

Some problems associated with running a Maths Support Service

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Abstract

There exist a number of reports that offer examples of good practice in setting up and providing mathematical support in Higher Education. In many cases a standard model of drop-in or surgery classes supplemented by online learning resources is adopted. This paper examines the problems associated with such a model following a critical review of the provision of Maths Support at Cardiff University. Key features of the support such as the effectiveness of drop-in support, the flooding of the service by groups of students, and the provision of a statistical consultancy are discussed. Commentary is also provided on the attempts made to manage these problem areas and investigations into possible alternative approaches.

1. Introduction

In the study by Perkin and Croft [1], it is recorded that of the 106 universities in the United Kingdom, 62.3% offer some form of mathematics support. It is also highlighted that a predominant feature of many of these services is the provision of drop-in or surgery classes along with supplementary learning resources. Given the reliance of this approach to deal with the so called 'Maths Problem' in Higher Education, this paper attempts to outline some of the practical problems inherent in such a model following a review of the key elements of the Maths Support Service (MSS) at Cardiff University.

A terse description of the MSS will be given, before detailing some of the problems encountered thus far and what might be done to nullify such problems in the future. These will include an examination of the role of the tutor (and student) within a drop-in session, the problem of being overrun or 'flooded' by a particular student group during a session, and the need or otherwise of setting up a formal statistical consultancy. Some of the positive practices and unexpected bonuses of running the service will also be presented, along with a small number of typical student profiles (see Appendix) to give benchmark scenarios for open-ended discussion.

2. The Cardiff University Maths Support Model

Following a successful small scale pilot initiative in 2005, the MSS was set-up in 2006, with contributions from the School of Mathematics and central University Learning and Teaching funds. The MSS is advertised as being freely available to all students, not just those studying a mathematically based degree, with the initial focus being on those students making the transition to university (e.g. preliminary and first year students). In particular, the aims of the MSS are:

- To promote the MSS among all current students, prospective students and staff.
- To create a relaxed environment where students are encouraged to discuss any of their mathematical problems.

- To assist students to develop a sound basis in the mathematical skills necessary to succeed in their particular subject areas.
- To work closely with individual Schools to improve the subject specific resources available (including assistance in subject specific tutorials if required).
- To monitor the provision of mathematical support across UK institutions, endeavour to apply examples of good practice and develop innovative approaches to further enhance the service provided.

It should also be noted that:

- The MSS is **not** intended to be used as a replacement for, or alternative to, any mathematical teaching provided by individual departments.
- It is **not** intended for the facility to be used as a mathematical/statistical consultancy.

In order to meet the aims outlined above, and following examples of good practice as outlined in [2], a model consisting of drop-in sessions was considered to be an effective and sustainable approach to adopt. The sessions are managed by a small number of enthusiastic members of staff from the School of Mathematics and a number of postgraduate students with experience in delivering tutorial sessions. In addition to this provision, a website utilising the many learning resources already available was created. For full details regarding the MSS the reader is directed to the corresponding website [3].

3. Problems Encountered

As outlined in [4], an important part of professional development is to review and reflect upon your own progress. This process of analysing your strengths as well as your deficiencies also applies to the development of any service. So despite a positive initial phase of development, some of the important and successful practices of the MSS are scrutinised below and ideas on how to further enhance the support being provided are outlined. To help investigate some of the problems in more detail we pose the following questions.

3.1 Are the drop-in sessions really helping the students to help themselves?

The one-to-one nature of a drop-in session provides a unique opportunity, in terms of university education, to get to know a student and to investigate their understanding of a particular concept. However, quite often students desire a quick-fire answer to a problem, with emphasis placed on how to enhance their marks, but not necessarily their understanding of a concept. So, it has potentially come to the view of some students, that the MSS is a useful stopover to get the few extra marks they need and not necessarily a relaxed mechanism to 'chew the fat' of some topics with someone who has a bit more experience.

Tutors are reminded that their role is not to provide solutions to students but to encourage students to explore ideas and find their own solutions. Nevertheless, it is very easy for the focus of discussions to be on what the tutor does as opposed to what the student can do, particularly if the session is very busy. As a result, the 'support' provided can develop into an individual mini-lecture on a particular topic. Students are often very appreciative to receive this refresher but given that they have already been lectured on the topic, and tend to have detailed notes, just repeating the information already available to them is probably not the most effective use of a MSS tutor, even if the ideas are presented in a more clear and digestible manner than previously.

Both general education literature [5] and that in a mathematical context [6] suggest that more active learning takes place when students are encouraged to engage with material, form their own ideas, and challenge their misconceptions. Therefore an alternative approach would be for tutors to develop a style based around posing effective and sometimes challenging questions. As well as hopefully encouraging a deeper approach to learning, this method also potentially makes more efficient use of the time available in a drop-in session. The initial MSS

model focused on matching an 'expert' with a problem. This can lead to difficulties if the expert is busy, or not available. Hence, by shifting the focus back onto the student, expectation on the tutor to provide 'the answer' is reduced and less time is wasted waiting for a particular tutor to become available.

It is clear that implementing such an approach is not without its difficulties. In particular, it is likely to make some students feel less comfortable, and care would have to be taken not to intimidate them with the questioning. Therefore, consideration of the various forms of student motivation [7] and learning styles [8] that exist should not be underestimated. For example, in [7] Seifert refers to following theories:

- Attribution theory - the perceived cause of an outcome. E.g. effort, luck, mistakes by the teacher.
- Self-efficacy theory - a person's judgement about his/her capability to perform a task at a specified level.
- Self-worth theory – the judgement one makes about one's sense of worth and dignity as a person.
- Goal theory - behaviours that are a function of desires to achieve particular goals.

Each of these concepts can be directly related to the students that walk into maths support services every day. For example, self-efficacy is strongly associated with students who believe they 'can't do maths', and furthermore, all support services will have experienced students who adopt a strategic approach to learning, i.e. the attainment of high grades with or without understanding (Goal theory). Simply being aware of these factors influencing student engagement can be powerful tools that aid the development of the support provided.

Given the range of approaches adopted by students, it is vitally important that tutors are given time and opportunity to enhance the skills necessary to provide appropriate support. To assist with this we have created four 'typical student profiles' which will form the base of a workshop prior to the next academic session. Here all MSS tutors will be encouraged to share and reflect upon the range of strategies that could be employed in the varying circumstances. The profiles are included in the Appendix, and the reader is invited to add their own thoughts on effective approaches to dealing with such queries, by submitting their comments on the web form available via the Cardiff University Maths Support website [3].

3.2 Can we be better prepared to cope with the service being flooded by students?

By flooding, we refer to large groups of students, possibly with the same query, attending a drop-in session at the same time. This is an issue that did not arise during the first year of running the MSS, but increased student attendance during the last academic year has at times put a significant strain on resources. Of course, this could be seen as a positive aspect in terms of student engagement with the service; however, it can also have a detrimental effect on the level of support provided.

This situation puts extreme pressure on the tutors to minimise the waiting time for students, especially as some students expect to be individually led through a range of examples by a tutor. This can lead to 'quick fixes' being used instead of establishing the actual root of a problem. Therefore, the argument for a more student focussed approach as outlined above becomes even more relevant.

The methods currently adopted during incidents of flooding are twofold. Firstly, additional tutors are timetabled 'on standby' for each of the sessions. This provides a more cost-effective approach for covering busy sessions, given that due to the informal nature of a drop-in session, it is virtually impossible to predict in advance when the flooding will occur. In addition, for incidents involving large groups of students with similar queries, a practice of re-locating the corresponding students to an alternative venue has been adopted. The re-located group is still overseen by a tutor, but the temptation to provide a lecture to the group is resisted. Instead the group are encouraged to work together and discuss various ideas and approaches to the problems. The importance of dialogue in learning is often undervalued in mathematics, where the common perception is one of individuals working alone in an attempt to obtain the solution to a problem. However, as highlighted in [9], Carnell reports on how "a community of learners generates knowledge". Indeed, in practice it has proved to be very effective with

students actively taking part in sessions by explaining and presenting ideas to others in the group. As a result a more concerted effort in general is adopted to encourage discourse among students within all drop-in sessions.

Requiring a 'breakout' room of this nature is not something that was originally anticipated, and having a room available cannot always be guaranteed. Therefore, is it possible for an alternative model to be considered?

One possibility is presented by examining the findings of the Counselling Service at Cardiff University [10], [11]. In an attempt to reduce their extensive waiting lists and the number of repeat visits required, the perhaps counterintuitive step of increasing the time allocated to an initial support session from 20 minutes to 90 minutes was taken. It had the desired effect. Despite seeing approximately the same number of students as in 2007, as of September 2008 the Service has no waiting list for the first time in ten years. It was found that spending this additional amount of time with the client during the first meeting allowed problems to be explored and a plan to be formulated regarding future goals, thus reducing the requirement of future support.

This approach may not be suitable for all queries faced by a maths support service, but it does fit the ideology of helping students to help themselves. As a result, a similar method will be trialled by the MSS in Cardiff during the forthcoming academic year, with particular focus on students who believe they 'can't do maths' and groups of students undertaking project work.

3.3 Should the MSS be providing a Statistical Consultancy?

As outlined in section 2 above, it is not intended for the MSS to be used as a statistical consultancy. However, since its inception, the MSS has experienced a sharp increase in the number of students requiring statistical assistance with detailed research work, with more and more examples bordering on consultancy work. To date the MSS has been fortunate to have tutors with the necessary experience available to meet the demand (in most cases), but it has been increasingly necessary to inform students on what are acceptable levels of support. Furthermore, with the sometimes subjective nature of statistical analysis, it was felt necessary to produce a disclaimer to protect tutors in case suggestions, particularly for research work, were misinterpreted in any way or incorrect. This has now been adopted on all MSS feedback forms and is outlined below.

Disclaimer: The role of the service is to support students to produce their own work. Therefore it is the responsibility of the student to verify any methods/results discussed during the sessions and any subsequent work that is produced.

Given the obvious demand for more complex statistical support/consultancy the MSS has assisted the University in putting forward proposals for additional statistical support specifically for research work to run in conjunction with the current service. In the meantime however, resources will continue to be made available to assist in queries of this nature, albeit in an informal manner.

It should also be noted that providing this form of support has also led to some unexpected bonuses. Relationships developed from initial support has helped with communication between Schools and created further inter-disciplinary research and teaching opportunities. Individual tutors have also benefited in some cases by being included as co-authors in corresponding research work.

4. Further considerations

Clearly there are many other considerations that need to be taken into account when setting up and running a maths support service of this nature, such as funding, staffing, not to mention the formal measurement of the effectiveness of such services (which is probably worthy of a research project of its own!). For a more exhaustive list of considerations the reader is directed to the work of Lawson, Croft and Halpin [2].

It should also be noted that despite the issues presented here, setting up and running a mathematical support service is an extremely rewarding experience which can make a difference, as the following typical student comments make clear.

"Brilliant, really helpful, would probably have dropped out if it wasn't for Maths Support." Year 1 student – Music

"Would fail without the help." Year 2 student – Maths

"I have spent a long time looking for somebody who might be able to help me with my statistical problem and nobody has been able to offer me the level of support and information that I have required or that the tutor has just provided me with. It has made such a refreshing change to come away from a meeting feeling like I understand what is possible with my data and confident enough to try it out for myself." Doctoral Researcher – English, Communication and Philosophy

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Appendix

Mathematics Support Service: Typical Student Profiles

Student A – “I can’t do maths”

Student A is currently on a Chemistry degree scheme with a high numeracy content. As the main focus of the degree scheme is Chemistry, and not the numeracy, the numeric part of the course is taught very quickly with multiple question sheets set. Student A has never felt particularly confident with maths, and the high turnover of work that he has to do makes him feel less and less secure about his ability.

Student A attends Maths Support with a file full of jumbled notes, half attempted question sheets and an uncompleted coursework that is due in the next few days. When he is approached by a support tutor, and asked what the problem is, he replies “I can’t do maths”.

Student B – “Here is my data, what statistical test do I use?”

Student B is a postgraduate student in Optometry, and has been collecting data for her thesis over the past three years. When it comes to finally analyse the data, Student B’s supervisor, who knows very little about statistics, recommends that she attends the Maths Support Service.

Student B also has little experience of statistics, and has only picked up some key terms and concepts from browsing the internet. She is getting really frustrated as she feels isolated, and doesn’t know anyone in her home department that can help with statistics.

Student B attends Maths Support, with a laptop and a spreadsheet full of data. After explaining to a tutor the story behind the data, she asks “What statistical test do I use?”

Student C – “How do I integrate – my exam is later this afternoon”

Student C has an exam later this afternoon and so runs into Maths Support with just a few pens and pencils. He always leaves things until the last minute, and is still unsure how to integrate some simple functions, but he wants to be quickly taught the basics so that he might do better in the exam this afternoon. Student C can stay for twenty minutes only, and so asks a tutor “How do I integrate?”

Student D – “How do I do question 4?”

Student D is a Maths student, who has been working on a coursework assignment in the library. She manages questions 1 to 3 fine, but comes to a halt as soon as she sees question 4. Student D looks at the time, and notices that a Maths Support session is happening down the corridor.

Student D walks into Maths Support with the coursework sheet, and asks the tutor “How do I do question 4?” Afterwards, she calls into Maths Support again, and asks “Is my answer correct for question 2?”