

LONDON MATHEMATICAL SOCIETY

Statement on requirements for facilities and resources for teaching mathematics in HE

An update on the Statement on the Teaching and Assessment of Mathematics Degrees

Introduction

This statement is aimed at providing evidence-based guidance on the types of infrastructure necessary for the delivery both of mathematics degrees and of mathematics service teaching within other subjects. With many universities undertaking significant building projects as well as refurbishing and refreshing teaching spaces, this statement is intended to help those involved in the design of new teaching space, as well as the refurbishment of existing teaching space, to ensure that the mathematics can be taught and learnt in an academically appropriate way.

Regardless of the method of teaching, be it large lectures or small tutorials, students working individually or in groups, students need to have adequate desk space on which to work. This holds for all disciplines and applies to all teaching spaces, as teaching spaces are often shared across disciplines.

The statement should be read alongside the QAA Benchmark Statement which provides more detailed recommendations on regulation, degree classification and subject content.

Display tools

Tools that enable mathematical communication, e.g. displaying exposition of a topic by teachers and learners as it is developed in real time, have always had and continue to play an important role in the learning of mathematics. These tools need to enable users to write directly on them and be visible to the whole class – partly because mathematical formulae and diagrams are much easier to write than to type quickly, and also to enable the lecturer and the learners to share ideas and develop arguments in real time. One of the cheapest ways of providing such facilities, needing very little ongoing maintenance, are black or white boards. However, there are more technological ways of achieving the same results e.g. data visualisers, tablet computers [MWK]. Whichever solution is chosen, screens/boards need to be large enough and located so that they can be seen by all in the room, are accessible to those writing on them, and ideally enable material to persist over time. Learners and teachers will often need to refer back to earlier material e.g. an argument developed at the start of a session might be needed later on to make a further deduction. In other words, one or two small display screens in a classroom that can only be used for one type of output at a time are insufficient and are likely to detract from the learning experience of the students.

Lecture recording

The use of lecture recording to enhance the learning experience is as valuable to students of mathematics as it is to students of other disciplines. Given the above emphasis on displaying mathematics as it is developed as an integral part of learning, it is important that recording methods are flexible enough to capture all displayed material, e.g. to capture what is written on all the

display surfaces used during a session. A fixed camera that only focuses on the podium may not pick up the full content of a session. This can be mitigated through combining a fixed camera with other recording mechanisms e.g. input from a data visualiser or tablet computer if a more flexible camera system is unavailable.

Provision of materials in advance

As part of reasonable adjustment legislation, many universities require staff to provide course materials ahead of sessions. This is often done in mathematics through the provision of gapped or skeletal notes, which provide the essential theoretical elements to be covered in the session, with space for the learner to complete examples and make their own notes.

Textbooks, whether in hard copy or electronic books, can also be a valuable tool for mathematics students and are used as part of providing materials in advance.

Flipped classroom teaching, where the students receive materials in advance and the teaching sessions are used to develop deeper understanding of the topics, are becoming more widespread. Research indicates that this approach is highly effective in promoting deep learning [CFW]. The interactive discussions that take place during the sessions are a critical part of the learning experience, emphasizing the requirement for sufficient display space and flexible recording systems.

Online submission of coursework

Universities are increasingly introducing systems for students to submit coursework and receive feedback on their work electronically. These can enhance the student experience, providing an auditable submission trail and a reliable method of returning marked work. Twenty five years of the internet have not yet resulted in methods for typing mathematics that are anything like as efficient as writing it, so if such systems are introduced there should be provision for students submitting mathematically-based work to hand-write their work and scan it into electronic format in order to submit.

For the same reason, there are also challenges for staff required to mark mathematically-based work on-screen. If staff are expected to mark work on-screen they need to be provided with tools for hand-marking (e.g. tablet computers to allow hand-annotation of scanned PDF documents), otherwise the task of marking work will take significantly longer than before, reducing the amount of staff time available for teaching and research.

e-Assessment tools

A number of e-assessment and feedback tools have been developed in order to provide formative and summative feedback on work in an efficient way, freeing up staff time to engage directly with students and to provide more extensive feedback on work that is less easily automatically assessed [eAA]. Currently it is possible to use such e-assessment tools for a lot of mathematically-based work, including quite complex tasks such as programming and multi-staged questions [RMT], [GWH]. Investment in appropriate infrastructure (e.g. servers, back-office IT support) can provide a significant pay-off in terms of providing students with extensive feedback opportunities in an efficient way.

Technology-Enhanced Active Learning Spaces

Technology Enhanced Active Learning (TEAL) Spaces are classrooms that have been adapted to encourage interactive learning in small groups supported by technology available to the students and staff [MIT]. These can be very effectively used for the teaching of mathematical subjects as they typically provide a good amount of desk-space for students to use and good visual access to display screens. In addition, they provide the opportunity for small group working during the class and access to tools such as mathematical software. They can be a valuable addition to the suite of classroom spaces available to staff.

References

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