

***“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***

Holly Gilbert, Mark Hodds, and Duncan Lawson

sigma Mathematics and Statistics Support Centre,

Research Centre for Global Learning (GLEA)

Coventry University

Email: gilberth2@uni.coventry.ac.uk

Abstract

Mathematics and statistics support (MSS) is now firmly embedded in the learning and teaching infra-structure of most UK universities and in many universities worldwide. In common with other higher education activities, in response to restrictions put in place to reduce the spread of Covid-19, MSS transitioned rapidly to online delivery in spring 2020. This paper reports on thinking within the practitioner community about good practice in the delivery of online MSS. A two-phase approach was used to collect this shared wisdom: an initial questionnaire in May 2020 (just after provision had moved online) and interviews with practitioners in January/February 2021 after colleagues had some experience in online provision and had had the opportunity to reflect on and modify the measures hastily put in place in spring 2020. The focus of the study is not only on what is currently being provided but also on what MSS will look like once all pandemic related restrictions have been ended. The overall feeling of the participants is that face-to-face MSS will return as the dominant form of delivery but that the benefits of online provision are such that a significant minority of provision will remain in this form.

Keywords: Mathematics and Statistics Support, Online Learning, Online Teaching, Covid-19

1. Introduction

Mathematics and Statistics Support (MSS) is the provision of additional learning opportunities which sit alongside the 'regular' teaching activities (such as lectures, tutorials, workshops, etc.) on a course (Lawson, Halpin and Croft, 2003). Engagement with these additional opportunities is usually voluntary – these are typically opt-in services. MSS can take several forms (including online resources, paper-based worksheets, drop-in centres, pre-booked appointments and peer collaboration). The support that is most valued by students is personal, one-to-one interaction with a tutor (Lawson, Halpin and Croft, 2003).

MSS is now an established part of the higher education infra-structure in many countries including the UK, Ireland, Australia, USA and Germany (Grove, Croft and Lawson (2020), Cronin, Cole, Clancy et al. (2016), MacGillivray(2009), Mills, Rickard and Guest (2020), Schürmann, Gildehaus, Liebendörfer et al (2020)).

The introduction of lockdown measures as a means of reducing the spread of the Covid-19 virus in the UK in March 2020 required universities to change their practices very quickly. All teaching and student-facing activity was rapidly moved online. Similar circumstances applied in most countries around the world. This paper considers the way that MSS provision responded to this enforced migration to online support.

Online teaching in mathematics and statistics may present greater challenges than in some other subjects, particularly due to the need to present formatted mathematical text. In “standard” teaching, this can be mitigated to some extent by preparing appropriate materials before the teaching session. However, the spontaneous nature of one-to-one, face-to-face MSS provision, with the frequent practice of both tutor and student writing on the same piece of paper and a high level of student-tutor interaction, presented additional challenges. National surveys of MSS conducted before Covid-19 restrictions in the UK, Ireland, and USA (Grove et al (2020), Cronin et al (2016), Johns and Mills (2020)) had revealed that online support was offered only by a small number of institutions, and that take up of this offer was very small. The MSS community had been slow to progress the online support agenda, quite probably because of the difficulties discussed here.

In this paper, we report on a two-stage investigation of the way that MSS providers have responded to the challenges of online delivery being the dominant (often, the only) form of support permitted. The first stage of this investigation was a questionnaire distributed in May 2020 using the **sigma**-network¹ mailing list. The timing of this questionnaire was such that it gathered reactions from MSS practitioners whilst they were in the first stages of delivering online. The questions explored such things as what they were providing, what software platforms they were using, how many students were engaging and how they thought online MSS might develop as they became more accustomed to it.

The second stage of the investigation was to carry out in-depth interviews with 12 MSS practitioners from around the world in January 2021. In the UK, MSS provision moved predominantly online in March 2020 as an emergency measure and operated in this way until the end of the 19/20 academic year in May/June 2020. There was then time for reflection and refinement of the provision for semester 1 of the academic year 20/21. By staging the interviews in January 2021, there was opportunity for interviewees to reflect both on how they had responded in the first urgent phase of the move to online provision and also on the

¹ The **sigma** network (www.sigma-network.ac.uk) is a professional association of MSS practitioners with membership from around the world.

differences in operation when there had been more time to plan the provision (and indeed to learn from experiences in the March – June period).

In the next section of this paper, a short summary of the findings of the closed questions from the May 2020 survey is given. (A full report of these findings is available in Hodds (2020)). This is followed, in Section 3, by a thematic analysis of the final open-ended question from the May 2020 questionnaire where respondents were asked whether or not they thought that best practice in online MSS was replication (as far as is possible) of face-to-face methods and to consider how such support might develop in the future. In Section 4, a question-by-question summary of the responses to the January 2021 interviews is presented, followed, in Section 5, by a quantitative analysis of the whole corpus of interview evidence, identifying key themes in the minds of MSS practitioners. The paper closes with conclusions that can be drawn from the data collected and its subsequent analysis.

2. Survey into online maths and stats support provisions, May 2020

To capture the range of support being offered in the hurried move to online provision, and reflections on the success and effectiveness of that support, a survey was sent out in May 2020 to support providers. Predominantly, responses came from institutions in the UK (72) and the Republic of Ireland (11), but there were also responses from mainland European (6), US (2) and Australian (1) institutions. A complete list of the questions asked in this survey can be found in Hodds (2020).

The survey revealed that 94% of institutions who responded and were based in the UK, offered online support of some kind during the first UK lockdown period. Furthermore, 74% of these institutions saw a large reduction in the number of students using the services when compared to previous years. Similar results were provided in the data from institutions outside the UK and overall, an average of 116 students utilised services between March and May 2020 at each institution. To put this number in context, a survey by Grove et al (2020) revealed that the average number of students engaging with MSS at least once across 68 surveyed institutions in 2018 was 500.

Respondents suggested several reasons for the reduction in student numbers using the services on offer. These included:

- a lack of motivation from the students: caused by the situation generally and also the fact that most institutions either removed exams or assessed through time constrained assessments taken at home with no detriment policies;
- a lack of equipment or issues with infra-structure: students rarely had access to writing tablets, some were not able to obtain computers or laptops, or had poor broadband causing connection problems;
- a loss of the sense of community: students use physical support services (particularly the drop-in centre) as a safe space to learn and, particularly, to collaborate with peers - a virtual equivalent of this was not available.

Staff also faced issues including:

- a lack of confidence in providing the support to a high enough standard through the technology available;
- the technology itself not being up to standard or failing;
- staff themselves not having, or not being provided with, the equipment needed to be able to provide support from home.

As staff were the respondents in this survey, responses regarding issues they faced can be regarded as first-hand evidence whereas responses regarding the student point of view can only be classed as anecdotal evidence. Despite the issues, practitioners did report several positives regarding the use of online support. These most commonly occurring responses are summarised below in Table 1 along with some of the negatives suggested. It should be noted for Table 1 that responses often contained multiple themes and therefore the percentages provided do not add up to 100%.

<u>Positives of online support</u>	<u>Negatives of online support</u>
Accessibility (Recording sessions and providing captions over) (22%)	Cannot see the reactions of students – loss of the personal connection (50%)
Flexibility for students (19%)	Technical hiccups (25%)
Less confident students may access more support than when support is physical (14%)	Writing out solutions is more difficult (19%)
Easier to focus on one student for longer (11%)	Sense of community is lost (10%)
No need to physically go to a centre (10%)	Fair access issues: online support requires student to have appropriate equipment (10%)
Supporting more students at satellite Campuses (8%)	Difficult to leave the student to attempt something without them feeling abandoned (8%)
Students may feel it is a safer environment (4%)	Lack of training in the systems (8%)
Anonymity (3%)	Fewer students using the services (6%)
	The increase in time needed for each student (6%)

Table 1: Most commonly reported positives and negatives of online MSS in May 2020 (percentages in brackets represent the proportion of responses relating to each theme)

It is interesting to note that some respondents reported less confident students seemed more likely to engage with online support than they were with physical support. It is perhaps the ability to remain fairly anonymous (for example, not turning the camera on when receiving online support) that is a key factor here as many anxious students tend to stay away from mathematics classes and are often frightened they will be judged when asking for help (Maloney and Beilock, 2012). Furthermore, it is also interesting that statistics support levels remained fairly consistent when compared to normal times. It appeared that it was easier to provide statistics support online, perhaps due to it primarily being based around discussion and use of various software whereas mathematics support frequently requires some formatted mathematics to be written at some point. Therefore, providing online statistics support is not particularly different as the screen is just shared rather than the student and the support tutor looking at the same screen in the same physical space.

Overall there are clear advantages and disadvantages to online support, as highlighted by respondents to the survey. A detailed report of the closed questions on the survey can be found on the **sigma** National Network website (Hodds, 2020). However, there was a final, open-ended question on the survey regarding MSS in the future that was not included in this report. The next section of this paper presents an analysis of the responses to that question.

3. Initial thoughts on the future of MSS, May 2020

The last question on the May 2020 survey asked respondents:

“Should delivering maths and stats support online change the nature of our approach? One way to approach online maths and stats support is to look for ways to replicate as best we can the way we give support when working face-to-face. Is this the best way to approach online maths and stats support or should we be adopting different approaches for online support? If so, what approaches?”

This compound open-ended question relating to MSS in the future produced an array of responses requiring further analysis. The primary objective was to identify MSS practitioners' opinions of how the community should be proceeding with online support going forward. Addressing whether respondents felt the change in situation requires changes to the nature of the MSS approach, it specifically looked at whether respondents thought the approach to online support should be to replicate face-to-face support methods, or whether adopting new methods was needed.

The question yielded 74 responses which were analysed using a general inductive approach as described by Thomas (2006). The raw text data was read repeatedly, each time identifying the key ideas or phrases within each response. Gradually, by identifying similarities to other answers, links could be established between ideas and condensed into common underlying themes. These themes could then also be broken down into more detailed ideas. Each response was given a number and eventually categorized into these derived groups. Some responses were placed into more than one category and in three cases, more than two, as there were often several ideas and opinions communicated by a single respondent.

Two coders analysed the raw text data, independently producing their own list of themes, which were compared to assess the trustworthiness of the identified categories. A high level of overlap was found, giving the groups validity. The differences were mainly whether a category should be standalone or a sub-group of another; smaller groups linked by an overall idea but providing different additional information. With the generation of a new category, the two sets were merged together to produce a final set of seven thematic groups, detailing the main ideas about the future of online MSS.

Three categories arose as a direct result of the question that was asked, namely: Do or do not replicate face-to-face support, and those that could not answer. Each of these groups could

then also be further broken down into the common reasons why respondents believed so. The percentages given below by each theme title indicate the proportion of the responses that were categorised as being within that theme. It should be mentioned that not all 74 responses fit into these three categories, as some respondents did not state their opinions of replication, and neither did they state that they were unsure, focusing their answer on the other parts of the compound question, or taking the opportunity to talk about anything they deemed important to mention.

Do not replicate – 17.6%

The consensus of this category was that the respondents feel that face-to-face support methods should not be replicated online as they are two very different settings with their own strengths and weaknesses. More specific rationale included the difficulty of replication due to this fact, often wasting time and resources and still not achieving the same result, or not being able to achieve full replication in the first place for lack of know-how or resources. Some also stated that online support has its own benefits, and that simply replicating previous methods would not utilise them, particularly regarding access and availability. One respondent stated, *“I think it's very difficult to always replicate online what we do face-to-face...”* with another describing *“...we don't need to worry about venues, we could offer [online] tutorial support to students on much more regular basis...”*. This category also includes two respondents that did not give a reason why they thought we should not replicate.

Replicate -16.2%

In the opposing argument, only slightly fewer practitioners felt that we should be replicating face-to-face support methods online, as they have already proven to be successful. Some responses went further and stated face-to-face methods are better than an online approach. Responses included *“we should aim to replicate as best as we can our approach when working face-to-face”* and *“Face-to-face teaching remains priority”*.

Cannot answer the question – 32.4%

Some practitioners felt they could not give an answer at the time of the survey. This was the most common direct response to the question. This group of responses breaks up into two main rationales as to why they could not answer the question: those straightforwardly unsure, and those who stated they required more research before being able to decide or give an opinion. This category also included the one respondent who stated they did not understand the question. Supporting textual data includes *“I'm unsure what to say to this one”* and *“Not enough is known but research like this will help”*.

The remaining four themes arose naturally as a result of the open-endedness of the question, with respondents being able to say whatever they thought relevant without a specific prompt. It should be noted that, due to their compound nature, some responses are categorised into both one of the above three themes and one of the four themes below. However, (as noted above) others only fall into one of the four themes below, whilst still others are only categorised into one of the above three themes.

Trying things out – 6.8%

Some answers described methods or adaptations that respondents were currently trying or had tried but had not been successful or where they were unsure about how to progress them. Although only containing five responses making it the smallest category, this was included as a theme as it can be a useful benchmark for seeing how methods have improved. Two responses were a description of how communication barriers in an online setting are being overcome, “...it is a good practice to re-write the last equation or last two lines of the analysis on the new page to help with continuation of the discussion when providing online support.”, and three related to issues practitioners were facing in new support methods, “tutorials revolved more around "how to be successful in an online class" than around mathematics concepts”.

Blended approach – 9.5%

During the discussion between the two coders, it became clear there were two different definitions of a ‘blended approach’ in practitioners’ answers, and this category encompasses both. Most responses in this category described a blended approach as having online support methods running alongside in-person face-to-face MSS at the same time, “we can support students both face-to-face and online”. However, a couple described a blended approach as being wholly online, but utilising a combination of recreating face-to-face methods, while also introducing some new online methods, “a mix of replicating the way things are done face-to-face and trying to find new ways of doing things”. Responses mentioning a blended approach generally recognised both formats had their own strengths and weaknesses, but rather than choosing one over the other, suggested that a combination could utilise both, providing a range of benefits, particularly in respect of access to support.

Open to new approaches – 27.0%

This category contains responses suggesting the practitioner is currently leaning towards either replication or non-replication but is not 100% fixed as to which direction we should go and so is still open to new approaches, “...we should be replicating face-to-face teaching, but just like in face-to-face, we should keep an open mind about ways to improve the support”. This category can also be broken down into sub-groups providing additional information as to

why the respondent is open to new approaches. A regular similarity, mentioned by six different respondents, was stating that they were recreating face-to-face methods 'for lack of better methods', or that this was not proving successful and so were looking for a better approach. Examples include, "*At present we are replicating face-to-face for want of better methods*", and "*...we tried to replicate as best we could our existing services. However, student engagement was low.*". These responses were not included in the replicate category as it is clear that the practitioners do not feel this is the best approach and are open to alternatives. Also included in this category are statements claiming online methods are better than face-to-face and that we should be moving support online anyway. These responses are clearly open to new online approaches but did not give a lot of detail about how, "*we should continue to offer more online support for students*".

Looking for the best option - 21.6%

This final category arose as a result of the discussion between the two coders. It was noted that although many responses stated or implied they were open to new approaches, the level of certainty differed. Some responses were currently leaning to one side, uncertain of what we should do, whereas other responses were sure that we need to look for the best approach regardless of what direction that may be. Answers placed in this category, totalling 21.6% of responses, often recognised weakness on both sides and so were neither for or against replication, resulting in being open to all potential methods. A key phrase identified for this thematic group was wanting enhancement and/or improvement, without indicating where this enhancement might come. Practitioners were generally in agreement that the goal of MSS remains the same regardless of the form it is in and therefore we should be looking for the best methods regardless of the situation. "*All options should be explored, different approaches work with different students.*", and simply, "*It will adapt - the goal remains the same*".

The final question of the May 2020 survey produced a range of different responses. Although there were slightly more practitioners stating that we should not be replicating face-to-face methods and rather embracing new online methods instead (the new methods were often not specified), the most common occurrence was that practitioners were unsure about how to approach MSS going forward. This uncertainty was reflected in the more open themes, particularly trying things out and being open to new approaches. At that stage of the pandemic, with widespread provision of online MSS having been in place for only two months, this

uncertainty was probably to be expected. Nonetheless, it was hopeful that many practitioners were open to adapting their current methods of support.

Recognising that the responses to this questionnaire were made very soon after the rapid transition to online MSS took place, it was felt appropriate to revisit some of these issues after more time had passed. It was therefore decided to carry out a further stage of data collection in January 2021, after the completion of semester 1 of the academic year. By this time, practitioners had had the summer vacation of 2020 to reflect on and modify their online provision and then experience of having delivered this modified provision for a semester. It was felt that in-depth interviews of practitioners from different types of institution would yield richer data than a second questionnaire. Sections 4 and 5 of this paper present analyses of the responses from interviews of MSS practitioners around the world in the early months of 2021.

4. Review of answers to interview questions

12 practitioners from institutions offering some form of online provision during the pandemic were interviewed for this study in January and February 2021 and all 12 had completed the survey in May 2020. They represented a broad range of provisions, including specialist part-time and online only institutions, as well as traditional and newer institutions, and covered universities based in the UK, Ireland, Czech Republic, and Australia. Interviews were conducted and recorded on Microsoft Teams, and transcripts of the interviews were produced for analysis. Participants were asked 10 questions regarding the details of the MSS provided during the pandemic and the practitioners' opinions about what support might be like when there are no longer any Covid-related restrictions in place. A complete list of the questions asked during the interviews is given in Appendix 1. A summary of their answers is provided below.

Question 1. What online MSS is your institution offering?

Different institutions were offering different MSS provision according to the needs of students and capabilities of staff. All institutions interviewed were offering some form of online support. Nearly all were offering one-to-one, pre-booked appointments, most offered a form of online drop-in service, and some offered embedded tutorials and workshops. In most institutions, the online services available to students had expanded for the start of the year 2020/21 when compared with those available in May 2020. One institution in the UK reported offering socially distanced face-to-face support within their centre through bookable

appointments in the period before the second lockdown. To preserve “covid-security”, the number of students able to access this face-to-face support at any time was just six, compared with a centre capacity in non-Covid times of 50.

Question 2. Reflecting on what has happened in MSS since the pandemic, do you see any benefits from the new ways of working that have been introduced? And any disadvantages? Furthermore, have your opinions regarding online MSS changed between May 2020 and the end of 2020?

The biggest reported benefit of online support was accessibility for distance learners. Students from remote campuses were finally able to get the same level of support as students based on main campuses. Furthermore, it was reported by several institutions that some students who had been reluctant to access in-person MSS were more at ease with online support. As one interviewee stated: *“I think a lot of students didn't like that they could be seen by other people struggling [in a physical centre] ... I think a lot of students... like the idea that, you know, if they're sitting at home and finding it difficult, they can just grab their laptop and within maybe 15 minutes they're talking to a specialist in that subject”*. Nearly all practitioners who were interviewed mentioned the ability for students to remain anonymised and not have to travel to a physical centre as a positive. For example: *“...the online side is just so convenient for them and it just it takes away a lot of the embarrassment because embarrassment is... a huge factor of students not engaging with [maths and stats support]”*.

In recent years, the provision of workshops on particular topics that cause difficulty for many students has become an important part of MSS (Grove et al, 2020). Providing workshops online was also seen as a big advantage of online support due to the larger numbers of students able to attend when compared to a physical space. Many practitioners who had been providing workshops and tutorials reported a large increase in the number of students attending these workshops when compared to in-person delivery. However, providing a workshop online is more staff intensive as often a second (and sometimes a third) staff member was reported as being needed to answer queries in the chat and to step in when technological problems occurred. Again, anonymity and being able to work from home was cited as a major reason for this increase in workshop attendance.

The participants reported that the majority of students do not switch their cameras on when receiving online MSS and this “anonymity” encouraged students to engage with online support. However, this was the biggest disadvantage of online MSS from the tutors' perspective: *“The human factor I think is what's missing to a great extent, and you can have all the technology in the world but the human factor is a massive part of support”*. This form of

“anonymity” removed the ability for tutors to use body language and visual cues to determine student understanding which are a big part of providing support in a physical centre. Practitioners mentioned that students were often quick to say they understood something but there was no way of confirming this. It appears therefore that students are happy to come for support, but many do not wish to be seen whilst getting that support.

The other main disadvantage was the lack of social interaction in an online provision. Many students use physical centres as a place to work collaboratively with peers and communities of practice are established. This allows for peer mentoring and provides a safe space for learning to take place, with a rapport built up between student and tutor. Online support does not appear to allow for this as successfully.

A final issue raised was in relation to inadvertently providing help with assessments. To mitigate this risk, some provisions forced students to book in advance during assessment periods and to state the query they wanted to ask. However, caution was still needed as it is much more difficult to determine online whether a question is from an assessment.

Opinions regarding online support have almost unanimously changed for the better. At the start of the pandemic, everything was rushed in order that some kind of MSS was available. At this point, staff were less aware of what the capabilities of online support were. Indeed: *“it was probably just pure ignorance that I didn't know that these [online] tools existed and I was probably not so open to them existing”* and being forced to use online methods was initially a concern. Some institutions had previously resisted providing online support: *“Specifically before the pandemic... we were really dead set against doing online appointments and to the point when a student asked we replied ‘oh we'll only do them if you're a distance learner or you've got a really good reason’”* which in the initial period of lockdown would have made things much harder. However, provisions are now more experienced in using online methods, and practitioners report being more confident, so more opportunities to provide high quality support are becoming available. Despite this, many practitioners interviewed stated that online support was still not their preferred form of support: *“...I think we've become more used to it [online support] and therefore more comfortable with it. I still don't think that it's, uh, the most effective form of support but the improvements or the improved accessibility and flexibility that it gives students kind of partly pays that off”*.

Question 3. Are there any online methods that you are not currently offering that you would like to in the future? If so, what is holding you back in implementing these methods?

There were very few answers given to this question, suggesting that practitioners felt they were doing as much as they could. Of those that did answer, suggestions included providing more opportunities for group work and social study spaces as well as generic workshops. The limiting factors to putting these in place were the availability of appropriate technology for effective implementation.

Question 4. How are you advertising your online MSS Service? Do you feel it is successful?

Due to the restrictions, provisions were advertised through the expected ways such as through email, messages on virtual learning environments, websites, social media, and through lecturers. In the first lockdown, practitioners commented on how they felt students were getting overwhelmed with the number of emails and information that was being given to them (Hodds, 2020). Therefore, practitioners in these interviews stated that emailing students had not been working and alternative methods needed to be sought.

There was a mixed response to whether their advertising had been successful. Some saw their advertising as a success because they were seeing students from subjects they had never seen before. On the other hand, many more practitioners thought their advertising had not been successful. One obvious difference is physical support centres advertise themselves: *“you walk past [the support centre] so you think ‘oh, what’s that? oh look, that might be useful’ so anybody who comes into the library is aware”*. Online support offerings do not have this method of advertising so students cannot see how successful they are. Alongside this, the physical centres have built up rapport with students and staff over previous years whereas online support systems have not. Therefore, less advertising was previously needed as word of mouth and tradition did much of the advertising for the provision. Some provisions mentioned that student recommendations were still happening despite the social restrictions however the majority felt this had stopped. Indeed, it was suggested that *“the most successful way that’s got those students in is a... student recommending a peer”* and *“you need a culture from students and what you want is students to say ‘oh yeah, I went to [the support provision], it was helpful. Um, you should, you should go there too’, uh, and that takes time to build up.”* Finally, the connection some provisions had with staff had been lost so that form of advertising had also been lost: *“the relationship that we would have had with the course tutors before the pandemic, I don’t think that’s carried over and I think we’ve missed out on getting the course tutors to advertise”*.

Those provisions who thought their advertising had been successful tended to be smaller and were doing more to advertise to students than they had done before. Examples included getting involved in online induction processes for the first time, using virtual learning environments to post adverts on, and one institution managed to send out text message alerts to students.

Question 5. How many students are accessing your service? Has this number changed since the beginning of the pandemic and if so, why do you think this may be?

Again, the majority of practitioners who were interviewed for this study reported a decrease in student numbers. Interviewees from larger support provisions reported major decreases in their usage whereas some smaller provisions actually reported increases and, in one case, record numbers during the 2020-21 academic year. However, when compared to the beginning of the pandemic, the numbers of students using provisions had increased in all cases. This is despite advertising not being considered successful in most cases, as reported above.

Standard support offerings, such as drop-ins or appointments, had seen large decreases in numbers during the first lockdown that have only slightly picked up between September and December 2020. Several practitioners also reported a large decrease in the numbers of engineering students using services, although one institution reported seeing a large increase from their second year engineers, but this was an exception. Conversely, it was reported that use of workshops and statistics support offerings have been stable or even better than was seen prior to the pandemic.

The main reason provided for seeing an increase in the numbers of students when compared to May 2020 was that students were now more used to the online systems of learning and support. When the pandemic hit, many institutions were forced to change their services almost overnight, leaving students confused and overwhelmed. As time has progressed, staff and students have grown more used to the ways of working remotely. Therefore, students are not only more likely now to use the services provided but also understand better how they work. Also, it was suggested that despite getting used to the online experience, students are finding it much harder to learn in general and therefore are more likely to seek out support: *“So we think we're getting the questions that before peers would answer, or students would ask their lecturers face-to-face at the end of the lecture. Whereas now, they don't have those opportunities and so yeah, I think they're coming to us.”*

Question 6. Have you found a difference in engagement of different student groups?

As this question was quite open, answers discussed differences between courses with and without students who are traditionally mathematics-averse, gender differences, and year of study differences. As described above, several institutions have seen a large reduction in the numbers of engineering students using provisions but a large increase in the numbers of traditionally mathematics-averse students, such as nurses, bio-scientists, and psychologists doing statistical tests for projects and dissertations. Many of these courses traditionally have a larger proportion of female students so several practitioners reported seeing more female students than males. This finding may seem surprising to some however it does correlate with previous research into gender differences in engagement with MSS (Ní Fhloinn, Fitzmaurice, Mac an Bhaird, and O'Sullivan, 2016). Due to statistics support engagement levels remaining relatively unchanged in many institutions, final year student numbers have remained stable, with first year students making up the majority of the remaining visits to online provisions. However, some practitioners reported that they had received a boost in first year numbers due to added provisions being provided for these students. These provisions included extra workshops or catch-up sessions due to missing several months of study whilst being in lockdown and not completing A level examinations or equivalent.

Question 7. In your opinion what do you think will make students engage with online MSS more?

The first issue suggested that needed addressing to get students to engage more was improving accessibility. The online set up at many provisions requires students to click through several links, fill out forms, or access several different systems and websites with different passwords and logins for each. When compared with the ease of walking into a physical centre and taking a seat, this process is often too long and difficult for students. As one interviewee stated: *"I don't think that's anyone's fault, I think it's just sometimes for some reason students find it a little bit difficult to, as I said, you know, follow the links... you have to click this other thing and then this other thing. I think especially at the very start the students seem to get lost"*.

A second issue suggested was to improve the pedagogy of online learning, and not just for MSS practitioners. Indeed, it was suggested that we need to: *"give the time to academic staff and the training to academic staff and support staff to understand the pedagogy that is behind online teaching"*. Currently, everyone is still experimenting with effective ways of providing online learning, without much personal or shared (departmental/ institutional) experience to draw on. In this developmental phase, it is inevitable that mistakes will be made

and some students receive a bad experience. These students may therefore be unlikely to re-engage, particularly with voluntary learning opportunities such as MSS. This is perhaps similar to those students who suffer from mathematics anxiety trying to avoid mathematics as much as possible, stemming from bad experiences in school as a child (e.g. Maloney and Beilock, 2012). Furthermore, showing students what is involved in online MSS may improve engagement and reduce such anxiety towards it: *"I think there must be students out there that aren't booking appointments but need them because they just don't know quite what it's going to be like"*.

A final suggestion on how to improve engagement focused on re-establishing relationships and improving communication with administration teams in universities. Prior to the pandemic, many provisions had good relationships with students and faculty staff members which, in turn, increased engagement year on year. Going to an online system has removed this relationship and so students are less aware of the services than they would have been: *"I think re-establishing the relationship with course tutors, um, and for remote sites, establishing to begin with a relationship [will improve engagement]"*, *"I think it's we've got to communicate more with the unit coordinators... I think we've just got to push that a bit more"*. Alongside this, just getting students (and lecturers) to recommend the provision to friends and colleagues after using it will also provide higher engagement: *"I think it's much more that personal recommendation rather than anything that we try to do with posters and videos or whatever"*. Physical provisions had this embedded as they were social learning spaces and recommendations happened naturally within friendship groups, again something that is currently lacking online.

Question 8. When pandemic restrictions are lifted and we enter a new normal, would you continue with the online support methods your institution currently uses?

Everyone who was interviewed stated they would continue with some form of online support, however what was offered would be reduced. Many practitioners felt that when face-to-face support is available again, online support would be provided as a supplementary offering predominantly to students on remote campuses or online learners. Indeed, many of the interviewees felt online support offered more flexibility for specialist groups of learners such as mature, part-time, and distance learners. Despite this, it was suggested that online drop-ins and appointments would continue but would be reduced to allow for face-to-face support to return. It seems that many practitioners feel face-to-face support is

the gold standard level of support whose quality still, currently, cannot be fully matched online. Due to limited staffing levels, face-to-face support offerings should take precedent over online offerings: *“Everyone seems to be agreeing at the minute that face-to-face is the way forward, it can't be replicated particularly well online”*.

Despite this, one area where there was more positivity regarding online support was through workshops. As mentioned earlier, more students have engaged with online workshops than used to with face-to-face ones. Therefore, it was often suggested by interviewees that an important discussion needed to be had regarding whether all workshops should continue to be offered online as this reaches more students in a smaller number of sessions.

Question 9. What are the biggest drawbacks of online MSS that need fixing? Any ideas about how they might be fixed?

The interviews revealed two major drawbacks of online support that need fixing. The first concerned the engagement issues described previously: *“if the students don't come it doesn't matter how technically good it is”*. Without student engagement there is no service and therefore no other issues that need fixing. Indeed, alongside this, as one interviewee stated, it is about: *“Communication! Communication! Communication!”* How we communicate with the students to get them to engage and the current lack of effective communication methods available were cited as a major drawback of online support.

The second drawback was surrounding the technology. Firstly, the question of fair access arose: *“A lot of students don't have the means to access decent technology which, yeah, you know, and it's quite clear when some students, you know, they might have poor wi-fi because of where they live, their laptop might not be able to keep up with, you know, a video call”*. MSS provisions pride themselves on being open and accessible to all. If some students are unable to access technology which enables engagement with online support then provisions are no longer open to all. The next issue with technology focused on breakout rooms. Practitioners reported that they felt breakout rooms currently available on different platforms do not provide the features MSS practitioners are looking for. Breakout rooms were suggested as a way to increase engagement by using them as social areas for learning, where students could work together but be able to come out of the breakout room to ask for help. This would simulate the physical centre aspect of social learning and interaction. A suggestion was that online support needed: *“something that feels more natural, that feels more like, you know, you*

come in and you would be greeted by a receptionist and be asked 'what [do] you need help with?' and there's like more interaction."

When asked how these issues could be solved, very few suggestions were offered. Some drawbacks clearly have no easy answer. However, one major theme came from these answers which was to continue as a practitioner-community sharing ideas and experiences. Many interviewees thanked the work of the national networks of MSS practitioners and wanted to see the networks provide more opportunities to share examples of good practice in online support.- Those interviewed felt this would be the best way to overcome some of the drawbacks described as well as improve what is available to students.

Question 10. What do you think MSS will look like at your university when there are no pandemic-based restrictions on what you are permitted to do?

Most interviewees felt that there would be a return to face-to-face support in the ways that were provided to students pre-pandemic; however, this would be supplemented with online support methods, mainly to support students who could not access face-to-face support or to continue to offer a mechanism that was highly utilised by less confident students. Practitioners were keen to try and expand the pre-pandemic service by using the experiences gained with online mechanisms where: *"students can choose what they deem as the best learning method for them"*. The general consensus seemed to be around a 70-30% or 80-20% split in favour of face-to-face methods over online methods of MSS.

A final issue raised around the future of MSS related to assessment. If more assessment is online than before the pandemic, then MSS provisions will need to keep in place what were originally intended as ad hoc measures to reduce the risks of students getting inappropriate help on summative assessments. As one interviewee stated: *"I think the number of academic misconduct instances were up by about a thousand percent at the end of last year uhso, yeah, that's one of the battles that we're fighting"*.

5. Qualitative Analysis of interview questions

Following the same approach as described in section 3, the twelve transcripts were analysed using Thomas's general inductive approach to identify the common underlying themes (Thomas, 2006).

The number of times an idea was mentioned was recorded as well as the number of individuals who raised that idea. This is because if a participant has mentioned the same idea

multiple times across the interview, it is probably safe to assume that this is a main concern for them; only counting it once would lose that impact. However, also counting the number of individuals concerned with a theme, reduces possible skew of more talkative interviewees. If a participant began to discuss an idea, moved on to discuss something else, and then returned back to that original idea sometime later, it was counted as two mentions. If several ideas were mentioned in one go but all linked to a common theme (for example, talking about footfall, word of mouth and email overload together, which can all be linked under advertising), they were also counted as separate mentions.

When reading through the transcripts, to identify overarching themes, it was important to distinguish between a common idea that was brought forward by the questions asked, and those that occurred naturally during discussion. Therefore, an idea was only considered as a theme if it had been repetitively mentioned throughout the entire interview, or at different points across the interviews, and not just in response to a specific question. It was common for practitioners to mention areas of MSS that were the topic of later questions, hence some themes are linked to question material, but are still considered an overarching theme for this reason. Therefore, additionally there is some overlap between the themes addressed in the previous section and the overall themes discussed here, but this is to be expected, and highlights the main concerns practitioners expressed.

Initially there were 20 identifiable shared ideas about online MSS by the 12 participants, ranging from some having been mentioned by all, to some mentioned only by four. To establish an idea of the main concerns shared during the interviews, only themes mentioned by eight or more participants were then considered to be overall themes. Therefore, they were condensed down, either by merging ideas together under one shared theme, or removing those that were least mentioned. Eight thematic groups remained containing current opinions of online MSS.

Reduced Interaction

Reduced interaction was the biggest concern shared by the 12 participants, mentioned at least once by all 12, and a total of 45 times. It was also the most mentioned theme by five participants. This category encompasses the barriers to effective interaction that online MSS presents and contains two key points.

Firstly, the most mentioned point was tutors not being able to access visual clues (body language, etc.) to gauge student understanding. Regularly mentioned as a result of technology

(and particularly with students either not having cameras or not turning them on), the largest concern was practitioners not being able to know if the students were following or not and in particular, not knowing if they were being truthful when claiming they did understand. Much unspoken communication is lost when not being able to read body language or facial expressions, “...*not really knowing if the student has actually understood what you're saying. if your ideas are getting across*”, “... [in face-to-face support] *you can see the whites of the eyes, so you know whether they understand them or not...*”.

Secondly, loss of interaction in general was also a great concern, “...*it's that kind of interaction, student-tutor and student-student interaction I think that's difficult to resolve*”. Whether the interaction was student-to-student, student-to-tutor or staff-to-staff, anyone involved with MSS was mentioned at least once by the practitioners as being affected by a reduced interaction, with one participant even mentioning the struggles of establishing relationships between remote campuses. Student group work, in particular, was brought up by six participants. These comments ranged from the lost opportunity for groups of students just to use MSS centres as a workspace, to failed attempts at trying to recreate social learning interactions online.

Flexibility

This thematic group was also mentioned at least once by every participant, with 35 mentions in total. All key points made in this group were positive towards online MSS and highlight what practitioners felt was the main benefit of this new way of working.

As reported in Section four, accessibility was acknowledged as the foremost benefit, particularly in regard to remote campuses, “...*some students will find it more convenient...because they're um they're part-time students or because they're from remote campuses*”. Particularly with online drop-in, interviewees often referred to the ease of students accessing support immediately rather than having to travel to campus to access the support, making them more inclined to use it. This links to the ability to offer support for more hours than in-person methods could be offered for, for various reasons such as student schedules and venue availability for institutions without a physical centre. The availability of more timeslots means online support can be provided at a time that suits the individual student, and this was regularly mentioned as another advantage: “...*and the benefit to being online is that we can reach our students when they are available to be reached...rather than it being a face-to-face thing on a Tuesday evening and if a student has to be taking their child to cubs or whatever...we*”.

can run them during the day, evenings, Saturdays, Sundays. um we can run them at times suitable for our students that are living abroad...and I think that's the real advantage to online support that you can't have with face-to-face support."

Both these points extend to being more accessible to all types of students, having the opportunity to access support from an external location at a time that suits the student can reach those that could not be reached by in-person MSS. Mature students who commute or have children to care for were regularly referenced as greatly benefiting from the new flexibility. But the benefits apply to students in general who can still ask questions even after returning home. All these factors apply to regular student life but are especially important when external circumstances due to the pandemic are interfering with academic life, making traveling to campus even more difficult or sometimes impossible. This also links to another advantage to the change in situation mentioned, particularly in regard to what institutions are planning moving forward, giving the students the choice of online or in-person support. Half the participants stated at least once that their opinions towards online MSS were negative before the pandemic, but they are now recognising the flexibility that offering both online and face-to-face support can provide, *"We can just say 'well if you want it online we'll have it online'"*.

Technology

There were slightly mixed opinions of technology, but generally the opinions were negative. Three practitioners mentioned some positives of current technology, mainly praising that what they have works well, but with the caveat that this is probably only for the time being. Nevertheless, it is evident that most practitioners are finding technology to be troublesome, with 9 out of 12 giving at least one example of issues. Most often these related to sharing work and writing mathematics: *"I'm hoping that software comes along that's better than the stuff we've got just now for writing maths"*, *"students holding up pieces of paper to the camera so that you can try and read their working is not good especially when you're sharing a whiteboard"*. Practitioners have mentioned that tablets and styluses can be a solution, but a lot of students do not have access to that technology, or institutions do not have the funds to provide them, with some students even lacking basic needs for online MSS such as a microphone. *"...some students don't even have microphones. Their microphone doesn't work and their camera doesn't work and, you know, trying to explain to someone, you know, some kind of classical mechanics problem without them being able to talk to you can be quite difficult indeed."*

It is interesting to note however, as mentioned in Section two, practitioners are still stating the fact that statistics support is relatively unaffected, or has even benefited from the change to online, as it does not face the same barriers as mathematics support, particularly the pen and paper problem. A participant explained, “*so I only do statistics support but I find that incredibly useful to have the shared screen and to have you know students working on their own computers they're comfortable with*” and “*I think it was easier for me to adapt with the stats background because so much happens really on the computer anyways*”.

Other technological issues mentioned the quality of internet connections, students having to download software at home and the (lack of) functionality of breakout rooms. However, one participant expressed the view that due to the current situation, software companies will be striving to improve the technology currently on offer (to gain a market advantage over their rivals), and so regardless of the current issues, technology will hopefully improve.

Advertising concerns

Although participants were asked in question four of the interview about their institution's advertising of online MSS and if they deemed it successful, advertising concerns were regularly mentioned throughout the duration of the entire interview, and within responses to different questions, and so it is categorised as an overall theme. This aligns with the findings of Johns and Mills (2020) who also identified issues concerning advertising of online MSS in their study. Within this theme there are three key areas: word of mouth, footfall and information overload.

Word of mouth was of the greatest concern, mentioned 15 times by all but two participants. The majority of comments described the importance of word of mouth in their institution's advertising of MSS; be that students telling their peers, lecturers telling their students or support staff informing non-support staff. These practitioners felt that this loss has contributed most to the drop in numbers engaging: “*...we would inform the students and let them know to tell other people that, you know, 'please tell your friends, if there's other people, you can come along and do group sessions'*”. Additionally, many expressed the view that getting students to inform their peers was a goal regardless of the pandemic. However, it is made harder by the pandemic since the students are having fewer conversations with their peers.

Information overload was the second most frequent concern, particularly with emails to students. Practitioners worried, especially during the induction period, that students are overwhelmed and/or irritated by the amount of information received, and so support centre emails were regularly going unread, "*I'm also like there has probably been cohorts that we've irritated with the amount of trying ... you might actually irritate them to the point that they're like 'oh, them. I can't stand them'...*".

Finally, several participants raised the issue of footfall, that is, students simply becoming aware of the MSS provision simply by walking past the drop-in centre. There was a consensus of not having previously realised how influential having an accessible in-person site was for drawing students in.

Effort

Effort was an interesting category to consider as it very much seemed to arise as a result of the reflection period after the end of the academic year 2019/20. Participants have had time to think about their support methods, the strengths and weaknesses and why any problems they have come across may be occurring. That online support requires additional effort from students and staff alike was a rationale regularly provided by practitioners. Examples of this include: "*...it [online group work] would involve a lot of learning effort on the students*", "*...we've [academic staff] just got to push that [communicating to students] a bit more and get them doing more to push the students through lectures/tutorials announcements*". Areas requiring more effort were generally related to students actively approaching and using the service, or staff learning how to use new software. One participant claimed more effort is needed from both parties to make online MSS successful, "*many of the disadvantages can be handled by cooperation of students and tutors. So, both of us have to accept the new norm. Both of us have to change their behaviour, change their habits.*".

The other main point in this category was motivation, especially the influence of outside commitments due to the pandemic. "*...every student's struggling aren't they, with the pandemic, that they're finding it a lot harder to study*". Reasons for changed engagement levels ranged from students just not wanting to participate with the online learning methods, or thinking examinations will be easier due to the pandemic so requiring less work, to both students and staff having outside influences reducing opportunities for academic engagement, such as childcare, illness, and technology issues.

Time

This category had a split opinion. Eight participants in total mentioned a situation related to time, with 24 mentions overall, and it was a key concern for one participant. Four gave examples of the new online situation not allowing enough time to achieve things, and three stated that the new online environment has given them more time, with one further participant sharing an experience of both sides.

The negatives were unanimous in saying that online methods take up more time. This covered a range of activities from the creation process of new methods to performing the methods themselves, it left less time for other activities like creating advertisements or planning improvements: “...*what you could do face-to-face probably takes you 25 minutes longer to do online*”, “*we didn't really also have the time to create like proper posters and notifications*”. Four other mentions of time also included current support methods not using time efficiently and ideas on what may be more efficient.

On the other hand, four participants found that moving to online support methods freed up time to achieve more. Benefits included tutors having more time to prepare answers to problems as they are submitted beforehand, “*it can sometimes give the tutors the time to, you know, go and look at, go and look at some information for it*”, and additional time freed up from face-to-face methods meant time spent on thinking about the future, and what is next for MSS, “*...we've got essentially all this extra time that we've paid people, that we're paying people for, to be a bit innovative and to try different things*”.

Anxiety

Anxiety was regularly mentioned in both a positive and negative light. The most common response, as stated in the previous section, was that online MSS methods offer a larger form of anonymity, especially as a lot of institutions do not request students to have their cameras on. Therefore, students who are more socially anxious, who would be unlikely to walk into a physical centre for help, feel safer in an online environment. Embarrassment was a key word in identifying this thematic group, however as one participant picked up on, embarrassment also comes from not wanting your own self to realise you are unable do something. “*I think that's the problem with asking for help at all. It's that to ask for help you have to admit that you can't do it and that is a really big thing for anyone to do*”.

However, online MSS can also create its own anxiety: “*...there's nothing more awful than being at an online event and you know the presentation hasn't started yet so you're looking into everybody's camera and everybody's sitting there like nobody knows if we're having small*

talk now or not", and: *"face-to-face it's just so much more powerful for getting them to calm down and yeah kind of stop fretting or stop worrying"*, which produces another barrier to overcome.

Knowledge

This final category includes any statement about students and staff, whether they are employed in MSS provision within the institution or outside of it, requiring more knowledge around providing online support. This thematic group was mentioned by eight participants, a total of 18 times and was even the main concern of one participant.

The majority of the concern went towards the staff as opposed to students, with six participants to one stating concerns respectively, and one participant expressing a concern with both. A large part of these responses related to pedagogical practices, and staff requiring more training and knowledge in how to best teach online; particularly with teaching students how to adapt their study skills to this new environment to learn effectively. *"...all of us mathematicians and mathematics teachers should deeply think about the pedagogical questions. How to uh make students be active, how to teach students how they should learn, how they should study"*. Additionally, as to be expected, concerns were raised about the requirement of teaching all MSS staff about how to use any of the new technology or software the institution's support centre is now utilising for online support. *"We don't want to be teaching people about the system as well as providing support in maths and stats"*. This links to other themes, with some practitioners stating that having to learn new software requires both time and effort, and as a result is off-putting to staff and students who have already had to deal with all other aspects of university also moving online.

The other main area for concern, involving both staff and students, was simply being fully informed of what their institution's MSS centre offers, in order to either pass on the information to students, *"sometimes we have to, we have to educate staff, quite often admin staff um so that they know that there is, they know the services they're offering"*, or in the students' case, how to access support themselves, *"And then I suppose the other thing that's a barrier is just knowing, like I think you can't engage with something if you don't know about it"*.

6. Discussion and Conclusions

The work conducted for this paper has given an insight into how the pandemic has changed MSS and what practitioners feel about these changes. The data collected in May 2020 provided a snapshot when changes were swiftly implemented whereas the interviews conducted in January and February 2021 give insight after a period of reflection and more established implementation.

Reflecting on the themes generated from the May 2020 open-ended question discussed in Section three, being unsure about the future of online MSS was the most common response. Eight months later, all participants in the interviews stated they would like to continue with some form of online support. Returning to face-to-face methods is still very much positively anticipated, but practitioners are a lot more open to online methods as an addition. It is clear therefore from the interviews that practitioners are now embracing online support more than they were in May 2020 but many still do not see it as a replacement to face-to-face support. We can conclude that practitioners believe that MSS in the new normal will be a hybrid of face-to-face and online support but predominantly face-to-face. Online support, it appears, will be used to supplement the main physical support service and provide support for distance and remote learners.

The analysis in Section three also described the four naturally underlying themes as a blended approach, trying new things, open to new approaches, and looking for the best approach. Data from the interviews suggest that provisions are now more aware of the weaknesses and areas for improvement. The benefits online methods can have now seem clearer to practitioners and they no longer assume they will revert straight back to traditional methods of MSS once lockdown restrictions are lifted. Similarly, access and availability were regularly mentioned across multiple categories in May 2020, but was mentioned ever more frequently in the interviews to the extent that it became its own theme in the most recent data, clearly showing it is still regarded as the upmost benefit to online MSS.

Provisions are still seeing lower numbers of students engaging with services when compared to pre-pandemic levels, although this has increased when compared with the end of the 2019-20 academic year. A key issue related to this is communication with students. Traditional advertising methods such as emails appear to have little effect on getting students to engage. The loss of interactions and word-of-mouth advertising clearly has had a detrimental effect on engagement. It is possible that the pandemic itself has caused students to engage;

certainly, there is evidence of reduced motivation with 67% of students self-reporting as being less motivated when learning online compared to face-to-face (Barber, 2021).

Despite general low engagement, practitioners have reported seeing more students online who would be less inclined to visit a physical support centre. These students were reported as being generally more anxious or maths averse and found comfort in hiding behind cameras that were switched off, communicating instead through the text chat. However, this has led to practitioners reporting a difficulty in providing a service of a good enough standard as body language, facial expressions, and other visual cues cannot be used to determine understanding. There is therefore a question of being able to get the balance right to allow for anxious students to feel comfortable enough to ask for support but also ensuring the support is as good as it is when in a physical centre.

It is clear that a key obstacle for everyone is the technology. There were many issues reported that reduced the quality of service available or made it harder to provide support, particularly with mathematical questions. From the data however, we can infer what practitioners believe would be sufficient to provide support to students that was of an acceptable quality:

- good broadband connection, to be able to video conference;
- a computing device with enough power for good quality video conferencing;
- a microphone and headphones;
- A camera;
- a computing device which is able to receive hand-written (input) for mathematics support;
- good access to relevant statistical software (e.g. SPSS) for statistics support.

In terms of software, there was also a strong feeling that the current breakout rooms capabilities of the commonly used online meeting software packages are not yet sufficiently developed to provide a high quality environment for social learning opportunities in the way that physical drop-in centres do.

Despite the obvious issues faced, there are indeed benefits to online support reported. Statistics support in particular was cited as being easier and reached as many, if not more, students than in traditional settings. The nature of statistics support allows for this; most questions tend to be around the use of software or on which test to run for a particular set of

data. Furthermore, statistics workshops on typical issues can be recorded and can have more participants attend than a physical space would allow. Therefore, providing statistics support online is comparable, or may even be better, when compared to a physical setting. On the other hand, mathematics support, which requires the ability to write formulae (for example) and symbols, is much harder to replicate online.

Going forward there are several aspects that will need to be considered. Firstly, and possibly most importantly, we need to discover the student perspective (for example, Barber (2021) reports that 29% of surveyed students said that they did not want any aspect of their course to remain online once the Covid-19 pandemic is over). This paper discusses the opinions and ideas of staff in MSS, providing anecdotal evidence on student opinions and perspectives. The student perspective to online MSS will be vital in shaping how we improve our practice in the future. Secondly, we need to discover exactly why students who have traditionally shied away from seeking support in a physical setting are coming in larger numbers to online support. Similarly, why have students who are traditionally the main users of MSS (such as engineering students) not engaged as much with online support? It maybe that the anecdotal evidence suggested in this paper, such as feeling more comfortable with being fairly anonymous with a camera switched off and the loss of social interactions respectively, are indeed the main factors for these issues but again, until the student experience has been analysed, we cannot say for certain. Finally, we need to consider those students who have only experienced online MSS and how they engage with physical settings when they are reopened. Many students will have not experienced a physical MSS centre and students coming to university in 2021 will have had at least a year of restricted learning. Practitioners will need to adapt and consider how to best support these students so that MSS provisions provide the best quality support to all students in all locations in the “new normal”.

(Word Count: 11140 excluding References)

REFERENCES

- Barber, M. (2021) *Gravity assist: Propelling higher education towards a brighter future*, Office for Students, London. Retrieved from <https://ofslivefs.blob.core.windows.net/files/Gravity%20assist/Gravity-assist-DTL-finalforweb.pdf> (26 February 2021)
- Cronin, A., Cole, J., Clancy, M., Breen, C. & O'Se, D. (2016). An audit of mathematics support provision on the island of Ireland in 2015. Dublin: National Forum for the Enhancement of Teaching and Learning in Higher Education. Retrieved from <http://www.sigma-network.ac.uk/wp-content/uploads/2019/02/Audit-of-MLS-provision-Ireland.pdf> (25 February 2021)
- Grove, M., Croft, T., & Lawson, D. (2020). The extent and uptake of mathematics support in higher education: results from the 2018 survey, *Teaching Mathematics and its Applications*. 39(2), 86-104.
- Hodds, M. (2020) A report into the changes in Mathematics and Statistics support practices due to Covid-19, A report for the sigma Network for Excellence in Mathematics and Statistics Support. Retrieved from <http://www.sigma-network.ac.uk/wp-content/uploads/2020/07/Report-into-the-changes-in-Maths-and-Stats-Support-practice-during-Covid-19.pdf> (5 February 2021)
- Johns, C. & Mills, M. (2020) Online tutoring during the COVID-19 pandemic: Recommendations for good practice, *PRIMUS*, <https://doi.org/10.1080/10511970.2020.1818336>
- Lawson, D., Croft, T., & Halpin, M. (2003). *Good practice in the provision of mathematics support centres*. 2nd Edn. LTSN Maths, Stats and OR Network. Retrieved from https://s3.eu-west-2.amazonaws.com/assets.creode.advancehe-document-manager/documents/hea/private/goodpracticeprovision_1568036760.pdf (26 February 2021)
- Maloney, E., and Beilock, S. (2012). Math Anxiety: who has it, why it develops, and how to guard against it, *Trends in Cognitive Sciences*. 16(8), 404-406.
- MacGillivray, H. (2009). Learning support in mathematics and statistics in Australian universities – A guide for the university sector. The Australian Learning and Teaching Council. Retrieved from <https://www.mathcentre.ac.uk/resources/uploaded/guide--altc-learning-support-in-maths-and-stats.pdf> (26 February 2021)
- Mills, M., Rickard, B. & Guest, B. (2020). Survey of mathematics tutoring centres in the USA, *International Journal of Mathematical Education in Science and Technology*, <https://doi.org/10.1080/0020739X.2020.1798525>
-

Ní Fhloinn, E., Fitzmaurice, O., Mac an Bhaird, C., and O'Sullivan, C. (2016) Gender Differences in the Level of Engagement with Mathematics Support in Higher Education in Ireland, *International Journal of Research in Undergraduate Mathematics Education*. 2(3), 297–317.

Schürmann, M., Gildehaus, L., Liebendörfer, M. Schaper, N., Biehler, R., Hochmuth, R. ... Lankeit, E. (2020) Mathematics learning support centres in Germany – an overview, *Teaching Mathematics and Its Applications*, <http://doi.org/10.1093/teamat/hraa007>

Thomas, D. R. (2006) 'A General Inductive Approach for Analyzing Qualitative Evaluation Data'. *The American Journal of Evaluation* 27 (2), 237-246

APPENDIX 1: Interview Questions

1. What online Mathematics and Statistics support is your institution offering?
2. Reflecting on what has happened in MSS since the pandemic, do you see any benefits from the new ways of working that have been introduced. And any disadvantages?
 - a. Have you found your opinions have changed?
3. Are there any online methods that you are not currently offering that you would like to in the future? If so, what is holding you back in implementing these methods?
4. How are you advertising your online MSS?
 - a. Do you feel it is successful?
5. How many students are accessing your service?
 - a. Has this number changed since the beginning of the pandemic and If so, why do you think this may be?
6. Have you found a difference in engagement of different student groups?
7. In your opinion what do you think will make students engage with online MSS more?
8. When pandemic restrictions are lifted and we enter a new normal, would you continue with the online support methods your institution currently uses?
9. What are the biggest drawbacks of online MSS that need fixing? Any ideas about how they might be fixed?
10. What do you think MSS will look like at your university when there are no pandemic-based restrictions on what you are permitted to do?

Author's Biographies

Holly Gilbert (gilberth2@coventry.ac.uk): Holly received a Master in Science with Honours in Mathematical Sciences (Ecology and Evolution) upon completing a four years integrated Masters degree at The University of Exeter. In 2020 she began a PhD at Coventry University in Mathematics and Statistics support, looking at the effects of the pandemic on support services and potential changes going forward.

Mark Hodds (M.Hodds2@coventry.ac.uk): Mark completed his PhD in Mathematics Education at Loughborough University in 2014 and has been working as a mathematics support lecturer in **sigma** at Coventry University ever since. Recently he took up a secondment within the Research Centre for Global Learning (GLEA) at Coventry University, working in the Development, Engagement and Attainment theme. Mark is also a member of the steering group committee for the **sigma** National Network for Excellence in Mathematics and Statistics Support and works closely with the IMA Mathematics Teacher Training Scholarship scheme.

Duncan Lawson (duncan.lawson@coventry.ac.uk): after 5 years (2013-2018) as pro-vice-chancellor (Formative Education) at Newman University, Duncan returned to Coventry University where he had previously worked in mathematics support for over 20 years, having been a founding director of the **sigma** Centre for Excellence in University-wide mathematics and statistics support. He was awarded a National Teaching Fellowship in 2005, was jointly awarded the IMA Gold Medal 2016 for his outstanding contribution to mathematics education and received an MBE in 2019 for services to mathematics in higher education.