

The University of Edinburgh

Internal Periodic Review

School of Mathematics

Postgraduate Research provision

28 April – 30 April 2021

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Executive summary

This report comprises the outcomes from the internal review of postgraduate research provision in the School of Mathematics.

The review team found that the School of Mathematics has effective management of the quality of the student learning experience, academic standards, and enhancement and good practice.

The report provides commendations on the School's provision, recommendations for enhancement to report back on and suggestions on how to support developments.

Key Commendations

The review team commended the School in the utilisation of the Bayes Centre in its usefulness and contribution to the student experience. The efforts the School of Mathematics had made to integrate the Bayes Centre into the Mathematical Sciences community within Edinburgh were pivotal in fostering a vibrant and dynamic community which provided an opportunity for interactions and free flowing knowledge exchanges not only within the subject but also between disciplines.

The review team also commended the School in a number of areas relating to support for both students and staff. This included the provision of training, excellent levels of support in the use of technology in response to, and during, the current pandemic, and the collegiality and close working relationship which existed between the School of Mathematics within the University of Edinburgh and their equivalents at Heriot-Watt University.

Key recommendations

The top three recommendations that the review team identified for the School to prioritise were

Consideration of a simplified set of PhD Programmes

Consideration of a sustainable strategy for space requirements

The creation of an annual social/academic event for all PhD students

Commendations, recommendations and suggestions

Key strengths and areas of positive practice for sharing more widely across the institution.

No	Commendation	Section in report
1	The review team commends the School for their efforts and aim to make the CDT and non CDT student experience as close as possible.	2.1.2
2	In relation to the Bayes Centre, the review team commends the School, highlighting the usefulness of the Bayes Centre, and the contribution that the Bayes Centre had clearly made to the student experience.	2.1.3
3	The review team commends the School on their collegiality with Heriot-Watt University.	2.1.5
4	The review team commends the School for their use of technology in the face of Covid-19 challenges to maintain the vibrancy of their research groups, and to minimise the effects of distance.	2.1.8
5	The review team commends the provision of externally provided mental health training by the School.	2.3.1.3, 2.7.2
6	The review team commends the School on the provision of incentives for Student representatives and commends the student representatives for their initiative in organising the peer mentoring scheme and other activities.	2.4
7	The review team commends the School for its mentoring and funding of student ideas, and commends the students concerned for both their initiative and effort in setting up the Piscopia forum.	2.5.3
8	The review team commends the School for the strategies and actions it was taking to ensure diversity in PhD recruitment.	2.5.4
9	The review team commends the School for the opportunity it provided to Postgraduate tutors to play their role in developing material for courses during Covid preparations.	2.7.1
10	The review team commends the School for the existing training that it offered tutors.	2.7.1
11	The review team commends the School for the training that it provided to members of staff acting as new supervisors.	2.7.3
12	The responsiveness of the [Technical support] team during the current Covid pandemic to make equipment available to students, tutors and staff to enable work to continue was commended by the review team	2.8.2
13	The review team commends the School for the existing training that it offered to Postgraduate Research students.	2.1.4
14	The review team commends the School's management for the strategic vision to provide financial support aimed at encouraging and facilitating the successful growth of PhD programmes, and aiming to ensure equity amongst the student cohorts in terms of funding.	2.5.1
15	The review team commends the School for the breadth and depth of the training provision available for Postgraduate Research students, and for its financial support of that provision.	2.6.1
16	The review team commends the School for its existing provision around career preparation	2.6.3
17	The review team commends the School for its vision, leadership and day-to-day management in developing and operating a large, vibrant graduate programme	1

Recommendations for enhancement/Areas for further development

Priority	Recommendation	Section in report	Responsibility of
1	The review team recommends that the School consider a sustainable strategy for space requirements of a growing graduate school.	2.1.3	School
2	The review team recommends that the School consider the value of a simplified set of PhD programmes, and seek to align them with the future strategy of the School.	2.1.1	School
3	The review team recommends that the School consider the introduction of more academic / social events for PhD students, with specific attention to the current first year cohort in order to help in the catching up of any lost cohort building opportunities.	2.8.1	School
4	The review team recommends that the School of Mathematics engage with and encourage all Schools and subject areas within the Kings Buildings campus to advocate to University Senior Management for the re-instatement of the Kings Buildings Shuttle Bus service.	2.1.7	School
5	The review team recommends that students should be explicitly advised and directed toward relevant sources of information on opportunities following from PhD study.	2.6.3	School
6	The review team recommends that the School consider reintroduction of tutor peer review, the implementation of continued tutor training in higher years, and the development of computer lab specific training.	2.7.1.2	School
7	The review team recommends that the School explore training tutors around the pedagogical use of technology in enhancement of the student experience.	2.7.1.2	School
8	The review team recommends that the School explore extending the good practice of initial meetings with tutors and course organisers to other appropriate courses.	2.7.1.2	School
9	The review team recommends that the School consider the introduction of a	2.7.1.2	School

	standardised set of information about courses for tutors.		
10	The review team recommends that the School of Mathematics reflect on all of the changes that have taken place due to Covid-19, and consider whether there would be benefit in maintaining any of these changes going forward.	2.8.3	School

Suggestions for noting

If an issue is minor but the review team nevertheless wants to flag it as a potentially useful action, it will be couched as a suggestion rather than a formal recommendation. Suggestions are not tracked in onward reporting. Suggestions can also be useful in giving further context to recommendations.

No	Suggestion	Section in report
1	The review team suggests the School considers two PhD programmes, one in Mathematical Sciences and one in Integrated Mathematical Sciences (for CDT admissions).	2.1.1
2	The review team suggests the School be more proactive in giving tours to prospective applicants.	2.5.4
3	The review team suggests that the School target Universities with diverse Undergraduate programmes in relation to PhD recruitment, in order to further aid diversification.	2.5.4
4	The review team suggests that the School consider adding individual training paths in addition to current set paths in the Schools current offering. This is in the context of professional training paths.	2.1.4
5	The review team suggests that the School utilise the International Centre for Mathematical Sciences (ICMS) to bring together students from traditionally underrepresented groups in order to build community and encourage them to continue to PhD study.	2.5.4
6	The review team suggests that the school provide clarity around expected number of teaching hours for Postgraduate tutors, and ensure that the sign up form states that it is not a requirement to teach in each block.	2.7.1.2
7	The review team suggests that the School publicise Platform One, which is Edinburgh's online meeting place for students to connect with fellow students and graduates, and the subject of career planning be added to the Annual Review form or process.	2.6.3
8	The review team suggests that in relation to the Teaching Café, staff should ensure that tutors are invited, and made aware that they are able to participate in these discussions.	2.7.1.2
9	The review team suggests that the School should offer refresher training for Postgraduate tutors in later years, taking the opportunity to bring new and experienced tutors together.	2.7.1.2
10	The review team suggests that the School should reflect on highlighting the ability to study part-time in their recruitment strategy, and the flexibility that this might afford to students.	2.5.4

11	The review team suggests that consideration be given to a retreat (within budgetary constraints) and/or poster session, which would provide an opportunity for 2nd, 3rd, 4th years to present work and would help to reinforce cohorts. This would be in parallel to what takes place on CDT programmes.	2.8.1
12	The review team suggests that, referencing practice within other institutions, the School consider exploration of informal relationships for joint supervision of a small number of PhD students.	2.1.6
13	The review team suggests that the School explore: the possibility of shortening the review period; moving the timings of Annual Reviews; give consideration to having the first supervisor alone sign off if this was workable within regulation to reduce administrative burden; and encourage student ownership of the review process to ensure that completion of the review procedures was student driven.	2.2.3

Section A – Introduction

Scope of review

Range of provision considered by the review (see Appendix 1).

The Internal Periodic Review of the School Mathematics Postgraduate Research Provision in 2020/21 consisted of:

- The University's remit for internal review (listed in Appendix 2)
- The two subject specific remit items for the review:
 - Supporting and enhancing the community of the Maxwell Institute Graduate School (MIGS):
 - How can the school move to a more flexible PhD programme structure which will enable students to broaden their knowledge and make the programmes attractive to a diverse range of applicants
- The Reflective Report and additional material provided in advance of the review
- The final report produced by the review team
- Action by the School and others to whom recommendations were remitted following the review

Review Team Members

Convener	Dr Richard Holt
External Member	Professor Christoph Thiele
External Member	Professor Radek Erban
External Member	Dr Rebecca Killick
Internal Member	Professor Margaret Graham
Student Member	Ms Marie-Christine Opitz
Review Team Administrator	Mr Stuart Fitzpatrick

The School

The School of Mathematics is one of seven Schools in the College of Science and Engineering.

Physical location and summary of facilities

The School of Mathematics is based at the University's King's Buildings Campus in the James Clerk Maxwell Building (JCMB) and in the Bayes Centre in the University's Central Campus. Academic, professional services staff and year 2-4 PhD students are based in JCMB and first year PhD students are based in the Bayes Centre. The School is involved in a long-standing collaboration with Heriot-Watt University (HWU) in the Maxwell Institute (MI) for Mathematical Sciences which combines the research activities in the mathematical sciences in the School of Mathematics at the University of Edinburgh (UoE), and the School of Mathematical and Computer Sciences at Heriot-Watt University (HWU). This collaboration saw the establishment of a joint Maxwell Institute Graduate School (MIGS) in 2017.

Date of previous review

6 and 7 November 2014

Reflective Report:

Written by: Prof Martin Dindos, Head of Graduate School
Mrs Katy Cameron, Graduate School Manager

Input from: Ms Isabelle Hanlon, CDT Administrator

Student input: Bella Deutsch, Marius Spoitu, Andrew Beckett, Josh Fogg

Section B – Main report

1 Strategic overview

The School of Mathematics is well regarded in the international mathematics community, and is large and diverse. The Graduate School offers research postgraduate programmes in the following:

- Algebra and Number Theory;
- Analysis;
- Applied and Computational Mathematics;
- Geometry and Topology;
- Mathematical Physics;
- Optimisation and Operational Research;
- Probability and Stochastic Analysis;
- Statistics;
- Mathematical Education.

Research provision within the School is grouped into themes. These themes are Applied & Computational Mathematics, Analysis & Probability, Data & Decisions, Structure & Symmetry, and Technology Enhanced Mathematical Sciences Education.

In addition to this, the School is involved in a collaboration with Heriot-Watt University in the Maxwell Institute (MI) for Mathematical Sciences, which combines the research activities in the mathematical sciences in the School of Mathematics at the University of Edinburgh, and the School of Mathematical and Computer Sciences at Heriot-Watt University. This collaboration saw the establishment of a joint Maxwell Institute Graduate School (MIGS) in 2017. The Maxwell Institute Graduate School was run in collaboration with Heriot-Watt University with joint Directors of the Graduate School. Students are either registered on a University of Edinburgh or Heriot-Watt University programme. MIGS is overseen by Maxwell Institute Graduate School Committee (MIGSC) consisting of members from both Universities and convened by the Directors of the Graduate Schools. All first year Maxwell Institute students are based in the Bayes Centre and move in later years to JCMB if they are University of Edinburgh students or to Heriot-Watt's Riccarton campus if they are Heriot-Watt students.

Two Centre for Doctoral Training (CDT) programmes (Maxwell Institute in Mathematical Analysis and its Applications (MIGSAA) and Mathematical Modelling, Analysis & Computation in the Maxwell Institute (MAC-MIGS)) exist, and are made up of registered students at both the University of Edinburgh and Heriot-Watt University. Students in MIGSAA and MAC-MIGS CDTs receive degrees from both University of Edinburgh and Heriot-Watt University.

A key strategic aim of the School of Mathematics is that all academic members of staff were able to supervise at least two PhD students. To achieve this aim, the School has invested its own income into PhD recruitment and scholarships. This, together with successes in attracting UKRI funding (in the form of funding for the CDT programmes and Doctoral Training Programmes) as well as other external funding, has led to a significant increase in student numbers since the last Internal Periodic Review.

The review team **commends** the School for its vision, leadership and day-to-day management in developing and operating a large, vibrant graduate programme.

2 Enhancing the student experience

2.1 The approach to enhancing Learning and Teaching

- 2.1.1 The School had identified their current PhD programme structure as one of their subject specific remit items (How can the school move to a more flexible PhD programme structure which will enable students to broaden their knowledge and make the programmes attractive to a diverse range of applicants?). In discussions with both staff and students over the course of the review, the review team noted that the current structure and offering, whilst varied, was not necessarily representative of what students experienced whilst within the School. There was a desire within the School to simplify their PhD offerings, and the School were considering various ways of achieving this goal. The review team **recommended** that the School consider the value of a simplified set of PhD programmes, and seek to align them with the future strategy of the School. The review team **suggested** that the School might consider having just two PhD programmes, one PhD in Mathematical Sciences, and one integrated PhD in Mathematical Sciences reflecting the different maximum programme duration for non-CDT and CDT students.
- 2.1.2 The School provided a training programme which aligned with SCQF level 12 descriptors. Within the School's model of having both regular (non-CDT, MIGS) PhD students and CDT students, there was scope for both types of student to undertake training courses on advanced topics in different branches of mathematics. Within CDT, these courses were credit bearing, and formed a taught element of the programme. In non-CDT, these courses were not credit bearing but were nevertheless open to students as training, which the School saw as a fundamental aspect of their degrees and as an aid to help students widen their mathematical background during their first year. The review team **commended** the School for their efforts and aim to make the CDT and non-CDT student experience as close as possible.
- 2.1.3 The review team noted that the majority of the School's Learning and Teaching, in so far as it related to Postgraduate Research, was delivered in collaboration with Heriot-Watt University under the banner of the Maxwell Institute and the CDTs. This collaboration delivered a joint year 1 cohort experience in the Bayes centre with joint lectures, tutorials. The School also jointly delivered academic and non-academic skill training. In relation to the Bayes Centre, the review team **commended** the School and its management team, highlighting the usefulness of the Bayes Centre, and the contribution that the Bayes Centre had clearly made to the student experience. The efforts that the School of Mathematics had made to integrate Bayes Centre into the Mathematical Sciences community within Edinburgh were clear and beneficial. The fact that all students began their studies together in Bayes, then subsequently moved to quieter areas in subsequent years appeared to work well and foster the development of a vibrant academic community. The students who talked to the review panel felt very connected to the Bayes Centre and the vibrant and dynamic community within it. The Bayes Centre presented opportunity for interaction and the possibility for free flowing knowledge exchange between disciplines. The review team noted that the School had experienced a growth in cohort numbers in recent years, and had a view to further expansion of this. The review team also noted the capacity constraints and limited space for faculty at the Bayes Centre and the need to accommodate later years of larger PhD cohorts in JCMB. As such, the review team **recommended** that the School consider the creation of a sustainable strategy for space requirements of a growing graduate school.

- 2.1.4 In relation to the training offered, the review team noted that non-CDT students were asked to sign up to one of two streams. These were the Industry stream and the Teaching stream. The Industry stream was designed for students wishing to expand their activities outwith the University and to help students develop the applicability of their research within industry. The Teaching stream was designed for students who wished to pursue further a career in academia, and could also be used to obtain Higher Education Academy accreditation in the form of an Associate Fellowship of the Higher Education Academic (AFHEA). The review team **commended** the existing training and **suggested** that the School consider allowing students to switch between training paths in addition to the current set paths outlined above in order to increase flexibility.
- 2.1.5 The review team **commended** the School on their collegiality with Heriot-Watt University. It was clear that the Maxwell Institute, as a joint provision of both institutions, was equally reliant on both institutions and their shared commitment to the delivery of high-quality teaching and research.
- 2.1.6 The review team noted that it was not uncommon for the School to receive interest from other UK and international universities with proposals for joint supervision and sometimes joint funding of PhD students. The School felt that there was a complexity to University arrangements in this area which made setting up such ventures problematic, and this in turn limited the opportunity for establishing collaborative partnerships. The review team **suggested** that, referencing practice within other institutions, the School explored informal relationships for joint supervision with interested partners where the number of PhD students involved was likely to be small.
- 2.1.7 The review team noted that the delivery of courses, and the wider engagement of students with the programme throughout the course of their studies, was enhanced greatly by the ability to interact and liaise with fellow students and staff across the multiple physical locations occupied by the School. With the location of the Bayes Centre in the University's Central area, and the JCMB in the Kings Buildings campus, the review team identified the requirement for ease of access and movement between the sites. The University had, until the Covid-19 pandemic, offered a free to use shuttle bus service for students and staff, in partnership with Lothian Buses. The future availability and status of this service was unclear. The review team noted that this issue would not be unique to the School of Mathematics, as a number of different Schools occupied space in both the Central area and Kings Buildings. The review team **recommended** that the School of Mathematics engage with and encourage all Schools and subject areas within the Kings Buildings campus to advocate to University Senior Management for the re-instatement of the Kings Buildings Shuttle Bus service.
- 2.1.8 The review team, in meetings with both students and staff, had heard that the Covid-19 pandemic had necessitated a change in everyday working and interactions. The utilisation of technology to help facilitate a smooth transition from traditional to hybrid learning and teaching had played a large role in enabling continuation of much of the School's activities, including research seminars and reading groups. Whilst specifics will be discussed within later sections of the report, the review team **commended** the School for their use of technology in the face of Covid-19 challenges to maintain the vibrancy of their research groups, and to minimise the effects of distance.

2.2 Assessment and Feedback

- 2.2.1 With PhD study being predominantly research, the focus of assessment and feedback within the School of Mathematics was on each student attaining specific research milestones. With the exception of the CDT programmes, students did not have formal course credit requirements.
- 2.2.2 At the end of each academic year, students produced a report on their progress which included achievements since their last review, courses and activities the student has participated in, and how any advice from the previous review had been acted upon. At the end of each year, progress was formally evaluated in an Annual Review. The Annual Review consisted of two parts, an online form and the report. The online Annual Review was commenced by the student. Once the student completed their section, the supervisors were notified. For students in year 1 a panel consisting of the supervising team and a member of the graduate school was then convened. The student presented their research and answered any questions from the panellists. This part of the review was particularly important as it gave an opportunity to fully assess work and research methodology and evaluate whether the student was progressing adequately for completing a PhD within the timeframe allotted. The annual review then continued via the principal supervisor and second supervisor completing their sections of the online form. Once this was done, the comments were returned to the student to review and approve. The last step that completed the review was the approval of the Director of the Graduate School. The Director could also query the review and ask supervisors for additional information.
- 2.2.3 The review team, in conversations with members of both academic and professional services staff, had heard that the Annual Review procedures themselves were administratively complex as a result of the system in which they were carried out, EUCLID. EUCLID is the main student record system of the University, and there is a requirement that the Annual Review procedures be administered within it. The functionality of EUCLID was such that it was restrictive in the ability of a single party to fix issues and was dependent on each constituent party of the review completing a stage assigned to them at the appropriate time. There were further issues owing to the timing of Annual Reviews, in that they tended to fall in or around the end of an Academic Year, meaning that certain staff may be unavailable, which led to bottlenecks or delays in administratively progressing the review cycle. The review team **suggested** that the School explore the possibility of: shortening the review period; moving the timings of Annual Reviews; giving consideration to having the first supervisor alone sign off if this was workable within regulation to reduce administrative burden and encourage student ownership of the review process to ensure that completion of the review procedures was student driven.
- 2.3 Supporting students in their learning – all aspects of support relevant to students' learning including:

2.3.1 Academic and student support structures and mechanisms

- 2.3.1.1 Within the School of Mathematics, the first supervisor was the primary contact for a student in terms of academic support. Although the frequency of meetings between student and supervisor varied across the discipline, these meetings would normally take place on a weekly basis. Further academic support happened within research themes, with each theme facilitating academic interaction in the form of weekly seminar series and reading groups.
- 2.3.1.2 Typically, a second supervisor belonged to the same theme as the student and for this reason there were frequent informal interactions with second supervisors that went beyond the mandated once-per-semester meeting. In some cases, the second supervisor plays only a background role in the student's supervision and was unofficially seen as more of a pastoral role. The School had planned to formalise the role of a 'PhD mentor' in addition to a second supervisor to officially provide a more pastoral, impartial and independent source of advice to the student. The School envisioned that the PhD mentor should be the first point of contact for pastoral support for the mentees on non-academic matters which could be affecting their studies, guiding the student to the correct support mechanisms within the University.
- 2.3.1.3 The Graduate School in the School of Mathematics also played an important role in terms of student support. Professional Services staff dealt with most non-academic matters and the Director of the Graduate School dealt with academic issues such as progression issues, or changes in supervisory arrangements. The review team noted that the professional services staff within the Graduate School had undertaken externally provided mental health first aid training which had been well received and thought of as valuable and useful. The review team **commended** the provision of (externally-provided) mental health training by the School.

2.4. Listening to and responding to the Student Voice

The review team heard of a number of student-led community building initiatives, such as the organisation of colloquia by student representatives. Students who had participated in these activities spoke very positively about them. On a yearly basis, the School asked students to nominate representatives, including first year representatives, later year representatives, and a colloquium organiser. As an incentive, the representatives received an enhanced Travel & Conference Fund contribution for the length of time they acted in this capacity. They represented the student cohort on the School PG Studies Committee which met once a semester and participated in regular meetings with the Director of the Graduate School and Graduate School Office. They were also responsible for arranging social and cohort building activities for all students. In 2020/21, student representatives had established a mentoring programme which matched incoming students with two student mentors, one from within their theme and one from outside. The review team **commended** the School on the provision of incentives for Student representatives and **commended** the student representatives for their initiative in organising the peer mentoring scheme and other activities.

2.5 Accessibility, Inclusivity and Widening Participation

- 2.5.1 The School aims to offer an attractive destination for a wide range of applicants from diverse backgrounds. This aim forms part of the School's subject specific remit item. In particular, the School asked the review team to consider how it might develop a more flexible PhD programme structure, which could enable students to broaden their knowledge and make the programmes attractive to a diverse range of applicants. In September 2020, the School had proactively changed the length of funding that it offered to all students who were in receipt of a funded studentship. Students had previously been offered 3.5 years of funding, but were now offered 4 years funding, which was equivalent to a CDT studentship. The school had also standardised the stipend offered to all its students and proactively topped up the stipend of students who were in receipt of external scholarships which did not offer this level of support. The review team **commended** the School's management for the strategic vision to provide financial support aimed at encouraging and facilitating the successful growth of PhD programmes, and aiming to ensure equity amongst the student cohorts in terms of funding.
- 2.5.2 The School had struggled to recruit female students in some research areas but overall were at the national average level of female recruitment to their PhD programmes. In recognition of this, the School had implemented steps to ensure that those involved in interviewing or open days had undertaken unconscious bias and e-diversity training, with systems in place to ensure that this training had been completed. At meetings where recruitment decisions were discussed, diversity amongst the student cohort was considered. Any theme that failed to recruit a diverse cohort of students in one year was asked to present a plan to the Head of School to improve this for the following year.
- 2.5.3 The School also supported the Piscopia Initiative. This is a student-led forum whose goal was to increase the number of applications from women and non-binary students for PhD places in Mathematical Sciences. This had expanded from an initial focus on Scottish institutions to a focus on UK institutions. The organisers ran a comprehensive programme of formal and informal events designed to reach female and non-binary students who may be considering PhD study but felt there were barriers to this. The school had provided financial and in-kind support to the initiative. The review team **commended** the School for its mentoring and funding of student ideas and initiatives such as this, and **commended** the students concerned for both their initiative and effort in setting up the Piscopia forum.
- 2.5.4 The review team **commended** the School for the strategies and actions it was taking to ensure diversity in PhD recruitment. In recognition of the fact that this matter had been identified as a specific remit item that the School had sought input on from the review team, the review team **suggested** that the School, when able, offer tours to prospective applicants to translate offers into acceptances. Additionally, the review team **suggested** that the School target PhD recruitment initiatives at Universities with diverse undergraduate populations in the subject area in order to help with diversification. The review team also **suggested** that the School should consider highlighting the ability to study part-time and the flexibility that this might afford, as a way of attracting prospective students, including the acknowledgement and understanding of any barriers or problems that part-time study might come with, and a way to address these. The review team also **suggested** that the School explore whether it was possible to utilise the International Centre for Mathematical Sciences (ICMS) in a way which might bring together students from traditionally underrepresented groups in order to build community and encourage them to continue to PhD study.

2.6 Development of Employability and Graduate Attributes

2.6.1 Skills Training

The School of Mathematics offered a number of skills and research training activities. These were both academic and more general to prepare students for the next step of their career. Students had their own travel fund which they could use to attend meetings and conferences. Students could also seek additional funding by way of a short application outlining the use of money and how the student would benefit from funding.

Students also attained skills such as Python programming and presentation skills through training and practical presentation at seminars and Student conferences. Those students interested in academic teaching participated in the teaching stream and through this could obtain associate fellowship of the Higher Education Academy (HEA).

The School of Mathematics had also involved both Undergraduate and Postgraduate Research students in the ASID (Adapt, Support, Implement, Deliver) project in response to Covid-19. This primarily involved the development of online based teaching activities and resources. The review team **commended** the School for the breadth and depth of the training provision available for Postgraduate Research students, and for its financial support of that provision.

2.6.2 Links with Alumni and Industry

Students with interests in non-academic careers could participate in the Industry stream, as opposed to the Teaching stream. The Industry stream included industry placements and internship opportunities with industrial partners. The MAC-MIGS CDT had industrial partners present on its advisory board. Students could participate in industry sandpits, modelling camps and could choose an industrial project for fulfilment of their year 1 curriculum.

2.6.3 Preparing students for their future career

The School of Mathematics provided mock interview opportunities for students who were nearing the end of their studies and were interested in gaining interview practice. They also encouraged students to participate in events run by the Institute for Academic Development (IAD) around career opportunities, and provided weekly events which featured visiting speakers from different prospective employers. The review team **commended** the School on its existing provision and **recommended** that the School consider ways in which students should be explicitly advised and directed toward relevant sources of information on opportunities following from PhD study. The review team **suggested** that the School publicise Platform One, which was Edinburgh's online meeting place for students to connect with fellow students and graduates, and **suggested** that the subject of career planning be added to the Annual Review form or process.

2.7 Supporting and developing staff

2.7.1 Support and training for tutors and demonstrators

2.7.1.1 Postgraduate tutors in the School of Mathematics underwent an induction process where School procedures were explained. Typically, on each course, tutors were overseen by Course Organiser who was responsible for the overall delivery of course objectives. Any issue could be raised with Director of Teaching who then took this up with course organisers. The School of Mathematics did not recruit staff specifically to tutor. The majority of PhD students in the School of Mathematics opted to engage with tutoring. The School of Mathematics had developed their Teaching stream in part due to the fact that a large number of students considered careers in academia following completion of their PhD study. The review team had met with a number of students who were tutors. It was clear to the review team that tutors within the School of Mathematics were both valued and relied upon. Tutors had expressed that they, for the most part, were comfortable in their roles and responsibilities, and had enjoyed the opportunity in helping to develop teaching materials, especially in light of the School of Mathematics response to Covid-19. The review team **commended** the School for the opportunity it provided to Postgraduate tutors to play their role in developing material for courses during Covid preparations. The review team also **commended** the School for the existing training that it offered tutors, the ability to achieve associate fellowship status with the HEA through this, and the high stakes teaching opportunities it afforded tutors with appropriate experience; whereby tutors could help in the delivery of more senior honours courses, and occasionally in postgraduate taught courses.

2.7.1.2 Postgraduate tutors had explained that whilst they found their initial induction into tutoring useful, there was some variation in the continuation of support when it came to matters such as organisation of materials for specific courses, or information about specific courses. Additionally, some tutors had found difficulty in applying practical pedagogical skills and had felt that additional training in this area would be beneficial, not only to them, but to the students whom they tutored. There was also a degree of uncertainty regarding expected numbers of teaching hours, and whether teaching was a requirement for each semester if one wished to continue to teach in future semesters. Finally, tutors had stated that it would be useful if they were able to have more continuous input into teaching discussions, which would be beneficial in allowing them to meet the perceived needs of students. The review team **recommended** that the School consider the reintroduction of tutor peer review, the implementation of continued tutor training in higher years, and the development of computer lab specific training. The review team **recommended** that the School explore provision of further training around the pedagogical use of technology in enhancement of the student experience. The review team **recommended** that School explore extending the good practice of initial meetings with tutors and course organisers to other appropriate courses. The review team also **recommended** that the School consider the introduction of a standardised set of information about courses for tutors. The review team **suggested** that it would be beneficial to provide tutors with clarity around their expected number of teaching hours and ensure that the sign-up form stated that this was not a requirement for every semester. The review team also **suggested** that the School should explore methods of refresher training for tutors. The review team **suggested** that staff should ensure that tutors were aware that they were able to attend events such as the Teaching Café with members of staff.

2.7.2 Support and training for Professional Services and Support staff

Professional Services and Support staff were supported through the University's Annual Review procedures. The School had recently introduced mid-year reviews in addition to this, and Professional Services and Support staff were able to access training through a training budget which was equivalent to that afforded to academic staff. As already noted, the review team **commended** the provision of externally provided mental health first aid training to Professional Services staff in the Graduate School.

2.7.3 Approach to Continuing Professional Development (CPD) to enhance Learning and Teaching

The School of Mathematics encouraged staff to engage with the HEA and the Postgraduate Certificate in Academic Practice (PgCAP). The School also supported staff academic and research activity. The School has a dedicated team for early career development and has two mentors, the aim of which was to give every incoming staff guidance and advice on the promotion process and provide necessary support for staff career goals. Each staff member underwent an annual review where all aspects of career development were discussed with a more senior staff member, which was then accompanied by feedback regarding career objectives. Where staff were acting as supervisors, as the School of Mathematics aimed to have many staff involved in supervision, the review team found that staff found induction for new supervisors to be useful, and helpful in that experienced members of staff also contributed to these sessions. The review team **commended** the School for the training that it provided to members of staff, especially in their role as new supervisors.

2.8 Learning environment (physical and virtual)

2.8.1 As already noted, the School of Mathematics had made commendable use of the Bayes Centre in its operations. The Bayes Centre has been useful in cohort building, fostering interdisciplinary cohesion and knowledge exchange. The Covid-19 pandemic had unavoidably introduced challenges in terms of the traditional utilisation of physical space to enable cohort building. Students in the earlier years of their PhD study had highlighted that, for the short periods of time they had been able to access the Bayes Centre, they had enjoyed doing so and had found it beneficial. The review team **recommended** that the School consider the introduction of more academic / social events for PhD students, with specific attention to the current first year cohort in order to help in the catching up of any lost cohort building opportunities. The form that this took would be for the School to determine, but the School might consider the inclusion of posters and presentations, and perhaps inclusive sporting events. The review team **suggested** that consideration be given to a retreat, with appropriate considerations given to budget, and a poster session would provide an opportunity for 2nd, 3rd, 4th years to present work and would help to reinforce cohorts.

2.8.2 The School placed emphasis on learning technology and how this had been utilised in response to Covid-19, for example a swift move to using electronic marking software. The School had strong technical support and ability, and this was a clear asset for the School. In addition, the responsiveness of the Technical Support team during the current Covid pandemic to make equipment available to students, tutors and staff to enable work to continue was **commended** by the review team.

2.8.3 The review team **recommended** generally that the School of Mathematics reflect on all of the changes that have taken place due to Covid-19, and consider whether there would be benefit in maintaining any of these changes going forward.

3 Assurance and enhancement of provision

3.1 Setting and maintaining academic standards

The School operates within the University's Quality Framework and the review team is confident that academic standards are high. The approach employed within the School to setting, maintaining and reviewing academic standards is appropriate. Where External Examiner involvement was required as part of Boards of Examiners for the credit bearing element of CDT programmes, the School of Mathematics received External Examiner reports which reflected on their standards and provided comparisons and suggestions on whether there was room for enhancement of practice.

Appendices

Appendix 1 – Range of Provision

Algebra and Number Theory (PhD) (Full-time)
Algebra and Number Theory (PhD) (Part-time)
Analysis (PhD) (Full-time)
Analysis (PhD) (Part-time)
Applied and Computational Mathematics (PhD) (Full-time)
Applied and Computational Mathematics (PhD) (Part-time)
Geometry and Topology (PhD) (Full-time)
Geometry and Topology (PhD) (Part-time)
Mathematical Analysis and its Applications (Non-UoE Lead - jointly awarded with HWU) (PHD) (Full-time)
Mathematical Analysis and its Applications (UoE Lead with HWU) (PhD) - 8 Years (Part-Time)
Mathematical Modelling, Analysis and Computation (PhD with Integrated Study) (Non UoE lead with HW) - 4 years (Full-Time)
Mathematical Modelling, Analysis and Computation (PhD with Integrated Study) (UoE lead with HW) - 4 Years (Full-Time)
Mathematical Modelling, Analysis and Computation (PhD with Integrated Study) (UoE lead with HW) - Part-time 8 Years
Mathematical Physics (PhD) (Full-time)
Mathematical Physics (PhD) (Part-time)
Mathematics and Statistics (MSc by Research) - 1 Year (Full-time)
Mathematics Education (PhD) - 3 Years (Full-time)
Mathematics Education (PhD) - 6 Years (Part-time)
Mathematics (MSc by Research) (Full-time)
Mathematics (MSc by Research) (Part-time)
Optimization and Operational Research (PhD) (Full-time)
Optimization and Operational Research (PhD) (Part-time)
Probability and Stochastics (PhD) (Full-time)
Probability and Stochastics (PhD) (Part-time)
Statistics (PhD) (Full-time)
Statistics (PhD) (Part-time)

Appendix 2– University remit

The University remit provides consistent coverage of key elements across all of the University's internal reviews (undergraduate and postgraduate).

It covers all credit bearing provision within the scope of the review, including:

- Provision delivered in collaboration with others
- Transnational education
- Work-based provision and placements
- Online and distance learning
- Continuing Professional Development (CPD)
- Postgraduate Professional Development (PPD)
- Provision which provides only small volumes of credit
- Joint/Dual Degrees
- Massive Open Online Courses MOOCs (even if non-credit bearing)

1. Strategic overview

The strategic approach to:

- The management and resourcing of learning and teaching experience,
- The forward direction and the structures in place to support this.
- Developing business cases for new programmes and courses,
- Managing and reviewing its portfolio,
- Closing courses and programmes.

2. Enhancing the Student Experience

The approach to and effectiveness of:

- Supporting students in their learning
- Listening to and responding to the Student Voice
- Learning and Teaching
- Assessment and Feedback
- Accessibility, Inclusivity and Widening Participation
- Learning environment (physical and virtual)
- Development of Employability and Graduate Attributes
- Supporting and developing staff

3. Assurance and Enhancement of provision

The approach to and effectiveness of maintaining and enhancing academic standards and quality of provision in alignment with the University Quality Framework:

- Admissions and Recruitment
- Assessment, Progression and Achievement
- Programme and Course approval
- Annual Monitoring, Review and Reporting
- Operation of Boards of Studies, Exam Boards, Special Circumstances
- External Examining, themes and actions taken
- Alignment with SCQF (Scottish Credit and Qualifications Framework) level, relevant benchmark statements, UK Quality Code
- Accreditation and Collaborative activity and relationship with Professional/Accrediting bodies (if applicable)

Appendix 3 Additional information considered by review team

- School of Mathematics Reflective Report
- School Quality Assurance Reports 2017-18, 2018-19, 2019-20
- School Organisational Chart

- Graduate School Remits and Roles
- Programme Handbooks
- MAC-MIGS Programme Handbook
- School of Mathematics Degree Programme Tables (DPTs)
- Statistical Reports
- Equality Diversity Monitoring and Research Committee Report
- School Graduate Outcomes Data
- Postgraduate Research Experience Survey (PRES) 2019 results
- Student Staff Liaison Committee Minutes
- School Postgraduate Studies Committee Meeting Minutes
- University of Edinburgh Standard Remit
- Edinburgh University Students' Association (EUSA) School Report

Appendix 4 Number of students

Entry Programme Name	2015/6	2016/7	2017/8	2018/9	2019/20	2020/1	2021/2
Algebra and Number Theory (PhD) (Full-time)	2	3	0	0	1	4	0
Analysis (PhD) (Full-time)	0	0	0	2	0	6	0
Analysis (PhD) (Part-time)				0			
Applied and Computational Mathematics (PhD) (Full-time)	3	2	2	5	0	2	0
Applied and Computational Mathematics (PhD) (Part-time)						0	
Geometry and Topology (PhD) (Full-time)	3	1	1	5	5	3	0
Geometry and Topology (PhD) (Part-time)		0	0				
Mathematical Analysis and its Applications (UoE Lead - jointly awarded with HWU) (PhD) (Full-time)	12	12	16	17			
Mathematical Modelling, Analysis and Computation (PhD with Integrated Study) (UoE lead with HW) - 4 Years (Full-Time)					13	17	0
Mathematical Physics (PhD) (Full-time)	1	1	2	3	3	3	0
Mathematical Physics (PhD) (Part-time)					0		
Mathematics Education (PhD) - 3 Years (Full-time)				1	0	0	0
Mathematics Education (PhD) - 6 Years (Part-time)						0	
Optimization and Operational Research (PhD) (Full-time)	3	6	3	5	4	6	0
Optimization and Operational Research (PhD) (Part-time)		0		0	0		
Probability and Stochastics (PhD) (Full-time)	2	1	1	1	5	3	0
Probability and Stochastics (PhD) (Part-time)	0	0			0	0	
Statistics (PhD) (Full-time)	2	1	6	3	6	6	0
Statistics (PhD) (Part-time)				1		1	