Mathematicians Supporting Mathematicians: Our Role in Teaching and Learning

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Including:

- The establishment of a compulsory and weekly tutorial programme for all students in Year 1 and 2.
- A University-wide mathematics support centre (from 2012/13) and Peer Assisted Study Support (PASS) sessions.
- Subject-specific training for postgraduate students who teach and mark student work.
- Two new modules (one in Year 1 and one in Year 2), to allow students to engage in opportunities for problem solving and linked to developing their wider employability skills.
1. Background

“There is an increasing inhomogeneity in the mathematical attainments and knowledge of students entering science and engineering degree programmes.”

“The decline in skills and the increased variability within intakes are causing acute problems for those teaching mathematics-based modules across the full range of universities.”

Measuring the Mathematics Problem (2000)
The role of mathematics support...

“.... Now only a few years on, we see that the concept of mathematics support has not only become firmly embedded in UK Higher Education, but colleagues have moved on to gather data on the way students use such resources and look for optimal strategies for the delivery of this support, and this is perhaps the most convincing evidence of acceptance...

What might once have been described as a cottage industry now plays a respected and widely adopted role in Higher Education.”

Joe Kyle
Unintended consequences?

The ‘Sophomore Slump’:
“…for many of those staying [on the course] attainment was average and below, the problems of coping with the work were accompanied by growing disillusionment with mathematics…”

“Such students became mildly depressed in the second year and seemed to lack immediate sources of support and the motivation to seek these out.”

Brown et al. (2002)
Unintended consequences?

Managing expectations:
“…the experienced mismatch between their beliefs about the nature of mathematics and its rigorous university character soon makes them lose interest in mathematics and develop a negative attitude towards it.”

Daskalogianni and Simpson (2002)

“many of these same students reported their disappointment that the mathematics they were now learning had become so pure as to have no possible application…”

Brown et al. (2002)
Learning to learn mathematics

“Students often experience lectures at university as intimidating places and are not sure how to learn in them.”

“Informal peer learning can be very important to some students. The development of peer support groups can be officially facilitated but this is not often the case.”

“…it is not always clear what this [Independent Learning]… means, and many students…think it means they are expected not to seek help from staff.”
2. The importance of dialogue

“...negative feelings are generally associated with a perception of poorer dialogue when students enter university programmes, and vice versa.”

“...interactions with lecturers were often fewer and less engaging than students had expected, and this was associated with a negative view of the university experience and transition in particular.”

Williams (2015)
“Several independent research projects report that the enjoyment of mathematics by many undergraduate mathematicians decreases as they progress through their degree programme and this decrease is accompanied by increasing disillusionment and disengagement with their course and alienation from mathematics itself. These are students who choose to study mathematics at university and who are relatively well-qualified. Moreover, it is often the case that students who report such feelings are not failing students – indeed many are doing rather well.”

Croft & Grove (2015)
Understanding assessment

“...over one quarter of the modules (535) in the sample are assessed entirely by closed book examination and nearly 70% of the modules (1267) use closed book examinations for at least three quarters of the final mark.”

Problem sheets help students “understand and appreciate definitions and theorems mentioned in lectures, applying them in what are for students, novel contexts…they most often build on or activate book-work from the course”
We set out to:

1. Increase student (and staff) understanding of effective feedback.
2. Pilot mechanisms with a view to improving the quality of feedback received by learners.

Acknowledgments

Chris Good
Rosemary Dyson
Heather Collis, Calum Ridyard & Mano Sivantharajah
Chapter 12: Providing effective feedback

Mike Robinson, Sheffield Hallam University
Feedback Guidance

Designed by students to benefit students
by Heather Collis & Mano Sivantharajah

The purpose of this guide is to offer tips and advice on how to use the feedback you receive from lecturers to the best effect. It will allow you to know what you can expect from feedback provided by lecturers.

Staff Guide

A Guide to Effective Feedback
by Heather Collis & Mano Sivantharajah

The purpose of this guide is to offer suggestions on how to improve the effectiveness of feedback provided to students in the School of Mathematics. It also offers guidance that suggests possible uses of technology that can be used to aid feedback.

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Feedback as part of the tutorial system. . .

- In Years 1 & 2 feedback, and in particular how to use it effectively, is discussed in the compulsory (weekly) tutorials.

- In Year 1, assessed work is returned via the weekly tutorials allowing for discussion and more detailed individual feedback.
Have you received enough feedback on your submitted work (n=74)?

No real consensus – but 40% of students felt they received insufficient feedback!
Where might the issues lie?

“no - problem sheets are the main way to track progress and are not marked well enough.”

“I feel like the problem sheets could have more feedback as it is often very generic and doesn't say where particularly I have gone wrong.”

“No, comments were generally not detailed enough.”
Of the feedback types you said were available, please rate the quality of the feedback you received.
What was the best feedback you received?

- Online computer assisted assessments
- Informal discussion between students
- Comments from the tutor/lecturer posted on Canvas
- Comments from the tutor/lecturer in class (lecture, tutorial or problem class)
- Video with audio commentary of your problem sheet discussing your solution(s)
- Video of worked solution with supporting audio commentary
- Opportunity to talk to tutor/lecturer about the work
- Comments written on your problem sheet
- Mark on your problem sheet

The diagram shows the feedback received in different years (Year 1, Year 2, Year 3). The bars indicate the percentage of feedback for each option.
“I find discussion the best as often if you haven't done too well seeing a low mark on the page can be quite negative whereas by talking to a tutor they are able to pinpoint where you went wrong and how to gain marks.”

“Discussed what marks my friends got and compare our answers. Use my marks to see which questions I need to revise more.”
“Weekly tutorials with approachable tutors who have a clear understanding of the topics was also so useful, seeing how they and other students would attempt problems was very useful and motivated me to try harder…”

“Discussion in tutorials as allowed you to see how you can approach different questions on the same type and how to think of questions in a different way.”

“Tutorial sessions were useful as I could get help on the areas I personally struggled.”
Student views: Which feedback have you used most?

- Online computer assisted assessments
- Informal discussion between students
- Comments from the tutor/lecturer posted on Canvas
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Year 1
Year 2
Year 3
“Because if you don't understand something then talking to a lecturer about it really makes you get to the bottom of it. Then again, I often don't know that I don't understand something unless I lose a mark in a problem sheet for it.”
Coupled with the importance of model solutions. . .

Evidence of the development of skills in self-analysis:

“I compared my answers to model solutions and used them to draft future answers.”

“I have submitted half of the work only as sufficient feedback wasn't [sic] available, so I used to mark my work when the solutions were made available.”
What does this mean*?

- A lot of effort spent adding comments to problem sheets = very little perceived value.

- What is important:
  - A mark and an indication of where a mistake occurred.
  - Quick return of work and availability of model solutions.
  - Development of skills in self-analysis.

- Comments from staff are valued (in a session) when work is returned. Can stimulate dialogue.

- Opportunities for dialogue (peers, PGTAs, and staff) are crucial. How might these be increased?
3. A new role for mathematics support?

- The Mathematics Problem Before: Emphasis on
  - The first year of university
  - The transition to university
  - STEM students
The Changing Mathematics Problem

- There are increasing concerns that the mathematics problem affects higher year specialist mathematics students.
  - More academic support being sought and by students beyond their first year.

Where is the evidence?
The Mathematics Support Centre
# The Mathematics Support Centre

## Number of Overall Visits to the Mathematics Support Centre

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<tr>
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</thead>
<tbody>
<tr>
<td><strong>Total Mathematics Visits</strong></td>
<td>163</td>
<td>294</td>
<td>425</td>
<td>354</td>
<td>786</td>
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<tr>
<td><strong>Total Overall Visits</strong></td>
<td>482</td>
<td>571</td>
<td>875</td>
<td>793</td>
<td>980</td>
</tr>
<tr>
<td><strong>Percentage of Mathematics Visits</strong></td>
<td>33.8%</td>
<td>51.5%</td>
<td>48.6%</td>
<td>44.6%</td>
<td>80.2%</td>
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</table>
The Mathematics Support Centre

PERCENTAGE OF MATHEMATICS STUDENTS VISITING THE MATHEMATICS SUPPORT CENTRE

PERCENTAGE OF OVERALL VISITS OF MATHEMATICS STUDENTS THAT YEAR

YEAR

2012-13

2013-14

2014-15

2015-16

2016-17

1st YEAR

2nd YEAR

3rd YEAR

OTHER

0%

10%

20%

30%

40%

50%

60%

70%
The Mathematics Support Centre

Academic Year | Year 1 | Year 2 | Year 3
---|---|---|---
2012/13 | 44 | 8 | 0
2013/14 | 34 | $\frac{18}{29}$ | $\frac{4}{15}$
2014/15 | 22 | $\frac{10}{27}$ | $\frac{9}{30}$
2015/16 | 13 | $\frac{9}{25}$ | $\frac{6}{22}$
2016/17 | 47 | $\frac{8}{73}$ | $\frac{6}{84}$
What does this mean?

- MSC provides support to all students
- Specialist mathematics students, beyond their first year of university are now making a significant number of visits.
  - Why?

- Does this indicate the success or failure of the Mathematics Support Centre?
We set out to:

1. To understand why students beyond their first year of university use the MSC more
2. Why mathematics support is important to students
3. To determine what students look for/prefer when seeking additional mathematics support
4. To compare the above between year groups
### Questionnaire Results - Interactions and Dialogue

#### Most Used Supports at the University of Birmingham Categorised

<table>
<thead>
<tr>
<th></th>
<th>Standard In-Course</th>
<th>Internal Support</th>
<th>External Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always/Everyday and A Lot</td>
<td>Lectures 43/48</td>
<td>Lecture Capture 7/48</td>
<td>Friends 37/48</td>
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</tbody>
</table>

- 77% of students say that **interacting with friends** is one of their most commonly used forms of support.
“[Friends can] tailor explanations to my way of thinking”

“[Friends can] explain things in different ways”

“I can talk informally with them [friends]”

“I can ask them simpler questions without worrying about appearing daft”
Questionnaire Results - Interactions and Dialogue Trends

- “one-to-one” and “individual” support
  - With peers
  - Specific to the Mathematics Support Centre

- Interactions with lecturers not common
Questionnaire Results - Mathematics Support Centre

“I prefer the one to one experience provided by the Mathematics Support Centre, as it is more personal”

“Having other students explain things to you is a lot less intimidating and can therefore be a lot more understanding”

“The hours that the PhDs [postgraduate staff] are there is flexible around our timetable.”

“Individual help on a one-to-one basis.”
Questionnaire Results-
Mathematics Support Centre

- Generally positive responses from students
- Of the students rating above average – only one student was a first year student
- Generally positive responses from students

How The Mathematics Support Centre is Rated Compared to Other Forms of Mathematical Support

- Much Better
- A Little Better
- No Different
- A Little Worse
- A Lot Worse
Questionnaire Results - Confidence at University

<table>
<thead>
<tr>
<th>Has Mathematical Confidence Been Influenced By the Mathematics Support Centre</th>
<th>Yes</th>
<th>No</th>
<th>Unsure</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>14</td>
<td>23</td>
<td>7</td>
<td>44</td>
</tr>
<tr>
<td>MSC Visitors Only</td>
<td>14</td>
<td>8</td>
<td>4</td>
<td>26</td>
</tr>
</tbody>
</table>

- Weak trend: Students beyond their first year feel that their mathematical confidence has been influenced more compared to first year students.

- Something to look into!
Questionnaire Results - Success at University

<table>
<thead>
<tr>
<th>Has The Mathematics Support Centre Contributed to Success at University</th>
<th>Yes</th>
<th>No</th>
<th>Unsure</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>19</td>
<td>18</td>
<td>5</td>
<td>42</td>
</tr>
<tr>
<td>MSC Visitors Only</td>
<td>19</td>
<td>2</td>
<td>5</td>
<td>26</td>
</tr>
</tbody>
</table>

“allows me to develop my understanding of my modules”

“It helps to cement understanding of concepts in mathematics”
What we take away:

- Mathematics Support Centre popularity is increasing with new visitor numbers on the increase opposed to returning students.
- "one-to-one", "individual", "personal" support has appeal to students.
- There is value in further research!!!
  - Trends to differentiate year groups.
  - Are confidence levels increasing as students progress?
  - What is the contribution of the MSC to success?
Thank you!

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