

THE TALE OF THE TAIL: AN INVESTIGATION OF FAILING SINGLE HONOURS MATHEMATICS STUDENTS IN ONE UNIVERSITY

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We draw on data from an ESRC study: Students' Experiences of Undergraduate Mathematics (R000238564). The aim of the study is to understand better the reasons why students experience undergraduate mathematics courses in different ways and why some maintain or develop more positive attitudes than others to the subject. In this paper we focus on one group of second year students who were 'at risk' of failure. By comparing the 'failing' students with the rest of the cohort and with each other, we try to see if they could have been identified earlier. We also suggest ways in which the mathematics department might better support these struggling students.

INTRODUCTION

Over a period of three years we have gathered data on a cohort of single honours mathematics students who entered two traditional English universities in Autumn 2000. Most of these students will graduate in Summer 2003, although a minority will remain for a fourth year to complete the MMath/MSci degree. We collected data on the changing attitudes of these students in relation to their experiences of the course, of university life, and of relevant external circumstances. We used questionnaires (two in first year and one in each of second and third years) with the whole cohort (approximately 200 students), and individual, group and e-mail interviews with a case study group of 10-12 students at each university. These 10-12 students were chosen after the analysis of the first questionnaire to provide a broad representation of the range of students. To give a context for this data we attended lectures, tutorials and examples classes, and interviewed lecturers, tutors and course directors. We also gathered data on examination results, including those from A-levels, diagnostic tests and university examinations.

In this paper we focus on a group of 32 second year, single honours mathematics students at one university who were at risk of failure. We chose second rather than first year students since there was a certain amount of turbulence in first year with students settling in, changing courses and, in some cases, universities. By focusing on those in second year we reduced the sample to those who had committed themselves to studying single honours mathematics. After consulting the mathematics staff, we chose as our criterion for identifying these students, failure in two or more modules in examinations in January 2002: semester one, year two. Students and staff perceive failure in these examinations to be significant as they are the first to count towards the students' final degree mark. (At the end of first year, students have to gain 100/120 credits to be allowed to continue into second year but these credits do not count in any other way.) By comparing the 'failing' students with the rest of the

cohort and with each other, we wanted to try to identify any indicators that might have suggested they were 'at risk' and could, therefore, have been recognised earlier. We also wanted to use the analysis to suggest ways in which the mathematics department might better support these struggling students.

We begin by looking at the various quantitative data we have on the students before reflecting on some of the interview data. It should be pointed out that total numbers vary according to the numbers of students on the course at different census points.

THE TAIL IN RELATION TO THE WHOLE COHORT

A total of 32 students failed two or more modules in the semester one year two examinations. Table 1 shows the total number of students in the cohort according to the three, single honours mathematics courses, and how the 'failing' students relate to the cohort.

Course	Whole cohort	Female %	Male %	2+ fails %	Female % of F	Male % of M
mathematics	112 <i>100%</i>	34 <i>30%</i>	78 <i>70%</i>	26 <i>23%</i>	4 <i>12%</i>	22 <i>28%</i>
mathematical studies	18 <i>100%</i>	8 <i>44%</i>	10 <i>56%</i>	5 <i>28%</i>	2 <i>25%</i>	3 <i>30%</i>
mathematics with finance	20 <i>100%</i>	8 <i>40%</i>	12 <i>60%</i>	1 <i>5%</i>	0 <i>0%</i>	1 <i>8%</i>
Total	150 <i>100%</i>	50 <i>33%</i>	100 <i>67%</i>	32 <i>21%</i>	6 <i>12%</i>	26 <i>26%</i>

Table 1 - Students who failed two or more modules in semester 1, year 2 examinations (January 2002) and the whole cohort, according to course.

In these examinations, six modules were examined. We looked at the modules failed by the 32 'tail' students to see if there were any particular patterns but none emerged. Fails were spread fairly evenly across all modules.

We asked ourselves several questions. For example, what did we know about the 'failing' sub-set? What, if anything, did they have in common with each other, apart from failing two or more modules? In what ways (if any), apart from failing two or more modules, were they different from the rest of the cohort? Could these failures have been predicted?

DATA AVAILABLE AT THE START OF THE COURSE

First we looked at the students' entry point scores. These were based on the UCAS tariff where a student's A-level grades were rated as A=10, B=8, C=6 and so on. The score was the sum of these numbers. The mean for the students failing 2+ modules was about 4 points lower than for the others (26 rather than 22), which was a highly significant difference ($p < 0.001$).

We then examined A-level grades for mathematics and further mathematics and compared them with those students who were most successful (in the January 2002 examinations) and with the whole cohort. We had A-level data on 28 of the 32 students. The remaining 4 transferred in from other courses after the start of first year and we did not have their data. We found that almost twice as many of the most successful students gained A grades in mathematics (24, (86%) compared with 13, (46%) of the failures) and only a quarter as many gained Bs, (4, (14%), compared with 14, (50%) of the failures). One of the failures gained a C grade. When we look at the cohort as a whole, we see that of 163 students, 102 (63%) had an A grade, 59 (36%), a B and 2 (1%) a C grade.

We had hypothesised that a lower number of those who failed would have studied further mathematics but this was not the case. Almost equal numbers of top (19) and bottom (18) students had studied further mathematics at A-level, although those in the top group who gained an A grade (10) greatly outnumbered those in the bottom group (1). Interestingly, the proportions of students who had studied further mathematics in both top (68%) and bottom groups (64%) were greater than the 49% for the whole cohort.

PROGRESS IN THE FIRST YEAR

We then analysed quantitative data relating to students' progress in year 1, examining first the results of a diagnostic test (top mark 40) given on entry. Here we found that the scores of failing students were over-represented among those scoring 10-20 and under-represented among those scoring 30-40. Nevertheless, they by no means all cluster at the lower end, so it would have been difficult to tell this group apart from other students at this stage.

The next set of data we examined was the semester 1, year 1 examination results (January 2001). Six modules were examined but results did not count towards the final degree. Thirty of the 32 who subsequently failed two or more modules in second year were on the course in January 2001. We found that 4 of the 30 scored an average of under 40% in these examinations, 1 failing one of the six modules, 2 failing two and 1 failing three. Of the 11 who scored between 40% and 49%, 4 failed two modules, 3 failed one, and 4 passed all modules. Of the 10 in the 50-59% category, 5 failed one module, the other 5 passed all six. But 5 scored in the 2:1 equivalent range between 60% and 69% and passed all modules. When we look at other students who obtained under 40%, we find that, of the 10 only 3 remain on the course. While none of these has done very well, 2 have improved in each subsequent set of examinations. Of the 18 who scored between 40% and 49%, 10 remain and have obtained similar scores. This does suggest that the first set of university examinations is the first time that the second year failures, and others who withdrew or transferred, could have been reasonably identified, since all those scoring less than 50% left or continued to be at risk later. However a minority of the failing students in year two obtained good scores at this stage. It also has to be accepted that some of the other students who had

weak scores and decided on the basis of these to withdraw or transfer might have done better in the second year, had they remained.

The next data we analysed were the end of first year examination results (semester 2 year 1). Looking first at the later 'failing' group of students, we see that 7 of the 30 present gained under 40%. Of these 7, four had obtained under 40% in semester 1 examinations. The majority (16) obtained 40-50%. The 4 who gained between 50% and 59% had similar scores in the first set of examinations and the 3 with over 60% had done equally well in the first semester examinations, raising the question of why they did so badly in semester 1 year 2 examinations. Looking at the other students, we find that, of the 5 who obtained under 40%, 2 withdrew after these examinations; 1 was absent for the next set of examinations; 1 scored 42.5% and the other gained 56%. This again suggests that most of the later failing students, or those electing to leave, could have been readily identified to be at risk, although again about a quarter were still performing relatively well at that stage.

In our analysis of the largely quantitative data it is evident that this tail of 32 students is, in many ways, not obviously different from the rest of the cohort in relation to, for example, entry qualifications, the sorts of schools they attended, family background and part-time work. What we do see, however, when we look across the three sets of examination results, is that most of this group performed relatively poorly from the start.

SOME FINDINGS FROM INTERVIEWS

Clearly, it is insufficient to look only at examination results. Lectures, examples classes and examinations do not take place in a vacuum: all sorts of other issues and concerns impact on the lives and, therefore, the attitudes, motivation and performance of the students. To try to gain a better understanding of why these 32 students should be less successful, we now turn to our analysis of some interview data. Six of the 32 students have been interviewed and we have spoken with another 8 but these conversations were informal and not tape-recorded. After the semester 1 year 2 results were known, we interviewed 4 of them. In general terms, most of the male students came across as rather immature and socially gauche. The mathematics course was described variously as 'boring' and 'hard work'. Hard work seemed to elude all of them but it was not as if most were busy with other activities. Much of their time seemed to be frittered away doing 'nothing much', other than watching television, videos or playing pool. Some seemed lethargic, with little interest in anything. They knew their behaviour was non-productive but could not apply themselves to serious study. They were caught in a downward spiral and some seemed mildly depressed. It can be said with certainty that none was happy with the situation. None of the students had had a part-time job during term time in first year but four (that we know of) did in the first semester of second year. One of these spent more time talking about that than about the mathematics course. The part-time job was 'boring' but he saw himself as being essential to the running of the business and there was an immediate pay off: money. If he received a call on his mobile phone,

asking him to cover a shift, he usually agreed even where this meant missing lectures. He justified it by saying, 'they need me'. Another, on being asked how he felt about failing several modules, looked rather non-plussed for a while before smiling broadly. The football team he supported had won their match on the Saturday after his results were known and this success more than cancelled out his examination disappointment. Another two young men resembled a couple of 'Jack the lads'. They had plenty of life about them and lots of outside interests. Indeed, mathematics rather got in the way of more interesting activities. On enquiring about the whereabouts of one of them, we were told, "Oh, you won't see much of [his name]. He's not often here. He won't be back till next week. He's going into hospital, it's part of some clinical trials and he gets a rest and gets paid at the same time. He's always got some scam on the go". The other 'Jack the lad' worked part-time in a bar and enjoyed the social side of his work. He was perhaps more realistic about applying himself to serious study than most of the others.

I know what I'm like. There's no point in saying I'll work because I know I won't. I never worked at school, not really. Maths came easy to me; I could just do it but I never worked at it. I didn't do any revision for my GCSE and I got an A star. I like working in [the bar]. It suits me. I go in, do my shift and then go off with my mates for a few jars and that's all I want, really. There's people working there and they've got degrees. You don't need a degree to do that work, so.

All those spoken to blamed themselves for their lack of success; all considered they were capable of doing the work (if only they could get down to it); all except one (see above) spoke of turning over a new leaf. Self-deception seemed to run through the interviews and all rationalised their failures, albeit it in rather unconvincing ways.

Well, if I have to fail exams this is the best ones to fail because at least I'll have time to catch up before the summer.

I think it's a good lesson because I was just getting over 40 before but now, well I've failed, and it'll make me work otherwise I'll just fail again.

Several of these students socialised with other failing students. For example, one shared a house with others (non-mathematicians) who were doing equally badly. "We try to help each other but they don't do much work either. We'll say we'll work but we just end up chatting or watching telly or something". Another said: "I've been going about with [another student] but we're bad for each other because he's even lazier than me, so that doesn't help". Another replied that two of his best friends had withdrawn at the end of first year and he had had to make new friends but these new friends were not doing very well either. All these students demonstrated a general lack of motivation which seemed to be re-enforced by their peers. All students interviewed spoke about times of struggle but the more successful had friends to help them through the difficult times. The less successful ones were either social isolates or friends with equally unmotivated students.

CONCLUSION

From our data analysis, it is evident that these ‘failing’ students demonstrate a lack of academic preparedness. Students without suitable study skills or cognitive styles that are appropriate for study in higher education (HE) and lacking the ability to study independently and understand what is required to pass the course, are identified in the literature (NAO, 2002: 15, UCAS, 2002: 21). UCAS found that many experience difficulties in adjusting to the ‘mass independent’ learning of HE which is so different from the more cosseted learning styles associated with school or college study. UCAS (2002) and the NAO (2002) suggest that the gap in the pre-HE and HE learning experience may be widening, as a consequence of school and college league tables which mean that pre-HE ‘students tend to be “spoon-fed” for longer, and are now less well-equipped with individual or self-learning skills’ (NAO 2002: 15).

It is difficult to know what more the university could do to support these struggling students especially as they tend to withdraw when faced with lack of success and many find it difficult to talk openly and honestly about their situation. Additionally, staff are having to deal with ever-increasing numbers of students as a result of widening participation. However, our analysis suggests that greater efforts should be made through the system of compulsory tutorials and homework in first year to identify students at risk and to intervene more actively in such cases. Consideration also should be given to continuing with compulsory tutorials and homework in second year to make it easier for staff to check up on students at risk of failure.

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