than are boys. They estimated that they spent considerably more time on the task, and felt that the task was more worthwhile, interesting, and helped their understanding more than the boys, some of whom would prefer to be assessed by written examination only.

Additional comments suggest that the students commonly thought that this coursework was not worth the time spent on it, given the small percentage (albeit non-zero) of the total marks allocated to it.

CONCLUDING REMARKS

The current trend in England and Wales to downgrade and diminish coursework assessment in high stakes qualifications may enhance public confidence in the reliability of the assessment procedures used (although examinations are by no means infallible). However, timed written examinations cannot test everything one would like to see assessed in mathematics at this level, and their exclusive use is likely to impoverish the ‘construct’ being tested. On the evidence of this survey, it is also unlikely to encourage more girls to take up the study of mathematics post 16.

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