WORKSHOP REPORT

Mathematics Support : One-to-one, one-to-few or one-to-many

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Abstract

Many universities operate mathematics support; recent debate has included e.g. whether support should be face-to-face or online. However, another relevant question is how many students should be involved in a session. Students have mentioned that it would be good to have many students together so that they can see the answers to questions that others have. However, academics may argue that it is necessary to quiz students in order to specify the problem and this may not be appropriate in front of other students and these students may not benefit. This study will look at circumstances where maths support should be carried out on a one-to-one basis and occasions where it is beneficial for further students to be present.

Keywords: Mathematics, support, students, numbers.

1. Mathematics Support

Many universities offer mathematics support (Grove, Croft and Lawson, 2020). Croft, Grove and Lawson (2016) note that “The most common provision is the mathematics support centre which typically offers one-to-one support to students on a drop-in basis” with more details provided by (Lawson, 2012). They also note that “Other models of support are used effectively by universities (Marr and Grove, 2010)”.

1.1. Mathematics Support at the University of Manchester

At the University of Manchester (UoM), mathematics support has taken various forms over the years. A high point was the period between 2006 and 2009 when a room was preferentially booked for such a service for 20 hours per week and extensively during exam periods (Steele, 2010). This was staffed by various members of staff and Graduate Teaching Assistants and catered for enquiries generated by student projects (and Postgraduate research), staff enquiries etc. as well as questions arising from mathematics units (given to mathematics students and to those on service teaching units). From 2009, and until the present, the emphasis was changed to one anchored at the level of the course unit with each member of staff offering office hours or a drop in session, generally on a weekly basis.

Around 2016, a service was started at the University Library and dealt primarily with statistical enquiries. However, the rapidly-changing environment following the Covid pandemic meant that this service was discontinued in favour of other general means of support.

2. Types of support

The details of support vary greatly between universities e.g. physically based in mathematics buildings, buildings devoted to other disciplines or in student spaces such as unions or support areas (Marr and Grove, 2010).

The different models also vary in that they cater for a wide range of student numbers. Chiriac (2014) notes that “At the present time, there is strong scientific support for the benefits of students learning

and working in groups" but qualifies this by stating that "Similarly the question of why some group work turns out successfully and other work results in the opposite is still unsolved" and speculates that "It is important to differentiate between how the work is accomplished in the group, whether by working **in** a group or working **as** a group".

The number of students taking part in a discussion as part of maths support clearly has implications.

3. Models of support

In the experience of the author, one of the most satisfying times in mathematics support (indeed in academic life) is the moment that a student understands a concept in a manner that was not the case at the beginning of the session. Sometimes, this can be a slow and gradual thing while on other occasions, understanding can be sudden i.e. the "lightbulb moment".

Students are likely to spend a lot of time on the resources of the current topic or unit but sometimes the lightbulb moment arrives when realising the implications of something that has been learned in a previous unit or indeed learning to understand the pre-requisite material only as part of the current unit.

An important part of mathematics support is for the advisor to be able to gauge the level of understanding that the student has of the pre-requisite material and often this can only be carried out by means of questions.

Of course, students often "measure" in terms of "how long will I have to wait" and may become frustrated while watching several rounds of one-to-one interactions while waiting their turn. Sometimes, they may even point out that "I had the same question". Of course, if advisors bring watching students into an enquiry, they may (unwittingly) move the session between some of the categories below.

3.1. One-to-one interactions

In this scenario, the student has complete freedom to ask a question and the advisor has complete freedom to clarify the background by asking questions in return. One possible technique is for the advisor to ask the student to start explaining as any misconceptions may surface at this stage. Of course, the student may simply claim total misunderstanding and not attempt a partial explanation. However, it is possible that in this one-to-one situation, a student may be more forthcoming than if other students were watching. The interaction can continue through looking at notes and pre-requisites, trying similar examples etc. and is likely to help the student understand much better than a simple quote of the answer. At the end of the consultation, the advisor can **give** the student any materials written, e.g. printouts of HELM (Helping Engineers Learn Mathematics,) and other resources.

The drawback of this approach is that it is slow, can limit the number of students that can be seen and can be frustrating for students waiting (either in the same room and witnessing or in a waiting room).

3.2. One-to-two interactions

Much of the above applies when there are two students. Generally two students can be sat in such a way to communicate easily (visually – e.g. on paper – as well as vocally). Generally, it will be **one** student who asks the question and the advisor will probably want to know to what extent the second student really does have the same question and to what extent the second student really does understand the subject matter; the questioning can get awkward at this stage.

However, one advantage of a second student is that the advisor can encourage students to explain topics to each other for mutual benefit.

Again, waiting students may not appreciate all of the aspects of this.

3.3. One-to-several interactions

In this case several is defined as sufficiently few that the advisor can be aware of every student and attempt to have some form of interaction with each student. This will be a function of the advisor but generally will be single-figures.

One student will ask a question and the advisor will attempt to answer it. While the advisor can ask questions to the students, and most likely to the student who asked the question, it is not likely that the other students will be asked as individuals but may be asked as a group and significant responses may be rare. The advisor will, no doubt, answer the question but will not get too much of a feel for how many of the students truly understand the response.

3.4. One-to-many interactions

Once the number of participants gets beyond an extent where the advisor can attempt to interact with everyone, the nature of the activity changes again, beginning to resemble a lecture rather than a discussion or tutorial. This kind of activity often takes place in the runup to end-of-semester exams and can involve classes of more than 100 students (and conceivably up to 500 students in extreme cases) at UoM. It may be daunting for students to play an active part (either by raising the original question or by commenting, raising subsidiary questions etc). While electronic communication systems can play a role, they do create an asymmetry of communication and it can be difficult for the advisor to know how much students really do understand. Students may go away confident in that they have seen the correct answer but it is unclear how many of them really understand it enough to tackle similar (or slightly similar) problems.

4. Conclusions

Different models of how to run a mathematics support centre could be said to exist on a spectrum; at one end of the spectrum is a session run for a single student where this single student gets the maximum benefit from the session while the other end of the spectrum represents a session available to a large class but where the emphasis is on benefitting the maximum number of students but at the expense of the benefit being less focussed. However, this article has identified some intermediate ranges where particular types of interaction may take place.

The personal opinion of the author is that more effective support takes place with a smaller number of students. Data on what students perceive to be a more effective session is not currently available at UoM; while this may be a subject of further study, the immediate opinions on effectiveness that a student has on leaving the session may not be identical to the feelings on looking back at some point later during the studies.

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