What we can learn from attendance data at a mathematics support centre during and after campus closures due to COVID-19

Fionnán Howard[a], Eabhnat Ní Fhloinn[a]
[a]School of Mathematical Sciences, Dublin City University, Dublin, Ireland

ABSTRACT

In this paper, we consider the impact of campus closures on the Mathematics Learning Centre (MLC) in Dublin City University (DCU) in the wake of COVID-19 restrictions which required online teaching. Up to March 2020, the MLC operated as an in-person drop-in service in the university's main library. Any DCU student who needed additional mathematics support could "drop in" without making a booking in advance and get help from a tutor. There was no online provision on offer, although plans had been evolving to offer a skeleton online service in the evenings. From March 2020, and throughout the academic year 2020-21, the majority of university teaching in DCU took place completely online, as did the service offered by the MLC. By necessity, mathematics support took a different format to the previous in-person drop-in centre. Students could pre-book a 25-minute session online via Zoom with a tutor, and they could attend alone or as part of a small group as per their preference. There were no restrictions on how many sessions a student booked or how often they attended, although they were encouraged to book no more than one per day, to allow themselves time to work on the material covered in the session. Several papers have explored the practices implemented by Irish universities during the initial move to online learning in March 2020 (Hodds, 2020; Mac an Bhaird et al., 2021). Previous papers have reported on the in-person MLC attendance in DCU, and analysed trends in engagement and success rates of students who use the service (Jacob & Ní Fhloinn, 2019). However, no such analysis has been undertaken to date of engagement with the online support provision. Here, we will consider attendance patterns, with a particular focus on first year students compared to older year groups, to investigate any emerging trends. We will also discuss the knowledge gained by mathematics support providers following a full year of online provision and how this might impact future practice.

KEYWORDS

Mathematics support, attendance, COVID-19 restrictions, engagement, online learning

CONTACT Fionnán Howard fionnan.howard@dcu.ie

PLEASE CITE AS

Howard, F. & Ní Fhloinn, E (2022) What we can learn from attendance data at a mathematics support centre during and after campus closures due to COVID-19. In E. Costello, P. Girme, D. Hyland, T. Kaur, O. Kelly, T. McLoughlin, & P. Van Kampen (Eds) Proceedings of the CASTeL 9th STEM Education Research Conference (58-65) Dublin City University. https://doi.org/10.5281/zenodo.6902216

https://doi.org/10.5281/zenodo.6902216

Introduction

In DCU, the Mathematics Learning Centre (MLC) provides free, additional support with mathematics to DCU students studying any kind of mathematics (Jacob & Ní Fhloinn, 2019). The support acts in tandem with timetabled lectures and tutorials to allow students to address any mathematical difficulties they might have. The MLC generally operates as a drop-in service located in the main library on the Glasnevin campus. Students can avail of one-to-one help from a tutor or can attend in a small group. Students record their attendance upon arrival on a tablet, in order to track usage of the centre and help with planning staffing levels and so on. The room can hold up to 40 students at the same time and is generally staffed with two tutors, although this increases to three at busy times.

In March 2020, the COVID-19 pandemic resulted in an abrupt move to emergency remote teaching in higher education, and for the first time, the MLC provided support via an online medium. With only five weeks left in semester, the MLC offered students drop-in sessions via Zoom, but uptake was extremely low. Research by Gilbert et al. (2021) showed that teaching practitioners were uncertain as to how best to manage online support, especially in the early months of COVID-19 restrictions. For the academic year 2020/2021, there was more time to plan and collaborate across the mathematics support practitioner networks, learning from what had happened up until that point.

This paper reports on attendance data gathered from September 2020 until June 2021, during which time, teaching for the academic year 2020-21 was conducted online. The MLC operated online via Loop, the university's virtual learning environment (VLE), which is based on Moodle. This online system included some significantly different characteristics than the in-person support. Students now had to pre-book a time slot; each slot was limited to 25 minutes; and the number of slots was reduced compared to the in-person hours that had been available. The online sessions took place via Zoom, for which the university had a licence and so all staff and students had access via their institutional logins. Although a group option was provided when booking a slot, most students attended on their own. The tutor's camera was always turned on during the session, but students frequently preferred to remain off-camera and, on rare occasions, preferred to type rather than speak through the microphone.

In addition to the above, "support tutorials" were also available for some service-mathematics modules, as well as those taking mathematics degree programmes, and were conducted by the tutor for the module. These consisted of one hour per week where the tutor was available to answer any questions from students via Zoom, but without any prescribed material to be covered. Attendance at these sessions varied hugely depending on the module, with some regularly attended by most of the class, and others seeing just a handful of students. In addition, many students attended these sessions without any questions to ask, but simply to see if other students asked questions that might be important for them to understand. Tutors offered students the option of emailing questions in advance or using the private chat option in Zoom to send questions directly to the tutor so that students could pose questions anonymously, and this proved a far more popular approach than asking questions via a microphone.

Given the difficulty of gauging engagement from students who attended online support tutorials, we chose instead to focus on those who booked online support sessions and aim to address the research question "What were the levels of engagement with bookable online mathematics support sessions during the academic year 2020/2021?". It is of particular interest to establish any discernible patterns in this engagement in order to optimise the online support offering in the future.

https://doi.org/10.5281/zenodo.6902216

Literature review

Several publications have focussed on the initial change to online learning in Ireland in March 2020 and the months that followed (Mac and Bhaird et al., 2021; Ní Fhloinn & Fitzmaurice, 2021a; Ní Fhloinn & Fitzmaurice, 2021b). To date, the number of publications focused on mathematics in higher-level institutions during the pandemic is still relatively small (Ní Fhloinn & Fitzmaurice, 2021a, p. 2), although this number is ever-increasing, as might be expected, with some of the leading journals devoting special issues to the topic. Some of these publications have dealt with the student perspective (Hyland & O'Shea, 2021); others with the practitioners' experience (Ní Fhloinn & Fitzmaurice, 2021b).

Anecdotal evidence from the mathematics support community via the Teaching and Learning Mathematics Online (TALMO) events (www.talmo.uk) held early in the pandemic reported that engagement with mathematics support during the early months of the pandemic was greatly reduced across universities throughout Ireland and the UK. Hodds (2020) subsequently undertook a survey of mathematics support practitioners to investigate the changes to practices in mathematics support at this time. He found that 74% of UK institutions, 82% of Irish institutions and 63% of those elsewhere in the world reported lower numbers than in usual times, and in many cases, there were dramatically lower, with some institutions seeing the same number of students between March and May 2020 as they would normally see in a week, or even a day. This was certainly true of DCU; in the four days leading up to the campus closure (9th- 12th March 2020), there were 256 visits to the MLC, but between 19th March and 5th May 2020, there were only 98 online visits in total. The mathematics support centre in UCD reported a 79% drop in usage compared to the same period in the previous year (Mullen et al., 2021, p. 6).

Several studies have looked at the effectiveness of their approach to online support during the academic year 2020/2021, as this paper also does. Mac an Bhaird et al. (2021) explored the student perspective of the combination of online study groups and drop-in online mathematics support, as undertaken in Maynooth University. Students opted in to being placed in a study group of 4-5 students, with one tutor responsible for up to 3 groups per hour-long session. Students were generally positive about the experience, although they did note the difficulties that arose when others in their group did not engage or attend sessions. However, they appreciated the help from tutors and the structure provided by the study group environment, even if it was online.

O'Sullivan et al. (2021) considered the situation in Cork Institute of Technology (CIT). They investigated student engagement with their online asynchronous mathematics support page hosted on the university's virtual learning environment. First and second year non-mathematics specialty students, who were studying a mathematics module or statistics module provided by CIT mathematics department, were enrolled automatically. The analysis revealed that 73% of students had engaged with the service between January 2019 and May 2020. However, many students disengaged with the service. Overall, 83% of students spent thirty minutes or less engaging with the online system. They inferred that support systems should include as much relevant support as possible and clearly signpost it so that students can easily, and quickly, locate the resources they need.

Mullen et al. (2021) compared the experience of mathematics support of students and tutors in Ireland and Australia during this time period. They found that both groups spoke of the difficulties of learning and communicating with mathematics online as opposed to other subjects. Lower usage of mathematics support services emerged as an issue in Mullen et al. (2021) also.

https://doi.org/10.5281/zenodo.6902216

Methods

The attendance data were collected via Loop, the university's virtual learning environment (VLE), which is based on Moodle. The online maths support was offered through this platform using its appointment scheduling feature. This allows the user to schedule bookable appointment slots which are attached to a particular tutor.

The attendance data for 2020-21 were exported to include each student's date and time of attendance. The schedule for the semester was also included to determine the total number of sessions that were available and thus, how many slots were not booked. There was no need to validate student names, emails or numbers because these are extracted from their profile on Loop. The data were analysed using Google sheets (the equivalent of Microsoft Excel) with extensive use of pivot tables and charts.

Results

Although there was more time to plan for September 2020, compared to the initial move online in March 2020, it had initially been hoped that it would be possible to provide a skeleton in-person service as well as an online presence; in the end, the university decided that teaching would be online only, which removed the first possibility. As a result, there was uncertainty in determining how many hours of maths support should be provided online, and when they should be available. The analysis showed that, even in the busiest weeks, there were empty slots available to book.

There were four slots available before 2pm every weekday and a further four slots in the evening from Monday to Thursday during the semester. Mathematics support online was also provided for three exam periods: Semester 1 exams in January, Semester 2 exams in May and supplementary exams in August. For the week before examinations in January, 60 booking slots were provided over the course of one week. For Semester 2 exams, there were 40 slots per week available for four weeks, and for supplementary exams, there were 28 slots per week available for four weeks.

Overall, most slots were booked with 66% (242/368) booked in Semester 1, falling to 54% (229/424) in Semester 2. Over the academic year, 61% (736/1208) of the available slots were booked. This suggests that a sufficient level of support was provided, given the times of day selected for the slots, and the fact that students were encouraged to email the MLC if they needed a slot and a suitable one was not available to them.

Of the 736 total bookings, 471 were during term time: 242 in Semester 1 and 229 in Semester 2. The remaining bookings took place during one of the exam study periods. As noted in the introduction, group bookings were uncommon, accounting for only 3% (22/736) over the year. The majority of group bookings were made by first-year students (12/22), with half of all group bookings made by Actuarial Maths students from any year. Group bookings became less popular as the year progressed, with only six taking place after February 2021 in Semester 2.

The analysis showed that the majority of bookings over the year for online maths support were made by first-year students (summarised in Table 1). These attendees had never experienced the in-person mathematics support offered prior to March 2020.

https://doi.org/10.5281/zenodo.6902216

Table 1. *Number of slots booked by year for the academic year 2020-21*

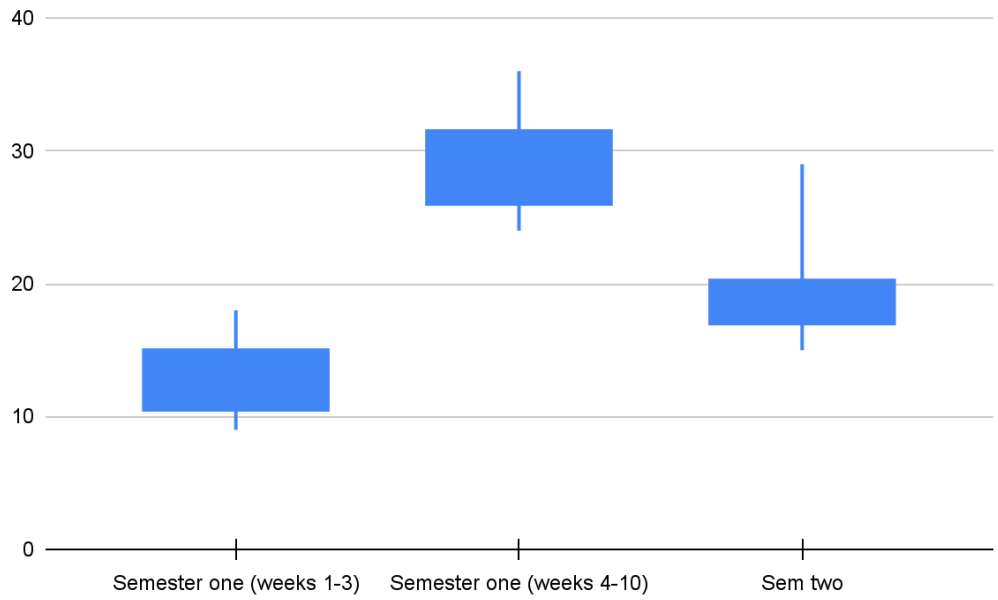
Year	1	2	3	4	Other	Total
Number of bookings	456	150	77	41	12	736
%	62.0%	20.4%	10.5%	5.6%	1.6%	

Three programmes made up 40% of the first-year bookings: Actuarial Mathematics (69), Accounting and Finance (50), and Common Entry into Actuarial and Financial Mathematics (66). The first and last of these programmes exclusively contain mathematics modules, while the middle one has a strong mathematics component throughout.

Trends over the semester

The first semester began with three weeks of lower numbers of bookings (9, 12 and 18), whereafter a median of 28 bookings per week persisted in weeks 4-10 with little variation (see Figure 1). Semester 2 saw a median of 18 bookings per week with a low variation (see Figure 1).

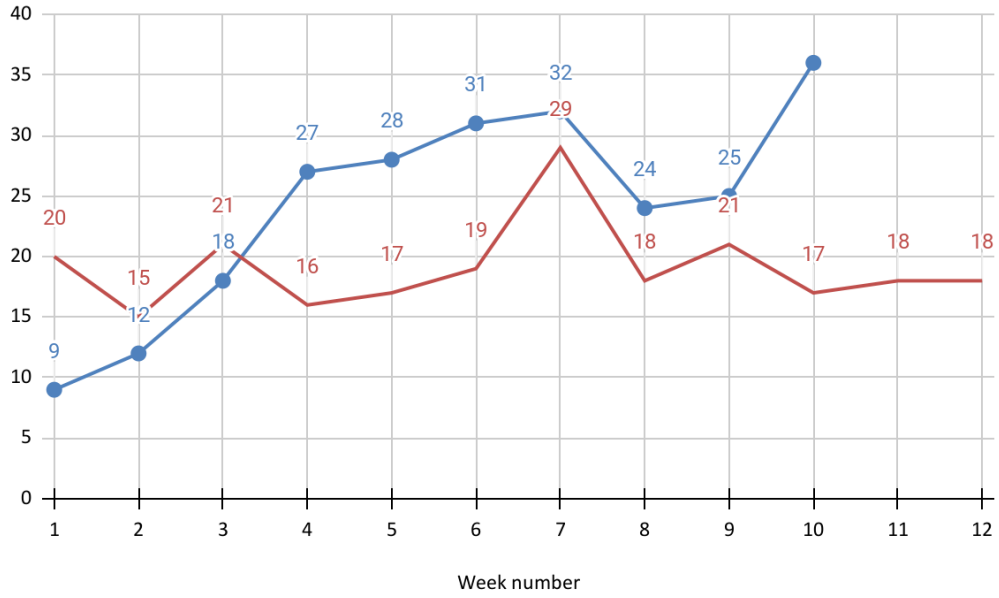
Figure 1. *Box plots of the range and interquartile range of the number of bookings made per week in semester 1 and semester 2*



While the number of bookings remained quite consistent for each of the periods shown in Figure 3, small spikes around continuous assessments were noted, driven by the groups who attended the MLC most (namely Actuarial Mathematics, Common Entry into Actuarial and Financial Mathematics, and Physical Education with Mathematics). The overall trends for both semesters are shown in Figure 2.

https://doi.org/10.5281/zenodo.6902216

Figure 2. *Line chart of the number of bookings for each week of semester 1 (in blue) and semester 2 (in red)*



A peak in week 7 of both semesters and in the final week of semester 1 were observed. Note that in semester 2, MLC support continued for four weeks after the end of the semester in preparation for exams. It was expected that there would be increased demand for online support in the lead-up to examinations. In fact, this depended very much on the amount of time available for study and support. Because the examinations took place after Christmas in Semester 1, there was only a single week of pre-exam revision time. In this one week before the January exams, there were 54 bookings, almost twice the median number for semester 1 bookings. However, there was considerably more time for study before the semester 2 exams, and in the four study weeks before and during the summer exams, the average number of bookings was only 20.75 per week. Finally, for the six weeks before August supplementary exams, the average number of bookings was 21.5 per week. It should however be noted that a large number of students take a mathematics module in Semester 1 that do not take one in Semester 2 (up to 600 first-year students in Business programmes, for example), and this is also likely to have skewed the booking pattern here.

How many students availed of mathematics support?

Overall, for the academic year 2020-21, 240 distinct students availed of our online support sessions, most of whom were first year students (62% = 148/240). Of course, many students returned several times throughout the year. Overall, 53% (127/240) of attendees (including the same percentage of first years) returned for at least one more session. This figure is close to the average of the in-person figures from previous years in the university (Jacob & Ní Fhloinn, 2019, Figure 8). A similar trend was observed for student numbers as that for the number of bookings. In semester 1, weeks 5, 6, 7 and 10 saw the highest number of attendees in one week (25, 26, 25, 25). In semester 2, every week had between 12 and 17 attendees, with a high of 17 in week 7 noted alongside three other weeks which had the same number of attendees.

https://doi.org/10.5281/zenodo.6902216

Discussion and Conclusions

This paper reports on the engagement levels with online mathematics support in the academic year 2020-21 in DCU, where teaching took place entirely online. Overall, there were 736 bookings for online support made by 240 students. By contrast, for the academic year 2018-2019, there were 4813 visits to the in-person drop-in service by 964 students. This shows the substantial drop in engagement with mathematics support when the offering was online only, in common with what was reported in Hodds (2020) across a wide range of universities. It should be noted that in reality, the situation may not have been as stark as it appears there, as some students may have opted to engage with the support tutorials that were offered instead of booking their own support session. However, these are not really comparable to the in-person drop-in service, and also it is difficult to gauge engagement in such tutorials, as mentioned earlier, so attendance at these has not been included in the above analysis.

Despite the greatly reduced numbers attending online mathematics support, it would seem that this was not due to insufficient provision, given that 39% of the available slots remained unbooked over the course of the year. In addition, students were encouraged to email and request a slot at a different time if needed (and indeed, a small number did so and were accommodated).

Overall, the pattern of attendance mimicked that observed in the in-person drop-in centre usually, where the overall attendance numbers dropped between first and second semester (due to the smaller numbers of students with a mathematics module in semester 2). Similarly, attendance peaks are generally experienced whenever there are assignments due, and this was also observed in the online provision.

Anecdotal reports from the tutors involved in the provision of online support was that those students who used the service seem to both value it and benefit from it, and this would seem to be borne out by the percentage of students who used the service repeatedly. Interestingly, the more experienced tutors who had spent several years working in the in-person service prior to teaching online were taken aback at how well-prepared many students were for their online session: students seem to have invested time and effort into planning what questions they had and what material they wanted to cover in a way that was far less common in the in-person service. This was particularly the case in the exam revision weeks. Although students generally focus on practicing exam questions towards the end of each semester, many attendees to the online service had attempted such questions and identified specific parts of the solutions that they were unsure about. Perhaps the 25-minute time limit motivated them to make the most of their time with the tutor, in contrast to the in-person service where there are no such time restrictions. We intend to encourage students to use online support in this manner in future.

For the reasons above, we expect the demand for online mathematics support to continue alongside that for traditional in-person support. The strongest benefits of maintaining online support include its accessibility for distance learners and that students can remain anonymous rather than attend a location with other students present (Gilbert, Hodds & Lawson, 2021, p. 303). Additionally, it has been reported by some practitioners that “less confident students seemed more likely to engage with online support than they were with physical support” (Gilbert, Hodds & Lawson, 2021, p. 298). Given the continued rate of COVID-19 infections, it is also of use to students to be able to access support remotely if they are contagious but not overly unwell.

The data under discussion helped us decide how to balance these priorities in heading into the academic year 2021-22. In-person learning returned and DCU opted to retain some online support in tandem. The data from this year is currently being investigated with a view to seeing

how first-year students responded to the joint offering of in-person and online support, and how second-year students (who spent their first year learning remotely) would choose to avail of support when they were back on campus. It is hoped that this information will give further insights into the future of online mathematics support provision in higher education.

References

Mac an Bhaird, C. et al. (2021) 'Student experiences of online study groups and drop-in mathematics support during COVID-19', Teaching Mathematics and its Applications: An International Journal of the IMA, (May 2020), pp. 1–18. https://doi.org/10.1093/teamat/hrab010/6352199.

Gilbert, H., Hodds, M. and Lawson, D. (2021) '"Everyone seems to be agreeing at the minute that face-to-face is the way forward": Practitioners' perspectives on post-pandemic mathematics and statistics support', Teaching Mathematics and its Applications: An International Journal of the IMA, 40(4), pp. 296–316. https://doi.org/10.1093/teamat/hrab019.

Hodds, M. (2020) A report into the changes in Mathematics and Statistics support practices due to COVID-19. The Sigma Network for Excellence in Mathematics and Statistics Support. Loughborough: Loughborough University.

Hyland, D. and O'Shea, A. (2021) 'The student perspective on teaching and assessment during initial COVID-19 related closures at Irish universities: Implications for the future', Teaching Mathematics and its Applications: An International Journal of the IMA, 40(4), pp. 455–477. https://doi.org/10.1093/teamat/hrab017.

Jacob, M. and Ní Fhloinn, E. (2019) 'A quantitative, longitudinal analysis of the impact of mathematics support in an Irish university', Teaching Mathematics and its Applications: An International Journal of the IMA, 38(4), pp. 216–229. https://doi.org/10.1093/teamat/hry012.

Mullen, C. et al. (2021) 'Mathematics is different: student and tutor perspectives from Ireland and Australia on online support during COVID-19', Teaching Mathematics and its Applications: An International Journal of the IMA, pp. 1–24. https://doi.org/10.1093/teamat/hrab014.

Ní Fhloinn, E. and Fitzmaurice, O. (2021a) 'Challenges and opportunities: Experiences of mathematics lecturers engaged in emergency remote teaching during the COVID-19 pandemic', Mathematics, 9(18). https://doi.org/10.3390/math9182303.

Ní Fhloinn, E. and Fitzmaurice, O. (2021b) 'How and why? Technology and practices used by university mathematics lecturers for emergency remote teaching during the COVID-19 pandemic', Teaching Mathematics and its Applications, 40(4), pp. 392–416. https://doi.org/10.1093/teamat/hrab018.

O'Sullivan, L., Casey, D. and Crowley, J. (2021) 'Asynchronous online mathematics learning support: An exploration of interaction data to inform future provision', Teaching Mathematics and its Applications: An International Journal of the IMA, 40(4), pp. 317–331. https://doi.org/10.1093/teamat/hrab016.