Student engagement with mathematics learning supports twelve years on

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In 2014, the Irish Mathematics Learning Support Network (IMLSN) published an extensive report on student evaluation of Mathematics Learning Support (MLS), following a multi-institutional survey questionnaire that was distributed in 2011 (O'Sullivan et al., 2014). This report analysed a variety of factors that influenced student engagement and the impact of MLS on students. In 2023, a similar questionnaire was distributed to undergraduate students in Dublin City University (DCU). Many questions in this new questionnaire were also asked in 2011, while other questions broached new topics such as students' confidence and performance through their educational journey. In this paper, we explore student engagement with MLS post-COVID-19 lockdowns, with a focus on the reasons students gave for why they had or had not engaged, and what might encourage them to engage. We compare these new data with the corresponding data from the 2011 survey and discuss the similarities and changes that have taken place in the twelve years since.

Keywords: mathematics learning support; higher education; student engagement; COVID-19; student survey

Introduction

Student engagement with MLS is an ongoing area of research, with various studies investigating different demographic factors and personal characteristics that influence engagement, as well as the impact of that engagement upon students and their retention, their grades, and their wellbeing (e.g., Grove et al., 2020; Gokhool, 2023). In 2011, the IMLSN conducted a survey of over 1600 students across nine HEIs in Ireland to investigate student engagement with MLS on a national scale (O'Sullivan et al., 2014). The 2014 report following this survey provided mathematics support practitioners with a wealth of information about student engagement, along with suggestions for how to modify support services to align with best practice.

One of the institutions surveyed by the IMLSN was DCU, which maintains an MLS service in the form of the Maths Learning Centre (MLC). This is a freely accessible support available to all DCU students looking for help with any kind of mathematics modules (Jacob & Ní Fhloinn, 2018). The MLC was founded in 2004, initially operating out of a small meeting-room and relocating in 2014 to a spacious room on the ground floor of the Glasnevin campus library. It operates as a drop-in service, where students can avail of one-to-one and group help from tutors.

In recent years, the MLC suffered the same consequences as many universities and university services in response to COVID-19 lockdowns. In the academic year from 2020-2021, the in-person service in the MLC was closed. In its place, support was available online via 25-minute Zoom calls made by appointment (see Howard & Ní Fhloinn, 2022, for further details about the 2020-2021 MLC services). In 2021-2022, the in-person service was reopened with restrictions: the timetable was reduced, students were required to register their attendance in advance, and a maximum of 24 students were allowed to use the room at a time. The online support remained active in tandem. In 2022-2023, as DCU returned to fully in-person learning, these COVID-19 restrictions were dropped and the MLC returned to its usual service. The online support continued to be offered, but with greatly reduced hours (see Deacon & Ní Fhloinn, 2023, for further details about online support attendance from 2020-2023).

As noted by Howard and Ní Fhloinn (2022) and Deacon and Ní Fhloinn (2023), and by others (e.g., O'Shea, 2022; Hodds, 2020), mathematics support attendance dropped drastically through COVID-19 lockdowns. While attendance figures have risen since as in-person services have returned to what they were pre-COVID-19 lockdowns, it is unclear what the possible impacts have been on current student engagement with

MLS due to COVID-19 and its disruption both to higher education institutions (HEIs) and pre-HEI education.

This research is therefore focused on current student engagement with the MLC as a comparison with the 2011 IMLSN survey. The research questions at the centre of this study are:

RQ1. Why do current students engage or not engage with MLS?

RQ2. Is this significantly different from twelve years ago?

The literature review for this study focuses on the findings of the 2011 IMLSN survey, and of other studies that have examined student engagement with MLS and the effect of the COVID-19 pandemic on HEI engagement.

Literature review

In mathematics education literature, many studies have focused their attention on students' engagement with mathematics learning support (MLS) (for a recent scoping literature review of the area, see Mullen et al., 2024). Some studies, such as the IMLSN national report (O'Sullivan et al., 2014) provided an overview of students' engagement with respect to several demographic factors. This report covered a broad variety of aspects of engagement, such as a students' gender, mature student status and course. The data in this report came from a survey of first-year students at nine Higher Education Institutions (HEIs), which was distributed in 2011. It provided mathematics support practitioners with a now frequently cited result: in the population surveyed, roughly one-third of students reported that they did not need mathematics support, roughly one-third of students reported needing help and sought it, and the remaining one-third of students reported needing help but did not seek it.

Where the IMLSN report covered a broad variety of demographic factors, other articles delved deeper into the specific results of that survey in certain areas. For instance, mature students (classified in Ireland as students older than 23 when starting their degree) remain a point of interest for practitioners, as their support needs differ from those of traditional students (Breen et al., 2015; Fitzmaurice et al. 2016). Mature students tend to make greater use of mathematics supports than their traditional counterparts, and they tend to seek help not just to pass exams or assignments, but to seek a deeper understanding of material. Their adult life experiences motivate mature students to seek help and engage.

Female and male students also tend to engage differently with MLS (Ní Fhloinn et al., 2016). Female students tended to engage much more frequently than male students, though it is unclear why exactly this is the case. Since female students tend to present more frequently with mathematics anxiety than male students (Carey et al., 2019) and tend to have lower self-conceptions with respect to mathematics than male students (Mendick, 2005), it may be for these reasons that female students are more inclined to engage with supports where available. However, despite this, it appeared that both female and male students benefitted from MLS equally. A more recent study involving only engineering students showed different results, with female students no more likely to attend than male – although females were outnumbered ten to one in that study, and the authors speculated that those females may have higher confidence in their maths skills having chosen a non-traditional discipline to study (Gokhool et al., 2022).

One particular area of interest with student engagement is that of 'at risk' students. These are students in the final one-third as mentioned above: students who, despite potentially needing support, do not seek it. Many such students may cite structural issues with the provision of MLS as a reason for non-engagement: a lack of

information about the service, awkward opening times, and so on (O'Sullivan et al., 2014). However, as Symonds (2009) argued, these may only be surface-level responses made by these students, and implementing the changes suggested by these 'at risk' students may not actually encourage students to engage.

Clearly, student engagement with MLS is a complex topic, depending on a variety of factors as mentioned above. Following the COVID-19 pandemic, there are further factors that are only now being explored. As online support has become more ubiquitous as a form of MLS offered by HEIs, pedagogical shifts have begun to take place. Due to the restriction of non-verbal cues in an online setting, and due to technical problems with students trying to share their work, some tutors have found it harder to diagnose students' problems (Mullen et al., 2022). Tutors were worried that they were "talking at, rather than to, students" (Mullen et al., 2022, p.74). However, despite these issues and despite the major reduction of students who engaged with MLS during COVID-19 lockdowns (Hodds, 2020), students who attended online supports out of necessity during the 2020-2021 academic year who continued to have mathematics modules in later academic years appeared to continue engaging online in those following years (Deacon & Ní Fhloinn, 2023). After engaging with online support once, they seemed to be more comfortable continuing to engage online even after COVID-19 lockdowns. However, it is unclear if these effects will last beyond the initial few years following lockdowns.

Methodology

In order to investigate the potential changes in how students were engaging with MLS, an anonymous student survey was designed consisting of a questionnaire based primarily on the questions asked in the 2011 IMLSN survey. Ethical approval for this was obtained from Dublin City University (DCUREC/2023/004). The questionnaire

was divided into three main sections. The first section covered background information about the student, such as their gender and Leaving Certificate (terminal examination in Irish post-primary) level and grade. The student was then asked to complete one of two remaining sections. If the student had engaged with the MLC, they were asked about their engagement and about the impact that the supports had had on them. If they had not engaged with the MLC, they were asked why they had not engaged and what might encourage them to. Some questions were entirely open-ended, some had a selection of responses with an 'other' category where students could write in their own response, and some required a response on a five-point Likert scale.

This survey was distributed to DCU students who had a mathematics module of some kind. To distribute the questionnaire, an MLC tutor visited lectures of first- and second-year mathematics students and asked the students to complete the questionnaire. Students had the option of completing the questionnaire either as a paper survey or via an online form using Google sheets. Almost all students did so via the online form. The online form was also available via a QR code which was posted on the desks in the MLC drop-in centre.

The qualitative data were analysed using Grounded Theory analysis (Chun Tie et al., 2019). This allows the systematic development of a theory based on the data collected, rather than a hypothesis-based approach. Initial coding of the data generated various labels, which were then subsequently re-coded into broader categories. The coding was conducted by both authors of this paper independently and then compared to ensure intercoder reliability. Both the qualitative coding and the quantitative statistical tests were completed using Excel.

Results

A total of 493 students responded to the survey. The portions of students who engaged

with the MLC is broken down in Table 1. Of those, 164 (33.3%) responded that they had used the MLC services and 329 (66.7%) responded that they had not. In both groups, most students (152 and 316 respectively) gave a response when asked why they had or had not engaged.

Why engage?

There were 152 responses to the question "*Why did you first decide to use the MLC or its services?*" from the 164 students who engaged with the MLC. This question had an open text box response, and these responses were coded into the categories shown in Table 1. Note that some responses were coded into more than one category.

Table 1. Breakdown of why students first engaged with the MLC

Category	**Sample responses**	**Number**	**% of responses**
Assignment/Exam Responses that mentioned looking for help with coursework (e.g., assignments, tutorials) or with preparing for exams.	*"Study for exams"* *"When I got my first homework"* *"For help with tricky examples in lectures and tutorials"*	57	37.5%
Struggling/Needed help Responses that mentioned struggling, not being able to do maths, needing help.	*"Couldn't figure out the work" "Was struggling need a hand" "Needed help to catch up on maths topics"*	47	30.9%
Help/Understanding Responses that mentioned looking for a better understanding or more positively mentioned help	*"To get a better understanding"* *"To help better understand notes and assignments"* *"To help with questions and to check my answers to questions"*	33	21.7%
Specific topic	*"1st Year of College, was finding calculus difficult"*	16	10.5%

Students who mentioned a specific topic or area.	*"For help understanding matrix notation with double subscripts"*		
Friends/Peers/Place to study Responses that mentioned using the MLC as a place to study with friends, or that mentioned being recommended by peers.	*"Helps me concentrate on studying"* *"To do homework with friends"* *"Classmates were going in, and it sounded like it would be a helpful resource to avail of"*	15	9.9%
Difficult Responses that mentioned maths being difficult	*"Maths is hard"* *"Found linear maths difficult"* *"For help with tricky examples in lectures and tutorials"*	14	9.2%
Background/Ability Responses that mentioned time away from education, previous educational attainment, or mathematical ability	*"Knew I wasn't able for the modules we were doing and needed the extra help"* *"I felt retarded"* *"I'm a mature student and I needed to refresh my knowledge"*	6	7.9%
Other	*"In 1st Year"* *"Interest in conversations about maths"*	12	4.0%

Table 2. Why students first engaged with MLS in the 2011 survey vs. corresponding categories in 2023

Category 2011	**% of rp.s**	**% of rp.s**	**Category 2023**
Assignments/Examinations	41.3%	37.5%	**Assignment/Exam**
Struggling & Extra Help	25.7%	30.9%	**Struggling/Needed Help**
Improve Understanding	15.9%	21.7%	**Help/Understanding**
Mathematics Difficult	9.7%	9.2%	**Difficult**
Background/Ability	7.5%	7.9%	**Background/Ability**

In the 2011 IMLSN survey, the responses to the same question resulted in similar codes: *Background/Ability*, *Improve Understanding*, *Assignments/Examinations*, *Extra Help*, *Struggling*, and *Mathematics Difficult*. Since both authors of this paper were already familiar with the IMLSN survey (in fact, the second author of this paper was also an author of the IMLSN report), it is inevitable that the coding for this new survey was influenced by the IMLSN survey codes. Very similar numbers of students were coded into equivalent categories between the two surveys (see Table 2). It may be reasonable to conclude that the reasons that students seek out maths support are largely unchanged on the macro scale.

Due to the comparisons being made with the 2011 survey, some of the categories found in the 2023 survey (namely *Friends/Peers/Place to study*, *Specific topic*, and *Other*) have been omitted from some of the tables and figures that follow. In addition, although the categories that emerged from both studies are quite similar, they are not always identical but have been treated as identical for the purposes of matching corresponding categories (e.g. *Mathematics Difficult* and *Difficult*, or *Improve Understanding* and *Help/Understanding*).

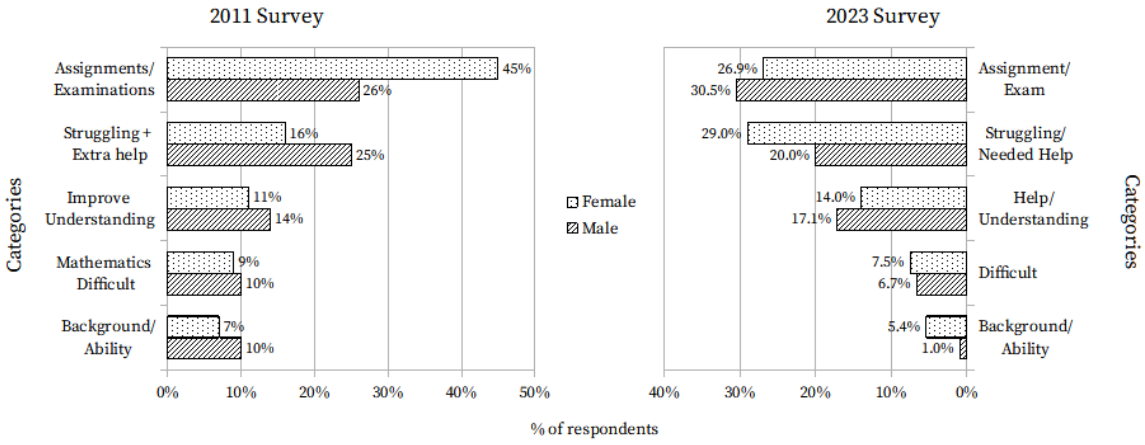
1.1 Gender differences

The IMLSN report contains an analysis of the gender breakdown of respondents, including a summary of the gender differences between how students engaged and did not engage. Further analysis of these results was done by Ní Fhloinn et al. (2016). To summarise, around 45% of female respondents engaged with maths supports, while only 30% of male respondents engaged. In contrast, in the 2023 survey roughly 35% of the female respondents engaged with the MLC, and roughly 32% of male respondents engaged. It is not necessarily true that a significantly smaller portion of female students

are now engaging with the mathematics supports, since the 2011 survey was completed by students from various different institutions, while the 2023 survey was only completed by students in DCU. With this caveat in mind, it may still be productive to examine the differences between the female-male breakdown between 2011 and 2023.

There appears to be a significant difference between the responses given by female and male students in 2011 compared to those given in 2023 (see Figure 1). The female-male split is reversed in almost every category. In 2011, a much larger portion of female respondents than male respondents cited *Assignment/ Examinations* as the main reason they decided to use MLS. In 2023, significantly fewer female respondents and more male respondents decided to use the MLC for this reason (Fisher Exact test, $p<0.001$). Similarly, in 2011, a significantly larger portion of male respondents than female respondents engaged to get *Extra Help* or because they were *Struggling*. In 2023, significantly fewer male respondents and more female respondents gave the corresponding response of *Struggling/Needed Help* (Fisher Exact test, $p=0.043$).

Figure 1. Why female and male students first engaged with MLS in the 2011 survey vs. corresponding categories in 2023



Note: As this is a comparison between the categories in 2011 and 2023, it omits the additional categories in 2023 of *Friends/Peers/Place to study*, *Specific topic* and *Other*,

which do not have a counterpart in the 2011 survey results.

In addition to these results, 9% of female responses and 7% of male responses cited *Friends/Peers/Place to study* as a reason to attend, with both groups mentioning similar reasonings. Most (5 out of 8, or 63%) of the female responses in this category came from the *Actuary & Finance* cohort, while the male responses were divided among several cohorts. Another 5% of female responses and 10% of male responses cited a *Specific topic* as their reason to attend; most male respondents mentioned 'linear maths' (i.e., linear algebra) as a point of difficulty, while responses from female students mentioned a diversity of topics.

One point worth noting is that many female students who were coded into Assignment/Exam made distressed or fatalist comments such as "Impossible homework assignments" or "... didn't even know what the question was asking us to do or how to begin answering the question", with many mentioning the possibly of failure: "I thought I was going to fail my exam", "I was desperate not to fail maths". Male respondents in this category tended to be more reserved, with comments like "Difficulty with assignment" or "Because I was stuck with a homework assignment". In fact, no male student in any category mentioned failure in response to this question.

1.2 Mature students

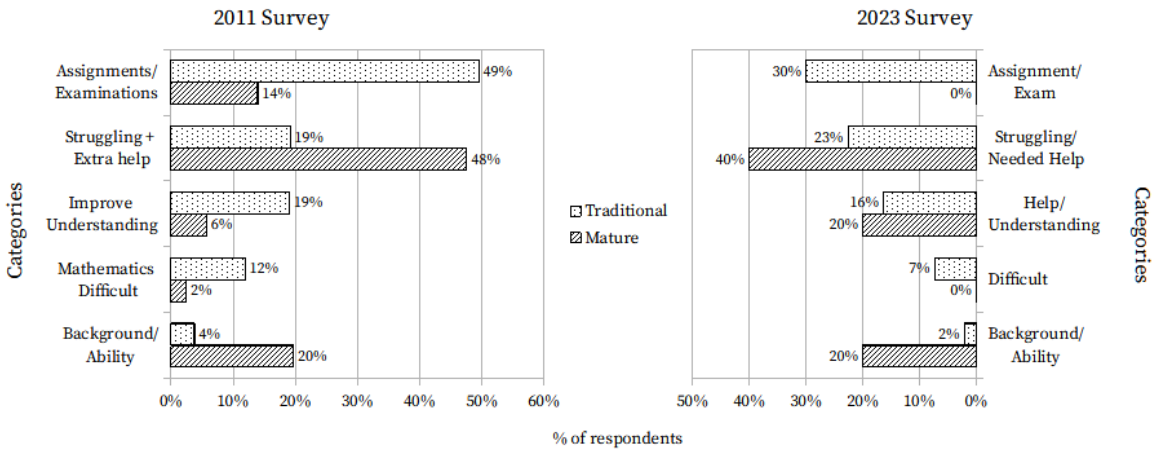
A mature student is classified in Ireland as a student that is 23 years of age or older on the 1st of January of the year of registration to higher education (O'Sullivan et al., 2014). The IMLSN report analysed mature students as a group of interest and noted statistically significant results regarding how mature students used and viewed maths supports. In particular, the report found that mature students had different motivations for seeking support than their traditional (i.e., non-mature) counterparts. The report also notes that mature students were much more likely to use the supports than traditional

students: a significantly higher proportion of mature students (62%) engaged with supports compared to traditional students (32%). In the 2023 survey, once again a significantly higher portion of mature students (58%) engaged with maths supports than their traditional counterparts (32%) (Fisher Exact test, p=0.015).

Figure 2 shows a breakdown of comparisons between the 2011 and 2023 data of why mature and traditional students first engaged with MLS. Since very few mature students responded to the survey, there is not much to say of statistical significance. The results from the 2023 survey do not appear markedly different from those in 2011.

As in the 2011 survey, the most common reason mature students sought support was that they were *Struggling/Needed Help*. Such respondents mentioned that they were struggling, or that they felt they were falling behind: "*... I realized that I wasn't keeping up with my peers*". No mature students in 2023 mentioned any *Assignment/Exam*, nor that mathematics was *Difficult*, nor did any mention *Friends/Peers/Place to study* as a reason they attended. One mature student did mention a *Specific topic*; they first attended "*... when I was struggling with proofs*".

Figure 2. Why mature and traditional students first engaged with MLS in 2011 vs. corresponding categories in 2023



Note: This figure similarly misses the additional categories in 2023 for the sake of

comparison with the 2011 survey.

1.3 Disciplines of study

Students who responded to the survey were from a variety of degree programmes. Those programmes were categorised into five disciplines: *Science*, *Computing*, *Engineering*, *Business*, and *Actuary & Finance*. While the last of these five is a more specific discipline than the other four, including only two degree programmes (and their joint common entry programme), it constitutes a large portion of the student body who attend the MLC and so has been categorised on its own.

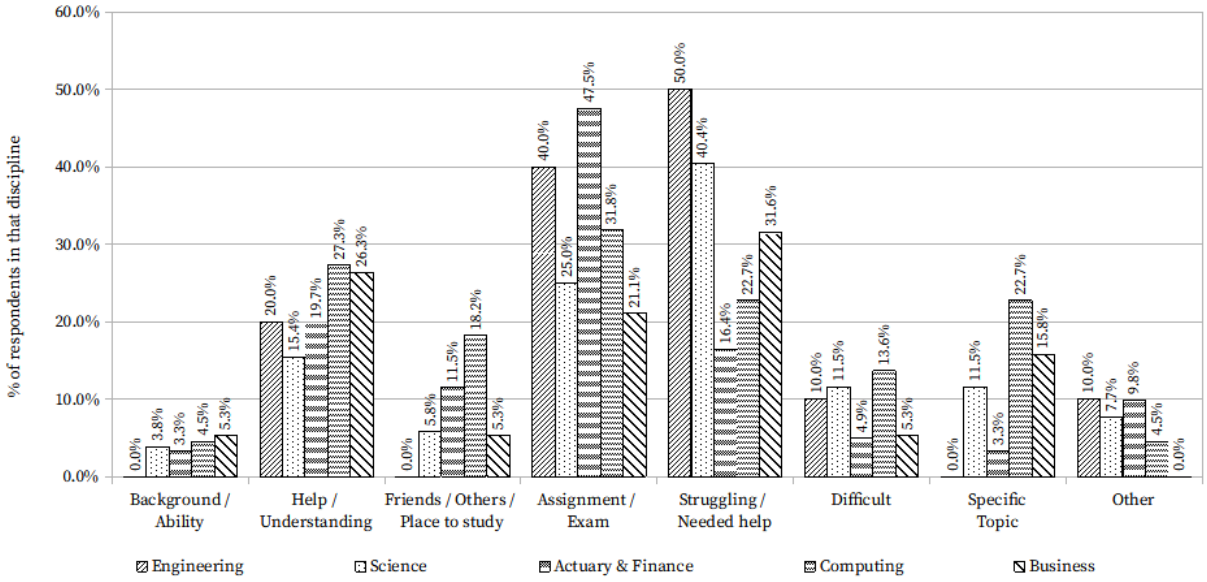
While the 2014 report provided some details about the breakdown of disciplines, it did not discuss the differences between disciplines in why students engaged with MLS. There are some large disparities between the attendance of the different discipline groups. Especially notable is the very high attendance of the *Actuary & Finance* cohort. Anecdotally, the *Actuary & Finance* students tended to use the MLC as a social study space to work on their assignments, with some students attending despite rarely engaging with the tutors. A significantly larger portion of the *Actuary & Finance* students cited an *Assignment/Exam* as their reason for attending compared to the other disciplines (Fisher Exact test, $p=0.004$), which may reflect this tendency to use the space to work on assignments together. Such students mentioned that they "*... come together with others to try to solve homework exercises*", and that they attended "*When I got my first homework*".

Table 3. Breakdown of respondents into their disciplines and whether or not they attended the MLC

Discipline	**Total**	**Attended MLC**	**% of total**
Science	147	52	35.4%
Computing	36	22	61.1%

Engineering	118	10	8.5%
Business	123	19	15.5%
Actuary & Finance	69	61	88.4%

Figure 3. Why students from different disciplines first engaged with the MLC in 2023



Significantly more *Computing* students than students in other disciplines tended to cite a *Specific topic* as their reason for first attending (Fisher Exact test, p=0.034). All but one student specifically mentioned linear algebra as their reason for first attending the MLC. This aligns with the result that male students also mostly cited linear additional as their *Specific topic*, possibly because most *Computing* students who responded to the survey were male.

Science students tended to cite *Struggling/Needed Help* at a significantly higher rate than other disciplines (Fisher Exact test, p=0.034). Many such students mentioned that they were 'stuck' or that they felt they were falling behind in their learning: "... *I realized that I wasn't keeping up with my peers*".

2 Why not engage?

Of the 329 students who said they had not attended the MLC, 316 students responded to the question "*If you did not use the MLC, why not?*". This was a multiple choice question, which included an '*Other*' option where respondents could write their own response into an open text box. The available choices are shown in Table 4. Note that respondents had the ability to select more than one option, and many did.

Many respondents claimed they did not need help with mathematics. Table 5 details the breakdown of responses if these respondents are removed from the data.

Table 4. Breakdown of why respondents did not engage with the MLC (n=316)

Reason given	Total	% of total
I do not need help with Maths	129	40.8%
I was afraid or embarrassed to go	91	28.8%
The times do not suit me	65	20.6%
I did not know where it was	44	13.9%
I hate Maths	39	12.3%
I never heard of the Maths Learning Centre	17	5.4%
Other	35	11.1%

Table 5. Breakdown of why respondents did not engage with the MLC, excluding respondents who reported not needing help with maths (n=187)

Reason given	Total	% of total
I was afraid or embarrassed to go	83	44.4%
The times do not suit me	56	30.0%
I did not know where it was	39	20.9%
I hate Maths	36	19.3%
I never heard of the Maths Learning Centre	17	9.1%
Other	35	18.7%

There were 35 comments made as part of the *Other* category of responses. Some of these responses were a non-response of "*N*" or "*Na*". The remaining 21 responses were categorised as outlined in Table 6.

Table 6. Breakdown of *Other* reasons students did not engage with the MLC

Category	**Sample responses**	**Number**	**% of responses**
Do not need help with maths Responses that mentioned not needing help or not having much maths content.	*"Never needed it"* *"Dont have a lot of maths in my course"* *"My problem with maths work is related to organisation and planning, as opposed to difficulty with maths."*	7	37.5%
Lacked motivation Responses that mentioned laziness or a lack of motivation	*"Too lazy"* *"Laziness to do outside activities besides class hours"* *"Was never pushed to go always felt it was too much effort to try and do it"*	3	30.9%
Did not use the MLC Responses that mentioned not engaging with the MLC without further commentary.	*"I just haven't gone yet"* *"Never got around to using it"*	2	21.7%
Accessibility Responses that mentioned difficulties accessing the MLC.	*"Knew about MLC but didn't know how to approach going"* *"Don't live on campus"*	2	10.5%
Used other resources instead Responses where the respondent mentioned already having resources that sufficed outside of the MLC	*"course materials were enough"* *"Use my bf to explain"*	2	9.9%
Negative comments about the service	*"I went in one day to look for help with a question and*	2	9.2%

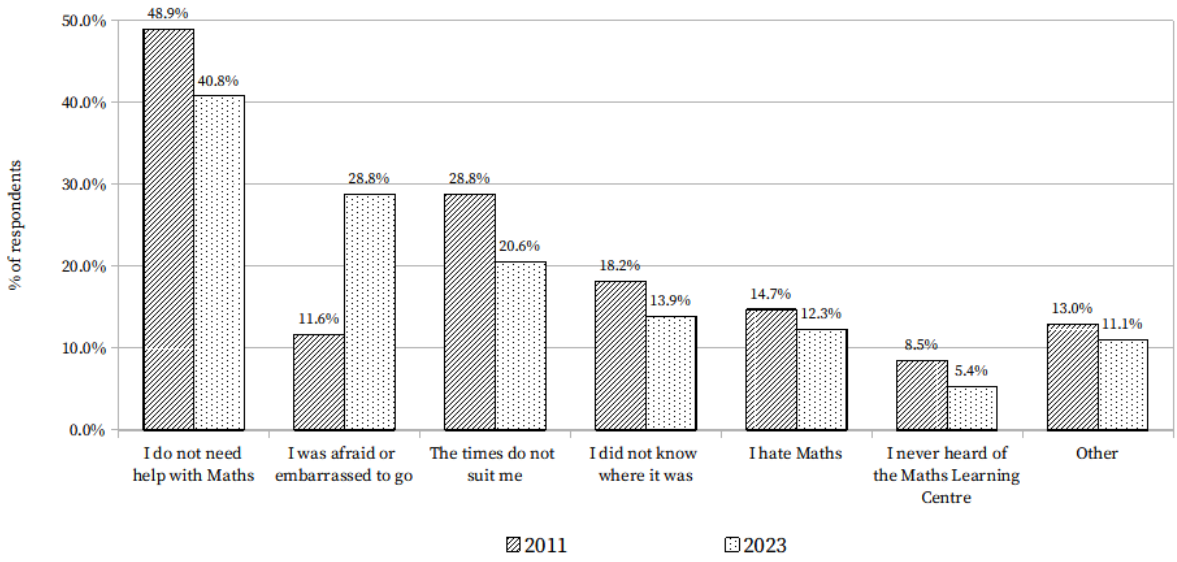
Responses where the respondents had a negative attitude towards the MLC	*nobody assisted me"* *"Think its overrated"*		
Forgot about the MLC Responses that mentioned not remembering the support was available.	*"I didn't think to go"* *"I forget that it's there"*	2	7.9%
Too busy Responses that mentioned being too busy to attend the MLC.	*"Busy and have other interests"*	1	4.0%

Of these additional comments, approximately one third mentioned they *do not need help with maths*, saying they "*Never needed it*" or that their issues "*... related to organisation and planning, as opposed to difficulty with maths*". Some responses mentioned they *lacked motivation*, that they were "*too lazy*" to attend, or that it felt like "*too much effort to try and do it*".

In the 2011 study, the same question was asked of respondents with the same available multiple-choice answers. The comparison between these two sets of results is shown in Figure 4.

The most striking difference between the two studies is the change in how many students reported being *afraid or embarrassed*. In the 2014 report, 119 out of 1024 students (11.9%) reported being *afraid or embarrassed* as the reason they did not attend supports. In contrast, a significantly higher portion of students in the 2023 survey, 129 out of 316 students (28.8%) reported being *afraid or embarrassed* as the reason they did not attend the MLC (Fisher Exact test, $p<0.001$).

Figure 4. Reasons why respondents did not attend MLS in 2011 vs. in 2023



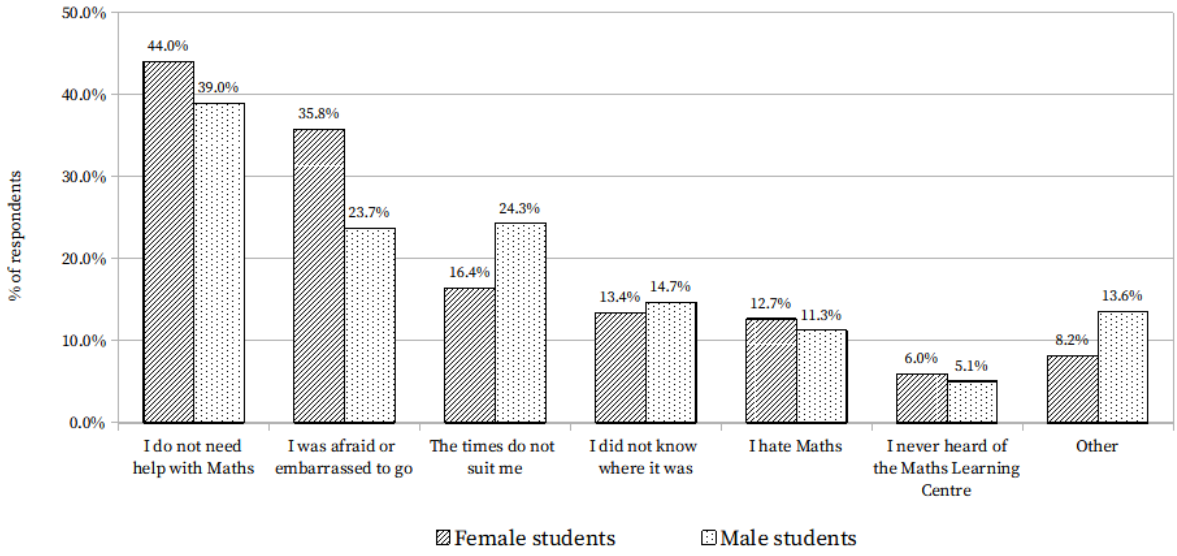
Additionally, a significantly smaller portion of students in the 2023 survey, 65 out of 316 (20.6%), reported the *times do not suit* as the reason they did not attend, versus 295 out of 1024 students (28.8%) in 2011 reporting the same (Fisher Exact test, p=0.004). This may simply reflect the much larger number of students who reported being *afraid or embarrassed* instead. It may also reflect an increase in the number of hours the MLC was available to these students, compared to the average number of hours MLS was available to students in 2011. In 2023, the MLC in DCU was available to students 35 hours per week. This is in contrast to 2011, when the MLC was available to students 20 hours per week. In a 2015 survey of institutions in Ireland, MLS was available to students for an average of 22 hours per week across nine universities and 19 hours per week across eleven Institutes of Technology (Cronin et al., 2016).

2.1 Gender differences

There are several significant differences between how female and male students responded to this question. In particular worth noting is the discrepancy between how many male and female respondents reported being *afraid or embarrassed*. Male

students tended to report being *afraid or embarrassed* (23.7% of male respondents) about as frequently as they reported the *times do not suit* (24.3% of male respondents). Female students however tended to report being *afraid or embarrassed* (35.8% of female respondents) significantly more than male respondents (Fisher Exact test, p=0.007), and tended to report the *times do not suit* (16.4% of female respondents) significantly less than male respondents (Fisher Exact test, p=0.027).

Figure 5. Reasons why female and male students did not attend the MLC



There are a number of reasons why female students might tend to report being *afraid or embarrassed* more frequently than male students. Female students may simply be more likely to be embarrassed or worried about mathematics in general compared to male students. As mentioned in the literature review, female students tend to present more frequently with mathematics anxiety than male students (Carey et al., 2019), and also tend to have lower mathematical self-conceptions of themselves (Mendick, 2005). Additionally, male students tend to avoid the appearance of incompetence when it comes to mathematics (Skaalvik & Skaalvik, 2004). This may make male students less likely to admit that they are embarrassed or worried about their mathematical ability.

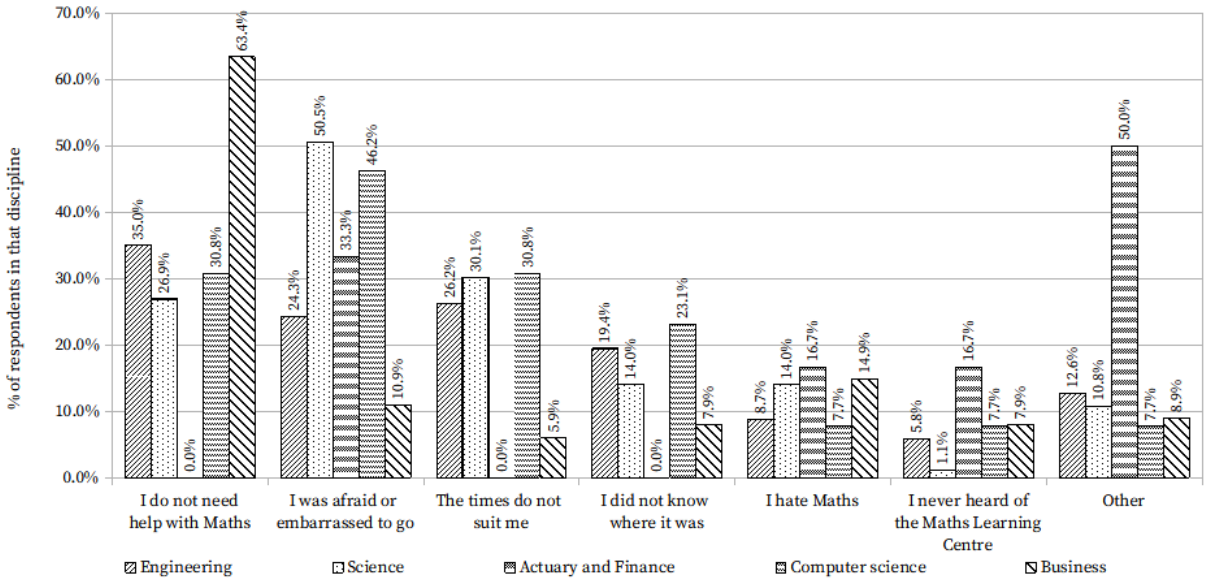
2.2 Mature students

Of the eight mature students who said they had not attended the MLC, six responded that they *do not need help with Maths*, and the remaining two responded that they *hate Maths*. Again, since very few mature students responded to the survey, there is not much to say of statistical significance. It may be that mature students who need help with maths tend to attend the MLC, and so those who do not attend tend to be those who did not need help.

2.3 Disciplines of study

As noted in the previous section on why students engaged, there were large differences between how many students from each discipline engaged with the MLC. In particular worth noting is that most *Actuary & Finance* and *Computing* students surveyed engaged with the MLC, and so there is perhaps less to say of significance about these students than those in other disciplines.

Figure 6. Reasons why students in different disciplines did not attend the MLC



Students in *Business* related courses tended to say they *do not need help with Maths* significantly more than other disciplines (Fisher Exact test, $p<0.001$). In response to the following question about what might encourage them to attend, some *Business* students mentioned that the mathematics involved in their course was not a problem for them, that they would attend "*if the maths that was being taught was difficult*" or if "*maths was more involved in my course*". It may be that since the *Business* course students have generally fewer difficult mathematics modules, they are less likely to need help. This aligns with the relatively small number of *Business* students who attended the MLC.

While *Actuary & Finance* students tended to choose the *Other* option significantly more than other disciplines (Fisher Exact test, $p=0.018$), these account for just three of six total responses from *Actuary & Finance* students. These open responses were "*Don't live on campus*", "*N*" and "*Think its overrated*". The latter comment was one of only two *Other* responses categorised as *Negative comments about the service*. *Science* students had the highest portion of respondents reporting that they did not attend due to being *afraid or embarrassed* and did so significantly more than other disciplines (Fisher Exact test, $p<0.001$).

3 What would encourage engagement?

Of the 329 students who said they had not attended the MLC, 122 students responded to the question "*What would encourage you to use the MLC and its services if you needed to?*". This question had an open text box for responses, and the responses were coded into the categories shown in Table 7.

Table 7. Breakdown of what might encourage students to engage with the MLC

Category	**Sample responses**	**Number**	**% of responses**

If needed Encouraged to engage if needed or if they were struggling.	*"If I was struggling"* *"If the maths that was being taught was difficult"* *"I think I would use it if I had a question that no one else seemed to be able to answer"*	46	37.1%
Resources Encouraged to engage if specific resources were available, such as online worksheets or subject specific workshops.	*"Short online videos possibly"* *"If they put on classes specific to what I was covering at the time"* *"Notes provided/ online resources"*	18	14.5%
Structure Encouraged to engage if structural problems were solved, such as attendance being worth marks or the support being available at different times.	*"If there were times that suited me"* *"If it Goes towards a module percentage"*	18	14.5%
Promotion Encouraged to engage if the MLC was better or differently advertised.	*"Lecturers encouraged it"* *"More accessible information on times and material covered"*	16	12.9%
Peers Encouraged to engage if they could do so as a group or with friends	*"If my friends went"* *"Going in with a group"*	8	6.5%
I do not know Responses where respondents were not sure what would encourage them.	*"I'm not sure"* *"don't know"*	5	4.0%
Embarrassed Encouraged to engage if it were less embarrassing to do so	*"I'm not sure how this would translate into actual solutions but if I knew I wouldn't be judged for not knowing something basic or*	2	1.6%

	something that I probably should already know. "		
Other Responses mentioning free food or non-applicable responses such as "*yes*".	*"Yes"* *"Free food"* *"Keep up the good work"*	11	8.9%

The results from the 2023 and 2011 surveys diverge in the categories found in the responses to this question, so it is not possible to directly compare the results. However, there are some broader comparisons worth mentioning. The most common response category in both the 2011 and 2023 surveys was that students would attend supports if needed (29.1% of respondents in 2011, 37.1% in 2023). Many students in 2011 reported that they would attend if the structure or resources of the supports were different. Comparable numbers of students wanted better opening times (17.1%), different available resources (14.9%), and more information available readily available about the service (13.4%). These proportions of respondents are similar to those in the 2023 survey in the categories of structure, resources and promotion.

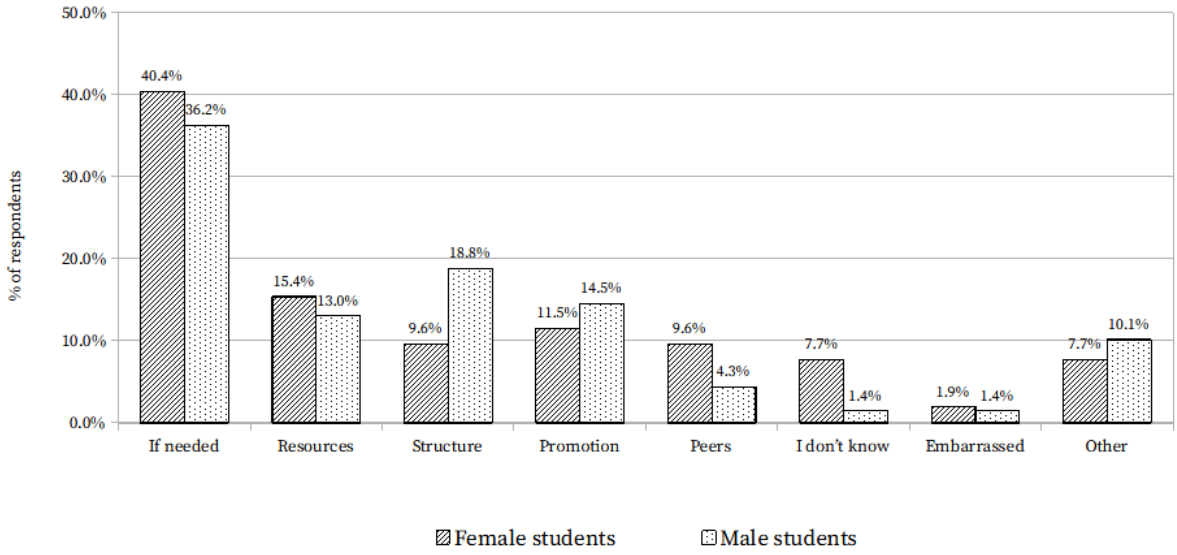
It is perhaps concerning how many students mentioned times not suiting them both in response to the previous question and to this question, given that the MLC in DCU was available to students 35 hours per week. As mentioned in the literature review, these may only be surface-level responses made by these students, and a deeper investigation may reveal these responses to be deflections away from the real reasons these students are not engaging (Symonds, 2009).

3.1 Gender differences

Of the 122 students who responded to this question, 52 female students and 69 male students responded. The breakdown of their responses into the categories discussed

above are shown in Figure 7.

Figure 7. What might encourage female and male students to engage with the MLC



While there are some minor variations between the responses of female and male students to this question, in particular in the number of comments female and male students made about the structure of the support, there were no significant differences found between their responses. This is in contrast to the results of the 2011 survey, where female students were much more likely to say that better times would encourage them to attend, and where male students were more likely to say that they would attend if needed.

3.2 Mature students

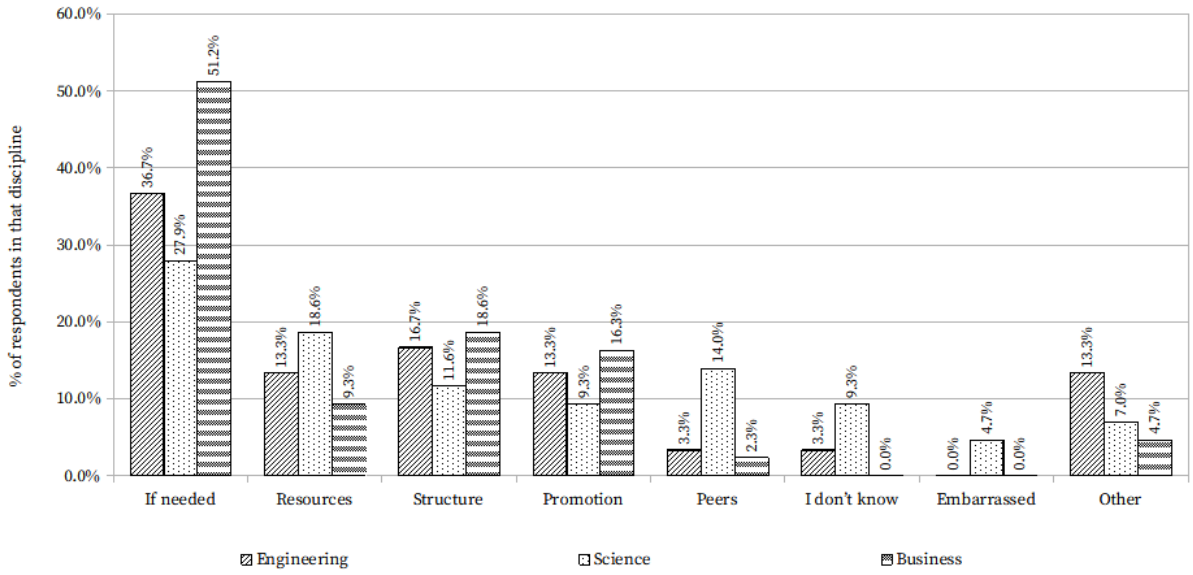
Only two mature students responded to this question. These two responses were to do with the *structure* of the support: "*If it was a required module I would definitely use mlc*", and to do with the *resources* available: "*Different tutors catering to different parts of mathematics*".

3.3 Disciplines of study

A total of three *Actuary & Finance* students and three *Computing* students responded to this question. One *Actuary & Finance* student said they would be encouraged to attend if the *Resources* were improved, if "*tutors are good there*". The other two *Actuary & Finance* made *Other* comments: "*not really*" and "*yes*".

The three *Computing* students mentioned that they would be encouraged to attend by improved *Resources* such as "*more teachers to explain*", better promotion such as "*advertising what topics would be discussed for each session*", and *If needed*: "*If I was really struggling and felt I really didn't understand the material on my own*".

Figure 8. What might encourage students in different disciplines to engage with the MLC



A breakdown of responses from the remaining disciplines is shown in Figure 8. Students in *Business* related courses were significantly more likely than students in other disciplines to say they would attend if needed (Fisher Exact test, p=0.013). This aligns with their responses to the previous question where many such students said they did not need help. Students in *Science* courses were significantly more likely to mention

their *peers* than other disciplines (Fisher Exact test, p=0.020). These students mentioned "*going with a group*" and "*going with friends*" as potential motivators for engaging.

Discussion

With the caveat that the survey was distributed to students in the MLC itself alongside the distribution to students within their lectures, the engagement of students appears to still broadly be split into thirds in the same way as in 2011. Roughly one-third of students did not need mathematics support, roughly one-third of students needed help and sought it, and the remaining one-third of students needed help but did not seek it. Additionally, students tended to engage with MLS for broadly the same reasons as in 2011: to help prepare for assignments and exams, because they were struggling or needed help, to improve their understanding, and so on.

However, students have begun to cite different reasons for not engaging. Many fewer students cited times not suiting than had previously, and many more students cited their fear or embarrassment as being a barrier to their attendance. It may be that fear and embarrassment were the main reasons preventing students from engaging with MLS in 2011 as well, but that these students felt more able to deflect these feelings onto structural issues with the MLS available (Symonds, 2009). Perhaps in 2023 when the MLC was available to students many more hours in the week, students felt less able to deflect onto that specific reason. It may also be the case that students in 2023 were more willing to be honest about their feelings of fear and embarrassment than those in 2011. Almost all students who responded to the survey in this study did so via the online survey, and so may have felt greater anonymity than students in 2011 who responded via paper surveys.

One concerning point of note is that (again with the caveat of how the survey was distributed to students) roughly one third of students appeared to need help but did

not seek it, despite structural changes taking place since the 2011 survey. This discrepancy is likely explained in part by the impact of COVID-19 lockdowns. Students may have become more reliant on online resources than in-person resources, perhaps evidenced by some students reporting that they would be encouraged to engage with the MLC if it provided online supports. Students also may have become accustomed to working with others through virtual means such as WhatsApp or Discord servers (Liebendörfer et al., 2023), rather than engaging with others in-person, and are therefore less likely to engage with in-person supports.

Additionally, before the pandemic lockdowns, word of mouth was an effective means of advertising MLS (Hodds, 2020). During lockdowns, word of mouth appeared to be a less effective tool (Gilbert et al., 2023). It may be the case that since students in the third or fourth year of their degree could not avail of the MLC's in-person supports during their first or second year, they are no longer providing the same word of mouth advertising as before. Some students reported that they would be encouraged to attend the MLC if their friends were going too, though the percentage of students who reported this is comparable to that of the similar "student feedback" category of responses found in the 2011 survey.

Another concerning point to note, alongside the one third of students who appeared to need help but did not seek it, is that the suggestions students give for what might encourage them to engage are broadly the same as twelve years ago. Students are still looking for more available times (despite much wider availability), students are still looking for better advertising about what resources are available (despite further advertising), and students are still looking for more and varied available resources (despite more resources being available). MLS was certainly available at more times to these students than it had been in 2011, so this first suggestion is surprising but perhaps

in line with the deflection of fear and embarrassment onto structural issues as noted earlier. The MLC was also better advertised in 2023 than it was in 2011, in part simply due to its much more prominent location in the library, but also from increased publicity through social media pages on Instagram, X (formerly Twitter) and Facebook. Finally, the MLC has more resources available to students than in 2011, largely due to the increased space available in the newer room, including a small library of introductory textbooks, printed worksheets covering a variety of foundational topics, and a website which directs students to other available resources online.

These suggestions from students may be deflections away from the real reasons for not engaging, but they may also indicate that the provisions offered by MLS centres following the COVID-19 lockdowns must change to accommodate new learning styles.

The authors report there are no competing interests to declare.

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