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# Mathematics support centres' online presence: provision in Ireland and the UK in 2018

Ciarán Mac an Bhaird*, Peter Mulligan and James O'Malley
*Department of Mathematics and Statistics, Maynooth University, Maynooth, Co. Kildare, Ireland*

* *Corresponding author. Email:* ciaran.macanbhaird@mu.ie

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**Mathematics Support Centres are available in the majority of Higher Education Institutions in Ireland and the UK. Whilst the online presence of these centres appears to be increasing, there is little research to date which considers its breadth or effectiveness. In this paper we consider the results of a survey on the online presence of support centres in Ireland and the UK. We discuss the opportunities that arise from such a presence, the challenges that exist and what the results of the survey mean for individual practitioners and the wider mathematics support community.**

## 1. Introduction

Mathematics Support Centre (MSC) is often the given name, though there are variations, for the unit within a Higher Education Institution (HEI) which provides Mathematics Learning Support (MLS). MLS is typically described as mathematical and or statistical supports which are available for students in addition to their lectures, tutorials and assignments etc. (Lawson *et al.*, 2003). The availability of MLS has increased dramatically in recent decades and is now available in the majority of HEIs across Ireland and the UK (Ahmed *et al.*, 2018, Cronin *et al.*, 2016, Grove *et al.*, 2019). Ongoing research is looking at the level of MLS provision in Germany (Schürmann *et al.*, 2020) and the USA (Mac an Bhaird and Thomas, in preparation), and MacGillivray (2008) describes the situation in Australia.

Two key factors in the success of MLS have been the establishment of strong national and international collaborative communities of MLS practitioners, e.g. the Irish Mathematics Learning Support Network (IMLSN), the Scottish Mathematics Support Network (SMSN) and **sigma** (Network for Excellence in Mathematics and Statistics Support) (Croft *et al.*, 2015), and a strong ethos that MLS should be appropriately evaluated to provide best practice based on research (Matthews *et al.*, 2013, Lawson *et al.*, 2019).

The MSC in Maynooth University was established in 2007 and, based on advice from other MLS practitioners, we established our own website. For further details on the development of this website, see Mac an Bhaird *et al.* (2020a, 2020b). In summary, it initially provided information on MSC services, and some links to external websites with resources. As the MSC became more popular, the website also

grew, especially in terms of the range and detail of both internal and external resources. The website also contained links to resources on the institutional virtual learning environment (VLE) and to the MSC's social media accounts. Its progression was very similar to that laid out in the **sigma** best practice guide by Mac an Bhaird and Lawson (2012, p. 17):

> '. . . we should mention the importance of websites for any support initiative. Initially, it is sufficient to have a basic website, so if students want to find out more about the support, they can access a description of the support on offer, how it works, opening hours, ethos, staff and links to resources. The website should, in time, become another support outside of your opening hours which students can use as a focal point for resources. Many centres also use their institutions' Virtual Learning Environment (VLE) to deliver online materials or online courses'.

Since 2007, we maintained control over the structure and content of the website; however, in early 2018, due to potential university policy adjustments, the possibility of mandatory changes to the MSC website emerged. As all other services we provide are practiced based on research—for example, Mac an Bhaird *et al.* (2009) and Berry *et al.* (2015) consider the impact of MSC attendance on student retention and progression, we decided that this was an opportune time to assess the MSC website and related online supports.

Initially, we decided to run a student evaluation with a view to informing any potential changes (Mac an Bhaird *et al.*, 2020a, 2020b). To place our website and connected online features in context, we conducted a review of MLS literature. Whilst we found increasing references to this aspect of MLS, especially in more recent publications, we found very little research and, to the best of our knowledge, no study has previously focused solely on an evaluation of the effectiveness of the online presence of an MSC. Indeed, such research does not feature in the MLS literature review survey papers of Matthews *et al.* (2013) or Lawson *et al.* (2019).

In order to determine how our online provision compares to that of other MSCs in Ireland and the UK, we developed and issued a survey to MLS practitioners in relation to the online presence of their MSCs. In this paper, we provide further detail on the rationale for this research project with reference to relevant literature, and we outline our methodology. The results of the survey and their analysis are the main focus of the paper. We close with a discussion on the key findings and their implications for the wider MLS community.

## 2. Background and methodology

### *2.1. MSC websites and online presence in MLS literature*

In this section, we review MLS literature which relates to the online presence of an MSC. By online presence, we mean anything we could find in the literature which refers to MSC websites and VLEs, including online resources, social media etc., sometimes referred to as Information and Communications Technologies (ICTs). We only considered literature which referred directly to MSCs or MLS, and in almost all the literature that follows, references to online presence play only a small role.

Lawson *et al.* (2002) is one of the earliest papers which pays specific attention to an MSC website. They refer to the staff intensive nature of MLS and their (Coventry University) introduction of a website in an attempt to improve the effectiveness of their services. The enhancement rather than the replacement of existing tutor support was a key point raised.

> '*Surveys of students show that one-to-one support with a tutor is valued very highly. However, staff time is an expensive and limited resource. It is therefore important that other ways of supporting students*

> *are fully utilised so that staff time can be channelled to where it is most needed. For this reason the introduction of a web-site for the Centre was seen as highly desirable*.' (Lawson *et al.*, 2002, p. 2).

They describe website content which outline the MLS services provided in addition to online resources and assessment, and an email facility to allow students and tutors discuss mathematical problems. They close with a brief section on the 'Evaluation of Use', and this focuses mainly on the number of hits on various features of the website and the timing of these online visits throughout the academic year.

Coventry University's MSC website also features in the 2003 'Maths Support for Students' report by the Learning and Teaching Support Network (LTSN) MathsTEAM. Additional content here highlights the importance of creating awareness of the MSC website. It describes how the website featured as a standard learning resource link on the module pages of the institution's (recently adapted) VLE, and they recommend the sharing of resources due to the time intensive nature of their development. The role of the website as part of an MSC's services is also addressed:

> '*The website is only one part of the wide ranging support provided by Coventry University Mathematics Support Centre. Whilst setting up a website to make resources available electronically is reasonably straightforward, if this is done in isolation it may not provide a great deal of benefit to students. The website needs to be part of a larger support provision*.' (LTSN, 2003, p. 51).

Lawson *et al.* (2003) describe a survey of MLS provision in the UK to which 95 Higher Education Institutions (HEIs) responded, with 46 having some level of MLS. Twenty-five percent reported having online examples and, of the 25% who also reported having videos available, 70% referred to how rarely they were used. This was a much higher non-engagement level than with any other MLS service featured.

During the 2000s and early 2010s, those teaching in HEIs, including MLS practitioners, often described new initiatives at the annual CETL-MSOR Conference or in MSOR Connections. CETL-MSOR is an annual conference for those involved in HE mathematics, statistics and operations research teaching, learning and support. A review of conference proceedings (2006–2011, available via http://www.sigma-network.ac.uk/cetl-msor/archive-of-cetl-msor-conference-proceedings-2006-2012/) and articles (2000–2012, available via http://icse.xyz/mathstore/node/568.html) shows steady increase in the use of technology to support students. Furthermore, the IMLSN has had 'technology' as the main theme of their annual workshops twice, in 2009 (Ní Fhloinn, 2010) and 2015 (Cronin and Breen, 2015). Descriptions of exactly how, if at all, technologies were incorporated or integrated as part of an MSC's online presence were not common.

In 2010, Patel and Rossiter, who reported on student engagement with and awareness of the MSC at the University of Sheffield, included questions on online resources as part of their MLS student evaluations and also briefly describe the development of their website. '*An effort has been made to organise the mainly paper-based online resources in such a way as to enable students to get to topics quickly, and the authors are very encouraged to see that 8 out of the 39 students who made use of the support did so exclusively via the resources.*' (Patel and Rossiter, 2010, p101).

The **sigma** guide for MLS tutors (Croft *et al.*, 2011) had a short section dedicated to online resources and provided a list of resources, each with a brief informative overview. Also in 2011, one aim of a summer student intern MLS project in the University of Exeter was to create an online hub for students which would allow them to help each other. They state that '*Our aim was not to replicate the existing panorama of online resources for maths and stats, but to validate them through student review and build a framework for a sustainable student support community.*' (Cooper et al., 2011, p. 41).

The **sigma** guide on 'gathering student feedback' (Green and Croft, 2012) listed the MSC website and VLE as possible options when proposing potential survey questions on how students found out about an

MSC. Other potential survey questions referred to student use of the MSC website, its various features and enhancements that students would like to see.

The HE STEM Guide (Lawson, 2012) mostly features MLS cases studies from five HEIs, and the level of detail provided on their online presence varies greatly. One institution refers to their website address once, whereas three other institutions report a mix of 'operational data' such as opening hours, locations etc. (which one institution complemented via Twitter). Links to both external and internal resources, use of iPad in MSC for ease of access to online resources and assistance via email are also listed. The fifth institution, Coventry University, outlines a comprehensive suite of online supports, mostly described earlier, and also includes an 'in-house' recording studio which was used to make short videos made available to students through iTunes. However, the key point that comes through again is that '*The resource that students most value is the personal one-to-one support*' (Lawson, 2012, p. 9).

In the **sigma** guide on setting up an MSC (Mac an Bhaird and Lawson, 2012), there are multiple references to the online presence of an MSC. For example, they mention MSCs using their VLE to organise appointments and

> '*institutions post the notes from these workshops onto their VLE, and also include relevant online resources. Some institutions are also using their VLE to provide online support on basic materials. This can be a very effective use of staff time and resources; however engagement levels are sometimes low.*' (Mac an Bhaird and Lawson, 2012, p. 15).

They also refer to websites as one of many routes for MSC advertisement, they highlight the involvement of students in designing videos to promote MSC engagement, and they briefly describe physical and online resources. They emphasise the importance of sharing online resources amongst the wider MLS community:

> '*we strongly advise against starting the production of your own resources on a large scale without a thorough investigation of existing materials. There is a wealth of material that is already freely available and your time would be better spent actually working with students rather than producing another version of existing material. You should only produce resources for niche topics where no materials currently exist and then make them available through the mathcentre community project.*' (Mac an Bhaird and Lawson, 2012, p. 18).

In 2011 in Ireland, a large-scale student evaluation of MLS was carried out by a subcommittee of the IMLSN (O'Sullivan *et al.*, 2014). It featured responses from 1,633 first-year service mathematics students across 9 HEIs. ICT was the broad term used to cover online support/website, email questions service, CALMAT software etc. In 8 of the HEIs, students were asked to rate ICT, and there were 268 responses. Over 55% indicated that ICT enabled supports were quite or extremely worthwhile, and just less than 19% felt that they were not worthwhile. However, when compared with other face-to-face MLS services in this report, ICTs were the least positively endorsed. Coding of 112 additional open comments gave 5 main categories: satisfaction level with services provided (41%), issues with quality of materials/layout/ease of access (28%), prefer human help with mathematics (12.5%), did not know it was there (9%), and issues related to the time required to engage with online materials (9%). Based on the analysis of this data, the authors added a recommendation:

> '*Given that ICT enabled Supports play an increasing role in MLS services, the rating and comments would suggest that issues regarding the digital literacy skills of students and the practical issues of accessing the online materials/services provided require further consideration if these services are to be of maximum benefit to students. We recommend that: Further investigation be undertaken to explore how MLS providers can enhance the online resources and services available to students, and increase*

*student awareness of and improve student accessibility to these ICT enabled Supports.*' (O'Sullivan *et al.*, 2014, p.83).

This recommendation indirectly led to our current study, and the impact of the 2014 IMLSN report has been quite significant in other ways. As a result of a separate recommendation, the IMLSN decided to conduct a survey of MLS provision on the island of Ireland in 2015 (Cronin *et al.*, 2016), and that survey had some questions which were specific to online support.

Twelve of the 25 HEIs that provided MLS indicated that they offered online support, and of the remaining 13, 9 reported that they planned to introduce some level of online support. When asked about the type of online support they provided, 10 of the 12 HEIs offered more than one type.

'*Links to websites (such as mathcentre) and video tutorials were most widespread. A dedicated website or virtual learning environment (VLE) and revision notes were also relatively common. Only one institution surveyed listed social media as an available form of MLS. MLS via Skype appointments was equally rare. A virtual drop-in service was not offered at any institution surveyed.*' (Cronin *et al.*, 2016, p. 23).

When giving an overview of their findings in comparison to a 2008 survey of MLS provision, the report mentions that the types of online MLS available in both surveys are similar, and that online supports are underused when compared with other types of MLS. They recommend

'*. . . a need to investigate the reasons for the underuse of ICT and whether the digital capacity of students, staff, institutions or MLS resources are relevant factors.*' (Cronin *et al.*, 2016, p.62)

Elsewhere in the 2015 survey, when the 25 respondents were asked about their methods for advertising MLS services, online options such as websites (11), Moodle/Blackboard (7) and Facebook/Twitter (5) were amongst those selected. However, the report does refer to a lack of clarity on whether respondents were referring to the institutional or MSC website, and no information was received on the effectiveness of these advertising methods.

The 2014 IMLSN report also influenced the IMLSN's decision to have their 2015 workshop focus on maximising the benefits of technology in MLS (Cronin and Breen, 2015). At that workshop, there was a presentation on a prototype virtual online drop-in across three HEIs in Dublin. At that time, these HEIs were potentially going to amalgamate into one larger HEI.

This virtual drop-in was reported on in full in Breen *et al.* (2016). Initially, they conducted surveys of staff and students in the three HEIs about delivery methods for MLS. They found that 71% of staff and 88% of students preferred exclusively or mostly in person support when compared with online. Only in one HEI did staff, and students indicate a preference for exclusively online MLS and this HEI was teaching several modules online. As a result of these findings and the recommendation from the 2011 IMLSN survey, the authors decided to develop an online drop-in service and '*hope*[d] *to replicate the in-person experience as much as possible in a virtual environment*' (Breen *et al.*, 2016, p. 12). They used Adobe Connect and a single session for all students, which allowed students to communicate with each other as well as with the tutor. They commented that

'*Overall students were positive towards the concept of the Virtual Drop-in service. However, they felt that the technical issues that arose during the trials, such as feedback and slow connection issues, would need to be addressed in order for this service to be implemented successfully.*' (Breen *et al.*, 2016, p. 13).

Another student internship project in 2015 at the University of Bath considered online MLS. Collins-Jones (2016) briefly describes how she talked locally with students, staff and other support services and conducted a survey of other MSCs on the methods they used to promote their MLS services.

Whilst the results of this survey are not published, the author remarks that social media was highlighted as one method people '*wanted to start using but didn't know how or felt constrained by time*' (Collins-Jones, 2016, p.28). Whilst the author provides some detail on how they used Facebook, Twitter and a social media management dashboard (https://hootesuite.com/) during the project, they also added that students did not report they first found out about MLS services via Facebook and Twitter. This internship project also led to the production of a social media guide (http://www.sigma-network.ac.uk/wp-content/uploads/2016/05/Social-Media-Guide.pdf).

Finally, in this section, the authors recently discovered 'A Handbook for Directors of Quantitative and Mathematics Support Centres' produced in 2016 in the US by Coulombe *et al.* This guide contains a chapter (Nuffer, 2016) dedicated to 'virtual presence', where they initially provide a comprehensive description of functional aspects such as the merits of static and dynamic websites, choosing a web host and establishing a domain etc. Of most relevance to us is their section 'Recommended Features for Websites', where many suggestions were consistent with what we have seen already. However, there were several details which we had not previously encountered—for example, they mentioned recommended design styles, fonts and colours for websites, and having 'tutorial report forms' and 'tutor evaluation forms' on the website.

### 2.2. *Methodology*

Given the prevalence of MLS provision in HEIs in Ireland and the UK, and the fact that no previous research has focused exclusively on the online presence of MSCs, we decided to have the majority of our survey in open format with a view to capturing as much data as possible. We developed a survey with 13 questions over three main sections, and we tested the survey layout and questions with colleagues in our institution who were not involved with the MSC or the research project. Based on their feedback, small adjustments were made, mainly to address points of clarity in relation to the wording of certain questions. All questions except 8, 9 and 13 had yes/no options followed by a space for the respondent to provide extra detail. Questions 8, 9 and 13 were open-response only. Ethical approval was granted in April 2018 and the final survey was distributed via IMLSN, SMSN and **sigma** mailing lists. These are the main mailing lists for MLS practitioners in Ireland and the UK.

We received 33 completed surveys by email and verified that the 12 Irish and 21 UK responses came from distinct institutions and from the person responsible for MLS in that institution at the time. Based on some of the findings reported in Grove *et al.* (2019), this corresponds to a response rate of approximately 28% of institutions who provide MLS.

All survey responses were entered electronically into Microsoft Excel. Prior to data analysis, each institution was given a unique code, and any identifying characteristics were removed from open responses. The open responses were coded separately by each author, who then met to discuss and agree on the main categories of response that emerged from the data. This is consistent with the *Grounded Theory* method of data analysis (Strauss and Corbin, 1998).

## 3. Results

The survey had three parts, with the following very general headings (heading titles were not used in the survey): extent of online presence (Questions 1–3), data, advertisement and social media (Questions 4–7), and further MLS practitioner opinion (Questions 8–13). We will use this structure throughout this section, and $n = 33$ throughout unless otherwise indicated.

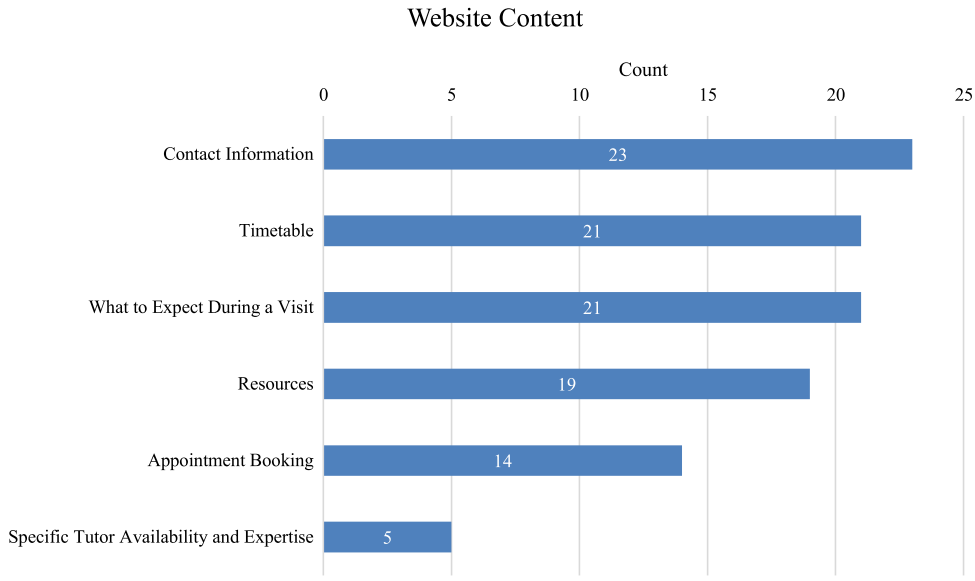


FIG. 1 Categories of response on content of MLS website ($n$=27)

### *3.1. Extent of online presence*

In Question 1, respondents were asked '*Do you have a website for your MLS provision?*', 27 selecting 'yes' and 6 'no'. All 27 who answered 'yes' elaborated on the content of their website, some giving multiple examples. See Fig. 1 for the six categories of response. Of the 19 who hosted resources on their website, 13 of these provided links to external resources, 8 offered resources developed by that institution, and 4 hosted quizzes or diagnostic tests.

Twenty-six of the 27 indicated that their website was tied to their institution's wider web presence '*We are limited in the design of the website as it must comply with our central* [institutional] *design policies'*. Three of these noted that this created an obstacle with respect to their design and content provision as they were restricted by wider institutional policies '*We are constrained by digital media rules as to what can be hosted directly, how it is written and how it is linked together*' and '*We see this a serious obstacle to advertising the service to current and prospective students. Work is ongoing to include an external facing webpage on the university website*'. Only one MSC reported that their website was autonomous within its institution's web structures.

Of the six respondents who answered 'no' to Question 1, four added comments, all of which detailed how information about their service was provided elsewhere '*All details in respect of the Maths Learning Support Centre are posted on our VLE (Blackboard) through a Teaching and Learning Student Hub. Weekly timetables are made available through departmental notice boards also'.*

In Question 2, we asked '*Do you provide online virtual (non-physical) MLS for students' mathematical/statistical queries (e.g. corresponding through skype, emails, online chat)?*'. Twenty-three picked 'yes' and 10 'no'. Four of the 23 indicated that they offered this service in relation to statistics enquiries only.

Eighteen said they responded to emails, 16 of these gave details on the nature of the emails and some gave multiple responses. Nine of 16 said that they answered questions over email, 5 of these 9 qualified

their response by stating that they only answered questions via email if it is '*absolutely necessary*' or if the questions were simple enough '*We answer questions via email in cases that this can be done easily. If not, then we encourage the student to visit the centre*'. Six of the 16 respondents who gave details about emailing students said that they responded to student 'queries', it was unclear if these queries were of a mathematical nature or simply general questions about their service '*I have answered a number of queries through emails and I have also set up course discussion forum using the VLEs discussion board facility*'. Two of the 16 who supported students via emails specified that tutors often followed up with additional resources, and another 2 made use of graphics tablets or similar technology to bolster their support '*Email (supplemented by graphics tablet) only now but have used Wimba Classroom before and YouTube before and have experimented with Scribblar and Blackboard Collaborate. Have also recorded some statstutor workshops using Panopto*'.

Twelve respondents indicated that their MSCs provided Skype appointments for students, though five then qualified this by saying that, whilst they have the facility in place, there had not been much uptake for these sessions '*We provide occasional Skype tutorials. However, they are not very popular and a little clumsy to set up. Email support/correspondence is more preferred by students but even this is negligible in comparison to physical support*'. A further 5 of these 12 specified that Skype is made available only when a student cannot attend a drop-in session, either due to disability, attending a satellite campus or being on an apprenticeship. Eight MSCs provided sessions using some form of virtual classroom such as Blackboard Collaborate, Adobe Connect, slack.com etc. '*now it is mainly responding to questions by email and I have occasionally used adobe connect to speak with students and answer questions'*. Two of these eight indicated that these sessions were intended as a support for students in satellite campuses and one further respondent praised their usefulness as an out-of-hours support to students working full time jobs. '*Advantages here are that tutors can host sessions at 11pm-1am for example to suit student demand as so many students work fulltime jobs these days as well as studying full time. Students appraise these slack sessions as very helpful though anecdotally I feel this is because their exam query is answered quickly and efficiently - using the usual mentoring MSC model style of tutoring is not feasible via slack*'.

Nineteen respondents provided support via Skype or a virtual classroom (one provided both), and four gave additional information. They indicated that these supports were poor from a technological standpoint e.g. synchronisation issues or Wi-Fi dropping '*Also tutor evaluations state that nothing can replace the face-to-face tuition and slack is far from ideal but previous virtual MSC experiments with Google Groups, Skype, Google Hangouts were technically poor*'.

Finally, in this part of the survey, respondents were asked in Question 3 '*Do you have a virtual learning environment (VLE, e.g. Moodle, Blackboard etc.) for your MLS provision?*', 27 selecting 'yes' and 6 'no'. The 27 respondents gave details of their VLE platform, see Fig. 2. The respondent that used both Blackboard and Moodle stated that they hosted general information on an academic support page on Blackboard and all their resources on Moodle. They did, however, acknowledge that asking students to use two VLEs is '*not ideal'*. Twenty-six of these 27 had a VLE solely dedicated to their MLS service whilst one had a presence on a wider academic support VLE page.

All 27 also indicated that they provided some type of resources: 3 reporting that they provided discipline or module specific resources on their VLE '*The Moodle page is a collection of publicly available free resources and in-house produced video tutorials. It is static and used for directing students to relevant and trustworthy sources more than anything*'. Eight provided quizzes and diagnostic tests, and three indicated that they used Numbas as part of their support provision via their VLE page '*This offers notes for some courses with blackboard multiple choice questions. It also contains online formative self-assessment questions using Numbas. Many modules have a question bank but not all. It is a work in progress*'.

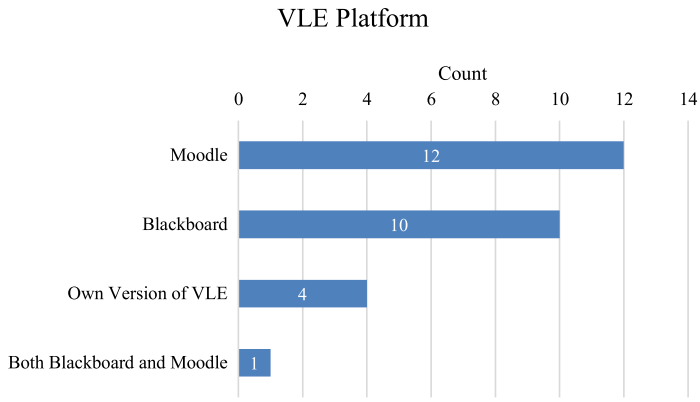


FIG. 2 VLE Platforms used ($n$=27).

Eight respondents also indicated that they used these VLEs to provide information about their services, such as opening hours etc. '*we use it to communicate timetables and sessions at the start of every week*'.

### 3.2. *Data, advertisement and social media*

There were 32 responses to Question 4, '*Do you keep a record of the number of visits or uses to your ICT(s)?*', with 11 indicating 'yes' and 21 'no'. Six of these 11 reported that they made use of their VLE's inbuilt tracking system, 2 used video view counters and 1 measured hits on their website '*Activity on the moodle support module was recorded as part of a study a couple of years ago but no monitoring takes place now*'.

Of the 21 who said 'no', 12 respondents clarified by saying that they had the means of accessing this information but did not currently make use of it '*We tried using Google Analytics but lost track of it, you need to embed analytics at such a granular level e.g. you need to attach "click through" metrics and embed them in each page e.g. for each PDF that might get downloaded – similar issues with Blackboard their* '*statistics tracking*' *cannot be trusted as was discovered at* [this institution]'.

Of the remaining nine who responded 'no', five commented that they did not collect this information nor did they have to means to '*No, Unfortunately we have to use a website that is organised and run through IT that we have no control over.*' and '*No, it is technically very difficult to do as our VLE website is available for all* [our] *students and staff*'.

In Question 5, we asked '*Have you evaluated or measured the effectiveness of these ICTs in any way?*', and 32 respondents answered. Eleven selected 'yes', and 21 'no'. Of the 11 who did evaluate their ICTs, 7 of these did so through student surveys or focus groups '*BOS* [Bristol Online Survey] *and focus groups*', three made use of their ICTs' usage stats (video views, VLE hit counters) and one indicated that their screencasts were evaluated in the past but did not specify how.

Twenty-one indicated that they had not evaluated their ICTs, and 11 of these gave comments: 3 specified lack of time or expertise '*Time and resourcing is a major culprit for not being able to do this*'. A further three said that they rely on informal feedback from students to gauge the usefulness of their ICTs '*Occasionally we received positive feedback from students*', and two stated that they intended to evaluate in the future and two said that they did not need to.

We then asked, in Question 6, '*Have you taken any specific steps to advertise or increase engagement with your ICTs?*', and there were 32 responses in total. Twenty-one respondents answered 'yes',—for example, '*We have posters, in class shout outs, display screen ads about the mlsc, all of which give the web address. It isn't clear how effective these are because we haven't done a careful analysis.*' and '*We give out 'maths support' bookmarks to students (publicity purposes especially during Induction) which has a link to the Maths Support Moodle*'. Whilst 11 respondents selected 'no', 4 of these clarified that, whilst they did promote their ICT services, they had not taken any *specific* steps to do so '*No, our online resources are advertised alongside the centre itself (during class visits, open days, etc.) but we have not conducted a specific advertising campaign that focussed solely on this*'. If we analyse the data from this point of view, 25 respondents have advertised their ICT provision whilst 16 have taken *specific* steps to advertise ICT supports (outside of their regular advertisement). The nature of the advertisement used by the 25 respondents is quite varied and is presented in Fig. 3.

Finally, in this section (Question 7), we asked '*Do you use social media as part of your MLS provision?*', 25 respondents selected 'yes' and 8 'no'. Of the 25 who used social media, 16 used Facebook and 20 used Twitter (13 used both platforms), and 2 that indicated they used social media did not specify which sites. Two respondents, both of whom also used Facebook and Twitter, indicated that they had tried or planned to try Instagram but reported that the time intensive nature of its upkeep was a barrier '*We have recently discussed using Instagram but again, due to a lack of time we haven't yet pursued this*'. This sentiment was echoed by a further three respondents who also mentioned the time intensive nature of social media upkeep.

Of the 25 MSCs that used social media, 21 clarified what they used it for, with many giving multiple uses. Twenty used it to advertise their services and provide general information '*Both platforms are used to advertise the timetable, any surveys and competitions we run, and to provide competitions/games/-general mathematics fun and information*'. Two used social media to provide content and resources, and

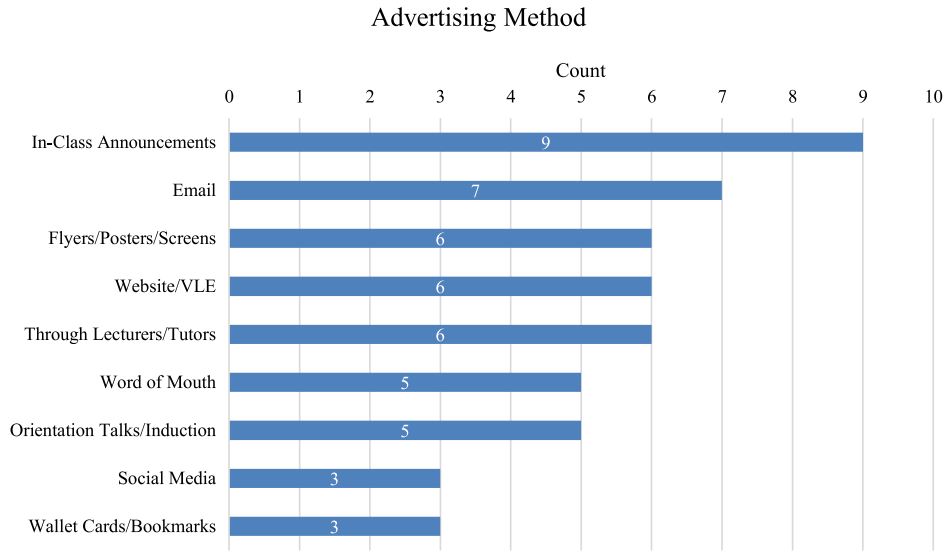


FIG. 3 Methods used to advertise ICT provision ($n = 25$).

one used Facebook to facilitate student communication '*We have used Facebook groups to provide a forum for students to engage and interact with each other*'.

Seven of the 25 respondents to this question reported on their own lack of engagement with their social media '*It really requires someone to maintain interactions and having a dedicated person to this would mean resources would have to be moved from drop-in support*'.

Of the 25 respondents who indicated that they did use social media, 9 of them did not have their own dedicated social media account; instead, information is posted through a wider academic support or library social media page. The issue of institutional control is mentioned here again with two respondents remarking that social media usage is centralised to a university marketing team or equivalent body which makes the process of posting slow and difficult '*all online media is currently under the university control, which means that any tweet we want to put up has to go through the main channels and is quite slow*'.

### *3.3. MLS practitioners' general feedback on ICTs*

In Question 8, we asked '*Please briefly give your opinion on the importance and role of ICTs (those listed above and or others) as part of MLS provision*', and 31 responded. The main categories of response are presented in Fig. 4.

Most respondents simply gave a short answer such as '*advertisement of resources*' without giving their opinion on why this was important. However, comments in some of the categories gave additional detail. Of the 21 respondents who mentioned the provision of resources as an important role of ICTs, 7 of these responses were also coded in the category of those who considered relevant/reliable resources to be important '*I have selected resources for which I can guarantee the academic accuracy, and which are specifically relevant to students studying in my institution. Nowadays, students inevitably search answers online, plus an increasing number of students study online degrees, or from distant places, so ITCs are becoming increasingly relevant*'.

Eight respondents remarked that ICTs were useful as an add-on to existing supports '*I see it as a useful add on. To achieve anything more substantial I would need to have extra time and funding*'. Six of

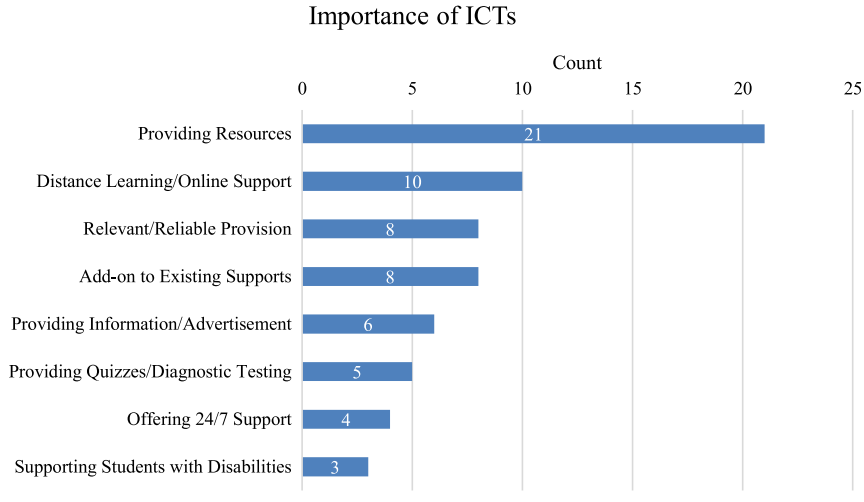


FIG. 4 Importance and role of ICTs ($n = 31$).

these then clarified that this was the case as 1–1 support is more important and should not be replaced by ICT support '*I think that there is no replacement for the effectiveness of in-person mathematics support, however there is scope for this to be supplemented by online supports to cater for students with different learning needs*'.

We asked in Question 9 '*If you have integrated ICTs into your standard MLS provision, briefly comment on how you have done so*', 21 respondents answered this question. Eighteen indicated that they did integrate ICT's into their standard provision with some respondents giving multiple answers. Seventeen of these 18 indicated that they used ICTs to deliver resources to their students '*The website contains the resources that we point students in the direction of when they have completed their diagnostic test. The results show the students the areas they need to work on with a suggested list of worksheets – these are the ones on our site*'. Six used ICTs to provide online support such as Skype appointments or email queries '*As mentioned before we also use online appointments via Skype for statistics support for distance learners*'. Six delivered diagnostic tests or quizzes online, and three used ICTs as a means of providing session management or a booking system. The session management is used by centres to keep details of every MSC visit which can then be reported back to tutors or lecturers '*Our main resource is our session management system which gives the details of every MSC visit (e.g. Module code/name, length of visit, nature and classification of query and how (and if) it was resolved). These details are all fed back to 50+ lecturers/module coordinators each Friday (during term) via an automated email*'. Two of the 17 centres who integrated online resources into their standard MSC provision used Numbas.

Of the three respondents who answered no to Question 9, two stated that they had plans to integrate ICTs into their provision in future. One respondent added '*We have not done so but from next year staff will have access to iPads for more easily showing resources to students/using Geogebra etc. We will also be collecting usage data electronically from next year. We also help with (mathematical) programming and mathematical typesetting queries in our dropins. There are computers available for this with access to any and all software used on campus*'.

Thirty respondents answered Question 10, '*Do you see any negative aspects to providing ICT support?*'. Eighteen answered 'yes' and 12 answered 'no'. Seven of the 12 who answered 'no' made no comment, all 5 of those who did comment followed up with caveats or considerations that they said must be observed when providing ICTs. These considerations have been included with the 'yes' responses to give a total of 23.

Of the 23 who made comments about negative aspects to ICT support, or considerations when providing these supports, 16 indicated that ICTs should not be used as a replacement for 1–1 provision, and that a blended approach was required '*No, I think it can have a role complementing the face-to-face support and there are perhaps two aspects: Passive provision (i.e. resources) and active provision (online real-time tutorials)* [ . . . ] *In terms of making (passive) resources available through a VLE, this can be easily done but we need to ensure that we do not confuse this with* '*mathematics support*' *as it is not*' and '*No, I don't think so once they don't replace face to face. I think for a lot of students, particularly those currently likely to attend a support centre face to face is hard to beat*'. Two of these 16 also voiced their concern that online provision would be used as an excuse for cutting 1–1 support by institutional authorities '*No, I don't think ICT support has any particularly negative aspects but I believe there are [ . . . ] areas which need to be taken in to account when developing ICT support: Are the resources part of a blended approach to support, involving face-to-face support as well, or are they designed to replace face-to-face support? A recognition that the development and maintenance of ICT support is a resource intensive process and should not be seen as a way of reducing the budget for this provision*'.

Ten of 23 remarked that time and resource constraints were a central issue '*providing quality online materials and support can be labour-intensive especially during the set-up phase and setting aside the*

*time and resource to do this well has implications for what else you can offer whilst the resources are being developed*'. Two respondents commented on how technology is not always accessible to those students from disadvantaged backgrounds '*. . . but there is evidence to say that online support does not compare favourably with the one-on-one drop in service. Some students will not own laptops or have a PC at home so any resource made available online should also be mirrored by the physical walk-in service. Also websites, links die over time or don't get maintained and so what is a recommended link one year may be outdated or gone the next*'. Three commented on the reliability of technology with one respondent remarking on the difficulty of finding an ICT package which can effectively display and present mathematical material. In terms of resource reliability, two respondents flagged the dangers of students finding unsuitable material online '*Are the resources tailored to the needs of the students and how involved are the students in their development?*' A further two comments were made by different respondents on the dangers of students misdiagnosing their issues and hence not getting the most effective help '*Some students may see ICT support as a sufficient alternative to visiting the MSSC and speaking to a tutor face-to-face. Without doing so, they may not correctly self-diagnose whatever issues they are facing and this may lead them to concentrating on material that won't help them overcome these issues*'. Two centres further remarked on how too much ICT support can be a bad thing '*More generally, there comes a point where providing more resources becomes unhelpful, as students will look for solutions online rather than sitting down and thinking hard about a problem/topic*'. These echoed the sentiments of four other respondents who had concerns regarding student disengagement from courses or material due to lack of face to face contact and poor performance.

In Question 11, we asked '*Would you like to provide additional ICT supports?*', and 30 of the 32 respondents answered 'yes'. In total, 29 of those who answered 'yes' and one who answered 'no' left comments. There were two main categories of response. Twelve indicated that they would like to provide more online resources e.g. links to videos, of these 12, 6 specifically mention developing their own resources '*Develop more resources internally and make use of the VLE*'. Eleven responded that they would like to provide additional online/virtual supports e.g. Skype '*If we had the staff I would love to run drop in online but it* [would] *have to be some form of video in order to interact correctly with the student(s)*'. Three respondents indicated that they would like to develop more quizzes or online assessment; two mentioned they would like to improve their website, with one of these also wishing to provide study tips; and one indicated that they would like to invest in technology such as iPads in order to '*emulate the "blackboard" in the virtual world for distance learning students*'. One respondent also answered yes to this question but said they were unsure of what form these additional supports would take.

Interestingly, 9 of the 29 who answered yes did so with some caveats. Seven of these highlighted that, whilst they would like to expand their ICT supports, time and resources were a limiting factor '*I'm planning to expand our page on online resources and to look into options to use social media and to offer online support. However, resources are very limited, so we'll need to take one step at a time*'. Three said that they would prioritise their face-to-face support before ICT support, and two also indicated that sourcing appropriate software was difficult.

Of the two respondents who answered 'no' to this question only one made a comment '*This would not necessarily be my priority, as I would* [like] *to see other changes being made to Maths support first (location/teaching space/staffing)*'.

There were 33 responses from Question 12, '*Have you applied for/received funding specifically for the development of ICTs (those listed above and or others)?*', with 16 selecting 'yes' and 17 'no'. The most common use of this funding was for the development or collection of online resources (11). Four used funding to develop quizzes or diagnostic tests, two to set up or develop their webpages and one to

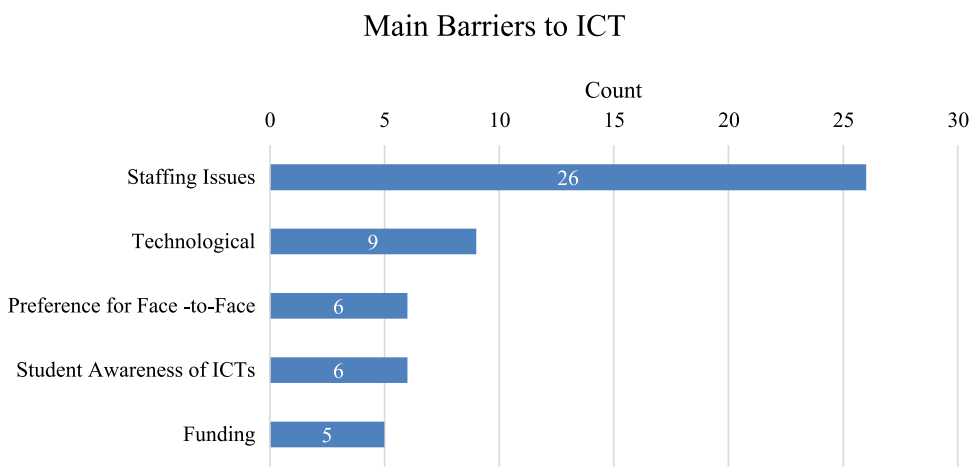


FIG. 5 Main barriers to ICTs ($n = 31$).

translate material into Welsh. Two centres aimed to use the funding to develop virtual drop-ins '*We have some internal funding to work on updating our webpages and VLE resources*'. One further respondent hoped to develop their social media for the purpose of online student support '*Funding was provided by the sigma Network to explore use of social media*'.

Eight respondents indicated that they received funding from internal sources such as Offices of Teaching and Learning, Distance Learning etc. Two respondents indicated that they had not received funding but received support from Digital Learning and IT Services. Seven respondents indicated that they received funding from external resources—for example, from The National Forum for the Enhancement of Teaching and Learning in Higher Education and from **sigma**.

Of the 17 who answered 'no' to this question, 4 made relevant comments. Two stated that they hoped to pursue funding in the future—'*not as yet, but would welcome any ideas that may be worth pursuing*', and the other referred to no recent applications '*Probably back in the mists of time, but not recently*' and '*Not in the last 10 years*'. The remaining 13 made no further comment.

Finally, in Question 13, we asked respondents to '*Please describe what you see as the main barrier(s) (if any) to the provision of or engagement with ICTs (those listed above and others) in your institution (e.g. wifi or device availability, skill set of staff/students, digital capacity of institution etc.)*'. Thirty-one responded, and the main categories of response are presented in Fig. 5.

Staffing issues included staff skills and lack of staff time/availability/numbers. Technological issues included problems dealing with mathematical notation, data storage concerns and central institutional control of websites, social media etc. Similar to Question 8, many responses were short and simply stated '*funding*', for example. Other responses were much more detailed, and coding placed them in several categories. For example: '*Staff time and costs and the university web management system that means we are not able to edit our own materials online*', '*Many students prefer face to face support. It is sometimes difficult to get access to relevant software because of license and funding issues*,' and '*Many available tools do not support mathematical notation; skype, email, blackboard etc. Moreover, there is a real value in seeing mathematics being done 'live'. While this could be achieved in a skype session using a tablet, existing technologies are awkward and expensive (and of course, the student at the other end probably won't have such a device)*'.

## 4. Discussion

Nuffer (2016, p. 125) states '*In addition to its physical location, a QMaSC* [Quantitative and Mathematics Support Centre] *must be virtually present in meeting the needs of students*'. Though no previous study has specifically researched this topic, it appears from MLS literature that the development of the virtual or online presence of MSCs in Ireland and the UK has steadily increased since the early 2000s. Recent studies (O'Sullivan *et al.*, 2014; Cronin *et al.*, 2016) reported 8 (of 9) and 12 (of 25) HEIs respectively who identified some level of ICT or online support, albeit that the relevant questions were small parts of much larger surveys. In our survey, all 33 HEIs who responded had some level of online MSC presence, though this is hardly surprising as they chose to respond to the survey. Nevertheless, we do get interesting insight on the extent and detail of this online presence, the opportunities that it presents and the challenges that individual MSCs and the wider MLS community face.

All but one MSC in this survey had either a website ($n = 27$) or used a VLE ($n = 27$), and the majority ($n = 22$) had both. The most common use for these sites was for the dissemination of MSC operational information such as opening hours, tutor schedules, how to use the MSC etc. and is consistent with any descriptions we found in literature (Lawson *et al.*, 2002) and suggestions in various MLS guidelines and reports (Lawson, 2012; Mac an Bhaird and Lawson, 2012; Nuffer, 2016). In our survey, operational information was more likely to be placed on websites rather than on VLEs.

The provision of online examples or videos, sometimes supplemented by diagnostic testing or assessment, is not new to MLS, see—for example, Lawson *et al.* (2002). Though their use is often recommended (Croft *et al.*, 2011), their implementation has not been uniform (Lawson *et al.*, 2003; Cronin *et al.*, 2016). In this survey, the majority of HEIs ($n = 19$) made online resources available, mainly via links to external websites or locally developed materials. Through their VLE, eight MSCs also provided diagnostic tests and quizzes, and three used the e-assessment system Numbas. Furthermore, 20 HEIs reported that they provided virtual support through Skype or a virtual classroom, e.g. Adobe Connect, though the number of MSCs that used this support on a regular basis was much lower.

When specifically asked about the importance and role of ICTs, the provision of resources and extra math support were the most commonly coded comments. Respondents appeared to regard online material and ICTs as a useful repository for content which is accessible 24/7, especially when face-to-face was not available. The role of online supports to supplement existing provision is highlighted in MLS guides (Mac an Bhaird and Lawson, 2012; Nuffer, 2016), and in this survey, eight respondents stressed the point that online supports should complement rather than replace face-to-face. MLS guides and respondents to this survey also indicated that both MSC staff and students had a preference for face-to-face support, and we found similarly when we surveyed students in our own institution (Mac an Bhaird, 2020a, 2020b). Two respondents raised the concern that authorities in a HEI might identify a successful online support as a cheaper alternative to face-to-face. Respondents also identified the provision of resources as a method to ensure reliable and relevant online support, as opposed to what students may generally find on the internet. We believe that it is important that MLS practitioners carefully consider how students might engage with online supports. Goldman *et al.* (2012) suggest that stronger students are better than weaker students at identifying reliable websites when searching for information online. Our own surveys of student use of online resources (Mac an Bhaird et al., 2020a, 2020b) indicated that the reliability of resources they found online (external to the institution) was not always a concern for most students.

The 'current' practices reported in the survey indicated that ICTs appeared to be used for advertisement slightly more often than for the provision of resources. However, when asked about the role and importance of ICTs, only 6 comments mentioned the advertisement of MLS services whereas 21 referred to the provision of resources. This might suggest that practitioners want to provide more resources, and this becomes very clear when you consider responses to the question 'Would you like to provide additional

ICT supports?'. Thirty of 32 respondents said yes, and 25 responses featured resources or virtual supports. Cronin *et al.* (2016) found that, of 13 HEIs not providing online support, 9 planned to start.

However, perhaps a surprising outcome from this survey was the low level of evaluation of the online presence of the MSCs reported, especially when compared with the culture of research-based practice which is embedded in MLS (Matthews *et al.*, 2013, Lawson *et al.*, 2019). Only 11 of 32 indicated that they evaluated or measured the effectiveness of their ICTs, and 9 specified how they did so. Seven had questions as part of their annual MSC survey or conducted interviews, and two considered usage data. These methods of evaluation are consistent with the limited number of examples of data collection we found in the literature (Lawson *et al.*, 2002; Patel and Rossiter, 2009). Of the 32 respondents, only 2 appear to have published research which focussed on evaluating their ICTs (Lawless *et al.*, 2016; Breen *et al.*, 2016). There also appears to be a lack of awareness of what other practitioners are doing in this area. For example, 12 respondents in this survey referred to 'expanding their resources' with 7 specifying that they would like to do so internal to their institution. However, only one respondent referred to sharing resources with others and mentioned the mathcentre community project (http://www.mathcentre.ac.uk/courses/mathematics-support-centre/community-project-resources/) which aims to support the sharing of MLS resources and avoid replication of work, as highlighted by Mac an Bhaird and Lawson (2012).

In a multi-institutional student survey of MLS O'Sullivan *et al.* (2014) found that ICT was the least positively endorsed MLS resource. The fact that many practitioners in this survey identified issues with their online presence highlights the importance of greater collaboration and dissemination in this area. All but one website for MLS was directly linked to their institutional website structures, and several respondents identified that this inhibited their website design and content. Whilst 20 reported providing virtual support, 10 respondents added that it is rarely used, and 4 commented on technical issues. When asked about negative aspects of providing ICT, the most common category of response was 'time and resource constraints', e.g. the time needed for staff to develop and maintain quality online supports, and technological issues encountered by both staff and students. When specifically asked about the main barriers to the provision of or engagement with ICTs, time constraints, staffing numbers and skills, and technological limitations were the main categories of response. The skills required to develop ICTs have not traditionally featured as a standard part of MLS training. However, this appears to be changing. In a recent initiative on the development of MLS tutor training micro-credentials (O'Sullivan *et al.*, in preparation), one of the four initial micro-credentials is 'digital capacity' which aims '*to give tutors a framework of knowledge of digital tools and techniques that enhance mathematics learning and to inform tutors how to best to employ these to support learners . . .*'.

The situation with social media perhaps provides a good exemplar with which to close the discussion. Social media usage in MLS appears to have increased markedly in recent years. Its first mention in the literature was the use of Twitter for advertisement of services in one institution in Lawson *et al.* (2012). The 2015 survey of MLS in Ireland had one (of 25) HEI listing social media as a form of MLS. In our survey, 25 HEIs used social media as part of their provision, 20 indicated that they used it to advertise their services, and 2 used it to share resources. However, seven of the respondents referred to a general lack of engagement with social media and in nine of the HEIs social media usage was under central institutional control, and posting could be '*quite slow*' as a result. Almost all social media usage was via Facebook (16) or Twitter (20). However, recent surveys have indicated a shift away by younger people from Facebook and Twitter towards other platforms such as Instagram and Snapchat (Anderson and Jiang, 2018). Two respondents referenced the use of Instagram, with one of these highlighting the effort involved to maintain it and the other stating that they had very few followers.

Furthermore, there is limited research on the effectiveness of using social media in MLS. Collins-Jones (2016) informs us that the use of social media is a powerful tool in the promotion of

an MSC, so it is no great surprise that many MSCs are using social media of a way to interact with their students. However, as this paper (Collins-Jones, 2016) is a report on an intern project and not a research paper, there is no data or evaluation of the effectiveness of using social media in this way. Research by Ahmed and Honeychurch (2016) and (Goodband *et al.*, 2012) identify both positive and negative aspects to the promotion of student usage of Facebook Groups. Though these studies did feature students taking mathematics, they did not focus on MLS.

## 5. Conclusion and next stage

There are some limitations to this study. For example, the sample size was small (approximately 28% response rate from the MLS community in Ireland and the UK) and self-selecting, in the sense that practitioners who provided online MLS were probably more likely to answer the survey than those who did not provide online MLS. Furthermore, in one or two cases, it was not easy to categorise responses—for example, when respondents said they responded by email to student queries, it was not clear if the queries were of a mathematical or operational nature. Nevertheless, we believe the findings have merit and can be built upon by the wider MLS community.

A diverse range of practices are being utilised, and whilst respondents are broadly positive, they face a number of challenges including institutional control, staff time and skills and a myriad of technical issues. It also appears that MLS staff are often not disseminating their practices in relation to ICTs, with many seemingly unaware of what others are doing in this area and HEIs appear to be developing their own resources, possibly reproducing those that already exist.

As a result of this first look at MSCs' online presence, we have a number of recommendations.

We recommend that, before an MLS practitioner decides to invest precious time and resources on developing their online presence, they should carefully consider why they are developing these resources. Are there similar resources out there that could be used? What role do they see for these supports in their provision, do they complement existing supports and is their development an effective use of time and resources? An email to MLS mailing lists which outlines their objectives and questions would be a good first step.

We recommend that practitioners evaluate their initiatives, and there are multiple sources of guidance and information for those new to this area. In addition to contacting colleagues via the MLS mailing lists for advice, there is the **sigma** Evaluation and Impact Special Interest Group (http://www.sigma-network.ac.uk/sigs/evaluation-impact-sig/) and publications which give comprehensive overviews of MLS research (Matthews *et al.*, 2013, Lawson *et al.*, 2019). We also recommend that researchers disseminate their findings. We believe that workshops and conferences organised via the MLS networks in Ireland and the UK would be the best medium, in addition to special editions of MLS journals.

Finally, we recommend that another survey on the online presence of MLS be carried out. This could be conducted at a less busy time of the academic year, which would potentially get a higher response rate. It may make sense to focus on a specific section, e.g. on the use of social media, and this would allow a more detailed and precise investigation. In the current (March 2020) Covid-19 situation, where most MSCs appear to be turning to online supports, we suggest that a study which reports on the different approaches taken would be very beneficial.

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**Ciarán Mac an Bhaird** received his PhD in Mathematics from MU. He is the Director of the Mathematics Support Centre and has been a lecturer in the Mathematics and Statistics Department since 2007. He was a founding committee member of the Irish Mathematics Learning Support Network (IMLSN) and conducts research in mathematics education, the history of mathematics and algebraic number theory.

**Peter Mulligan** received his master's degree in mathematics from MU in 2006 and is also fully qualified secondary school teacher, obtaining a master's degree in education from DCU in 2013. He has been tutoring in the Mathematics Support Centre in MU since 2010 and is currently the tutor representative on the IMLSN committee. He also conducts research in mathematics education.

**James O'Malley** received his MA in performance and musicology from Maynooth University where he also obtained a BA in mathematics and music. He has been working as a tutor in the mathematics and statistics department since 2013. He was awarded a National Teaching Hero award in 2016 and an IMLSN Tutor Excellence award in 2019. James remains an active musician whilst conducting research in mathematics education.