Student experiences of online study groups and drop-in mathematics support during COVID-19

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In this paper, we consider the changes to mathematics learning support (MLS) at Maynooth University due to the COVID-19 pandemic, including the provision of novel online study groups aimed at increasing student engagement and interaction. We briefly outline the local, national and international impact of COVID-19 on MLS and then focus on the results of a student survey. Respondents who regularly used online MLS were broadly positive about their experiences. They cited, in particular, the influence of tutors and the scheduled study groups, which provided structure and motivation as well as the opportunity to work with others and ask questions in less intimidating small groups. However, some respondents highlighted factors that impacted negatively on their engagement. These included low attendance or interaction from peers, timetabling issues or busy schedules, lack of awareness of the details of the services and increased feelings of discomfort and anxiety in an online environment. We consider how this student feedback may influence our future online and in-person supports.

1. Introduction

Mathematics learning supports (MLS) are normally available to students in higher education (HE) through a mathematics support centre (MSC). Lawson *et al.* (2003) state that '*The term ''Mathematics Support Centre'' should be interpreted to mean a facility offered to students (not necessarily of mathematics) which is in addition to their regular programme of teaching through lectures, tutorials, seminars, problem classes, personal tutorials, etc.*' (Lawson *et al.*, 2003, p. 9). While in-person MLS was prevalent in HE in Ireland (Cronin *et al.*, 2016) and the UK (Ahmed *et al.*, 2018; Grove *et al.*, 2020), and commonplace in many other countries: Australia (MacGillivray, 2009), Germany (Schürmann *et al.*, 2020) and in the US (Mills *et al.*, 2020), prior to COVID-19, the use of online MLS was much less evident (Mac an Bhaird *et al.*, 2020).

The rapid move to online MLS in March–May 2020 led to a broad range of responses within the wider MLS and mathematical lecturing community (Hodds, 2020; Johns & Mills, 2021). At Maynooth University (MU), we initially responded to emails and monitored Moodle module fora and then added

online drop-in support via Microsoft Teams (Teams). However, similar to other HE institutions (HEIs) in Ireland and the UK, student engagement figures were low (Hodds, 2020). During summer 2020, when it became clear that we would have to continue with online MLS in 2020–2021, we decided to complement our online drop-in with the option of study groups. These had proved to be an effective way to improve student engagement in a separate in-person project at MU, and we hoped that they might also recreate some of the social and interactive aspects of in-person MLS in an online environment. While semester 1 had an increase in the average student engagement figures when compared with March–May, online synchronous support was a new departure for us. Towards the end of semester 1, as far as the authors could determine, no other published study had focused on students' views of online MLS. Thus, as our MLS provision and that of many other MSCs are contingent on research-based practice (Lawson *et al.*, 2019), we decided to evaluate our online support through a student survey. We sought to answer the following research question: what was student opinion of our online MLS provision?

In the rest of this paper, we describe the MLS available at MU prior to COVID-19, from March to May 2020 and during semester 1 of 2020–2021. We provide a brief literature review of online MLS and outline the methodology. We then present the results of the student survey and an analysis of open-response questions. We discuss the survey outcomes, how they tie in with existing literature and disseminated reports during COVID-19 and how they answer our research question. We close by considering the implications for our services at MU and for the wider MLS community.

2. Background

2.1 Pre-COVID-19

Prior to the onset of the pandemic, all Department of Mathematics and Statistics (Department) undergraduates received similar instruction, assessment and support. Lectures were in-person and not commonly supplemented by additional digital resources. Weekly assignments, which contributed to continuous assessment, were posted on Moodle. Students submitted paper copies and there was a subsequent, compulsory, small-group tutorial.

The MSC was based in the university library with seating for around 120 people. The main provision was a drop-in service where students attended individually or as part of a group. As reported elsewhere, for example in Solomon *et al.* (2010), student feedback identified the non-judgmental and social atmosphere as a key factor in a positive MSC experience, and they often used the room to study with peers. The majority of queries related to assignments, and while tutors would not provide solutions, they would go through examples from the lecture notes or available practice questions. From the start of semester 2 2019–2020 until 12 March, we provided drop-in for 24 h per week, which equated to 127 tutor hours in a full week.

Weekly workshops were also provided for first-years and study groups for computer science (CS) students. Study groups were established in semester 1 2019–2020, as part of a HE authority funded project, to increase first- and second-year CS student retention and engagement with mathematics. Sandoval-Lucero *et al.* (2012) identified that participation in study groups appeared to improve student engagement, which is a recurring issue for CS students, in addition to social isolation, networking and the relevance of mathematics (Biggers *et al.*, 2008). Study groups continued into semester 2, when there were seven groups of 4–5 students who met once each week in the MSC, where a tutor would check on their progress. At the start of the semester, each group received guidance on the effective operation of a functioning group.

2.2   March to May 2020

Due to Government COVID-19 guidelines, MU closed to in-person teaching from 13 March. We used the following week, an inter-semester break, to prepare for the transition to an exclusively online environment. Prior to this, the MSC had never provided online drop-in support, though it maintains an extensive suite of resources on its website (https://msc.maths.nuim.ie/). Cognisant of the varying circumstances of staff and MU students, including childcare responsibilities and technological issues such as poor broadband or unsuitable equipment, the Department and MSC decided to amalgamate existing MSC drop-in and tutorial hours to provide online support through monitoring module Moodle fora. Moodle was already familiar to staff and students; it supports the upload of pictures and videos and is also compatible with Latex. Department assignments transitioned to Moodle quizzes, which were automatically graded, and pdf uploads corrected by tutors.

Engagement with supports was extremely poor, with 29 questions asked over the first two weeks, so we added online drop-in support on Teams for the remaining four weeks of term (beginning Monday, 6 April). Teams was available to staff and students prior to COVID-19 but rarely used. Engagement figures increased, although numbers were still low in comparison to those pre-COVID-19. A direct comparison is difficult, but the following data are presented to give a sense of the difference in MLS engagement figures. In semester 2 of 2018–2019, the average attendance at drop-in for a full MSC week (120 tutor hours) was 826 student visits per week. If we compare this to, for example, the week beginning Monday, 27 April 2020 (88 tutor hours), there were three Moodle queries and 59 student drop ins.

2.3   June to October 2020

When MSC services finished for the academic year, we reflected on our experiences of online MLS. We engaged with various conferences and workshops, including those organized by sigma (http://www. sigma-network.ac.uk/sigma-online-support-workshop-29th-may-2020/), the Irish Mathematics Learning Support Network (http://www.imlsn.ie/index.php/past-events/past-workshops/imlsn-workshop-12) and Teaching And Learning Mathematics Online (http://talmo.uk/daysei.html). Sharing experiences with other MLS practitioners, it was evident that student engagement was poor nationally and internationally.

When it became clear that MSC in-person supports would not be permitted for the start of the 2020–2021 academic year, we began preparations to deliver MLS exclusively online. Informed by the experiences from March to May 2020, as well as the insights gained from attending the international events, we decided to supplement our drop-in by introducing online study groups in an effort to replicate the social atmosphere of the MSC and increase student engagement and interaction. Our supports were advertised to all students who could avail of MLS, approximately 1,550 students taking service mathematics.

Sign-up for study groups took place via Moodle and 788 individuals registered for a weekly slot, to run for eight weeks. Students were given a number of hour-long slot choices and could select one. Students were randomly assigned to groups based on their year, course and time selection. Those who wanted to establish a study group with specific peers were allowed to do so. A Q&A session was organized the week before study groups began to explain how the study groups would work. This was also recorded and made available for students. Information on how the groups would work was also placed on the MSC Moodle page and website and reiterated by the tutor during the first meeting of each group. There were 162 groups, with typically 4–5 students per group. One tutor had responsibility for a maximum of three groups in one session, allocating their time equally to each group as much as possible. Each group was assigned a private Teams channel where they could meet and discuss any mathematical problems

they were experiencing. Students would initiate these meetings, and tutors would circulate between the groups to facilitate discussion and assist when necessary.

In addition to study groups, 32 year-specific and general drop-in hours were available. Workshops, in the form of asynchronously recorded videos, were available to first- and second-years. Equipment and appropriate tutor training were provided prior to the start of term. Over the course of semester 1, student engagement figures increased when compared to March–May, with 480 student visits to drop-in and 1,688 to study groups. However, of the 788 students who signed up for study groups, only 220 attended at least half their study group sessions and 319 attended none.

3. Literature review

Prior to COVID-19, there is evidence of the use of online drop-in MLS. One of the earliest examples reported on in Ireland or the UK is found in Breen *et al.* (2016), who describe the trial of an online drop-in using Adobe Connect across three HEIs in Dublin. Their reported aim was '...*to replicate the in-person experience as much as possible in a virtual environment*' (Breen *et al.*, 2016, p. 12). They found that students who engaged were largely positive about their experience but '...*technical issues that arose during the trials, such as feedback and slow connection issues, would need to be addressed in order for this service to be implemented successfully.*' (Breen *et al.*, 2016, p. 13). The service was not continued beyond the trial phase.

A 2018 survey of the online presence of MSCs received responses from 33 institutions across Ireland and the UK (Mac an Bhaird *et al.*, 2020). Twenty-three of these indicated that they provided online virtual (non-physical) MLS, with the majority (19) using a '...*virtual classroom such as Blackboard Collaborate, Adobe Connect,* slack.com *etc.*' (Mac an Bhaird *et al.*, 2020, p. 8). Where respondents added extra detail, they identified that these virtual supports were used in situations where students could not attend in-person drop-in. Additionally, while the flexibility that these supports offered to students and staff were highlighted, engagement was low, technological issues were seen as a barrier and in-person drop-in was favoured by tutors and MSC co-ordinators. Breen *et al.* (2016) had also found, in a survey conducted prior to their trial, that staff and students both indicated a preference for in-person over virtual support.

Based on a survey of 412 faculty members, Littlejohn examined the efficacy of online teaching as implemented at University College London during the pandemic. She remarked that the move to online teaching resulted in '*diminishing other forms of engagement and interaction, particularly those outside formal curriculum such as informal conversations and interactions.*' (Littlejohn, 2020, p. 57). She went on to suggest that interaction is possibly the most important online activity and highlighted the difficulties of reading non-verbal feedback from students in an online environment. In another study of staff opinion, Watermeyer *et al.* (2021) surveyed 1,148 academics from a variety of disciplines across UK institutions. They found that 50.5% of those surveyed reported not feeling prepared for the move to online teaching, with '...*academics bruised by their experience of emergency online transition...*' (Watermeyer *et al.*, 2021, p. 637). They went on to comment that students would inevitably suffer from the effects of remote learning and become disengaged from their studies and learning communities.

In Ireland, 601 students with disabilities, in further and HE, responded to a survey which focused on their experience of learning from home during the pandemic (AHEAD, 2020). Fifty-two percent disagreed or strongly disagreed with the statement *'I am coping well with learning from home'*, while 25% agreed or strongly agreed. The report found that 64% of respondents referred to a lack of structure to their day and lack of motivation to learn, 52% to distractions or other demands at home, 25% to a lack of clear communication from the college/centre of how they should engage in learning, 24% to the

reliability of their internet access and '*19% of respondents said that they do not have a private space in their home where they can engage with learning with minimal distraction and a further 33% said they only sometimes do . . .* ' (AHEAD, 2020, p. 23). One of several recommendations that the report made was to '*Explore ways in which to replace the informal face to face peer to peer support which learners typically receive on campus with an alternative online (e.g. buddy systems, online student chat rooms/meetings . . .).* ' (AHEAD, 2020, p. 41).

Two reports considered practitioners' experience of the transition to online MLS. Hodds (2020) provided a comprehensive report on a survey completed by 114 practitioners in 71 different institutions around the world. He reported that 94% of UK and 100% of Irish institutions continued to provide MLS online during the pandemic, despite having provided little or no online support before. Indeed, only 23 UK institutions referred to providing or planning to provide online support prior to COVID-19. The report also found that 74% of UK institutions, 82% of Irish institutions and 63% of other international institutions reported substantially lower numbers accessing supports during COVID-19 when compared to pre-COVID-19. Practitioners attributed this to several factors impacting students including busier home lives, technological issues, lower motivation and MLS advertising. The diminished *'sense of community'* (Hodds, 2020, p. 13) in online MLS was reported as a negative among MLS staff in these institutions. They reported that this was exacerbated by the anonymity of students attending without their microphones or cameras turned on, leading to difficulties gauging understanding through body language or facial expressions. In the UK however, where most of the online support was one-to-one, this nature of online support was acknowledged as a positive factor in engaging students who the respondents described as too shy or anxious to have attended their usual in-person provision. Overall, 12 UK institutions reported same/increased engagement when compared to pre-COVID-19.

Johns & Mills (2021) reported on the measures taken by 28 MSC Leaders in the USA when moving their MLS online in March 2020. Prior to COVID-19, all 28 offered in-person drop-in, 12 offered appointment-based support, three offered some form of online support and none offered asynchronous support. All 28 centres offered support online when the pandemic affected their in-person supports, 19 continued to provide drop-in online and 12 centres offered appointment-based support online though not all the same as those who offered this support prior to the pandemic. Seven centres began offering asynchronous online support, typically through fora and email. The favoured method for offering drop-in and appointment support was to use live video call with a shared whiteboard.

Only three institutions reported that they maintained their pre-COVID-19 levels of engagement, the remaining 25 cited low engagement as one of their main challenges. Possible reasons given for low attendance included students unable to access online support, finding help elsewhere online, being able to re-watch recorded lectures, being stressed and putting in less effort since exam format changed possibly making it easier to pass. Johns & Mills (2021) recommended offering both synchronous and asynchronous online support to cater to students with different levels of access to technology and those with time constraints preventing them from accessing live support. They also recommended training tutors how to operate the new technology and software used for online support and how to communicate effectively and use their pedagogical skills in the new online environment.

4. Methodology

In November 2020, we developed an anonymous survey hosted on www.onlinesurveys.ac.uk. It contained three main sections:

1. GDPR, consent and background questions.

2. Questions for those who did avail of MSC services (study groups, drop-in, workshops).
3. Questions for those who did not avail of any MSC services.

Questions were a mix of yes/no, Likert and open response. The survey was tested by colleagues not involved in the research and based on their feedback, some adjustments were made to the questions and layout. Ethical approval was granted in December 2020 and a link, along with a brief description of the purpose of the survey, was emailed to students. In total, 114 students completed the survey, comprising of two pre-degree students, 53 first-years, 32 second-years, 14 third-years and 13 fourth-years. Responses were downloaded to Microsoft Excel and each respondent was assigned a unique number e.g. 'R5'. Following the *thematic analysis* method of data analysis (Braun & Clarke, 2006), the authors split into two teams and coded open responses separately. After, we met to agree on the themes that emerged and discussed any discrepancies. Student responses to specific questions often contained comments which fell into different broad themes; however, no subtheme contained more than one comment from any respondent. For example, a student may have made three comments about their experience with a particular support, with two being positive and one negative. Coding would lead to further subcategorization, for example, with the two positive comments falling into the 'helped with time-management' and 'better understanding of mathematics' subthemes and the negative comment as 'experienced anxiety'.

In this paper, we focus on the engagement of students with synchronous online supports only. Responses were crosschecked with the background questions, for example, with the year of study of the respondent; however, no patterns of note emerged. Comments in relation to the provision of pre-recorded asynchronous workshops are reported on elsewhere.

5. Results

Respondents were asked in Question 1 '*Have you availed of ANY of the MSC services this semester (study groups, drop-in, workshops)?*', 88 indicated Yes and 26 No.

5.1 MSC study groups

Seventy-one of 88 respondents indicated that they availed of study groups (Question 2), and 70 of these responded to the following questions.

- **Respondents who engaged with MSC Study Groups (n = 70).** Question 3 asked '*Which of the following best describes your attendance at your study group session?*', see Table 1.

In Question 4, respondents were asked to '*Please describe your experiences of study groups, highlighting the aspects that worked well/did not work well, advantages/disadvantages etc.*'. Sixty-five

TABLE 1. *Description of attendance at study group sessions (n = 70)*

Option	Count
Attended all	24
Attended more than two but not all	29
Attended one or two	17

TABLE 2. *Level of agreement with impact of study groups on engagement and understanding (n = 70)*

Option	Increased engagement	Increased understanding
Strongly agree	27	33
Agree	20	18
Neutral	10	15
Disagree	11	4
Strongly disagree	2	0

responses were deemed relevant, with 47 respondents making 74 positive comments and 28 respondents making 32 negative comments.

Five main themes emerged from the 74 positive comments. Twenty-six comments related to tutors '*The tutors were extremely helpful and knowledgeable and their ability to adapt and teach in an unfamiliar environment is commendable!*' (R104). Another 11 discussed the benefit of working with other students, getting help from them or hearing the questions they asked of the tutor '*Amazing to get together in a small group and discuss problems with classmates and get the help of tutors when we desire*' (R80). Nine liked the social aspect of the study groups '*I am delighted that I have signed for a study group as it was very helpful with my studying and great to have at least some sort of socializing with other students as we cannot do it on campus.*' (R76).

Six referred to the small group size '*The tutorials are good but the smaller numbers in the study group made me feel much more comfortable to ask a question and they were also people I knew which helped as well*' (R101). Another six liked the fact that study groups were student-led and flexible '*Loved the way it was self-led, we could do what we felt we needed to do.* [The tutor] *was so helpful as well.*' (R13).

Three main themes emerged in the 32 negative comments. Fourteen comments related to students feeling anxious or awkward in the study groups '*Does not really work no one speaks only asking the tutor questions not interacting with each other*' (R57). Seven referred to low attendance '*Good idea, but little attendance from lots of others so that made it a little more limiting*' (R103) and six mentioned unsuitable timetables '*It was very hard to meet at the time assigned to us as our options were not very convenient to begin with.*' (R53).

The remaining five comments included references to tutor attitude, poor internet, the difficulty of concentrating at home and that online was not as helpful as in-person support.

In Questions 5 and 6, respondents were asked to indicate their level of agreement with the following statements: '*Being in a study group increased my engagement with mathematics in general.*' and '*Being in a study group increased my understanding of the mathematical material covered.*', see Table 2.

Respondents could also add comments to both questions. Coding of these highlighted similar and sometimes identical responses from students to both questions, and therefore all responses were coded together. In total, there were 78 positive comments split across four themes. Twenty-eight comments mentioned tutor assistance '*Every time I had a question, tutors explained everything so well and I enjoyed studying maths because of them.*' (R76). Another 23 referenced the benefits of working with peers '*We would look forward to getting together to do maths each week it really was a highlight just to have that social interaction with students again instead of watching some recorded lecture alone in your room.*' (R80). Seventeen referred to how being in a study group was a good motivation to work '[The study groups] *were so important. They gave structure to the maths modules because all of the lectures were recorded it was difficult to motivate yourself to watch them. Having the study group made me feel like I had to have them completed to benefit from it which was really good for my motivation. It helped me*

keep on top of the maths modules for sure.' (R101). Finally, ten comments highlighted the opportunity to ask questions *'I felt more capable of asking questions in the study groups because of the small size of the group. I was compelled to talk more in the groups and engage with the people, which made it easier to engage with the course content'* (R78).

Of the 11 non-positive comments, two indicated that study groups neither increased nor decreased their engagement or understanding. Six referred to the study group not working well, either because people did not show up or the members were not interacting with each other *'Apart from asking the tutor questions it was uncomfortable to engage with others on the group.'* (R57). Three indicated that study groups did not influence them as they did not like the nature of online learning.

In Question 7, respondents were asked *'Will you continue to use study groups in semester 2?'*, 61 selected 'Yes' and 9 'No', and Question 8 asked *'Based on your experience, in what ways can the MSC improve the study groups?'* Fifty-seven of the 70 respondents provided relevant responses, with 11 of these simply stating that the study groups could not be improved.

The remaining 46 respondents gave 49 comments, from which seven main themes emerged. Eleven mentioned having more students in a group *'Make the study groups bigger, it is awkward with only two people or by yourself because some do not turn up every week'* (R71). Nine comments indicated that tutors should have material/content prepared for students to work on content to cover *'maybe give a set of questions to do during the class based on topics that the group are struggling with'* (R23). Another eight respondents mentioned a lack flexibility in relation to the times and length of study groups *'The initial study group time I selected did not go ahead as there wasn't enough interest in it. I had to change to a different time that unfortunately did not suit me every week and as a result I missed a couple of the sessions.'* (R85).

Seven responses related to helping students become better acquainted with each other. Some comments put the onus on students *'There's a certain amount of work needed to be put in by students to develop their own study group once its formed. Engage with other members and go through the forming and norming of a group. This is obviously limited by interpersonal skills and the ability to connect through technology.'* (R14). Whereas others referred to more or less tutor engagement *'Have times when the tutor is not in the call so that the students feel compelled to work together on problems. It would help me become more familiar with the people in the class since it is difficult to make friends at this time...'* (R78).

Five comments generally wanted more time and interaction with tutors *'Perhaps, instead of the demonstrator popping in and out of the study group sessions, they could stay for the majority of the session.'* (R93). Another five suggested that the study groups would be better if they were in-person *'I personally felt that study groups to be held on-campus (if possible), so there would be an interaction with fellow mates and the tutor.'* (R87). Finally, three comments were coded as communication or advertisement as students had suggested implementing services that already existed *'...let people organise their group of friends to do maths...'* (R23).

● **Respondents who did not engage with MSC Study Groups (n = 17).** Question 9 asked 'Please explain why you did not avail of the MSC study groups?'. Seventeen respondents made 20 comments and one of these simply stated that they *'Didn't know it existed'* (R92). Of the remaining 19 comments, seven referred to time pressures *'With pre-recorded lectures and no structure to the day I found timetabling and routines very difficult this semester. I barely knew which day it was for most of the semester, never mind what time it was.'* (R90). Four comments indicated that students did not need help from the study groups *'Didn't see a need to. The topics we covered were pretty simple it was more of a question here or there that I was stuck on'* (R47), and three that they preferred to work alone.

Three comments outlined that students had attended the first few study groups but had a bad experience *'In the first* [meeting] *only one other person showed up and I did not know them, so we just chatted and*

TABLE 3. *Description of attendance at drop-in sessions (n = 39)*

Option	Count
Attended more than once per week	10
Attended once per week	10
Attended less than once per week	19

did not do any work. In the second meeting only two people showed up and I tried to encourage them to do maths, but they both did not seem bothered, so then I did not try to take part in any more meetings, and neither did anyone else from my group.' (R25). Two comments referred to anxiety or discomfort *'I have too much anxiety when it comes to tackling Math that I need one to one support.'* (R77).

Finally, in this section, Question 10 asked '*Is there anything we could have done/could do to encourage you to avail of the MSC study groups?*' Sixteen responses were relevant, of which six of these said there was nothing that would encourage them to attend and three were *'not sure'* (R25). Of the remaining seven comments, three suggested to increase awareness of the study groups and two would prefer to have them in-person. The final two comments referred to knowing people in the groups and timetabling problems.

5.2   MSC drop-in

Thirty-nine of 88 respondents indicated that they availed of drop-in in semester 1 (Question 11), and all responded to the following questions. In Question 12, respondents were asked '*Which of the following best describes your attendance at MSC drop-in sessions.*', see Table 3.

Question 13 asked respondents to '*Please describe your experiences of the MSC Drop-in, highlighting the aspects that worked well/did not work well, advantages/disadvantages etc.*'. There were 37 relevant responses with 43 comments, 36 were positive and seven negative.

Eighteen of the 36 positive comments were non-specific. Of the remaining eighteen, 12 referred to tutors '*It worked well for me, whoever I was talking to was really helpful and showed me how to approach questions in whichever topic I was puzzled by'* (R6). Four comments mentioned the flexibility of the service '*I liked the way you could just come and go as you please with your question, if you are busy, you do not have to stay the full hour.'* (R13). Finally, two highlighted the helpfulness of listening to other students talk with the tutor.

Four of the seven negative comments specifically mentioned timetabling issues '*The only disadvantage was sometimes having to wait a few hours or even until the next day for a tutor to be available for 2nd years'*(R10). The remaining three comments referred to matching tutors with topics, internet connectivity and anxiety.

In Questions 14 and 15, respondents were asked to indicate their level of agreement with the following statements: '*Attending the MSC Drop-in sessions increased my engagement with mathematics in general.*' and '*Attending the MSC Drop-in sessions increased my understanding of the mathematical material covered.*', see Table 4.

Respondents could also add comments to both questions. Again, coding of these highlighted similar and sometimes identical responses from students to both questions, and therefore all responses were coded together. There were 34 positive comments, and one main theme emerged. Twenty-five comments identified the more detailed explanations provided by tutors '*I engaged more with mathematics in general by attending the MSC drop-in sessions, because what I was shown/explained by the tutor made me understand my mathematics modules more.*' (R25). Six comments referred to drop-in as being motivating

TABLE 4. *Level of agreement with impact of drop-in on engagement and understanding (n = 39)*

Option	Increased engagement	Increased understanding
Strongly agree	16	24
Agree	14	10
Neutral	6	4
Disagree	3	1
Strongly disagree	0	0

or a productive use of their time '*I was able to ask my questions so that I could keep going with whatever questions I was doing. I was less likely to give up on a topic.*' (R54). Two comments referred to the small group sizes and one indicated a preference for online learning.

There were seven relevant non-positive comments. Three outlined that online support did not suit the student's learning needs '*I just find remote learning to be very unconducive to the MSC and mathematics in general.*' (R46). A further three indicated that they could not find the time to avail of the drop-in and one student felt that they would be holding other students back because of their weaker mathematical background.

In Question 16, respondents were asked '*Will you continue to use the drop-in in semester 2?*', 37 selected 'Yes' and 2 'No', and Question 17 asked '*Based on your experience, in what ways can the MSC improve the drop-in service?*' Thirty-four respondents made 36 relevant comments, of which 15 indicated that the service was fine as it was.

Eighteen of the 21 remaining comments referred to timetabling matters. Fourteen of these suggested more or different timeslots '*Have more slots available to first years, or at different times i.e., in the evening as it is the only time I'm free.*' (R13), '*The drop-in sessions were good, it's just that they clashed with lectures that were on at the same time*'. (R113), two suggested having more tutors available for final years '*Have at least two tutors instead of only one for final year*' (R27), and two mentioned advertisement '*An easily accessible timetable (maybe on the Moodle page) would be helpful*' (R90).

Of the remaining three comments on this question, two were negative about tutors '*Match the tutors to the content. Cannot stress that enough. I was left confused more times than not and I think that played a part in my overall attendance*' (R66). The final comment related to the future of online drop-in '*I think having the option to have online and on campus after the lockdown would be hugely beneficial to many students nationwide. As for people who cannot commute regularly to college, it would really help them to have access to this valuable resource online!*' (R97).

- **Respondents who did not attend the MSC drop-in (n = 49).** Question 18 asked '*Please explain why you did not avail of the MSC drop-in?*' All 49 respondents gave relevant answers, making a total of 53 comments.

Thirty-one comments indicated that these respondents felt that they did not need to attend the MSC drop-in, with 11 simply stating this. Of the remaining 20 comments, all felt that the existing support and resources in place were enough. Ten mentioned that attending the study groups sessions was sufficient for them '*I was happy waiting for my study group instead*' (R79), and ten that they utilized some combination of other MSC or Department supports '*Between lecture videos, notes, practice problems, tutorial sessions, lecturer Q&A sessions and study groups, I had no need to avail of the drop-in sessions, however I believe during the course of my studies and more difficult modules, drop ins will be invaluable to have as an added resource!*' (R104).

There were also 10 comments regarding timetabling issues, eight mentioning how busy they were '*Busy home life. I made time to go to my study group*' (R30) and two reporting clashes '*Most of the*

drop-in sessions collide with subjects on my timetable and I forgot' (R64)*.* Another eight comments were coded as advertisement of the service, for example *'I was not that aware of them.'* (R16). Four comments reported anxiety issues which impacted on their attendance *'Have anxiety so cannot go if I know my friend will not be there'* (R55).

Finally, in this section, in Question 19, respondents were asked *'Is there anything we could have done/could do to encourage you to avail of the MSC drop-in?'* There were 42 relevant responses, nine of whom were unsure or had no suggestions. Of the remaining 33 comments, 22 said nothing could be done, with 16 simply stating this. The remaining six of 22 reported that while nothing could be done, they *'...always knew they were there to use if* [they] *needed them.'* (R60). Nine respondents reported on issues relating to better advertising or a lack of awareness of the service *'Maybe send a reminder to everyone what times the drop-in sessions are at the beginning of the week.'* (R107), and one respondent stated that they *'...would like to have the option to have one-on-one calls with a tutor instead of group calls.'* (R78).

5.3   General questions for those who availed of MSC services (n = 88)

These respondents were asked (Question 20) *'Did you avail of online Mathematics Support for March–May 2020?'*, with 23 selecting 'Yes' and 65 'No'. Those who selected 'Yes' were given the option of comparing their experiences of online MLS in March–May to semester 1 (Question 21). Of the 12 comments, six indicated that online support was now better *'I found my experience of the online support this semester much more beneficial compared to my experience last semester. I was not used to online learning last semester and I did not feel comfortable in taking part in the online support regularly. This semester however I became much more comfortable with online learning and I took part in the online support almost every week.'* (R25). Four respondents felt the supports were the same or similar and two said the online support was better in March–May 2020.

In Question 22, respondents were asked *'Did you avail of in-person Mathematics Support prior to the end of March 2020?'*, with 39 selecting 'Yes' and 49 'No'.

Those who selected 'Yes' were given the option of comparing their in-person and online experience of MLS (Question 23). Three themes emerged from the 33 responses. The main theme, with 18 responses, indicated that in-person support was better. Six of these suggested that it was easier to ask questions *'I think the in-person experience is better as you can get your questions across better when the tutor is there beside you'* (R112). Four of the 18 mentioned that they liked in-person support as they could spend time studying in the MSC without having prepared questions for tutors, and another four preferred the informal atmosphere of in-person support. Two found in-person support better due to technological issues *'There's no chance of your internet dropping and missing half the explanation!'* (R24). Two further students highlighted being able to work with their peers *'In person experience I had previously was much more beneficial as not only the tutors help each other but the other students help each other.'* (R27).

In the second theme, seven students felt that the online support was better. They attributed this to ease of access to tutor time, the convenience of online support and study groups *'The online was actually better in my opinion. It was a small group of us with a dedicated tutor to run through anything we desire'* (R80). In the final theme, five respondents thought that the quality of the two forms of support were the same *'Both experiences were similar. Tutors would try their best in both situations and would try and use the technology they had to make it as understanding as possible.'* (R20).

TABLE 5. *Technological limitation/barriers students (semester 1) encountered*

Option	User count ($n = 88$)	Non-user count ($n = 26$)
Poor broadband	33	6
Access to a computer	3	3
No technological barriers	51	17
Other (please specify)	6	3

5.4 General questions for those who did not avail of MSC services (semester 1) ($n = 26$)

In Question 23, respondents were asked '*From your perspective, what are the advantages/disadvantages to online mathematics teaching?*' Twenty-three respondents gave relevant responses, making 32 comments. There were 14 comments on advantages, eight of which referred to being able to go at their own pace '*Advantages—You can go back over lectures if you do not understand. You can pause the lecture to take notes, i.e., you do not have to try to listen and write at the same time.*' (R83). Four mentioned the course content always being available online '*There is a great advantage in having notes and example easily available to everyone for the entire year . . . .*' (R86), one linked to new technology skills and one simply referred to the availability of support.

Of the 18 comments on disadvantages, 12 featured the lack of interaction with the lecturers and tutors '*Harder to understand material without being able to ask questions the traditional way*' (R98), five mentioned difficulties with focus and motivation '*It is harder to focus on an online lecture*' (R41) and one student referred to reduced social interactions.

None of these respondents had availed of online Mathematics Support for March–May 2020 (Question 24), and eight had availed of in-person support prior to the end of March 2020 (Question 25). Six of these responded to the follow up Question 26, '*If 'Yes' please indicate if this had any influence on our decision not to use online Mathematics Support this semester.*' Three said that it had '*no influence*' (R17), two that they did not know how to use online MSC '*I used the Maths support groups regularly in the library, but I do not know how it would work in a Teams meeting especially asking for help.*' (R115) and one student stated that '*. . . it was more the fact that the MSC was online that made me not want to use it*' (R105).

Both MSC users and non-users were asked '*What, if any, technological limitations/barriers did you encounter (e.g. poor broadband, access to computer, etc) while availing of the MSC's services? Tick all that apply.*', see Table 5.

Four of the 'Other' responses were relevant, mentioning poor laptop/computer quality.

Finally, all students who filled out the survey were given the option to leave further comments, and 17 gave relevant responses, with two main themes. Thirteen comments conveyed student gratitude for the MSC services and three expressed a preference for in-person provision '*I made very regular use of the MSC during on-campus times but find it hard to engage in online mode*' (R46).

6. Discussion

We start by considering the main themes which emerged from our analysis of the feedback of students who engaged with both study group and drop-in support.

Surveys of both MLS practitioners (Lawson *et al.*, 2003) and students (O'Sullivan *et al.*, 2014) identify the key role that tutors play in in-person MLS. Thus, it is perhaps not unexpected that the largest theme across our survey was the positive endorsement of tutors highlighting, among other traits, the variety

and clarity of explanation, and their adaptability to the online environment. However, the transfer of tutor MLS teaching and support skills to an online environment can be problematic (Johns & Mills, 2021). In a study carried out prior to COVID-19, MLS staff identified their technological skills as a potential barrier to online MLS (Mac an Bhaird *et al.*, 2020), and similar concerns in relation to these skills and appropriate training were pointed out in practitioner studies carried out after MLS online provision from March–May 2020 (Hodds, 2020; Johns & Mills, 2021). In our study, students reported no negative comments about the online skills of tutors, though it should be noted that all the MU MSC tutors had the experience of delivering online MLS from March–May to build upon. Furthermore, we place a significant emphasis on ongoing MLS tutor training, with most of our tutors completing digital badges in Communication and Digital Capacity (http://www.imlsn.ie/index.php/tutor-development), which included the trialling of technologies (Heraty *et al.*, 2021).

Studies of the initial move to online MLS carried out during the summer of 2020 highlighted, for most MLS providers, a dramatic decrease in student attendance, engagement and interaction (Hodds, 2020; Johns & Mills, 2021). The loss of community was speculated as one reason for this decrease (Hodds, 2020; Littlejohn, 2020), and the *International COVID-19 Student Well-being Survey*, as reported by Busse & Zeeb (2020), identified that students have had fewer peer contacts. However, in our study, the positive social experiences and benefits of working with peers, including the opportunity to listen to their questions and explanations, emerged as prominent themes '[It's] *just easier to see how you are getting on and some students put the maths in a way* [that is] *more understandable and it is nice to have help from peers and see how they do it.'* (R75). These comments came almost exclusively in relation to study groups which we established in an effort to improve student interactions and reintroduce some of the social elements of an in-person MSC '*Any questions we were stuck on, we could work through together, like we would in the MSC usually. It was as close to the real thing as we could get'* (R24). These findings are very encouraging and suggest study groups as a possible approach for the wider MLS community to consider to try and replicate the reported benefits of peer learning (Duah *et al.*, 2014) and of MSCs as social spaces (Solomon *et al.*, 2010) in an online environment.

Several other aspects of the synchronous supports emerged as positive themes in the student responses. Students reported that the supports in place gave their study structure and the sessions were flexible, productive and provided motivation. This again is encouraging, as other studies of student engagement with in-person teaching and support, for example Grehan *et al.* (2016), have identified that motivation is a key factor in determining student engagement with MLS. A lack of motivation and structure in an online setting was highlighted in both the Maynooth Students' Union (2020) and AHEAD (2020) student surveys, and student motivation was also emphasized by MLS practitioners as a cause for concern (Hodds, 2020). Students also mentioned that they preferred the small group sizes and, when answering survey questions on study groups, some respondents specifically stated that the group size made it easier or gave them the confidence to ask questions. Similarly, Grehan *et al.* (2016) found that students reported being much more comfortable and likely to ask questions in small groups, e.g. in tutorials or MSC, than when they were in large lectures.

So, for those respondents that attended regularly, the synchronous supports seem to have been largely successful. Also, the majority of users who responded to our survey indicated that they would continue to use these supports in semester 2. However, there were also a small number of negative comments from users and three main themes emerged.

Timetabling emerged as an issue for students with both supports, with students reporting clashes with other classes, not enough tutor slots available or students just being generally busy. Studies have shown (Maynooth Students' Union, 2020; AHEAD, 2020) that several factors during COVID-19, including access to a laptop, or increased family or work responsibilities, can impact negatively on student time

and availability. From an operational point of view, when compared with in-person support at MU where all drop-in sessions were for any student, there was a reduction in the number of drop-in hours available online as these were mostly year group specific, and we also used tutor hours to facilitate study groups. While students were given the option to change their slots to suit their schedule, very few did. Some studies refer to the reasons students provide for poor or non-engagement. For example, O'Sullivan et al. (2014) found that 'operational reasons', such as timetabling, were likely to be given by students with weaker rather than stronger mathematical backgrounds. However, we did not collect data on mathematical backgrounds in this study. It may be the case, particularly for first-year students, that they were overwhelmed by the amount of information they received, especially at the start of the academic year (Hodds, 2020). Anecdotally, when first-year students at MU were contacted in relation to poor engagement with the Department's online tutorials and assignments in semester 1, some responded that they had just signed up for everything and did not know what they were doing. We believe that this may explain the large numbers of first-year students, 210, who signed up to study groups but did not attend.

The second main theme in the negative comments was related to other students, specifically where respondents felt the low attendance or low engagement of their peers when they did attend negatively impacted on their own experience. These comments were almost all in relation to study groups, with all low attendance comments from first-year students and the low engagement comments split across all years. While the poor attendance of first-years may tie in with students feeling overwhelmed at the start of the academic year, it is also possible that the low attendance or engagement of peers is linked to the third category of negative response, awkwardness or discomfort online or in front of others. For example, '...my anxiety is too high with my lack in knowledge of Math that I was too shy to attend. The thought of anyone else joining the call put me off.' (R77). A small number of students reported anxiety in relation to both study groups and drop-in. Grehan et al. (2016) identified that embarrassment or a fear of getting things wrong in front of peers was a cause for some students to avoid their difficulties with mathematics which led, in some cases, to disengagement with the support in question. Interestingly, in Hodds (2020) and later, in a related study by Gilbert et al. (2021), many practitioners observed that students who may have been anxious about in-person support found online support less intimidating. These comments appear to have been largely in relation to appointment-based one-to-one support.

If we consider the comments given by respondents who did not use one or both synchronous supports, we see similar themes, for example timetabling issues, and awkwardness or discomfort. However, the main theme that emerged, almost entirely in relation to drop-in, was students indicating that they did not need to avail of the support. The main reason given was that existing supports, e.g. study groups, tutorials, lecture videos, etc., were sufficient, and similar reasons for non-engagement were identified by MLS practitioners (Johns & Mills, 2020). Hodds (2020) and Johns & Mills (2020) both reported that changes in exam procedures such as open book assessment and exams or no-detriment policies were also factors in students not availing of online supports. Locally, at MU, it should be noted that at the start of semester 1 Department tutorials changed from being after the submission of the corresponding assignment to being before. Lecturers also provided practice sheets related to the assignment which could be covered in these tutorials. This was to allow students the opportunity to ask questions of the tutor in advance of assignment submission. This role had been largely performed by the MSC in previous years.

The other main theme that emerged for non-engagement related to advertisement or communication, with students stating that they had not heard of the support, did not know the details of how it would work online or did not know what to do when they turned up. Symonds et al. (2008) reported similar reasons given for non-engagement by students with in-person MLS. However, Lawson (2015) questioned whether these responses were accurate and perhaps students were not admitting the real reasons. There is possible evidence for this in our responses. For example, 'more information. I received emails but

nothing was posted on Moodle for easy access.' (R66). An entire section of the MSC Moodle page, where students signed up for study groups, was dedicated to information about the study groups and how they operated. Some of these communication issues could be explained by students being overwhelmed at the start of the academic year. There is also some anecdotal evidence that students were not checking their MU email and they may have missed the information and guidance issued on the various supports. This information was regularly sent to them throughout the semester, via social media, Moodle and class emailing lists, and similar methods of communications were used by other MSCs (Gilbert *et al.*, 2021).

Finally, if we consider questions that were given to all users and non-users, there are some items of note. Access to functioning broadband and other technological issues are often cited as factors that could negatively impact on the online learning experience (AHEAD, 2020; Maynooth Students' Union, 2020). In our survey most respondents reported experiencing no technological barriers, and slightly over one-third highlighted poor broadband. We also asked respondents to compare their semester 1 online experience, with previous experiences of MLS. While numbers were small, more students thought that their semester 1 online experience was better than that in March–May. Also, more students indicated a preference for in-person over online support, referring to the informal and welcoming atmosphere of the MSC (Breen *et al.* 2016). Though, some students indicated a preference for online because of the study groups and suggestions that it was quieter and more convenient.

7. Conclusion

The purpose of this study was to establish student opinion on the synchronous online mathematics supports available in semester 1 with a view to informing the next stage of our online support provision at MU. There are several limitations to this survey, for example it was carried out after only one semester of online provision, the sample size was small and students who did not use online MLS in semester 1 are underrepresented, though all students who could avail of MLS were given the option of completing this survey. Further background questions, for example, gender and school mathematics level, may also have provided added insights into student responses. In the literature review and discussion, as synchronous MLS is relatively new, we often referenced in-person MLS. Hodges *et al.* (2020) inform us that it takes time to make an effective transition to online learning. Therefore, they caution making comparisons of the current online teaching and learning to that of traditional face-to-face instruction, due to the rushed nature with which the pandemic forced this transition. Nevertheless, the findings do inform our practice and we hope they will help fellow practitioners of MLS.

In relation to our research question, 'What was student opinion of our online MLS provision?', feedback from students who availed of the supports, as one might expect (Lawson *et al.*, 2003), was largely positive. They had a high opinion of the MLS tutors, the study groups and opportunities to work with peers. They also identified that the scheduled supports provided structure and motivated them to keep up with their studies. The main negative feedback included the poor attendance or engagement of their peers, timetable clashes and anxiousness or discomfort in an online setting. These last two themes also featured in the responses of students who did not avail of supports. However, the majority of these reported that they did not need to attend. Communication and advertisement about the services were also negatively commented on by both users and non-users.

These findings helped to inform our practice. We continued to offer study groups in semester 2 but made some adjustments. In an effort to tackle timetabling clashes and low attendance in some groups, we ran a new sign up for all study groups. One of the tutors, the final author, started sending reminders each morning to the students who had a study group meeting that day via their Teams channel. Factoring in the low engagement with our drop-in service, and the apparent success of one-to-one sessions in the UK

(Hodds, 2020) we removed many poorly attended drop-in hours and added 28 half-an-hour one-to-one bookable appointment slots each week in an attempt to reduce the awkwardness and discomfort students reported when being online with peers.

Establishing effective channels of communication with students remains problematic. Our online services were well advertised; information was easily accessible on Moodle and the MSC website. We also used social media and students were regularly messaged via Moodle and class mailing lists. These methods are consistent with those used by the wider community but MLS practitioners, in general, seem to be experiencing similar difficulties (Gilbert *et al.*, 2021). Clearly, changes need to be made to how we advertise our online services to students, and we recommend that the wider MLS community spends time considering and discussing this issue.

Pre-COVID-19, Mac an Bhaird *et al.* (2020) identified low levels of online MLS and related practitioner concerns. Our work provides an initial study of student experiences of online MLS provision, the majority of which were positive. Further research and sharing of the collective experiences of both staff and students and the wider MLS community are needed to provide additional insights into the effectiveness and longevity of online MLS. From the authors' perspective, it was interesting to see the mix of responses from students to this survey, with advantages and disadvantages to both in-person and online support highlighted. After in-person support returns, we intend to maintain the study groups, the one-to-one appointment service and some elements of online supports.

Acknowledgements

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