

## RESEARCH ARTICLE

# Changes with time of Practitioners' opinions of online Mathematics and Statistics Support

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## Abstract

As an established part of the infrastructure of many higher education institutions in the UK and across the world, Mathematics and Statistics Support (MSS), was forced to move to an online setting as a result of restrictions put in place due to the COVID-19 pandemic. With institutions offering limited online support prior to the pandemic, MSS practitioners were mostly unprepared to deliver online provisions. Survey data from May 2020 gives a first look at the immediate response of practitioners to online MSS. Interview data from January/February 2021 explores opinions after a period of reflection, and survey data from June 2021, over a year on from the initial sample, provides a direct comparison in opinion of online support a year later. This paper explores these three datasets, investigating the practitioner perspective and offers an overall reflection of how MSS practitioners' opinions of online support measures have changed from their "crisis-reaction" at the beginning of the pandemic to a more considered response as COVID-19 prevention measures are beginning to ease a year later.

**Keywords:** Mathematics and Statistics Support, online education, COVID-19, Practitioner perspective.

## 1. Introduction

Since its beginnings in the early 1990s, Mathematics and Statistics Support has become an established part of higher education infrastructure in many institutions across the UK and internationally (Lawson, Grove and Croft, 2020). However, prior to the COVID-19 pandemic, very little of this support was provided online (Cronin et al., 2016; Hodds, 2020); often a website presenting details about their in-person support being the only form on offer (Mac an Bhaird, Mulligan and O'Malley, 2020). Support practitioners were mostly hesitant and sometimes against using technology to deliver MSS online, as it was thought that support could not be offered as effectively as it could in person. The difficulty in writing formatted mathematical notation in an online setting, reported both prior to and during the pandemic (for example, Croft, 2000; Smith and Ferguson, 2004; Ní Fhloinn and Fitzmaurice, 2021), potentially being a key reason behind this. Regardless of opinion, when pandemic restrictions forced all levels of education online, MSS was not an exception and support practitioners were forced to move provisions online in order to continue supporting students.

This paper provides a three-stage reflection on how practitioners' opinions have changed over a year of pandemic restrictions, through the analysis of data sets collected at three sampling points. All data sets were collected by researchers based within **sigma**, Coventry University's mathematics and statistics support provision. The first stage is consideration of questionnaire data collected in May 2020. This offers a first look into the immediate response and MSS practitioners' initial opinions about online support methods, provided by institutions both in and outside of the UK, during the crisis-driven transition. The second dataset consists of interview data from January and February 2021. By this time, European practitioners had experienced a summer break and with that, a period of reflection on their institution's response, evaluating what had worked and what had not during the crisis reaction phase, with opinions not as influenced by the need for an immediate response. By the time the interviews took place, these practitioners had had a semester to implement a more planned online

support provision based on their reflection. Finally, the third dataset, survey data from May and June 2021, provides a look into practitioners' opinions a full year after the initial data set, at a time where many pandemic restrictions were about to be lifted, influencing ideas of online MSS going forward. An overall reflection is provided, comparing how practitioner opinions have changed or remained the same between the sampling points, with concentration on identified advantages and disadvantages, as well as student engagement.

Phase one and three data sets were collected using JISC Online surveys. Participants in the surveys were mostly recruited via email using the **sigma** Network JISCmail list and were therefore mainly from the UK. Interview participants in phase 2 were selected from those that participated in the phase one survey and gave consent to be contacted for future research, to cover a range of different types of UK institutions and also an international perspective. A more detailed breakdown of locations is given in the following sections. The interviews were conducted using MS Teams where the recordings were uploaded privately to YouTube to automatically generate transcripts, and then removed. The transcripts were then carefully checked against the original recordings and edited if necessary. All data collection for this study received ethical approval from Coventry University Research Ethics Committee.

## 2. May 2020 – First look at the immediate response

The first dataset comes from a large survey conducted in May 2020, alongside the **sigma** Network's first online workshop, on the topic of online support, receiving responses from 72 individual institutions across the world; 53 from the UK and 19 from outside of the UK: 11 from Ireland and 8 from the rest of the world, namely Germany, Norway, Czech Republic, United States of America and Australia. A preliminary report was published the following month (Hodds, 2020), and some of the key findings were as follows:

- **Opinion: 54% of UK practitioners stated online support was worse than in-person support. This was also the consensus across locations outside of the UK.** At this stage many practitioners felt that in-person support had advantages that online support could just not offer.
- **Negatives: The most frequently identified negatives of online support were lack of non-verbal communication, technology, and lack of training.** It was found that students were less engaged and regularly not turning on their cameras, and as a result, practitioners could no longer utilise unspoken communication, such as body language and eye contact, to try to determine whether students were engaged and understood the content. Increased technology use led to an increase in technological problems; furthermore, it was also stated that some students and staff did not possess the equipment required to best utilise online support. Finally, at this stage practitioners felt that they were not pedagogically equipped to deliver support in an online setting.
- **Engagement: 74% of UK institutions, 82% of Irish institutions and 63% of institutions from the rest of the world saw a large decline in student engagement.** Some UK institutions were seeing average student numbers across the first two months of the UK lockdown, equivalent to what they would have seen in one week prior to the pandemic.
- **Positives: The most frequently identified benefits to online support were flexibility and timings.** Online support is not confined to a physical location, so commuting is no longer necessary. This means support can be offered at more times and navigated at a student's own pace, making it more accommodating to student schedules. This in turn increases accessibility to students who may not have previously been able to utilise support offered, such as mature

students with childcare commitments, students on other campuses, or those with anxiety about in-person attendance.

- **72% of UK practitioners, 80+% of Irish practitioners and 33% of practitioners from rest of the world stated they would continue with some form of online support post pandemic.** At this stage, over a quarter of MSS practitioners in the UK stated that they would not or were unsure whether they would choose to continue with online support once the pandemic was over.

The final question on the survey was open-ended, and asked participants whether they thought the nature of the approach should change now that MSS had moved online. In particular, whether it was best to replicate in-person techniques in an online setting, or adopt new approaches, and if so what approaches. Thematic analysis (Thomas, 2006) was conducted on the 74 received responses, identifying shared phrases or ideas to link answers together into underlying themes. This produced seven themes in total.

Three themes directly arose as a result of the question: answers stating replicate, not to replicate and cannot answer. The remaining four themes arose due to the open nature of the question and were identified from other issues raised by the participants: trying things out, blended approach, open to new approaches and looking for the best option. A more detailed explanation of methodology and thematic categories identified can be found in Gilbert, Hodds and Lawson (2021).

Overall, the most common characteristic across answers to this question was uncertainty. Not only was the largest theme 'cannot answer the question', containing 32.4% of responses, but uncertainty could be identified in the other six themes as well: for example, stating we should be replicating in-person methods online, but not knowing how to do so, in the 'replicate' theme, and just wanting the best for their students even if they did not know what that was yet, in the 'looking for the best option' theme.

### 3. January/February 2021 – After a period of reflection and further implementation

Twelve interviews, conducted in January/February 2021, produced the second data set (Gilbert, Hodds and Lawson, 2021). Practitioners completing the May 2020 survey had the opportunity to give their consent to being contacted in the future for follow up research. Of those, we selected twelve that came from a variety of countries, namely England (7), Ireland (3), the Czech Republic (1) and Australia (1), to be interviewed. The seven selected from the UK covered a variety of institution types for example Russell Group, post-92 universities and distance learning centres. These opinions were gathered at a time where the majority of practitioners had been delivering a more considered online MSS for the first semester of the 2020/21 academic year, as this delivery followed a summer break with little or no MSS provided, allowing time for reflection. Practitioners had the opportunity to consider what had worked well during the crisis-reaction phase, what had not worked and potential reasons for these difficulties. A question-by-question analysis produced these main findings:

- **All institutions were offering some form of online support.** Institutions were mainly offering online drop-in sessions and pre-booked appointments with several also offering online workshops.
- **Engagement: The majority of practitioners still reported a decrease in student engagement when compared to before the pandemic, however, they were starting to see an increase from when support first moved online.** This was mainly applicable to larger institutions.

- **Benefits: Accessibility to distance learners was the most frequently identified benefit of online MSS.** As with the benefits identified in the May 2020 data set, the flexibility of online support increasing accessibility for distance learners, referring to any student distant from the location of MSS provision (and at this point all students were effectively distance learners), was still identified as the largest benefit to online support. This was a particular benefit for universities that have multiple campuses where previously only students who studied on the campus where the support was located could utilise it.
- **100% of practitioners wanted to offer some form of online support post pandemic.** Every practitioner interviewed provided reasoning as to why some form of online support should remain in their institution post pandemic, a clear increase from the 72% in May 2020.

As with the open question data in the previous data set, thematic analysis was performed looking at the interview transcripts as a whole, and eight thematic groups were identified based on both how many practitioners mentioned the theme, and total number of mentions. Figure 1 is a bar graph depicting these eight groups. Each bar is segmented into 12 sections representing the 12 practitioners, and if all segments are filled, every practitioner mentioned that theme at least once during their interview. The bars are plotted in order of importance based on how many practitioners mentioned the theme (i.e., how many of the 12 segments are filled) and then by how many times the theme was mentioned overall.

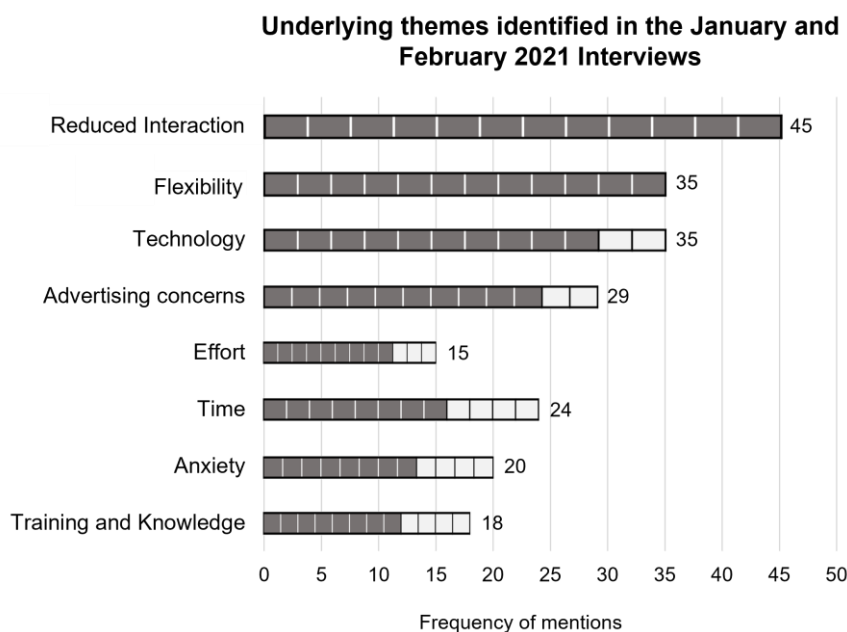


Figure 1. Bar graph depicting how many practitioners stated each of the underlying themes identified in the January and February 2021 interviews, and each theme’s total number of mentions.

- **Reduced Interaction.** As with May 2020, lack of unspoken communication and the inability to use visual cues to gauge student understanding, due to students not having their cameras on, was identified as the biggest barrier in online MSS.

- **Flexibility.** Flexibility remained the largest benefit of online MSS in practitioner opinion. At this sampling time, forward thinking was beginning to be displayed. Many of the responses coded into this category talked about offering students the choice between in-person and online depending on which suited them best. A blended approach started to become more popular.
- **Technology.** In both data sets so far, we had responses regarding statistics support not being as affected when support transitioned online. This was particularly in relation to mathematics online support having to involve writing formatted mathematical notation online (ideally on a shared surface), and statistics online support not having to face this difficulty.
- **Advertising concerns.** Although this was the topic of a question in the interview, advertising concerns were mentioned so regularly and not just in response to that question, by 10 different practitioners, that it became a category in its own right. The three most prominent concerns were word of mouth, particularly peer recommendation, footfall, the loss of students spontaneously walking in, and email overload, now that all areas of university life were online.
- **Effort.** This relates to the effort from both students and staff alike. With support only online, students can no longer walk past the physical centre and decide in the moment to walk in. If they want support, they have to actively seek it out. Likewise, staff have to actively learn new methods and grasp how to use technology new to them in order to support students as effectively as they did in person.
- **Time.** In this category, opinion was divided. One side of the debate was that online support takes longer online. Technological issues such as a stable internet connection and issues such as not knowing if the student understands, can cause practitioners to regularly repeat themselves. On the other hand, some practitioners suggested that online support saves time, from not having to commute to a physical location, and so more can be spent on things such as preparation and ideas for the future.
- **Anxiety.** Anxiety also presented a split opinion. Some practitioners believed that as students can remain in their home and not have to turn their cameras on, they feel more anonymous and comfortable, empowering some anxious students to engage with MSS. However, an opposing argument was made that online support can cause its own anxiety. If you ask a question in a busy support centre, only the people around you are likely to hear, but in a conference software's chat facility, everyone in the meeting will see.
- **Training and Knowledge.** Finally, many practitioners felt that they do not possess the pedagogical skills necessary to support students online, which is a concern that has remained from the May 2020 data set.

#### 4. June 2021 – A year of online support

Over a year after the initial data set, a June 2021 survey provides the final sample. At the time of the analysis here, there were 32 respondents from across 22 individual British Isles institutions. A similar survey was being conducted in Germany and an agreement was made with the German researchers that we would focus on UK and Ireland practitioner opinions and compare findings to those of the German study. The survey was designed based on the questions asked in both previous studies, so a comparison could be made.

The pattern in student engagement levels remained the same as identified in the previous data set. When comparing levels of engagement, during October 2020 – February 2021, to those before the pandemic, October 2019 – February 2020, practitioners were still seeing an overall decrease.

However, when compared to numbers during the initial phase of the pandemic, April 2020 – September 2020, numbers had increased.

Practitioners were asked about advantages and disadvantages in two open questions at the end of the survey. Flexibility and accessibility were again the most frequently identified advantages of online support. However, this was mentioned in only just over half (52.3%) of the 23 responses received for that question, a much lower percentage when compared to 100% of practitioners mentioning this benefit in the previous data set. This presents the question of whether flexibility and accessibility are becoming less of an advantage, or whether practitioners are just becoming desensitized to these benefits. The split opinion on time was also still present. There was a combined number of 40 responses across both the advantages (n=23) and disadvantages (n=17) questions; 20% of those were in reference to time. To break it down, 21.7% of advantage responses stated that online support saves time, and 17.6% of disadvantage responses stated online support is more time consuming.

Concerns about reduced interaction, particularly the lack of unspoken communication, were also still present in June. In May 2020, lack of non-visual communication was stated as the biggest issue with online support by a third of practitioners. Similarly in the second data set, reduced interaction was the largest underlying theme of the interviews, mentioned by 100% of the participants a total of 45 times. However, in June 2021, as shown in figure 2, when practitioners were asked whether they agreed with the statement that it is more difficult to determine how well students are engaged in online support, it resulted in more of a split opinion.

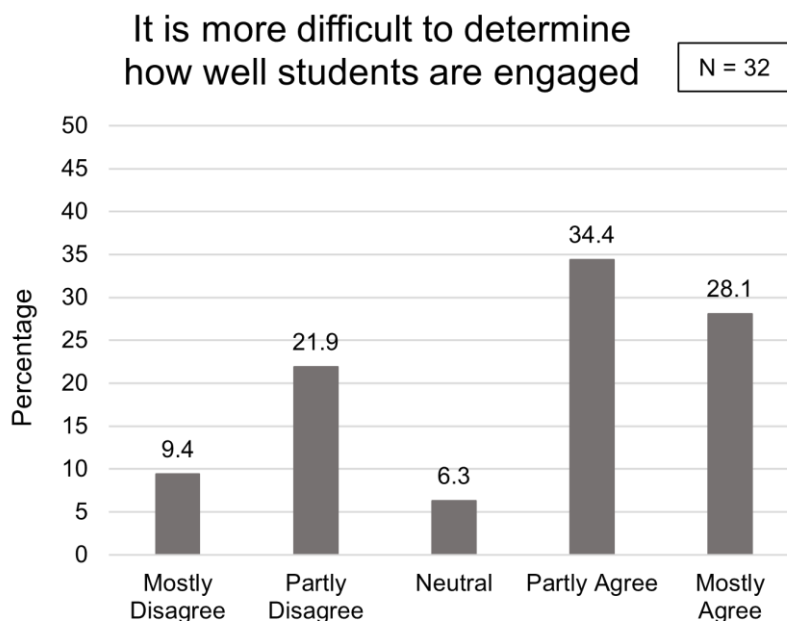


Figure 2. Bar graph showing the response distribution of practitioners when asked if it is more difficult to determine how well students are engaged during online mathematics and statistics support.

37.6% of 32 responses now either disagreed or were neutral, and 34.4% only partly agreed. Since student camera usage had not changed – when asked how often students have their cameras on, only 3.1% stated ‘always’ – something else has caused this change.



## 5. Discussion - The overall picture

The clearest change across the three data sets is that negativity and uncertainty regarding online support has changed to positivity. In May 2020, only 72% of practitioners stated that they would continue with some online support after the pandemic. This changed to 100% at both the second and third sampling times. When asked in the June 2021 survey how their attitude to online support had changed over the year, many respondents explained how hesitancy and even negativity towards online support before the pandemic, had been replaced by acceptance and positivity, using phrases such as '*greater understanding*' and '*enjoyment and confidence*'. The phrase 'in person is better' became much less frequent. This was foreshadowed in a case study in 2015 by Karal, Kokoc, Colak, & Yalcin. Two mathematics instructors, with no prior experience of distance teaching, taught their course using Adobe connect and a digital pen, and were observed and then interviewed. The authors stated that the instructors' negative attitude towards teaching mathematics online changed, as their experience of using the pen-based technology overcame their biases and resulted in them feeling as comfortable as they did teaching in person (Karal et al., 2015).

Flexibility and accessibility were most frequently identified by practitioners as the biggest advantages to online MSS at all three sampling points (however, in June 2021, when compared to the previous dataset, they were mentioned noticeably less). As the advantages of support being flexible and more accessible are well reported (as examples, see Bennett and Lockyer, 2004; Jagers, 2014; Johns and Mills, 2021), it suggests that other benefits are potentially being recognized more as flexibility and accessibility are now just 'expected' properties online support has. Less time wasted, and convenience were jointly the second most mentioned benefits to online MSS in June 2021 (21.7% of 23 responses). Practitioners stated that less time is wasted particularly in regard to students missing sessions; they have not had to waste time traveling to a location and sit waiting just for the students not to arrive. Online support being more convenient also relates to this; accessing resources and sharing content can happen a lot faster in an online setting and can be stored in one location.

The hurdles that educators have faced with students not having their cameras on while learning in an online setting have been well documented (as examples, see Dennen, Aubteen Darabi and Smith, 2007; Roberts, Malone, Moore, Russell-Webster and Caulfield, 2020; Castellie and Sarvary 2021), as well as identified by practitioners in all three data sets in this study. Unspoken communication can no longer be utilised to try and gauge student understanding. However, in June 2021, there was more of a split opinion. As average student camera usage has not improved, something else has caused this divide in opinion. One explanation may be that over the year, practitioners have found ways to overcome this barrier, using other methods to gauge students' understanding successfully, therefore the lack of unspoken communication has become less of a concern. Or there may be other disadvantages that are becoming more prominent. The next two disadvantages of highest concern in June 2021, were online support being time consuming (17.6%), and needing a higher level of pro-activeness from students to access services (11.8%), which were both concerns previously stated by practitioners during the January/February interviews.

Engagement levels are increasing. Although student numbers at each sampling point have remained lower than before the pandemic, in January/February 2021 and June 2021, practitioners stated they had seen an increase compared to when support first moved online. However, as methods being offered have remained relatively the same over the year, with online prebooked appointments, drop-ins, and workshops remaining the most offered provisions in each data set, further exploration is needed into why student numbers are now increasing. As with practitioners, it may be that students are becoming accustomed to online learning generally, leading to increased engagement with online MSS; of course, there may also be other influences contributing to the growing numbers.

## 6. Conclusion

Overall, practitioners' opinions of online MSS have improved over the space of the year. Being forced into supplying MSS online by the pandemic, helped practitioners overcome their pre-existing biases and general belief that it was not possible to deliver MSS online successfully. Practitioners became more aware of the benefits online support has to offer, rather than focusing on the initial negatives in a time of crisis, and saw that online MSS is not only possible, but it can be delivered to a high standard. As time progressed, offering chances for reflection, uncertainty and negativity decreased and explanations for identified barriers were explored, offering opportunity for improvement. Practitioners have stated that student numbers are now increasing but are still less than before the pandemic, so will require further investigation into the student perspective of online support methods.

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