

What type of student avails of mathematics support and why?

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Abstract

Students who avail of mathematics support vary both in terms of their mathematical ability and their reasons for seeking extra support. We will consider the conjecture that there is a difference in the pattern of attendance between first year groups and more senior students. We will consider attendance data from the first two years of operation of the National University of Ireland Maynooth Mathematics Support Centre. This data shows that at-risk first year students are more likely to attend the Mathematics Support Centre than students who are not deemed to be at-risk. For the senior students however, the majority attend not because they are in danger of failing, but because they want to maximise their grades.

1. Introduction

The Mathematics Support Centre (MSC) at the National University of Ireland Maynooth (NUIM) is now in its third year of operation. In the academic year 2007/2008 the drop-in centre had 2493 visits from 273 students, making it one of the busiest in the UK and Ireland. In its second year (2008/2009) there was a 93% increase in the number of visits to 4647 visits from 509 individual students. The MSC was originally set up in order to provide support for at-risk students. However, there was anecdotal evidence to suggest that other students were using the Centre also.

Many recent papers have reported on the benefits of mathematics support to first year students with weak mathematical backgrounds [1-3], and the authors have themselves discussed the impact of the MSC on the grades of first year students [4]. In addition, some authors have been able to report on the use of support services by students with strong mathematical backgrounds. Croft and Pell [5] consider the number of times first-year Engineering students attend the Mathematics Support Centre in Loughborough University and the grade they receive on their mathematics modules. They found that students who received the top grades were more likely to attend than those who failed or who just passed the module. They comment that the provision of mathematics support has moved from a remedial measure to one of enhancement for the whole student cohort. Similar results have been reported by MacGillivray [6]. She considered the attendance patterns of students, and found that engineering students at the Queensland University of Technology across all abilities make good use of the support services on offer there.

In this paper, we will present preliminary investigations into the type of student who visits the MSC. We present evidence which shows that the majority of first year students who attend the MSC are at-risk students. However, this is not the case for higher years, especially for final year degree students where the majority of attendees are not at-risk students but rather high achievers. The data collected and analysed in this paper comes from MSC attendance and registration forms, students' second level grades and Department of Mathematics diagnostic tests and end of semester exams.

2. Results

We will consider the composition of the student group that availed of the MSC drop-in services in 2008/09. The breakdown of attendances for 2007/08 was very similar. Perhaps the most basic question one might ask is what year groups use the MSC. In the year 2008/09, 54% of visits were by first year students registered for a mathematics module with the Mathematics Department. This group consists of Science students, for whom mathematics is compulsory, and Arts and Finance students who have chosen to study the Mathematics as one of their three first year subjects. For the sake of brevity, we will refer to the Arts and Finance group as the Arts group, since they take the same modules. Second year and third year mathematics students accounted for 24% and 9% of the visits respectively. The remainder (13%) of the visits were by students who were not registered for a mathematics module or by a small group of students who were taking a pure mathematics module. These percentages are not surprising if we consider the size of the year groups involved: approximately 500 students in first year Science and Arts; 200 students in second year Science and Arts; 100 students in third year Arts and Science; 40 students in pure mathematics. The breakdown of student numbers for the academic year 2007/2008 is consistent with these figures. There is evidence that the MSC is being used by students who are not registered for a mathematics module. Many of these students are studying Engineering, Psychology, Geography, Sociology and Economics. Since we do not have access to these departments' records, we will not be able to include these students in the analysis that follows.

Table 1 shows the percentages of the year groups who attended the centre. It is clear that there is a huge increase in the percentage of First Science and First Arts students attending and in the percentage of Second and Third Science students attending. The attendance rates for the Second and Third Arts groups were already high in 2007/08. These groups comprise of students who have chosen to study mathematics to degree level, they take Mathematics in all years of their degree and are traditionally very diligent students. The increase in the attendance rates of the first year students is particularly encouraging and is in part due to an initiative which will be reported on in another article.

Groups	2007/2008	2008/2009
First Science	32%	61%
First Arts	34%	55%
Second Science	37%	70%
Second Arts	70%	77%
Third Science	34%	59%
Third Arts	66%	65%

Table 1: Percentage of year groups attending the MSC

To get a more complete picture of the attendance patterns, we decided to consider the number of visits made by students from each year group. We only consider students who took the final examinations. This data is reported in Table 2. In this table we consider the percentage of the group who made no visit, one visit, two to five visits etc. In all of the analysis that follows, only data from the year 2008/09 will be used. It is clear that the pattern of visits is not uniform across the year groups. The Second Arts students attend very often. 32% of this group attended 21 times or more. The centre was open for 24 weeks of the year, so these students seem to be using the centre almost every week. The median number of visits for each year group was: 4 for First Science; 3 for First Arts; 4 for Second Science; 17.5 for Second Arts; 6 for Third Science; 6.5 for Third Arts.

The Second Arts students are a highly motivated group and usually do not fit into our at-risk category. We will now consider whether the MSC is catering mostly to at-risk students or to students striving to achieve high marks in their examinations.

Group	n	0 visits	1 visit	2-5 visits	6-10 visits	11-15 visits	16-20 visits	>20 visits
First Science	267	39%	10%	25%	12%	7%	2%	5%
First Arts	204	45%	15%	20%	12%	4%	2%	2%
Second Science	112	30%	15%	26%	9%	6%	5%	9%
Second Arts	47	23%	6%	4%	11%	15%	9%	32%
Third Science	32	41%	9%	19%	13%	6%	3%	9%
Third Arts	43	35%	7%	21%	14%	2%	9%	12%

Table 2: Numbers of visits to MSC in 2008/09 by year group

The Mathematics Department administers a diagnostic test to every First Arts and Science student in the first week of term. This test has 20 questions and students receive 3 marks for a correct answer and -1 for an incorrect answer. Students who receive 20 marks or less are considered to be at-risk of dropping out or failing their examinations. In the Irish Education system, students take an examination called the Leaving Certificate at the end of their second level education. Mathematics can be taken at Foundation, Ordinary or Higher levels. Only students who have passed Mathematics at Ordinary Level (OL) or Higher Level (HL) may enter university. Students who have studied mathematics at OL are often disadvantaged compared to their peers who have studied HL mathematics. For this reason, the Mathematics Department also considers OL students to be at-risk. An in-depth analysis of the breakdown of pass and fail rates within the HL and OL groups is available [4]. Table 3 shows the percentages of first year students in these at-risk categories who attended the MSC.

Group	Attendance	Leaving Cert Level		Diagnostic Test	
		HL	OL	Pass	Fail
First Arts	Attended >1	48%	54%	53%	73%
	Attended >15	2%	6%	5%	3%
First Science	Attended >1	45%	62%	57%	62%
	Attended >15	1%	8%	5%	7%

Table 3: Percentages of at-risk first year groups attending the MSC in 2008/09

It appears that on the whole the attendance rate for students in the at-risk categories is higher than the rate for the students who are not considered at risk. However the differences are not very big and HL students and those that have passed the diagnostic test are still attending the MSC.

For the second and third year students, we considered the grades that they achieved in their previous year. At NUIM, a final mark of 70-100% is a first class honours grade, 60-69% is a 2.1 grade, 50-59% is a 2.2 grade, 45-49% is a third class honours grade, 40-44% is a pass grade and 0-39% is a fail. Table 4 contains the percentages of students in each grade category who attended the MSC more than once, and more than 15 times. Data for the Third Science group is not included since Second Science was streamed in the previous year.

Table 4 shows that attendance rates are very even across the grades in Second Arts, Second Science students who scored 40-49% in first year were more likely to attend than students who achieved a first or second class grade. This pattern was reversed for the Third Arts group, here the high achievers from second year were more likely to attend than their peers.

Group	Attendance	Grade from Previous Year					
		1st	2.1	2.2	3rd	Pass	Fail
Second Arts	Attended >1	63%	91%	67%	100%	80%	50%
	Attended >15	16%	36%	42%	100%	40%	33%
Second Science	Attended >1	65%	59%	57%	80%	71%	40%
	Attended >15	11%	4%	30%	10%	6%	7%
Third Arts	Attended >1	79%	75%	64%	40%	33%	0%
	Attended >15	14%	38%	18%	20%	0%	0%

Table 4: Percentages of second and third year groups attending the MSC in 2008/09

3. Conclusions

This is a preliminary analysis of this data and a full statistical analysis is now underway. We intend to delve more deeply and to carry out tests that will allow us to compare the behaviour of different groups of students, for example we could ask if there are differences between First Arts and First Science students.

Our analysis to-date has shown that the MSC is very well attended by all year groups and also by students who are not studying mathematics. Students rarely make just one visit to the MSC with most of them returning again and again. The MSC seems to be catering well to all ability levels. The at-risk students in first year have good attendance rates as do the high achievers from the senior years. This shows that the centre is not viewed as a 'remedial mathematics' centre, but as a resource for the entire student body.

The analysis of attendance patterns has allowed us to tailor supports to the specific needs of different groups. For example, we have instituted a study group for Third Arts students moderated by an experienced tutor. We have also developed two online courses which cover basic mathematical skills. The online courses are supplemented by weekly workshops. One course is aimed at First Arts and Science students who are deemed to be at-risk. The other is aimed at students who are not studying mathematics but whose lack of basic mathematical knowledge hinders their progress in other subjects. Even though these additional supports have only been in place for one month, the feedback so far has been excellent.

References:

1. Patel, C., Little, J. (2006) Measuring Mathematics Support, *Teaching Mathematics and its Applications*, 25, 131-138.
2. Dowling, D., Nolan, B. (2006) Measuring the effectiveness of a maths learning experience – the Dublin City University experience, *Proceedings of the CETL-MSOR Conference 2006*, 51-54.
3. Lee, S., Harrison, M., Pell, P., Robinson, C. (2008) Predicting performance of first year engineering students and the importance of assessment tools therein, *Engineering Education*, 3, 44-51.
4. Mac an Bhaird, C., Morgan, T., O'Shea, A. (2009) The impact of the mathematics support centre on the grades of first year students at the National University of Ireland Maynooth, *Teaching Mathematics and its Applications*, 28, 117-122.
5. Pell, G., Croft, T. (2008) Mathematics Support – support for all?, *Teaching Mathematics and its Applications*, 27, 167-172.
6. MacGillivray, H. (2009) Learning support and students studying mathematics and statistics, *International Journal of Mathematics Education in Science and Technology*, 40, 455-472.