Students' perceptions of mathematics' coursework in first year of College (working paper)

ABSTRACT

Students taking AS Use of Mathematics course perceived coursework as a different learning, teaching and assessment experience from that of regular lessons and examinations. For many students, coursework provided a resource for conceptual understanding in a different, less stressful environment than that of time-pressured exams, something which in turn could enhance their grades and eventually help them to succeed in mathematics. Coursework was also seen by students, particularly those in vocational courses, as a means to gain practical knowledge, something that suited their interests. Many students (although not all) considered these aspects of coursework enjoyable and beneficial to them. The few comments on coursework (mainly from their GCSE experience) of students taking a traditional AS course agreed in general with those of their Use of Maths peers. These results point to the need of rethinking the policies that have abandoned coursework as a way of learning, teaching and assessing, especially if we want to increase participation in mathematics.

I. INTRODUCTION

The use of coursework at GCSE and A-levels was introduced some years ago with the intention of assessing "particular skills and topics that are, by their nature, unsuitable for assessment within a timed examination but are, nonetheless, important aspects of the specification" (MEI, 2006: 5).

Since then, coursework has been gradually reduced until it was discontinued from the GCSE Mathematics paper and almost all A-level Mathematics specifications do not contain coursework. The main practical reasons for discontinuing coursework were the teachers' and students' overload and a concern of plagiarism and help with the work from outsiders (ibid, 7, 8).

This paper examines what first year college students had to say and what we observed about the learning, teaching and assessment advantages and disadvantages of coursework. Because the traditional AS mathematics course does not contain any coursework, we focused our attention on the AS Use of Mathematics (UoM) course, which is assessed through exams and coursework (50% – 50%). We hypothesised that elements of the AS UoM Programme shape learning in distinct ways from the Traditional AS Mathematics course, especially the course's emphasis on (i) modelling, (ii) technology, and (iii) coursework, in ways that mediate the student experience of learning mathematics (and hence perhaps the kind of "mathematician" they might become). In this paper we focus on how coursework seems to mediate this experience.

II. BACKGROUND AND THEORETICAL FRAMEWORK

The UoM course was designed to 'concentrate on developing process skills of application, understanding (including understanding mathematical texts written by others), reasoning, explanation and communication' (AQA, 2008). It provides pedagogical (texts, technology, and assessment) tools that mediate pedagogy and learning. In this paper we focus in particular on coursework because we believe that it offers a highly valuable 'learning' experience.

III. METHOD/OLOGY

We interviewed 45 students (from 5 different Colleges across the UK) taking AS Mathematics courses: 22 students following a Traditional AS course and 23 students following an AS Use of Mathematics course (10 of these within a BTEC course in Engineering). Most of these students were selected because they were considered to be at risk of dropping out of Mathematics.

Students were interviewed at three different occasions: Data point 1 was at the beginning of the AS year, data point 2 was at the end of the AS year and data point 3 was during their A2 year when most of them have completed their UCAS form. The majority of interviews were conducted in an open way to explore with students their past and present experiences and future intentions as regards to Mathematics; we called these "biographical" interviews. At DP2 we also made a "pedagogical" interview with some of the students (31 in total, 17 from the traditional course, 10 from the Use of Mathematics-BTEC course and 4 from the Use of Mathematics course). This type of interview usually focused specifically on the 'pedagogy' of a recent lesson and the students' perception of this from their learner perspective.

Thus, in the majority of cases, if 'coursework' was raised as an issue by the interviewer or the student this would be because it was thought relevant in this context.

These interviews were transcribed and systematically coded and, for this analysis, all utterances that explicitly or implicitly referred to 'coursework' or 'projects' were selected. The student interviews were divided into three for the purposes of this analysis: UoM-BTEC students, UoM (non-BTEC) students, and Traditional AS students.

We also analyse some not untypical coursework, showing how the criteria of assessment impose a structure on the experience that students have in relation to coursework.

The approach to analysis is to interpret the students' meanings with a view to 'mapping the field' – illustrating all main themes with the diversity of views expressed amongst the sample. Bearing in mind the particularity of the student sample, we say "there is this view", "the explanation for these views was" or "this view was not expressed" for the three different groups.

III. RESULTS AND ANALYSIS

1. Results and analysis of students' interview quotes

i. UoM-BTEC students

A query of these students' interviews produced 60 selections/quotes drawn from 13 students from the 2 Colleges where UoM was being used to supplement vocational BTEC programmes.
The themes arising in these 60 quotes were:
Conceptual mathematics
Students talked about understanding, connecting, meaning-making and explaining mathematics through coursework. Coursework is understood by these students as offering opportunities to develop understanding, to be required to explain or discuss mathematics, to make connections and to connect mathematics. Most of these students spoke of this positively. For example, F talked about coursework as different

from his other lessons and as a way to understand, to "grasp" mathematical knowledge by having to do the work himself:

I: So what's the coursework doing that the lessons didn't do?
F: He (the teacher) taught part of the coursework. Well, he taught little, little chunks. So the full questions, I wouldn't understand them properly.
I: Yeah. So you're saying when you had the lessons, you sometimes didn't understand everything but now you're doing the coursework, somehow you've got to…
F: *Grasp of it.*
I: Yeah. Why's that, do you think? Is that difficult to…
F: Because *doing the work myself.*
I: Yeah. But when you do in the lessons, I presume you had questions to practice and other things…
F: They're more exam-wise. I don't know, it's hard to explain.
I: You see them as different things?
F: Yeah.

He also talked about how his mathematics projects connected to his engineering courses and what he wants to study in the future (telecommunications):

I: How do you find this connection between maths and…
F: Like, what I'm doing, going to be studying is telecommunications and the communication part of electronics and really *communication is signals and my first assignment for this was electronic signals so that connected really well actually*.
I: You found it understandable?
F: Oh, yeah.
I: And related. Maths was related to what you were doing?
F: Yeah. *Maths is related to what I'm going to study*.
I: So maths made you understand more the subjects or the subject as well made you understand more maths?
F: *Maths made me understand more*.

And H talked about how coursework helps him to see and understand mathematical concepts:

I: Are you learning any maths as you're doing your coursework?
H: Yes, I am.
I: What are you learning?
H: Like I said before, I'm not that good at doing exponential functions but the assignment I've got now, it basically, *you can see the exponential functions*. I have to differentiate the exponential function model so that *helps me a lot to understand.*
I: What do you think about the coursework and the exam? Because you've got the exam coming up. What do you feel about those 2 bits of assessment?
H: Coursework, I like doing coursework because *it involves a lot of research* but exam, I'm a bit nervous when it comes to it but when I get going I do really well.

Interestingly, H sometimes found coursework difficult when he gets stuck:

I: So tell me about when you like it and when you don't like it.
H: When I like it when you know, when you're doing it and you and your what's it called, fellow classmates talk, converse about it. Talk about it and then afterward you go home, you know what to do. Quite straightforward what to do. But the part I don't like is when *you're thinking about it and you don't seem to find the answer, that's*

stresses you out. You can get a headache from that. That's the part I hate.

Modelling and Technology

Students talked about modelling or doing applications via projects. Coursework was seen by these students as an opportunity to apply mathematics to projects in engineering and technology. Modelling is often described as a process of fitting models (usually functions via their graphs) to data representing some real situation; the concept of model-data 'fit' emerges.

For example, E talked about how enjoyable coursework was where he had to fit a model by adjusting certain parameters:

I: So in general how did you find the coursework?
E: It wasn't so difficult. *I enjoyed doing it.*
I: You enjoyed it.
E: Yeah. *I learned a lot because of it.*
I: Could you tell me which parts of this assignment did you enjoy more?
E: *Fitting the model*. It's good when the model is perfect, or almost perfect. *To see that your parameters are very good so*… yeah.

And H talked about how a major application project for his BTEC course incorporates different types of knowledge and how mathematics is applied in his own project:

H: IVA is basically, *we have to choose a different project that we have to build and explain how it works*.
I: Yeah.
H: So it doesn't relate to maths but some of my fellow…basically, I'm building an FM radio.
I: Right.
H: So at this one, it involves different types of chip, resistors, capacitors and regulators.
I: Right.
H: And some of the parts do different jobs so you have to put them together for it to work.
I Does any maths come into this?
(…)
H: Yeah. *Maths can do it when you have to find a frequency*.

Students talked about the use of technology (graphic calculators and computers) in relation to modelling projects where functions had to be fitted to data. For example, P talked about how he used the computer in his coursework, and how he was able to understand an equation, how it changed and curved:

I: (and) computers?
P: Oh yeah, the Autograph. I had some experience of autograph before, again last year. But I didn't really get it last year. This year I started to get it, I started to understand, "ah, ok - this is how it's done", this is where it goes, if you change this the graph will change. Yeah so *I started to understand how.... I started to understand more about the equation, how it works and everything and how it changes and how it curves*.
I: So it helped you in a way, you can say?
P: Yeah.
I: You are using it a lot or was it only during the coursework?
P: Only then. Only during the coursework. I think we did it once or twice or afterwards but that was about it.

And M talked about how as part of his coursework he used the computer to make the graph of a linear model:

I: So do you put a linear model to your data? So how do you find the linear model? Is it a good model or is it a bad model?
M: I had to linearise it so I could find the model or like the model or like the formula for Autograph. To do that, I had to linearise it and then find the gradient of the linear function. Then put that in the model.
I: How did you linearise it?
M: I have to write another table for…and then plot that against T and then just do a graph.

Paul talked about positive as well as negative aspects of the use of the computer in coursework:

I: Right. What about the use of computers? Do you usually use computers for this course?
Paul: Not for maths, not really and *I don't think it really helps that much* because you can only really use the calculator and autograph and *it's sort of limited cause the computer does it for you so you are not trying to work it out you are just type in equations.*
I: You don't find it useful in your learning?
Paul: *It is useful* because like the coursework now where we have to plot a graph which curves and *it's impossible to draw a straight line curve freehand and to find the exact equation of the line*… it's like 7.000000007 so…the computer can do that for you so you can work it out and then use the computer to say I was this close so… basically the same.

Performance

Students talked about coursework being easier than exams, and offered them a chance to improve their grades or ameliorate their poor exam performance. For example, P said his coursework will boost his grades even though he did not finished it all:

I: What about the coursework generally, did you complete it successfully? How did you find it?
P: I have poor time management, so I didn't finish it, but I think I could have... I think if I'd planned it right I think it would have been ok... I mean.....
I: How many pieces did you do?
P: Out of the three strands? Wait a minute - we did two, and I think a better one than the first one. I understood that one more and I enjoyed that one more.
I: So this, does it have an impact on your grade.
P: Yeah, *it boosts your grade*.

And Ch talked about how good it feels to get a good grade on coursework and how "do-able" it is to get a good mark on his course:

I: And now talking about Use of Maths, have you had any coursework back?
Ch: Yeah. We gave it all in and now we're just doing past exam papers.
I: How do you think you did in your coursework?
Ch: All the coursework, pretty good. *I've got around approximately 70%. It's nice.*
I: How much is the coursework, how much is the exams?
Ch: It's fifty-fifty.
I: Fifty-fifty. Ok. So your coursework is going well. And you're feeling confident

about the exam?
Ch: Yeah.
I: If things go well and you have your…which mark do you expect at the end for the overall course? Which one would you like to have, would you like to get? A mark?
Ch: Oh, like a mark? At least a C and above.
I: Ok. Could it be a B?
Ch: Yeah. *That's doable. If I really get pushed*.

Stress

Some students refer to coursework in relation to the stress of having to work to a deadline and the overload of work when deadlines for other subjects' coursework come all at once. However, other students talk about how coursework is less stressful than exams, provide them with a relief from exams stress and how coursework is easier than exams, giving them more confidence in doing coursework. For example, Hr is among students that sometimes find coursework stressful:

I: Is there a lot of course work in this course as well?
Hr: A lot.
I: How do you find that?
Hr: *Very stressful.*
I: Why?
Hr: There is a lot from everyone. *You just don't get one, it's just everyone together*. In a week you might get like 8, 9 or 7 and *you have to have them done by the next week.*

On the other hand, J talked about coursework as a relief from the stress of exams and how he feels confident about his work:

I: What about the coursework - you did all the pieces you had to do?
J: Yeah, I've done all of the coursework, it's all sorted out. I don't mind coursework, *because it gives you a little more time and you kind of don't have the pressure of sitting for an hour in an exam* and not knowing whether you've passed or failed or not.
I: Ok, right, so you feel confident about the general work?
J: Yeah, *I feel more confident about this course rather than taking A levels anyway*.

Pedagogy/Learning:

Coursework for these students was seen as complementary to their lessons, a different learning experience where they can learn in a different way. Coursework for them involved research, working on one's own but also discussing with other students and even getting help from teachers in a 'different' context. All this was generally seen as positive. For example, for H coursework involves research and working out, which is something 'quite good' from which he has 'learned a lot':

I: Have you started your assignment yet?
H: The assignment has started, but I haven't finished it yet.
I: What do you think about that?
H: *The assignment is quite good.*
I: Why is that?
H: Because a *lot of research, and a lot of working out.*
I: So you think its something you have learned?
H: *I have learned a lot.*

And for I, talking to his teacher about his coursework allows him to monitor his progress, and to discuss his "theories" with his mates allows him to see if he is going in the right direction:

I: So when you're doing your coursework or any other problem in mathematics, how do you know you are in the right track? I mean, for example, you were doing this assignment and how do you do…how do you know you are doing right or you're going in the wrong way?
E: Yeah. Always asking the teacher. For example, if I do the first part or second part, *I talk to my teacher and see my progress and if there are any questions…*
I: And if you couldn't ask your teacher?
E: Usually I talk to my friends and classmates. *We work together in class usually or even after the lessons, together sometimes as well we are comparing our answers, our theories.*
I: Yeah. So you help each other in the lesson? Do you discuss about coursework?
E: Yeah. Because *sometimes the lessons are for the coursework and not for teaching and we do the coursework together and the teacher helps us. And we are discussing everything.*

I: How do you find the help of your mates? Do you find it helpful?
E: Yeah, it's *very helpful because you can see if your answers are wrong if you're not doing something right.*

ii. UoM (non-BTEC) students

A query of these students' interviews produced 37 selections/quotes drawn from 14 students from the 2 Colleges where UoM was part of an academic programme (side by side with other AS/A levels).
The themes arising in these 37 quotes were:

Conceptual mathematics
Students talked about understanding, explaining, connecting and meaning-making in relation to their coursework. For example, A highlights how coursework makes him understand and how the knowledge acquired by this means 'sticks in your head':

I: What about the content of the course, how do you find it?
A: I think you can understand it more. I think in class you understand it and you take it in, *but with coursework you take it home and then you do it again and it sticks in your head*. *It stays in your head with you*. I think that is really good to do because if I learn something in class then by next week it may have gone, but if I go home, look at it, take it all in and maybe do a few problems on it and then I take it in a lot better and then I remember it the next lesson. *That is what you do with coursework, you take it home, you do it in your own time, really thinking about it and understanding what you are doing.*

And Md talks about how in coursework he has to research, make judgements and apply concepts previously learned which in turn makes it hard (this does not mean he has a negative attitude towards coursework):

I: Ok, and in terms of coursework, is it too much to research or is it the concepts in themselves that are hard to understand? What is it about coursework that's been difficult?
Md: Research wise - we've had to do research on where we got our data from, we've had

to comment on it, we've had to also do background knowledge, we've had to make methods and *we've had to make our first judgement* and in the judgement bit we've had to repeat what we've had to have found. *And what makes coursework hard is applying the concept to the preliminary data and applying - trying to recall what we've learnt from the previous lessons*. Therefore, I've struggled but I've got through it. So, that's what's been tough for me.

Mi, like Md, also finds coursework hard but he also recognises that what makes it hard (researching, connecting, and explaining) allows him to gain a far greater conceptual understanding than any he could have obtained in the traditional course:

I: So how are you finding those courseworks, hard or easy?

Mi: I think they are between, coz *you've got to have understanding to explain what you are doing, which is hard*. But, the.. it's like basic... like the one on sign, coughs and sneezes is like a basic, basic thingy. And basic like equation, a basic story to it... but *it's the explanation which is the harder bit, because you need to explain your maths which I don't think normal maths students (traditional course) do as well. They just go through piles of questions so...*

I: Is it is a case that you like to explain the .... like you were saying body mass index for what it is, the context, rather than just equations?

Mi: Yeah, it's.... *you need some background knowledge to why you're doing stuff to the equation like when you're graphing it out and stuff like that*. You need the background knowledge, which in maths (traditional course)... coz I did it for a while.... I know it was just like.... they'd give you like 20 questions, give you the answer on the back page. You work through them, then you check your answers and then you do another set of questions, so it was.... *I like this more, 'cos it gains understanding* and next year I'm hoping to do the maths course again, 'cos I'm going to try and do it in one year as well. Because *I think from this lesson I've gained more understanding that I was going to understand in there, 'cos we go into greater depth and more understanding to....*

Modelling and Technology

Students talked about how coursework is applied to other subjects, like A who talks about how his coursework related to business applications:

I: But what, I mean, if you are going to give us an example of what you remember during the whole year that you think you will apply in your life?

A: In my life? Well, for instance, I might not apply some of the stuff as much as other people because I'm going into more of a science course but other people, if you go into business and things like that, it can be…*it shows you how you can use it in business.* Stuff like describing graphs and stuff like, for instance, what was it, what was it now, it was decay and stuff like that and how things decay and things like that and you can work out stuff like the depreciation of things like cars and things like that and that's what we did. *That was one of the coursework we did, depreciation of cars for one of the extra pieces of coursework. And so you know, there are lots of different areas that it can cover.*

The use of technology related to coursework for some of these students is referred to in a positive way, like J, who thinks the computer helps in checking mistakes or visualising a graph:

I: What about the technology, I think you said some things at the beginning, you actually like it so much- using computers and.....

J: Yeah that helps, I think that helps. I used it in my coursework.
I: You did use it?
J: Yeah they *are helpful in teaching you about the equation of the line that you need and see like to check where you went wrong in an equation as well, which is good.*
I: So you feel good about that?
J: Yeah.

Performance

Some of these students talked about coursework as a way to improve their grades, even when they did not consider themselves to have 'a big head' or being overly intelligent. For example, J talked about it in a very positive way:

I: So how do you think it will go at the end?
J: I think I'll be fine this year, I do understand it and *it's not that I have a big head or anything but I think I can get an A or B… because it's 50% coursework as well…*
(…)
I: Do you enjoy it?
J: Yes because that's when *you know that you can get a good grade…* 'cause last year when I did pure and statistics *there was no coursework and I just hated that but this year it's 50%*.

Or A, for whom coursework provides a different experience from that of pressure-timed exams. Like J, A also talks about enjoying or feeling more comfortable with coursework than with other types of assessment:

A: I then thought Use of Maths was the better option because its 50% coursework and *I enjoy coursework more, I feel more comfortable* with coursework. I think in exams it's the pressure that you have got to finish in this time and you have to get all your answers right, whereas *coursework you can take your time and think about it more and there is no pressure and no-one shouting over your shoulder saying you do it in this time, "you have five minutes less" and all this. You do it in your own time, you type it up and you hand it in and you get feedback from the teacher and they will say "this is what you need to improve" and you can go away and prove it.* I think that is a lot better way of teaching.

Although students talk about coursework as helping them in their performance and providing them with a more enjoyable, 'easier' experience, some of them also talk about coursework as being difficult or hard. E describes this in the following way:

I: How do you feel about coursework in Maths?
E: *Coursework is quite difficult. But if you know what to do it makes it a lot easier.* But if you have to do finding out then it would be really difficult, but *in general it's alright.*

This suggests that the perception of ease in coursework is due to the experience of having enough time to 'think about it more', 'type it up' and 'get feedback' rather than to a lack of intellectual challenge. For example, E attributes this easiness in coursework to the fact that 'I get time to do it and I can go over my notes and things like that'. As observed before, students relate coursework with a greater conceptual understanding, like Mi who said:

I: So what makes it easier?

Mi: After Use of Maths? It's the way Use of Maths…it does a lot of stuff that's on the modules but it goes into greater detail sometimes and *a lot more understanding goes into it with the coursework right now*. And then in Use of Maths in particular you get more help because I think, *because it's coursework based, you have to have a lot more understanding of actually what's going on, even if it's easier than the A level maths.*

As with the BTEC students, some of these students talked about an overload of coursework with other subjects but despite this, most of them expressed their views on coursework as a relief of the pressure of exams.

Pedagogy/Learning:
For these students, coursework related to various learning experiences that were different to their normal lessons. For example A, who was cited before, thinks of coursework as a way to get feedback on his work and where the teacher can tell him 'this is what you need to improve', so he 'can go away and prove it', which for him is a 'lot better way of teaching'. And for Md, also cited before, coursework provides a learning experience where he has to research, comment on it, relate the data to background knowledge and make judgements to apply concepts to the data. Although he finds all this 'tough', he feels he has got through the 'challenge'.
For others, like T and Mi, coursework is an opportunity to get help from the teacher. And Ad, who 'didn't do too well' in a financial coursework (he got a C), realises that he needs to ask the teacher because 'in a normal lesson, if you don't ask for help, you won't get it'. Coursework not only provides an opportunity to get help from the teacher but also to learn with others, to have a social support. A expresses this in the following way:

I: What about group work? Did you have the chance to work in groups?
A: Yes quite a lot. Usually with coursework in the last year, coursework was done together in the groups.

Finally, coursework is seen as some students as writing an essay, which is a positive experience specially for students like A who are 'a klutz with exams':

I: How did you find the coursework that you had to do for this?
A: The coursework? I thought that was quite good actually. Because I'm a klutz with exams. I'm not very good with exams, *but written things, written coursework I'm quite good with and I found it quite good*, quite useful because the teacher gave us handouts and things like that and I think coursework's more supportive and you get more support whereas exams are more your own learning, your own thinking so coursework's quite good to support the exam as well as the learning. I thought the coursework was quite good really.

iii. Traditional AS students
A query of these students' interviews produced 19 selections/quotes which were mainly about coursework in other subjects or mathematics at GCSE, but many of these comments support those of the UoM students above.
For example, Am talks about her coursework in Applied Sciences where it counts as half the grade, and she is doing well on it. She would like to have coursework in her mathematics course to 'balance' a probable bad performance in the exam where there is a time pressure. However, even though coursework has features that she likes, she

also mentions the overload of work with other subjects and thinks that not having coursework in mathematics is a 'relief':

I: How do you think you are doing in your other subjects?
Am: I'm doing very well. In Applied Sciences we have an exam in June, but at the minute it's all coursework and so coursework counts as half of the grade at the end. In my courseworks that I have done so far, I have got like an average result. *I got my coursework today and out of six marks I got five which is good.* I think I am doing well in Science and Health and Social Care it interests me, therefore I am always looking into it deeper, like can you just explain this even though its not on the syllabus.
(…)
I: Do you wish you had coursework in maths?
Am: I think *it would help with your grade*. Because the exam, you've only got a set amount of time and you've got to get as many answers right in that time to pass and things, whereas *with coursework you've still got a set amount of time but you can write it at your own rate and you can research and you can do this and you can look at your notes and things. And it helps because even if you did bad in an exam, you'd still have the coursework part of it to back you up.* That's why in my other lessons, applied science I'm working at a B, I've already got a B for my coursework so even if I do horrible in the exam it'll still kind of balance one and other out *whereas maths, it's just if you don't do well in your exam then you haven't done well at all.* I wish sometimes there was *but then again there's more coursework and more on top of what I've already got to do in my other lessons, maths is like a relief.* You come and you do your lesson and then you go and you don't have to worry about getting home and finishing that bit up and finishing this bit up. You've done it.

And S talks about her mathematics coursework at school where she enjoyed it:

I: And maths?
S: I quite liked maths as well especially in the last 2 years because we had to do coursework and *I quite liked the coursework because it was more interesting than just working out of a book kind of thing.*
I: I don't know but some have the idea that coursework involves writing.
S: Yeah it does but it was like a big problem we kind of had to work out and we had to draw graphs and show our results and *it was more interesting than just doing questions all the time.*
I: What did you particularly like about coursework?
S: Well like, the fact *you could do it in your own time rather than if we had an exam we'd have to do it in a certain amount of time* and it was just all questions but with coursework it was more I don't know, I can't explain it, you could do it like, I don't know, I cannot explain it.

And F, for example, talks about the fact that coursework at GCSE was easier than exams and how coursework provided him with the opportunity to work collaboratively:

I: What do you think about coursework? Is it something you like?
F: *Coursework is easy,* it is not like you have got a long time to do it. You are given a certain amount of time. But *at exam you are not going to know what is going to happen. So I like coursework more than exams.*
(…)
I: So you like the idea that you can actually work at it and…?
F: *See who is doing what and just tell them what you did and they can tell you what they*

did. You can write down something that you have missed out.

I: So it's a bit more co-operation between people?

F: Yeah.

And, as before with the UoM students, those who consider themselves "good at writing" find coursework easy and a way to enhance their marks. For example W, who is thinking of taking a mathematics degree at university, expresses it in the following terms:

I: Have you done coursework before?

W: GCSE. Yeah.

I: And what do you think about that? Did you like it?

W: The algebraic stuff was alright. It's the probability stuff that was annoying. Algebra's easy though, isn't it, really so…

I: And the actual coursework. I mean, sitting down and researching or…

W: Yeah, *it's easy for me to write stuff down*. I got an A and a B in English. I can sit and write.

However, there are a few students who do not like coursework, like J who was 'too lazy to do coursework', or S who considers that 'writing is not proper maths'. As a consequence of this dislike, in his GCSE he did not consider coursework important enough to do it which in turn dragged down his good marks on the exam:

I: Really?

S: Really and it was quite annoying that because they dragged me down. And after that I couldn't be bothered to do the second piece because there was not enough time.

I: So this was at GCSE level?

S: Yes. And then it come to the exam. *In the exam I got about 70% of it right but again because I didn't do the coursework it dragged me down.*

2. Analysis of students' coursework

We analysed a coursework assignment called "The Sea Defence Wall", which was essentially a function-fitting task requiring that functions be seen as 'models' (figure 1). A grid that provides the assessment criteria for the coursework is presented in table 2.

We have cited before the comments on coursework of P, a UoM student in a BTEC Engineering course:

I: (and) computers?

P: Oh yeah, the Autograph. I had some experience of autograph before, again last year. But I didn't really get it last year. This year I started to get it, I started to understand, "ah, ok - this is how it's done", this is where it goes, if you change this the graph will change. Yeah so *I started to understand how.... I started to understand more about the equation, how it works and everything and how it changes and how it curves*.

I: So it helped you in a way, you can say?

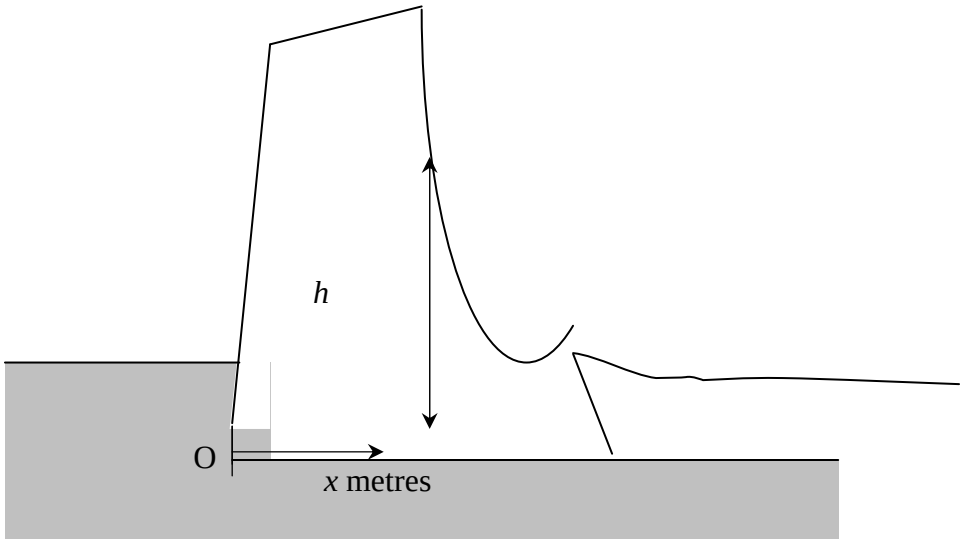
P: Yeah.

I: You are using it a lot or was it only during the coursework?

P: Only then. Only during the coursework. I think we did it once or twice or afterwards but that was about it.

The analysis of P's coursework (and assessment) provided insights into the learning value that coursework can offer.

ASSIGNMENT: SEA DEFENCE WALL



The diagram shows a cross-section of a sea defence wall. Detailed drawings of the structure give values for its vertical height above its base at points distance *x* metres from O. These are shown in the table below.

Horizontal distance from O, *x* metres	0	1	5	8	9	10
Vertical height of structure, *h* metres	0	12	14	3	4	0

Find suitable functions to model this data set. Consider the effectiveness of each function as a model and explain how the key features of each function relate to the real situation.
When work is completed on the wall measurements are taken at actual points and these values are given in the table below.

Horizontal distance from O, *x* metres	8.5	7.5	6.5	5.5
Vertical height of structure, *h* metres	3.5	3.5	5.5	9.5

Are these consistent with your model(s) or are the errors unacceptable? If the errors are too great, can you choose a better model / better models?

Figure 1. The Sea Defence Wall assignment

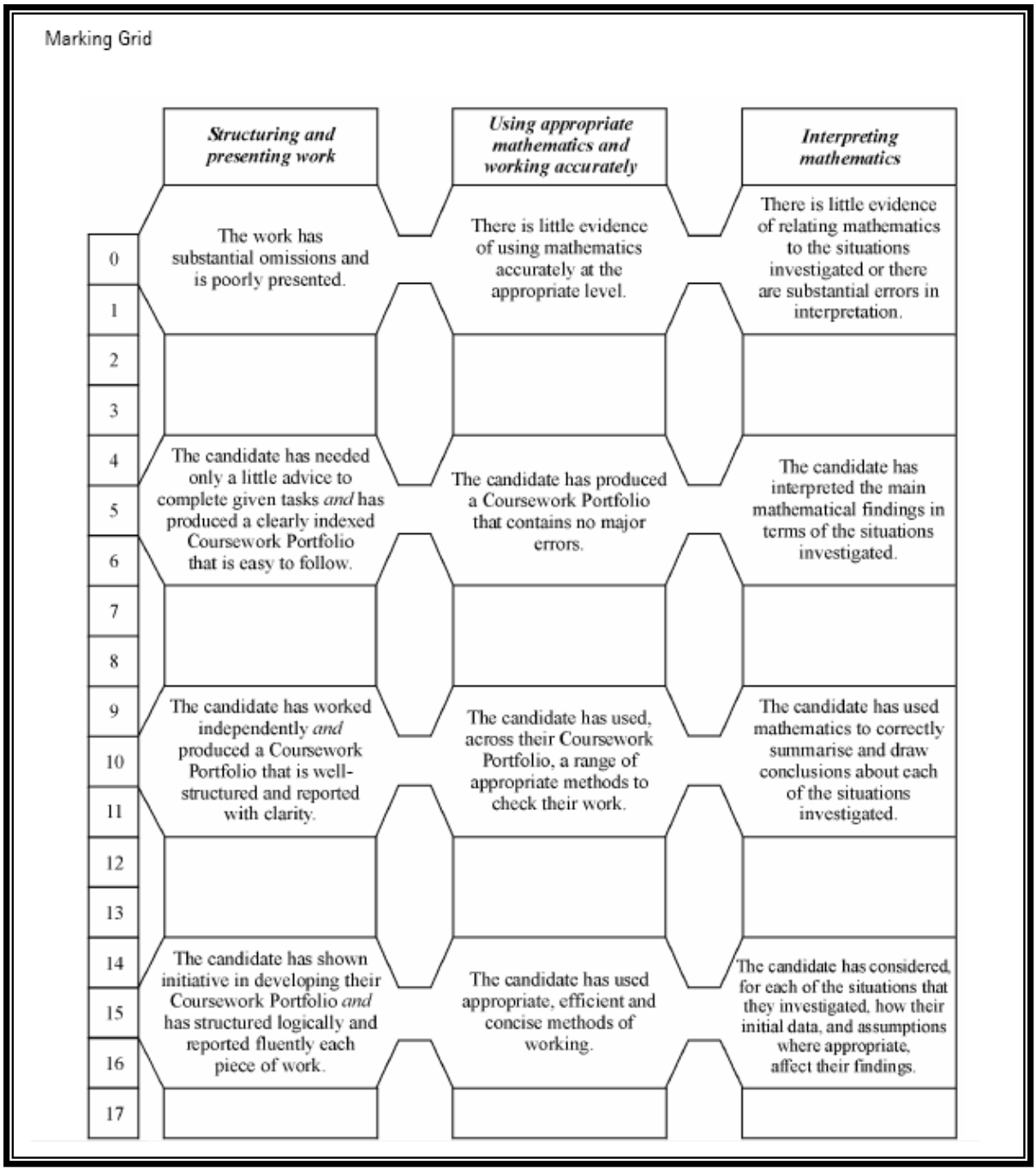


Figure 2. Marking grid for assessing coursework (taken from AQA, 2005)

For example, the appreciation of different methods/models in P's work develops through a contrast between algebraic approaches (predominant) and 'Autograph'. P's work clearly showed conceptual understanding rather than a procedural one and most of the examiner's comments reflected this, valuing the explanation of 'why' or asking for (implicitly) the reasons when these were suspected:

'Well-documented graph'

'Good explanation'

'Do you 'know' this is a point on the line?'

‘A very good description. He fully understands what he’s doing and why’

‘Good explanation’

‘Good explanation continues’

There are other comments in the examiner’s assessment that had to do with ‘checking’. We take these comments to indicate the way P’s work deals with some aspects of modelling:

‘Has checked 2 points, still to check it goes through (0,0)’

‘Good check’

‘Although he doesn’t describe every step in this process, both his initial description and the accuracy of his final result show that he has used the method competently and thoroughly’

‘Excellent – a completely accurate equation – and he has checked it fits all 3 points’

The examiner made comments in places where P’s work showed originality, non-standardness and high quality:

‘He seems to be calibrating Autograph!!!’

‘Amazing! He has zoomed to 10^-6 on the x-axis and 10^-5 on the y-axis. Strong confirmation!’

The analysis of P’s work and its assessment give some insights into how coursework contrasts with the experience of maths driven by short exam questions. The emphases on ‘explanation’, ‘modelling’ and ‘technology’ all come out in this task, and in the teacher’s appreciation of it[1].

Conclusions

Our summation of the collectivity of students’ views of coursework is that their coursework offered a different learning, teaching and assessment experience from that of regular lessons and examinations, because of the distinct structuring of time, resources, task-type and assessment criteria, and teacher-student (and sometimes student-student) interaction.

In particular the coursework made distinct demands of students ‘conceptual understanding’ (specifically their capacity to explain/communicate mathematically), ‘modelling’ (specifically their understanding of maths as models in solving problems in more or less ’practical’ applications), ‘using technology’ (e.g. graphic calculators or graphing packages’) under ‘non-exam, assignment’ conditions (in some ways less stressful, but in some cases adding work-stresses and demands of a different kind). The result for many students (but not all) was that they enjoyed/liked coursework, thought it would enhance their performance/grades, and helped them to succeed in mathematics.

[1] N.B. of course, the teacher’s remarks reflect the assessment criteria and the needs of a subsequent moderator to justify a mark!

Finally, some students recognised coursework as offering a different, or ‘complementary’ learning-teaching experience, where they had to work in different ways on their own, with their teacher, or with other students.

We conclude that coursework had a lot to offer in broadening these students’ experience of working with mathematics, and for some students was thought to help them succeed. It was only a few that thought that their grades might have been adversely affected by coursework compared to end of course exams.

Policy makers might want to consider these results in the light of increasing participation in mathematics, especially with those students that find the experience of a traditional exam assessed course too daunting. We do not deny that practical problems with coursework are real (overload and plagiarism) but an effort could be made to resolve these if only we become aware of the far greater benefits that coursework brings in terms of deep learning and understanding and a more enjoyable teaching and assessing experience.