University College Dublin
Maths Support Centre

Annual Report 2018/19

Contents

1 Executive Summary

Summary statistics of 2018/19 at the UCD MSC include:

- The number of visits was 5,560 from 1,409 unique students.

- Student visits from 189 distinct modules were recorded, an increase of 24 modules on the previous year.

- 66% of all visits were from students registered to level 0 or level 1 modules - an increase of 7% from 2017/18.

- The average time spent with a tutor was 28.1 minutes (an increase of 5.5 minutes) and the median time spent with a tutor was 17.5 minutes.

- The median wait time to see a MSC tutor was 8 minutes, an increase of 1.3 minutes on the previous year.

- 84% of all visits came from students registered to modules delivered by the School of Mathematics and Statistics (SMS), down 2% on the previous year.

- 16.5% of all visits were of a statistical nature, an increase of 2% on last year - 10% of all visits came from STAT modules within SMS.

- There were 3,878 one-on-one MSC sessions (a decrease of 124 one-on-one visits), and 614 MSC sessions with two or more students, an increase of 54 group visits.

- In semester two the MSC received visits from students registered to 44 modules delivered in semester one, i.e. repeat/resit student visitors.

Developments at the MSC during 2018/19 include:

- Updating both the online and in-house MSC maths and stats resources.

- Increased weekly opening hours from 41 hours to 43 in semester one by opening until 8pm each night of Monday through Thursday.

- Opening on two consecutive Saturdays in the run up to examination periods.

- Providing five weekly dedicated 2-hour slots for HEAR, DARE, Mature, International, QQI/FET and Access students.

- Hosting three CPD events for tutors and lecturers on mathematics and statistics education.

- Reorganising the MSC space to allow more wall areas for writing on.

In the 2018/19 academic year the UCD Maths Support Centre (MSC) received 5,560 student visits corresponding to 1,409 unique students studying 189 distinct modules representing all six colleges of the university. The MSC increased its opening hours from 41 hours per week in 2017/18 to 43 hours to include late night openings from 6-8pm each night Monday to Thursday in semester one. We opened for drop-in support for a total of 25 weeks of the academic year. The opening hours for semesters two were Monday to Thursday 10am-7.30pm and Friday 10am-1pm.

In August and September 2018 the MSC ran a series of maths support sessions for HEAR (Higher Education Access Route), DARE (Disability Access Route to Education), Access (Access to Science, Engineering and Agriculture), QQI/FET (Further Education and Training - formerly FETAC) and Mature student cohorts, supporting over 400 students in the process.

In May and June of 2019 the MSC assisted 67 Leaving Certificate students from DEIS (Delivering Equality of Opportunity in Schools) designated schools and 14 non-DEIS students with their impending state mathematics examinations. This is the largest number of Leaving Certificate students supported by the MSC through this programme since its inception in 2014.

The MSC facilitated over 50 hours of dedicated one-to-one support, which took place outside of the MSC, with students registered to the Access and Lifelong Learning Disability Support Service.

Also in 2018/19, the UCD MSC hosted visitors from the University of Oklahoma and University of Illinois, USA, Western Sydney University, Australia, Universität Paderborn, Germany and Sligo Institute of Technology, all of whom were interested in how UCD MSC session management software works.

The National Forum for the Enhancement of Teaching and Learning in Higher Education also visited the MSC management in 2019 to view a demonstration of the MSC feedback system as it aligns well with their enhancement theme on assessment.

2   Introduction

The Maths Support Centre (MSC) at UCD, offers free, non-judgmental academic support in mathematics and statistics for any UCD student registered to a level 0, 1 or 2 module. It is a drop-in service (not appointment based) and in 2018/19 was staffed by 28 skilled and welcoming tutors. The MSC, now in its 16th year of operation, is an established university-wide academic support unit offering drop-in support that is centrally and neutrally located in the James Joyce Library since

2013. The first three years of the UCD MSC saw an average of 480 visits per year while the last five years have experienced an average of 5,521 visits per year.

3   Governance and Oversight of the MSC

For the 2018/19 academic year the UCD MSC Oversight Committee consisted of Kevin Hutchinson (Chair), Maria Meehan, Head of Teaching and Learning SMS, Brendan Murphy, Head of School SMS, Áine Galvin, Director of UCD Teaching and Learning, Ted Cox and Nial Friel from the Applied and Computational Mathematics, and Statistics subjects of SMS respectively. The committee met on December 7th 2018, February 25th 2019 and May 30th 2019.

Separate regular meetings with MSC tutors and management are held throughout both semesters. The MSC annual report is sent to the Registrar's office each year where it is further disseminated to the University's Management Team via the Student Experience Group and a presentation is made at that same meeting by the MSC manager. The report is also sent to the Dean of Students, the Dean of Undergraduate Studies, the Librarian, relevant Programme Deans, relevant Heads of School, the Director of Access and Lifelong Learning, the Head of the Student Advisers Group, relevant Academic Student Advisors, the Students Union Undergraduate Education Officer and the SMS Office Manager.

4   The Year in Numbers

The number of recorded visits to the MSC in 2018/19 was 5,560 from 1,409 unique students. Semester one visits totalled 3,518 (an increase of 208 visits on the previous year), while our semester two visits were 2,042 down from 2,397 last year.

The annual number of recorded visits (and unique visitors) to the MSC for the past fourteen years is given in Figure 1. In August and early September of 2018 the MSC supported 661 visits from 400+ distinct students on the HEAR (Higher Education Access Route), DARE (Disability Access Route to Education), Access (Access to Science, Engineering & Agriculture), QQI/FET (Quality and Qualifications Ireland/Further Education Training, formerly FETAC), International and Mature route entries to UCD. **These visits are not recorded** on the MSC database as these students do not yet have their UCD student numbers at this time and so cannot log in to our system. Thus Figure 1 relates only to the number of recorded

visits/visitors to the MSC each year during the teaching and revision periods of each semester.
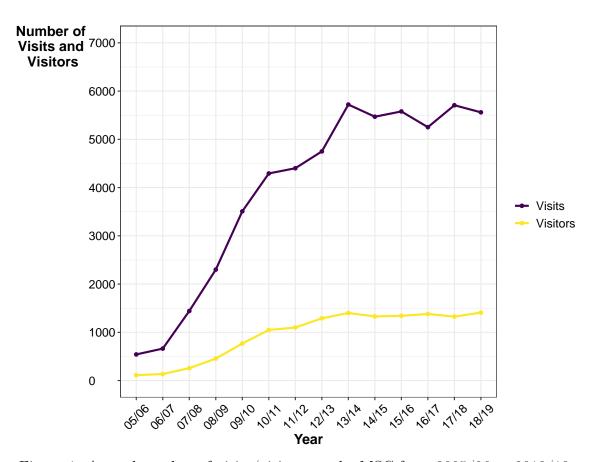

Figure 1: Annual number of visits/visitors to the MSC from 2005/06 to 2018/19

5   How MSC Data is Recorded

In 2018/19 the MSC further developed its data capture process. The MSC data management software system links directly to the UCD student records database so that an accurate record of each student's registration and MSC session details can be captured. This means the data collected at the MSC is robust and accurate allowing for detailed analysis. The visiting student enters his/her student number at a terminal upon log in and then he/she is given a place in the queue (displayed on the centre's projector screen) by the automated process. The feedback from each student visit is then anonymously recorded (with the consent of the visiting student) by the attending tutor(s) and uploaded to the MSC database. Module Coordinators

and lecturers have access to the MSC feedback for their respective module(s) and this feedback is also sent to them each Friday via an automated email. This process has proven an effective source of feedback for lecturing staff, MSC tutoring staff and management. MSC management are currently working with DCU Maths Learning Centre and the DCU IT team to adapt the UCD MSC software for DCU's needs. With the help of MSC tutors a short video has been produced explaining the MSC feedback system from the perspectives of the student visitor, the MSC tutor and the module lecturer, available at http://www.ucd.ie/msc/mscvideos/

6 Wait Times to see a MSC tutor

For the past four years the median wait time to see a MSC tutor has improved from 29.2 minutes (2015/16) to 13.6 minutes (2016/17) to 6.7 minutes in 2017/18 back up to **8 minutes** in 2018/19, all without an increase in tutor expenditure. This relatively short wait time is largely due to the implementation of a forecast model based on both historic data and real-time wait durations taken live from the MSC queue, which have allowed us to predict peak times so as to roster staff effectively. Figure 2 shows a boxplot of the median wait times to see a tutor for the past 5 years by each week of term. We can see the increase in wait times in week 7 when the many midterm examinations are held and again in weeks 11-14. Note that the MSC no longer opens for examination weeks.

Figure 3 shows the distribution for wait times for each day of the week in semester 1 of 2018/19 e.g. 50% of students waited 4.5 minutes or less to see a tutor on a Monday. Though there were more visits on a Monday (876) than Tuesday (832) the wait time was considerably less on the Monday. Analysis shows that this was due to the number of tutors hours being 4 less on Tuesday than on Monday and this was improved as the term progressed. The Friday figures are explained by the centre opening for 3 hours (10am-1pm) on a Friday when it is staffed by 2-3 tutors over that time.

The *time spent with a tutor* statistic has greatly improved also, from 16.2 minutes in 2015/16 to 21.4 minutes in 2016/17 to 22.6 minutes in 2017/18 and to **28.1 minutes** this year. This means almost 50% of MSC visitors spend nearly half an hour with a tutor.

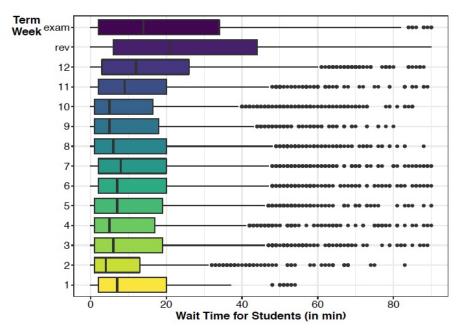## Wait Times by Term Week (2015-2019)

Figure 2: Wait time to see MSC tutor for 2015-2019 by week of term
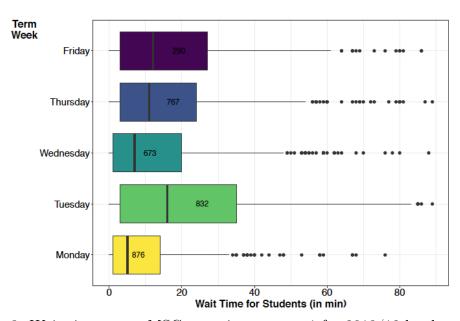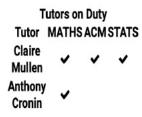
Wait Times for 2018/19 Sem 1 by Day of Week

Figure 3: Wait time to see MSC tutor in semester 1 for 2018/19 by day

The addition of the *expected time to see next tutor* display on the large projector screen in the MSC space (see Figure 4) helps visitors in the MSC to prepare for their query. In addition, the prediction model on the MSC website (see Figure 5) has also helped potential MSC visitors both on and off campus to decide if they will visit the MSC given their current time demands. This is implemented via an R-Shiny app and a live feed of data from the current MSC statistics which includes:

- Number of students working by themselves (i.e. tutor has started a tutorial with them and left them for now = number of students in paused tutorials).

- Number of students working with tutors (i.e. number of students in tutorials in active state).

- Number of student groups working by themselves (i.e. number of group tutorials in paused state).

- Number of student groups working with tutors (i.e. number of group tutorials in active state).

- Number of students waiting for a tutor (i.e. current queue size).

- How long student at the top of the queue has been waiting.

Figure 4: **Tutors on duty** & **Time to see next tutor** graphic displayed in MSC

Figure 5: A prediction model displaying the estimated wait time to see a tutor by day of the week and by week of the semester for 2018/19

7 Student Session Lengths, Students per Session and Student Return Rate

The average time spent with a tutor (excluding the time spent paused between tutors) was 28.1 minutes while. Table 1 below shows a table of the average time duration with an MSC tutor for the more common module visits by subject and stage, with the number of tutorial sessions in brackets e.g. STAT2 denotes students in stage 2 taking a statistics module, for which there were 165 (194) MSC visits in semester one (two) lasting 74.1 and 23.5 minutes respectively. The top section of the table refers to modules delivered by SMS and the bottom section describes modules taught outside of this school.

	ACM1	ACM2	MATH0	MATH1	MATH2	MST1	MST2	STAT1	STAT2
SEM 1	24.4 (113)	24.1 (118)	31.5 (199)	24.1 (1,509)	20.5 (296)	20.1 (114)	21.2 (198)		74.1 (165)
SEM 2	21.2 (62)	20.3 (61)	34.0 (119)	23.6 (474)	19.5 (151)	24.2 (130)	24.3 (196)	31.4 (111)	23.5 (194)
	ECON1	ECON2	PHYC1	FOR2	MIS1	MIS2			
SEM 1	13.2 (22)	23.6 (63)	21.4 (107)	17.5 (127)		16.2 (44)			
SEM 2	10.9 (21)	9.1 (9)	26.6 (51)		32.7 (110)				

Table 1: Time duration and visits with MSC tutor by subject and level

While the majority of MSC sessions are one-on-one sessions (3,878 visits or 69% of all sessions), where we define a session to be an interaction between a tutor and a student or students, there were 614 sessions with two or more students. These support sessions with two or more students demonstrate the popularity of this small-group peer support approach to learning, a trend we see increasing each year. There were 13 sessions with 8 or more students which represent "Hot Topics" (tutorial sessions dedicated to a particular topic of difficulty as identified by students and/or their lecturer) which are held outside regular MSC drop-in hours. These targeted sessions allow the MSC to run more efficiently and effectively.

Some 4,939 (or 88.8%) of all MSC visits were return visits with the median number of visits per student being two and the mean number of visits per student being 3.9. Some 584 students visited the MSC three or more times with 17 students 40 times or more.

8 MSC Visits by the Week

The number of MSC visits by week is given in Figures 9 and 10. As we can see there are no quiet weeks in the MSC (apart from week 1 of semester 1 when the MSC opens for two days only), with 292 weekly visits on average for semester one (excluding week 1) and 186 weekly visits, on average, for semester two. This year the number of visits during revision weeks was 578 (350 in semester one and 228 in semester two), accounting for 10.4% of all visits. As usual there is a peak in week 7 of both semesters coinciding with midterm examinations and multiple continuous assessment due dates, with a slight lull the following week (for both terms) before picking up again to peak attendances in weeks 10-13 of both terms. As usual semester one is the busier semester for the MSC and hence over 60% of the tutor expenditure budget is used in semester one.
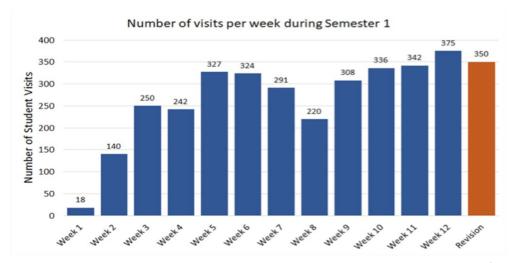
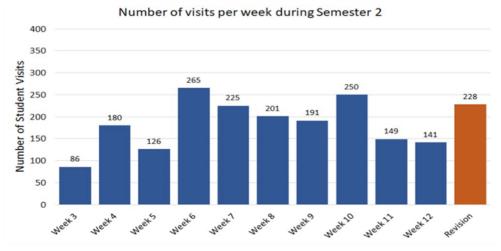Figure 9: Number of visits per week to MSC for semester one of 2018/19

Figure 10: Number of visits per week to MSC for semester two of 2018/19

9 Late Night Opening and Busiest Times

From October until December 2018 the MSC experimented with extending its opening hours to include a 6-8pm slot Monday through Thursday. There were 314 visits made during this time slot accounting for 9% of all semester one visits, a statistic which suggests that this development was welcome. The breakdown for the number of visits by day and by hour were also analysed. For example, Monday (871 visits) is the busiest day in semester one and Monday (576 visits) is the busiest day in semester two and the time periods of 10am-1pm (1,319 visits) in semester one and 11am-2pm (805 visits) in semester two are the busiest in terms of student log ins.

10 Module Levels in the MSC

The percentage of level 0, level 1 and level 2 visits was 14% (up 8.6%), 51.8% (down 1.8%), and 33% (down 7%) respectively. The 1% of visits from stage 3, stage 4 and postgraduate students refer to those students who logged in to the MSC system but were referred back to their lecture. This bucks the trend of the annual increase of stage 2 visits over 5 consecutive years. The proportion of level 2 students attending the MSC was 25% back in 2012/13, increased to 32% in 2015/16, and further increased to 40% in 2017/18. This year 1 in every 3 MSC visits are from stage two modules.

11 Modules served by the MSC

There were visits from 189 distinct modules at the MSC in 2018/19. Students from 129 distinct modules attended the MSC during semester one, traditionally the busier semester for the MSC, while 60 modules were represented during semester two (or 104 modules including repeat/resit visitors from semester one). The MSC received visits from 79 modules taught by the School of Mathematics and Statistics (SMS), equating to 4,385 (or 84%) of the total visits. The 110 non-SMS modules assisted by the MSC accounted for 1,175 visits (an increase of 47% on last years figure). There were 65 modules for which there was just one visit and 51 of these were from non-SMS modules. Visits related to statistics modules or modules with a statistics component accounted for 16.5% of all MSC visits this year (up 2% on last years figure). Of these 889 statistics visits, 540 (or 61%) were from statistics modules delivered by SMS.

12 MSC-Module Coordinator Partnerships

This year saw the further development of the MSC-Module Coordinator (MSC-MC) Partnership Agreement. Designed to ensure an alignment between the support offered at school level and at the MSC this agreement keeps all stakeholders (students, MSC tutors, teaching staff and management) informed of student learning. This year saw the signing of 33 MSC-MC Partnership Agreements relating to the modules most frequently represented at the MSC.

Module Coordinators have online access to the MSC (anonymous) feedback in real time that relates to their module(s). Module Coordinators and lecturers also receive

an automated email each Friday afternoon detailing (i) the number of visits and unique visitors the MSC has received from their module(s), (ii) the duration of each visit, (iii) a running count of the total visits over that particular semester and (iv) the nature of the student query (as interpreted by the attending MSC tutor(s)) and how it was remedied. As part of the Module Coordinator-Maths Support Centre Partnership (see Appendix 1), this feedback is sent to over forty lecturers, both prior to the start of the new academic year and in advance of semester two teaching in January. Included in this report are the following summary statistics:

- Summary stats for MSC visits from last academic year e.g. no. of visits, no. of distinct visitors, no. registered to sit terminal examination and no. of students that subsequently failed this exam

- A time series graph for the number of visits and distinct student visits per week of semester

- A chart showing the most commonly occurring difficulties

- A summary of the issues raised by MSC visitors and finally

- A qualitative description of each visit as recorded by the MSC system (via the attending MSC tutors).

These discussions help both parties to provide the best mathematical educational experience for the university's undergraduate students and ensure that sufficient support is offered at school level before the MSC is utilised by a particular student.

13   MSC Tutors

As always the success of the MSC is due to its committed staff. This year the MSC hired 28 tutors over both semesters, fifteen of which were re-hired from 2017/18 and thirteen of which were interviewed and trained in September. Five of this years' MSC tutor cohort have doctorates in Mathematics, Statistics or Mathematical Physics. Six tutors were completing their PhD studies in the School of Mathematics and Statistics, one was doing a research MSc in Mathematics Education and another was completing an MA in Mathematics. Five of our tutors were undergraduate students in 2018/19 and came through our tutor training programme in September 2018. Two of these undergraduate tutors are starting PhD programmes in September 2019, both on funded projects in the UCD School of Mathematics and Statistics, one an SFI Centre for Research Training in Foundations of Data Science funded project, and the other a UCD funded project on efficient energy systems. The remaining tutors were sourced from outside UCD. All MSC tutors undergo screening, interviews,

extensive training and mentoring throughout their time at the MSC. Every year the tutor turnover is high at the MSC where tutors either move to industry (e.g Optum Technology) or other high calibre educational institutions (e.g. Imperial College London) and so sourcing and retaining high quality mathematics tutors remains a significant challenge for the UCD MSC.

	2018/19	2017/18	2016/17	2015/16	2014/15	2013/14	Totals
Tutors newly hired	13	11	9	12	13	15	73
Tutors re-hired	15	10	13	13	10	3	64
Totals	28	21	22	25	23	18	137

Table 2: The number of new and re-hired MSC tutors for the past 6 years

Some of the 2018/19 MSC tutor team at a training event

13.1 Continuing Professional Development of MSC tutors

Twenty MSC tutors and five lecturers from the School of Mathematics and Statistics attended a seminar by Dr Niamh O'Meara from University of Limerick, entitled *The time allocated to mathematics in Ireland* which was held in the MSC on December

14 2018. A further seminar was held in the MSC on Friday May 3rd 2019 was given by Dr Diarmaid Hyland of DCU entitled *Linking theory with practice - How mathematics education can inform teaching at 3rd level* was well attended by both MSC tutoring staff and lecturing staff at SMS. A final seminar was held on May 22 2019 by visiting Associate Professor Sepideh Stewart from the University of Oklahoma titled *Moving between the worlds of mathematical thinking in Linear Algebra: Mathematicians deliberations and students' perspectives* These events contribute to the MSC tutors' continuing professional development and were paid for from the UCD Teaching and Learning Award the MSC tutors won in 2016/17.

14   Expenditure and Income

Tutor expenditure was the main expense totaling €72,667 with €42,726 spent in semester one and €29,941 in the typically less busy semester two. Miscellaneous items of expenditure from the non-pay category included: website maintenance (€200) and Copiprint expenses (€165).

The MSC received income of €420 from the joint Library/MSC Leaving Certificate Programme run in May and June of 2019. This scheme is offered free of charge to any 6th year student from a DEIS-designated school and such students are encouraged to attend as many of the two-hour sessions as they wish. The scheme is run on a cost-neutral basis with non-DEIS students paying €30 per 2-hour session. This income covers the tutors' pay.

15   Research and Communications at the MSC

A number of research projects were conducted at the MSC in 2018/19 including:

- A paper published in the International Journal of Mathematical Education in Science and Technology comparing two MSCs feedback data by Anthony Cronin, Donald Shearman, Alison Sneyd and Gizem Intepe titled. "Analysis using natural language processing of feedback data from two mathematics support centres".

- A conference presentation at CETL-MSOR in 2019 by Dr Emma Howard (UCD School of Psychology) and Anthony Cronin titled "Effective Tutor Timetabling Based on Identifying Busy Periods in a Maths Support Centre"

16   Outreach Activities at the MSC

16.1   UCD Library-MSC Leaving Certificate Programme

From May 27th to June 7th the MSC assisted 67 students in preparation for their Leaving Certificate Mathematics Examination with free maths support sessions being provided for 40 students from six DEIS schools (Delivering Equality of Opportunity in Schools): St Tiernans Community School, Dundrum, Loreto College Crumlin; Mount Carmel Secondary School; Marian College Ballsbridge; St Laurence College; and, Ballinteer Community School. The following six non-DEIS schools - Oatlands College, Muckross Park College, Coláiste Íosagáin, Mount Anville, St Michael's College and St Gerards School in Bray also participated in this scheme.

16.2   Maths Sparks, Maths Week, Engineers Ireland

From April to October 2018, the fifth installment of the SFI Discover-funded *Maths Sparks* took place. This is an outreach and public engagement programme designed and delivered by staff and undergraduate students from the School of Mathematics and Statistics to over 80 DEIS students from 12 local secondary schools with the voluntary assistance of MSC tutors and SMS undergraduates.

MSC management and tutors presented at local primary schools for Maths Week in October 2018 including Code Breaking talks for 12 schools (both primary and secondary) at Engineers Ireland headquarters in Dublin and also assisted with the Future You, Science Ambassador and Peer Mentoring programmes.

17   Summer Courses at the MSC

In August 2018 the MSC designed and delivered four 3-hour workshops for the 41 students registered to the Access to Science, Engineering and Agriculture programme. Four 2-hour workshops were also given to 30 students registered through the Mature Students office. Five 2-hour sessions were delivered to students coming to UCD through the HEAR (Higher Education Access Route) programme and one "Introduction to the Maths Support Centre" session for the DARE (Disability Access Route to Education) students. The MSC also attends and presents at many orientation events in the preceding weeks of term, including the International Orientation Programme for incoming students in August and January.

18   Future Developments and Recommendations

18.1   Developments for 2019/20

1. For 2019/20, the MSC aims to consolidate the 40+ existing partnerships with Module Coordinators from SMS and extend this to include more Module Coordinators and lecturers external to SMS.

2. As the number of student enrolments to mathematics related courses continues to grow the aim for the MSC is to continue to provide high quality academic support to UCD students accessing the service within the existing budget parameters and with the support of highly skilled tutors.

3. MSC management plans to undertake a quantitative study of the effectiveness of the MSC for at-risk students in relation to students failing first-year first-semester modules. Plans are underway with the Student Records manager and Deputy Director of Admissions to anonymously link the Leaving Certificate mathematics results with MSC visitors' university module results in a GDPR compliant manner.

4. We plan strengthening the governance and oversight of the MSC, including publishing the oversight committee's terms of reference, and MSC Director's job description on the MSC website, in addition to improvements to the feedback system for lecturers, MSC tutors and student users of the service.

18.2   Recommendations

1. The MSC management continues to receive numerous complaints from visiting students and tutors in relation to poor ventilation, temperature and lack of natural light within the centre. This stifles both students and working tutors and once again we recommend that a more suitable, and larger space to provide the service from be found. The recent announcement of plans for a new Learning and Teaching building on campus presents an opportunity for the MSC to put forward its case for re-location to more suitable accommodation within the time frame of the planning process.