Opinions differ about the nature, frequency and relative assessment weight of coursework in a mathematics degree. Short frequent coursework may aid week by week engagement while a smaller number of longer tasks may be better linked to real applications and give more opportunity for open ended questions. What should be the mix between assessment types? To what extent is copying a problem and how should this be balanced against the opportunity coursework can afford for investigation and originality?

Given the heavy dependence on marks for motivation, the award of some credit to formative assessment encourages students to engage with course material. Colleagues see the advantages of frequent small tasks with rapid feedback as aiding students both to keep up with material delivered at a far faster pace than at school, and in encouraging attendance at tutorials.

Conversely a smaller number of longer assignments encourages reflection about the interrelation of different parts of the course material and gives practice in the various stages of applying mathematics. Student reactions generally support colleagues’ views about the merits and possible limitations of each approach.

While at some institutions coursework is an integral part of summative assessment throughout the degree, in others it is seen, with the possible exception of a final year project, as something mainly for the first year.

This article presents a summary of views from colleagues and students about coursework and its role in motivation and assessment. These are gleaned from the interviews the HE curriculum team conducted at our own and partner institutions and all quotes come from these interviews.

Marks, motivation and assessment weight

It is a truth universally acknowledged that a student motivated to complete an assignment must be in want of some marks. Overstated, but there is certainly a lot of support for that view: “the largest group of students are probably the ones who if it’s not assessed, they’re not going to do it.”; “if I hand it in at five past ten will it still get a mark”\textsuperscript{a}; “getting them to do the tutorial questions is the hard thing. It’s always a problem, ... if it’s not assessed”; “They don’t get a mark, they don’t do it”.

This fixation with marks is seen as a possible consequence of the emphasis on accumulating coursework marks in school:
“by the time people have come to us from school, they already have it absolutely ingrained in them that coursework is for marks”;
“Yeah, every mark counts...It’s like money to them or something”.

Nevertheless there is still the feeling that subject interest rather than marks can be a motivator:

“enthusiastic students tend to be quite motivated just by their enthusiasm”; “in my six, yes, there I do get the impression that, that they’re not doing it just because we give them marks”.

Assignments are clearly sometimes valued for their own sake: “the assignments have been great. They really built confidence and were quite a lot of fun to do”.

A contributing factor to the general reluctance to do things which don’t carry marks is the need to be selective in the face of many competing calls for time, and students feel that mathematics degrees tend to have a high workload: “The work load in mathematics is so much higher than it is in all the other subjects”: “it’s a lot more hard work than I thought”.

Sometimes, the priority placed by students on marks is seen as indicative of a lack of genuine subject interest. Given the time pressures however it is not unreasonable for a student to feel that they should be able to express enthusiasm for their subject by doing something well which actually counts towards their degree.

A problem with giving a substantial proportion of the overall credit to coursework is the verification of its originality. One way round this is to make the coursework percentage small, 15% for example is, “just enough to motivate them to actually do it and put a bit of effort into it, but it’s not so much that we need to worry about them just copying it off of their friends”. Another approach is to increase the weight given to coursework, but to make the tasks individual in some way, either by having different tasks for each student (eg using randomised data) or by making the task sufficiently open ended so that no two answers should be the same.

Interpretation of marks also needs a re-think from A level, it can take students some time to realise that they are unlikely to get 100% and that they are actually doing very well if they get a mark in the late 60s:

“at A level I could understand everything, ... but the homework were like there were some questions I just didn’t understand at all .. once I realised that I wasn’t gonna get like 100% all the time... it’s not as much of a big deal now when I can’t do something”.

Frequent short coursework

At two of the institutions we talked to, coursework was set on a frequent basis every week or couple of weeks. Problems encountered included scalability of the marking process for large student numbers, setting the level to provide challenge while still being accessible to the majority, giving an appropriate place to on-line assessment and coping with copying.

With a small class, it is straightforward for the lecturer to mark small courseworks on a weekly or fortnightly basis. With a class of 300 this is clearly impossible and a team approach to marking must be taken, which can be difficult when, “you’re managing...different markers of varying skills”. The marking process necessitates the production of rigorous sets of “solutions for tutors and markers that are not the same as for the students”. This to some extent constrains the type of questions being asked since students need to be steered to produce answers in a reasonably standard form.

Nevertheless careful organisation can produce impressive turnaround times with one institution having a weekly cycle giving out, collecting in, marking and returning work all within the week. In another institution students were divided amongst small tutor groups which met weekly, and a variant of the team approach to marking was to have tutors marking their tutor group’s work. Advantages of this were seen to be that the tutor knew how their students were performing: “if I mark the stuff every week, then I, I roughly know what’s going on in their minds”, and also that feedback can be more meaningful: “if there is anything particular that they think the students are missing...they can feed that straight back to their tutorial group”.

In contrast, a tutor who was not responsible for marking their group’s work noted that it was more difficult to keep track of whether their students were keeping up because they only know that work had not been handed in when the rest was handed back.

Judging the correct amount of challenge and credit awarded can be difficult, as a colleague reported an impression from students: “there’s a sort of fine line between being challenged and you know finding that exciting, and then there’s only a small bit further where you just feel like
you’re drowning and think you can’t understand any of this”. Initially short assessments of a diagnostic nature are often given to ensure students have a common set of essential mathematical skills, and the level at which these are set reflects the common starting point assumed for the course. As the course proceeds, perceived difficulty is often linked to similarity between homework exercises and those worked through in class. A pragmatic tutorial structure which seemed to have worked well was:

“...first section .. a set of worked examples, ... second section...a set of questions that they’re going to tap in on in tutorials, ... and then finally, ...homework questions for them to tackle, which are not entirely unrelated to the ones they’ll have seen in the previous two sections”.

A small coursework percentage when spread between many assignments may not be sufficient to persuade some students to hand in a specific assignment which may only be worth 3% of the module mark: “they see it as [just] one zero rather than as a long scale”. Students want to feel sufficiently rewarded in marks terms for the effort they have put in to meet the level of challenge presented to them. After a more than usually difficult homework a colleague speculated on why the hand in rate was low in their, normally conscientious, tutorial group: “one person will have said, ‘Well why don’t we just not bother’ and they’ll just have gone, ‘Yeah.’” Even with marks attached, students are not used to not being chased for work and this takes some adjusting to: “no one’s gonna make you do it now so it’s just the exam that will come back at you if you’ve not done the work”; “it felt like nobody cared and I just had to get on with things”.

Having coursework on-line is useful both for automating the marking process and in providing rapid feedback. Sometimes it is done in staffed lab sessions: “we have 7 hours of computer lab sessions where they get to do coursework ... with the assistance of teaching assistants”. In other cases the online material is interactive and designed to be done independently. This however leads to a reconsideration of the purpose of exercise classes: “How do you fill the exercise class now that it’s no longer really necessary for coursework?” Ideally the free time could be used to consider additional material of interest to the module, however the exercise class then “becomes an unassessed component and that automatically means students don’t show up”. Students warned of the danger of the knock-on effect in exams of on-line coursework in which the answer could, to some extent be guessed: “…in the exam, if that question comes up, You may know the answer ..., but the actual working out you won’t know. So you just get that one mark, you lose the other seven or eight marks.”

A useful feature of on-line coursework is the potential to randomise the questions and thus make them individual: “Lovely thing is that all the problems are randomised. No two students have identical coursework. No simple way of cheating by copying”. This is one answer to a problem that is difficult to control with large student numbers when scripts are “farmed out in batches ... you might not always notice”.

Overall the model of having frequent (weekly or fortnightly) coursework with solutions available was seen by both colleagues and students as having substantial merit. A student commented: “I do like the structure ... in the sense that there is something to do every week and you know what you’ve got to do,” and, on the return of work and availability of solutions: “It’s always the next week.” but “if you want to go check, instead of just waiting to find out what you’ve got, you can go and check and see”.

Colleagues felt that the tutor marking system had an effect on attendance:

“almost 100% attendance record from the students. ...partly helped by having tutorial before where it has to be handed in”, and was manageable:

“I can cope with marking 6 pieces of work”. How popular the model was however,

“to some extent it depends on .....how good their tutor group actually is”.

One colleague again highlighted the copying problem: “weaker students copy a lot, so it’s not clear what the real benefit is of the course work”. It was also pointed out that from the marking point of view, with a large group, short standardised coursework are the only viable option:

“deep and longer course works would be good but you’d have to have the people to mark them ....I don’t think we could do that actually with, say, PhD students”.

Longer assignments

Notwithstanding the viability and feedback issues discussed above, the prevalent pattern in the other two institutions we talked to was to have a small number of much longer coursework in each module, although one of the two institutions used longer coursework as part of a mixed strategy: “... you’ll have things like phase tests, um bits of extended coursework, short bits of coursework.” They tended to count for a higher proportion of the total module marks: “the faculty policy is to give first years mostly coursework”, in contrast to the 15% cited for short assignments above, and
were seen as giving students the opportunity to look deeply into particular problems, often related to applications. As with shorter assignments the amount of challenge has to be carefully thought through. One colleague told the story of an instance in which students' understanding was tested by asking them to explicitly write down some terms in the series solution to a difference equation. This seemed only a small stage on from deriving the general series, but caused the students a lot of difficulty even though they had the correct general form.

Two practical problems with longer assignments are estimating how long they will take students, and the length of time taken to mark them. A colleague commented that they had no standard tariff for how long it would take students to write a given number of words. One student had complained to them that 4000 words would take too long, but after having completed the assignment said that in fact it had only taken about 15 hours, which was about right in terms of the total balance of work on the module. As noted above, it is difficult to have a team approach to consistently mark more open ended assignments which are not amenable to producing solutions in a highly standardised form to mark from. This means that the marking is carried out by the module tutor - or perhaps split between two people marking different parts of the assignment. Although the fewer number of such assignments - typically two or three per module - releases some marking resource it would be unviable for very large groups: “there’s a resource implication to a lot of these, anything where you're trying to do something which is personalised assessment…”.

The importance of making a clear link between what is required in an assignment and the lecture material was noted by one student: “we’ll get an assignment that is all about the bit of work that we've just done. So makes it pretty obvious what is wanting to be done”. This is in contrast to a module where it had not: "The two assignments that we had were very tangential to the work that we'd done in lectures. So makes it pretty obvious what is wanting to be done". And I don't think that's helped.”

 Longer assignments can involve a number of different types of assessment, including investigations requiring students to research some information and/or to apply some mathematics:

“people have got different forms of words for this - they call it project based learning, enquiry based learning, all of these things are being brought together”.

Putting together such an assignment often helps to develop key skills: “There's also bits of coursework that's been writing reports and researching reports ...that's something that I'll be

able to use later on as well.” Longer assignments also give the opportunity for group work, which is useful in fermenting discussion about mathematics and developing group working skills but can have its problems: “it's difficult because its group work and not everybody always puts in the same contributions, ... I've ended up doing a lot of work”.

Conclusions

Students largely put their effort in where marks are awarded, and there is general agreement amongst staff and students that frequent small assignments in the first year promote engagement. The key to this is rapid turnaround which requires a high degree of structure in the assignment and a good well organised team of markers - perhaps more viable in a department with a number of research students. Since for the marking to be viable, such coursework cannot be open ended the weight attached to it tends to be relatively low, typically 15%. This low weight means that the problem of copying is less significant, but may not always be sufficient to motivate when spread over a large number of assignments. On-line assessments are useful for rapid feedback and the possibility of randomised questions.

Where courses employ longer, less frequent assignments these generally come with greater weight, typically up to 50% in the first year. To justify such a weighting, this type of assignment must contain some material with significant challenge, perhaps by including an open ended element. Advantages can be that students come closer to the sort of mathematical process that might occur in a work situation, and that key skills are acquired which are transferrable to other contexts. A disadvantage is the staff resource needed for marking which makes it difficult to operate for large groups.

Good ideas

Despite the constraints of size, the concerns about copying and the obsession with marks, much effective assessment is clearly taking place. Amongst those things which seem to work especially well were:

• weekly short coursework cycle including marking and feedback;
• randomised on-line coursework with the proviso that the answers cannot be guessed;
• structured examples/assignment sheets which move from worked examples to tutorial questions to related assignment questions;
• tutor groups with tutors marking their own group's work;
• longer coursework's with a clearly indicated starting point in lecture material and with additional skills elements; and,
• a mixed diet of coursework including both shorter pieces with rapid feedback and longer pieces with a more investigative element.