The development and evolution of an advanced data management system in a Mathematics Support Centre

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Abstract

The interest in why and how to collect data from students visiting a Mathematics Support Centre is ongoing within the community. A related issue is what intelligence to collect and the need to ensure this process is both robust and effective.

In this paper we give a history, dating back to 2004, of the process of data collection within the Mathematics Support Centre in University College Dublin in Ireland. We describe the evolution of what we consider to be a sophisticated mathematics support data management system, which we piloted in the second semester of 2014-15. We finish by discussing how feedback received from lecturers and MSC tutors during 2014-15 has resulted in further improvements to the system.

Introduction

In the early days of mathematics support in the UK and Ireland, the primary function of data collection was to justify a centre's existence in order to secure permanent funding for the resource and/or the coordinator (Lawson, Halpin and Croft, 2001 and 2002; MacGillivray and Croft, 2011). Perhaps for this reason, most support centres now collect data on student visits as a matter of course. Generally centres have records relating to the number of attendees, their associated academic programmes, and some level of detail on the problems with which they present. Some centres use Excel, Google Drive or pen and paper, to record and analyse this data. This paper will outline the evolution of the data collection process in the Maths Support Centre (MSC) in University College Dublin (UCD), Ireland – from pen and paper records when the centre was first opened in 2004, to what we now regard as a sophisticated data management system (DMS). We will describe the DMS we have developed and will discuss how feedback from MSC tutors and lecturers has led to further improvements in the system.

Data collection efficiency

From 2003/04 to 2008/09 data collection in the UCD MSC consisted of tutors recording by hand into a log-book (Figure 1) the student name, module, and the topic for which help was sought. Due to a limited budget, only a very basic analysis of the data was undertaken each year, primarily to ascertain the number of annual visits, number of visits from each module, and percentage of student visits from each stage/year of study. In these first six years of the UCD MSC the average number of visitors per year was 954.

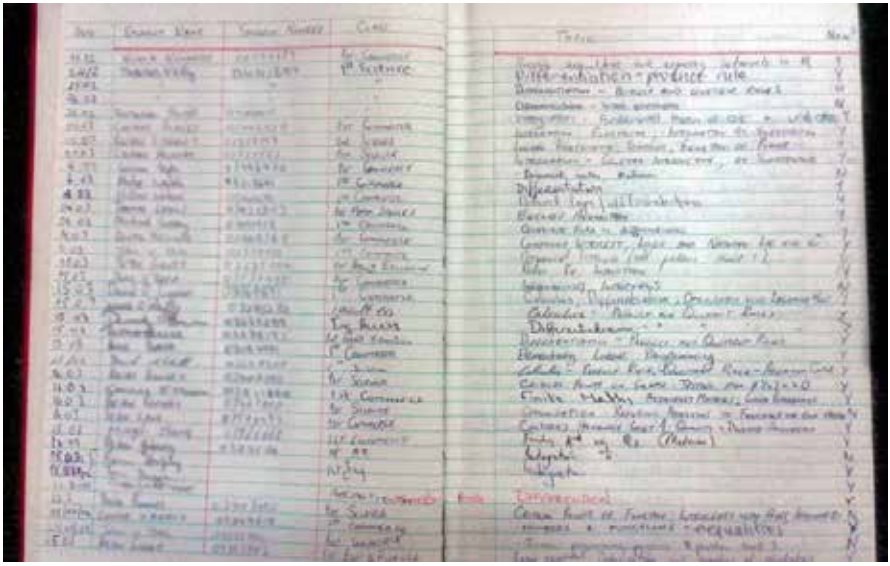

Figure 1: The original MSC log book

In 2009 the then manager Nuala Curley and mathematics lecturer, Dr Brendan Quigley, created an electronic data management system which consisted of four parts: (i) the student log-in (Figure 2), (ii) the tutor editor, (iii) the history log, and (iv) the administrator's account. The lecturers from the School of Mathematical Sciences also had the facility to access the anonymised feedback on each student visit, relating to his or her module(s). This database was hosted on the School's server and the pages were accessible via the School's Teaching and Learning webpages via a secure protocol.

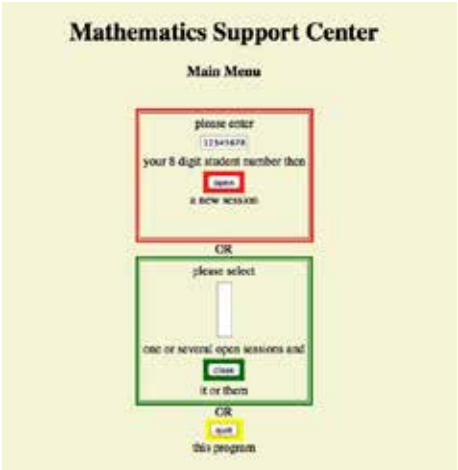

Figure 2.1
The 'old' student log-in

Figure 2.2 The 'old' student log-in

The first time a student visited the MSC, he or she had sixteen fields of information to complete, including items such as surname, first name, gender, programme code, module code, email address, and mathematical attainment prior to entering UCD. The student was also asked for his or her consent, or not, to use the data relating to the visit for research purposes.

This entire process involved the student navigating through three separate windows, two of which are illustrated in Figure 2. Experiments conducted in 2013/14 showed that students were taking anywhere from 75-180 seconds to log in to the system and they often required help from tutors to complete the process.

On subsequent visits to the centre a student had to input their student number and select the relevant module on logging in. If the student was seeking support relating to two modules, on receiving help for the first module, the student was then required to log out of the system, and log back in again in order to seek assistance with the second module. Apart from this being tedious, queues formed at the log-in machines when the MSC was busy and, ultimately valuable tutoring time was lost at the expense of trying to collect reliable data.

Issues of reliable data

As the electronic data collection process was based on the student self-reporting and selecting information there were many issues with the reliability of the data. For example, one lecturer noted that during one semester, only 50 of the 81 visits attributed to her module were in fact genuine. Reasons for these errors included students not knowing their module codes or titles. It became clear in a number of instances that some students were simply choosing the first module that appeared at the top of the drop-down list.

The student was also required to manually log out of the system when the session was over. Understandably, many would forget this step. Consequently, it would not be until some time later that a tutor or the manager would notice that the number of students logged in

exceeded the number present in the centre. This meant that the “length of visit” time for each student might not be reliable. This statistic is important for a number of reasons. It not only provides hard data to the university management on how long a student spends at the MSC on average, but also enables MSC management to verify anecdotal evidence that queries in some areas require a lot more tutor time than others.

Another problem was the issue of the student not logging in to the system at all. During both semesters of 2013/14 the MSC manager (the first author) conducted an experiment whereby on one day each week he would check the system to see how many students were logged in, and then count the students in the room. On average, over this 20-day experiment, the actual number of students present was underestimated by 22.5% in the system. While every effort was made to highlight the procedure of logging in (via pop-up signs, sandwich boards and posters), the number of recorded visits was very likely an underestimate of the true figure.

Since the academic year 2009/10 the average number of annual visits to the MSC has been 4,535 – a five-fold increase on average annual visits for the first six years of operation. With such a large volume of students, from a wide range of modules, programmes and levels, coming through our doors, it became a priority for us to redesign the DMS. The manager, in conjunction with the expertise and good will of Dr Raja Mukherji developed the new DMS over Christmas 2014. This was trialed during the second semester of 2014/15. We will now describe the system and explain how input from the manager, tutors and lecturers, has resulted in further improvement to it.

The new system

We now describe the DMS as we are about to start the academic year 2015/16. On visiting the centre, the student is required to input just two pieces of data - his or her student number, and whether he or she consents or not, to the anonymised data collected on the visit being used for research purposes (see Figure 3).

When the student number is entered, the student is given a three-letter code, which represents their place in the queue. These codes are displayed on a large projection screen in the MSC so tutors and students can see who is next in the queue. When the student’s turn arrives, the tutor asks the student which module they are seeking help with and starts the session (see Figure 3). This development has made a huge difference in solving the problem of students’ visits at the MSC going undocumented or recorded inaccurately.

This process also means that the time the student spends waiting to be seen by a tutor is not counted towards their ‘duration of visit’ statistic. However, the time spent queuing is captured to help inform management what the average waiting time is throughout the day and semester. A feature we are trialling this upcoming semester is to display the “time to see a tutor” statistic on the projection screen.

Figure 3.1: The new Data Management System

Figure 3.2 The new Data Management System

When the visit ends, the assisting tutor completes the session by clicking 'finish' on their console. The tutor then enters feedback into the DMS relating to the nature of the student's query and a short description of the support provided (see Figure 4). Over the last eighteen months, significant effort has gone into training the tutors on how to write these feedback entries. Much of this is due to Nuala Curley, who is conducting research into what constitutes a quality tutor entry, and she has worked closely with the MSC tutors to ensure the validity of these entries. A description of her work to date can be found in Curley and Meehan (2015a, 2015b).

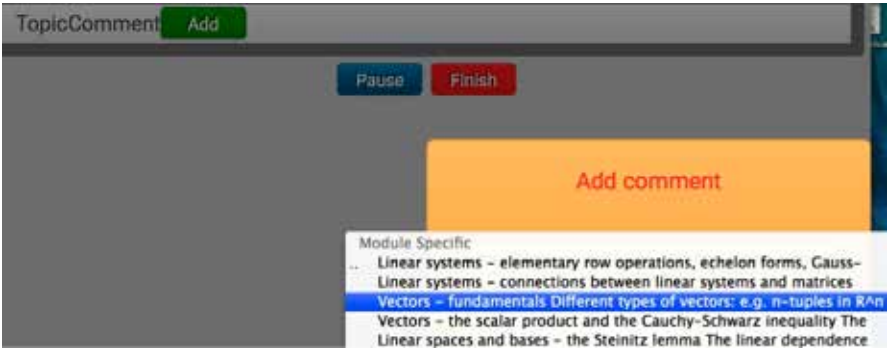

Figure 4: The tutor's screen

Essential in the development of the new DMS was gaining access to the university's central registry student database. This means that when the student inputs his or her student number into the DMS, the system then synchs with this central database, enabling us to see exactly which modules the student is registered to. Further data such as programme, year of study, gender, nationality, prior mathematical achievement, mature/traditional status et cetera can

then be accessed later via the central database if required for statistical analysis. The move away from students self-reporting their details is an important step in the recording of reliable data.

MSC tutors' and lecturers' feedback on the DMS

Throughout the piloting of the new DMS, the MSC tutors have provided invaluable feedback to the manager and developer on how to improve the system, particularly in relation to the queuing features of the system. In a focus group conducted with ten tutors in May 2015, we also received useful suggestions on how the inputting of the qualitative tutor entries might be improved. For example, some tutors suggested topics could be chosen from a drop-down list of most common problem areas.

Another research project being undertaken in the MSC aims to examine how useful the MSC feedback is to lecturers, and to ascertain if, and how, this feedback impacts on their practice. In semester one of 2014/15 thirteen lecturers of large first- or second-year mathematics and statistics classes agreed to take part in our study, with each participating in three one-to-one interviews in the fourth, eighth, and fifteenth week of the semester. The results of this study will be reported elsewhere. However in relation to the DMS we gained some important feedback.

A significant outcome of the first interview was that many lecturers were not accessing the MSC feedback for their modules because the process was too onerous – it required the web administrator to issue them with a password, which many admitted forgetting. Many stated that while checking the MSC feedback for their modules is important to them, it often slips their minds during busy teaching periods. To solve both of these issues, the DMS is now set up to send all lecturers an automated email each Friday, detailing the anonymised feedback entries for their module as recorded in the MSC that week (and preceding weeks).

Another initiative we plan to pilot this semester is to have a small number of lecturers input the learning outcomes for their modules into the DMS. These will then appear as drop-down menus when the MSC tutor inputs the student feedback for that lecturer's module (see Figure 5 below). The tutor will also have the opportunity to add a free-form response if desired.

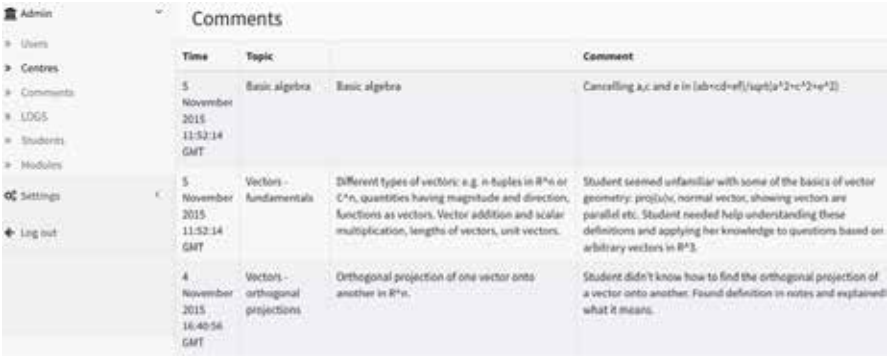

Figure 5: Lecturers' Learning Outcomes

Conclusions

In a busy centre such as ours, it is our hope that by having a reliable database which allows us to make evidenced-based decisions, we can provide a more efficient service, and most importantly, can take a more proactive, and less reactive, approach to mathematics support.

References

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