Maths Cafés: Are they everyone's cup of tea?

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Figure 1: An example of the promotional materials used – in this instance, a screen advert

Low Levels of Numeracy Skills - Poor Transition and Poor Progression

England has historically low levels of numeracy skills, with one in four adults 'functionally innumerate' (see, for example, Leitch 2006; Nuffield Foundation 2010; Rashid & Brooks 2010). The *Vorderman Report* (Vorderman *et al*. 2011) noted that only 50 per cent of teenagers in England and Wales pass (grade C or above) GCSE Mathematics and only 15 per cent go on to study A-Level Mathematics. In the context of higher education, this numeracy deficit influences student retention and progression rates. For example, the National Audit Office's (2007) report *Staying the Course: The retention of students in higher education* noted a low retention rate in STEM (Science, Technology, Engineering and Mathematics) subjects. However, the problem is not solely related to STEM subjects. It has been found that students in all disciplines which require some level of numeracy, however basic, struggle for a number of reasons:

- Firstly, GCSE Mathematics has been identified as 'failing' to develop life-long numeracy skills (Voderman *et al*. 2011);
- Secondly, the two-year plus 'gap' between school mathematics and entering university results in students being 'out of practice' when it comes to mathematics; and,
- Lastly - and partly as a result of the previous two reasons - 'maths anxiety' (Onwuegbuzie & Wilson 2003) can create a barrier to learning the numerical elements of subjects, as well as a longer-term intellectual resistance to working with numbers (Mulhearn & Wiley 2005).

The impact of weak numeracy skills on the higher education sector has been well documented (see, for example, British Academy 2012; Gibbs 2010; MacInnes 2010; Scott Jones & Goldring 2014; Voderman *et al*. 2011). For example, it has been found that students' successful transition and 'settling' into year one of university study can be disrupted by weak numeracy skills and/or 'maths anxiety'; ultimately influencing retention and progression. This is particularly the case with STEM subjects, as evidenced by lower progression rates amongst such disciplines across the sector. Clearly, there are both educational and financial consequences of poor numeracy skills, for students and universities.

Numeracy Support in Higher Education

There is a sector-wide disparity in how universities support students' literacy and numeracy. In response to the increasing awareness of dyslexia (and other forms of language-based learning difficulties) in the 1990s, the entire sector invested heavily in literacy and writing support. Support for literacy is clearly signposted, accessible and widely used in all universities. Addressing numeracy deficits, on the other hand, has been more piecemeal with at least a quarter of universities offering no numeracy support, and of those that do, the majority only target students on traditional STEM subjects (SIGMA 2012). Indeed, the typical higher education approach to supporting mathematics/numeracy (Lawson *et al*. 2012) is to base a 'maths support centre' - operated by academic staff or more typically postgraduate students - within the Mathematics departments of a university. The problem with this approach is that it tends to rely on students being proactive learners who seek out support - a model which does not work well if students a) do not realise they have a problem or b) their 'maths anxiety' prevents them from engaging with any available support. Additionally, Lawson (2012) found that support based in Mathematics departments often deterred students because students studying STEM subjects did not like to admit to having poor mathematics/numeracy skills, and students generally found Mathematics departments intimidating. For these reasons, some universities have now started placing mathematics support within 'non-intimidating' humanities or arts buildings (Lawson, 2012).

MMU's Numeracy Support Pilot Project

In the summer of 2014, MMU Directorate funded a Numeracy Support pilot project to provide numeracy support across the University. At the time, although individual departments (typically in the STEM disciplines) were providing some numeracy support through Learning Support Tutors (or similar), there was no formal institutional support for numeracy (in contrast to the successful literacy support offered by MMU's Writing project). The Numeracy Support pilot project aimed to address this disparity. The pilot project was 'housed' within the MMU Q-Step Centre in the Humanities, Languages and Social Science (HLSS) faculty, and Q-Step Centre staff provided the overall strategic leadership and support. The project consisted of three elements:

- A maths diagnostic tool;
- Data Buddies (undergraduate peer-assisted learners or PALs); and,
- Four Maths Cafés (staffed by the Data Buddies).

This article will look at just the Maths Cafés, and how they were viewed by the students who used them. However, before doing so, it is important to briefly outline the rationale for using undergraduate peer-assisted learners to staff the Cafés (as opposed to academic staff or postgraduates).

Data Buddies: A Peer-Assisted Learning Model

From the outset, the project chose to adopt a peer-assisted learning (PAL) model of support. Since the late 1990s, PAL has been increasingly implemented within the sector as a means of 'student-to-student support' (see Capstick *et al*. 2004; Topping, 1996). With a pedagogy centred on a shared dialogue between students, and when used to compliment (rather than replace) exisiting teaching, PAL has been found to increase both retention and progression (see Macintosh 2006; National Audit Office 2007). Capstick *et al*. (2004) found that the most effective PAL model saw undergraduate students from the year above working alongside new or less experienced students. Indeed, a range of research (see, for example, Capstick *et al*. 2004; Lawson *et al*. 2003; Topping 1996) has found that students are more likely to ask for help from someone closer to them in age with whom they can identify and therefore feel more at ease. The same research also highlights that - particularly in relation to technical or highly specialised material - academic staff can intimidate students. This, combined with the fact that students' maths anxiety can act as a barrier to seeking support (Lawson 2012) led to the decision to use undergraduates as PALs or 'Data Buddies'.

The decision to use undergraduates to deliver numeracy support is a departure from the model used by many other universities, who tend to rely on postgraduates and academic staff (Lawson *et al*. 2012). For the pilot project, the Data Buddies were all undergraduate students, predominantly third years, and from a range of disciplines. The Data Buddies were recruited through *Jobs4Students*; they then had to sit a maths test and achieve a minimum score in order for the project team to assess their functional numeracy skills. Once the students had passed the test, they then attended a half-day training session run by the MMU Q-Step Centre and CeLT. This training focused on: differing models of support; theories of coaching; data protection protocols; and confidentiality requirements. The training did not focus on curriculum content but rather the process of learning and supporting; it was stressed to the Data Buddies that they were not 'teachers' nor should staff (or students) treat them as such.

Overall, 36 Data Buddies were recruited to the project in 2014-15. The majority of the Buddies (n=16) were from Science and Engineering (specifically mathematics). The remainder were from Economics (n=7), Sociology (n=9) and Psychology (n=4). Although the original aim was to use students from within each faculty to deliver support solely within that specific faculty, this was not always possible due to the number of Data Buddies recruited from each faculty, and timetable clashes between classes and the Café opening times.

The Maths Cafés

The Numeracy Support pilot project officially launched in October 2014. The project team adopted a broad definition of numeracy to encompass statistical analysis, formal mathematics, and functional numeracy skills. The decision was also made to move away from the 'typical' numeracy support model of one central, static centre (such as Loughborough University's *Mathematics and Statistics Support Centre*). The rationale behind this was that given the nature of 'maths anxiety' among students it was felt that they would be less likely to actively seek out support. Additionally, support had to be in student-friendly spaces (Lawson 2012). Building on the 'pop-up' Maths Café trolley trialled by the University of Plymouth (see Lawson 2012), the MMU support project created four mobile, 'pop-up' Maths Cafés, each one sited beside a coffee shop/café in order to maximise accessibility for students.

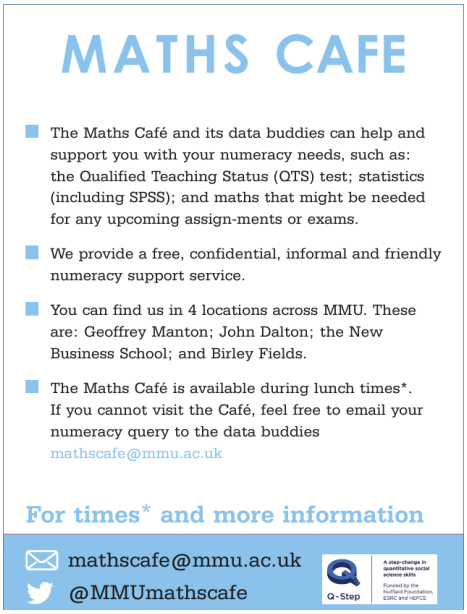

Figure 2: An example of the promotional materials used – in this instance, a flyer

Figure 3: One of the Maths Cafés in action

Four sites were selected for the Cafés:

- the John Dalton building (Faculty of Science and Engineering);
- the New Business School;
- the Geoffrey Manton building (Faculty of HLSS); and,
- the Brooks Building (Faculties of Education and HPSC).

These sites were chosen as they contain the highest numbers of students studying subjects with key numerical elements. Each Café ran for two hours over lunchtime, every day of the week except Wednesdays (the Café in the Brooks building ran on Wednesdays). The Cafés themselves consisted of:

- a trolley;
- a laptop, preloaded with subject-specific and generic numeracy information/guides/links;
- printed support materials;
- a 'zapper' to scan student ID cards to track usage; and,
- assorted flyers/leaflets on general numeracy issues.

The materials on each trolley and laptop were provided by academic staff, PSTs and SSOs within each of the different disciplines.

Two Data Buddies always staffed the Cafés. The Cafés operated a triage system whereby the Data Buddies attempted to resolve students' initial 'problems'; failing that, the Data Buddies then identified the next best form of support for the students and arranged for those students to get that support (for example, an appointment with a PST).

The Evaluation of the Maths Cafés

An evaluation of the Cafés began in May 2015 and ended in August 2015. The evaluation consisted of:

- an analysis of all the students who accessed the Cafés during terms 1 and 2 of 2014-15;
- an online survey of Maths Café users (n=34);
- a focus group with six of the Data Buddies; and,
- the tracking of Maths Café users' progression and assessment data.

How often were the Maths Cafés visited?

Data Buddies tracked users of the Maths Cafés by 'zapping' student ID cards, that then captured student information and stored it on a database. When it comes to assessing usage, though, it is important to remember that not all students wished to have their ID card scanned and during busy periods, Data Buddies struggled to record all data. Therefore, the Maths Café usage figure is certainly an under-estimate.

Between the 19th October 2014 and the 22nd March 2015, the four Maths Cafés were visited a total of 282 times, with the two busiest Cafés being those in the John Dalton building and the New Business School (*see Figure 4 below*). Interestingly, out of the 282 visits, nearly two fifths were 'repeat' visits from students who had already used one of the Cafés.

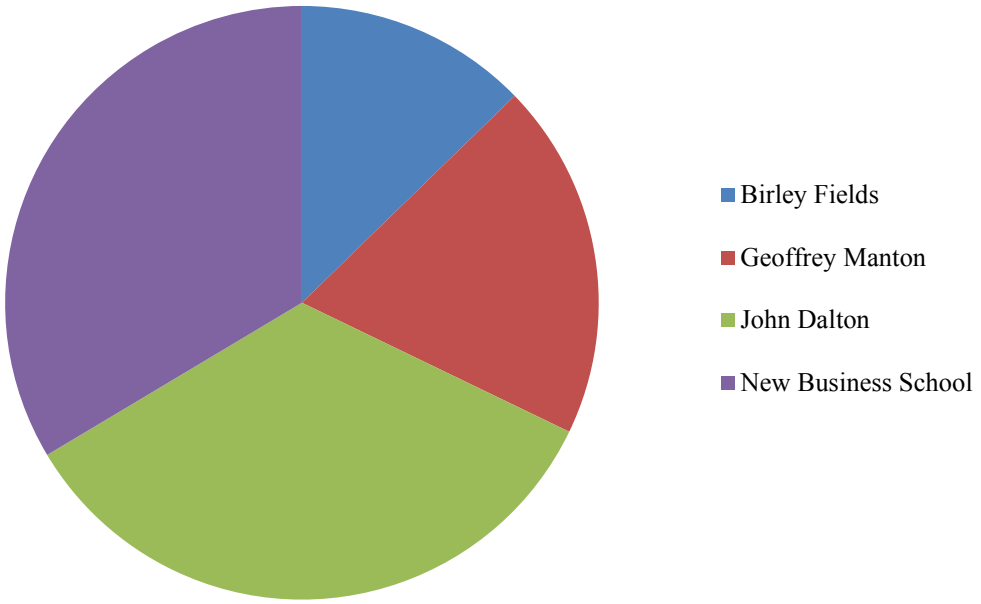

Figure 4: Number of visits to the Maths Cafés between October 2014 and March 2015

Home or Away?

Students were not restricted to visiting their 'home' Café (the Café in their own faculty). Interestingly, the majority of users of the John Dalton Café were 'home' students i.e. from Science and Engineering. However, half of the users of the Geoffrey Manton Café were students from other faculties, including for example, Art and Fashion students. In addition to this, and in line with research (Lawson 2012), a significant number of the users of the Geoffrey Manton Café were Economics and Mathematics students who appeared to have chosen not to visit the Café in their own faculty (*see Figure 5 overleaf*).

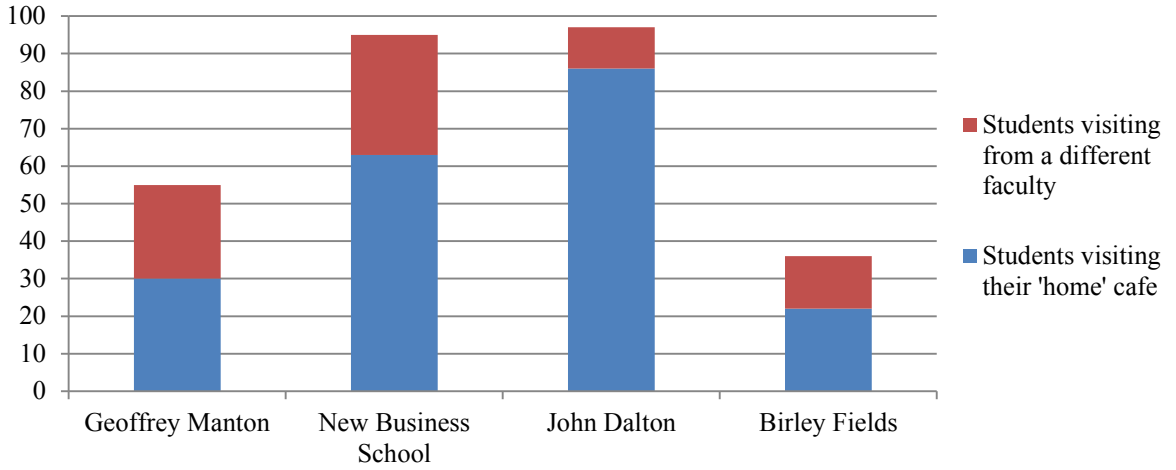

Figure 5: Number of visits by 'home' or 'away' students

Student Views of the Maths Café Service

The most common reasons for visiting the Café given by the students who responded to the online survey were 'for a general numeracy query' and/or 'help with a particular aspect of an assignment or forthcoming exam' (the majority response). The vast majority of the survey respondents found the Data Buddies to be either 'approachable' (32 per cent) or 'very approachable' (56 per cent); none of those surveyed found the Buddies to be 'unapproachable'. Nearly a third (31 per cent) were 'satisfied' and half (50 per cent) were 'very satisfied' with the help they received. Over four fifths (85 per cent) said that they would use the Maths Cafés again and nearly all (95 per cent) said that they would recommend the Cafés to a friend.

In terms of the times and locations of the Cafés, nearly three quarters (73 per cent) felt that the times of the Maths Cafés were convenient for students; importantly, though, 24 per cent were not aware of exactly when the Cafés were available, suggesting a need to improve publicity. Over four fifths (82 per cent) felt that the Café/s that they had visited was/were in the most appropriate location. Of those respondents who felt that the Cafés were not in the most suitable location, reasons such as - '*It would be better if it was in the library to. You can't expect every student to visit the Café*' - were given. This does raise the issue of whether or not students would actually prefer to have numeracy support offered in a fixed location (such as Loughborough's MSSC) in addition to the Maths Café trolleys.

Classroom or trolley?

Just over three fifths (61 per cent) would have preferred to visit the Maths Café in a classroom environment, as opposed to the existing pop-up Cafés[1]. Some of the reasons for this included:

- '*More confidential*'
- '*It's slightly more private*'
- '*It's more comfortable to sit down in a quiet place*'
- '*If it's a simple maths question you are asking then that can be addressed easily at the trolley. But for more challenging maths concepts I think a classroom, where you can sit down and go through the problem, would be required*'

[1] 'Semi-private' spaces for students to sit and spend longer with the Data Buddies are currently being trialled in the Geoffrey Manton building and the New Business School (where there are semi-private seating areas available).

Nonetheless, the remaining two-fifths (39 per cent) did prefer to visit the Maths Café trolleys. For example, responses included:

- '*It is most convenient if you're passing by*'
- '*Visible in a public area of campus. You don't need to track them down, and seeing them around reminds you of their service*'
- '*Convenient*'
- '*Easier to find and no pressure. Classroom feels too serious*'
- '*A more relaxed environment to ask general questions*'
- '*Accessible and not intimidating*'

Drop-in or appointment?

Although the majority of those surveyed appeared to like the drop-in nature of the Maths Cafés, just over a quarter (27 per cent) said that they would like to be able to book appointments[2]. Reasons included:

- '*More time to discuss things*'
- '*Sometimes, if there is another person there, I have to wait*'

Data Buddies or Staff?

Although just under two fifths (39 per cent) would have preferred the Cafés to be run by academic members of staff - the most common reason given being '*Staff would be more knowledgeable*' - the remaining 61 per cent preferred the Maths Cafés to be run by student Data Buddies, as opposed to members of staff. Some of the reasons for this included:

- '*More approachable*'
- '*Some questions feel silly to ask a lecturer*'
- '*It's nice to speak to someone your own age as you can relate more with them*'
- '*Fellow students … will probably be more understanding of the issues you're having and frustration at being unable to understand a mathematical concept on your own. This is in contrast to lecturers who often exhibit total bewilderment and disbelief when you are really struggling to grasp something*'

The Benefits of being a Data Buddy

As highlighted above, over three fifths of those surveyed preferred the Cafés to be run by the Data Buddies. However, being a Data Buddy had clear benefits for the Buddies themselves, not just the students they supported; and these benefits were not just short-term, but longer term as well. For example, the Buddies felt that being a Data Buddy enhanced their own learning, as well as providing them with specific employability skills:

- '*I want to go in to teaching, I thought it's a great time to actually see if I like it, and you get paid for it while you're doing it*' (Male Buddy 1)
- '*Something to put on my CV*' (Female Buddy 3)

[2] The possibility to offering bookable appointment during busy assessment periods is something that is currently being considered by the project team.

Additionally, many of the Data Buddies expressed a sense of personal satisfaction in supporting fellow students. For example: '*It's the satisfaction that you know you've helped someone and they're learning because you've helped them*' (Male Buddy 1).

Progression Data and Maths Café Users

In an attempt to 'concretise' the wider impact of the numeracy support offered by the four Cafés, progression data for all the students that had used the Cafés was analysed. While it is acknowledged that any relationship between Maths Café usage and student performance should be treated with caution - given the multitude of other factors that can influence student performance - some positive findings were evident. For example, the analysis found that:

- 100 per cent of the Level 4 students who used the Maths Cafés passed and progressed at the end of the academic year 2014-15; and,
- 91 per cent of all Level 5 and Level 6 students who used the Maths Cafés passed and progressed/graduated at the end of the academic year 2014-15. Indeed, 64 per cent of these students saw their marks increase from their previous year's results.

Conclusions

Overall, it was felt that the Maths Cafés had been a success. For example:

- The four Cafés received over 300 visits during the six months between October 2014 and March 2015, with around two fifths of these visits being repeat visits from those students who had already accessed the available support. This clearly demonstrates the need for numeracy support;
- The diversity of disciplines represented in the user data - for example, students studying Fashion and Art, and Film and Media, attended the Geoffrey Manton Café - suggests that numeracy support needs to be made available to all students, not simply those taking STEM subjects;
- The majority of Maths Café enquiries were resolved on-the-spot by the Data Buddies, implying that most students have difficulties with foundational or basic numerical concepts;
- Students rated the Data Buddies highly, thus demonstrating the utility of the PAL model - and in particular the use of undergraduates - for delivering numeracy support; and,
- There is a clear personal development and employability dividend in being a Data Buddy.

In addition to staffing the Maths Cafés, as part of the pilot project some of the Data Buddies were utilised by academic staff to provide in-class numeracy support. In these instances, the Buddies provided in-class support to students on a small range of units; these sessions were arranged in conjunction with academic staff and usually ran in the period running up to assessment deadlines. In these sessions, Data Buddies worked in the class offering help to students and guiding them with class activities. The Data Buddies proved very popular, with both staff and students. For example, as one Personal Support Tutor explained: '*In these classes it* [the Data Buddy] *makes a huge difference, because it just makes the class easier to run for me and it means that everyone gets to talk to someone, which I think is really nice*'. The students themselves tended to prefer support from the Data Buddies in class, as opposed to support from the academic member of staff. As a Student Experience Support Tutor highlighted: '*They can ask him* [the Data Buddy] *things that they can't ask me or the unit leader*'. Moreover, the Buddies themselves highlighted the utility of this approach:

- '*Sometimes the way the teachers teach they* [the students] *don't understand it, but then when I go and explain the way I've learnt it myself then yes, that's better* [for the students]' (Female Buddy 3)
- '*Don't forget we were doing it last year. ... We managed to get our heads around it and ... we sort of tell them* [the students] *how we did it last year*' (Male Buddy 3)

Bearing these comments in mind, it is clear that the use of undergraduate PALs to provide in-class numeracy support is something that needs to be developed further in the future.

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