

SPOTLIGHTS

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Day after day we witness how Apple technologies truly enrich the lives of students and staff, transforming the way they live, learn and work.

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MIDDLESEX UNIVERSITY

Mathematics with iPad

How providing Mathematics students with a fully managed iPad solution is transforming student learning and support at Middlesex University.



Context

About Middlesex University

The Department of Design Engineering and Mathematics at Middlesex University is one of five in the university's Faculty of Science and Technology, employing around 60 staff. Tuition is delivered to some 200 undergraduate and postgraduate students, who are enrolled on the department's 23 specialist programmes in product design, design engineering, telecommunications engineering, architectural technology, mathematics and statistics, and aviation. Most of these

students are campus-based, with some learning through distance education and others on work-based programmes in employment.

In addition, the department provides support teaching for over 2,000 students in other subjects across the university and at partner colleges.



The challenge

Creating high quality learning experiences online

Prior to 2020, the department had already made extensive use of the university's Moodle Virtual Learning Environment, and taught students using a wide variety of other specialist and general software. But it was the Covid-19 pandemic which led to the rapid transition of all learning to an online setting. This raised some challenges for the department as to how aspects of the traditional learning experience could be replicated in an online environment.

Specifically, lecturers needed a way to:

Record and share live sessions capturing the development of mathematical proofs and calculations, such as real-time annotation of mathematical documents.

Assess student progress and easily provide individual feedback.

Record short videos of mathematical concepts to aid students' independent learning.

The solution

Using iPad to facilitate collaborative digital learning

The department has introduced a scheme whereby students are issued with iPads which are loaned to them for the duration of their course, and then returned to the university upon completion. Teaching staff, as well as around 30 students on undergraduate and postgraduate specialist mathematics courses, have so far been provided with the iPads.

“iPads have been essential to learning, teaching and assessment during COVID.”

Why iPad?

Easy integration with conferencing platforms such as Zoom, as well as collaborative learning apps including MS Whiteboard and Miro.

Access to interactive learning apps specific to mathematics, such as Augmented Reality graphical calculators.

Touch screen and Apple

Pencil allow interactivity with documents and texts.

Compact, lightweight and easy for students to carry between campus or remote learning locations.

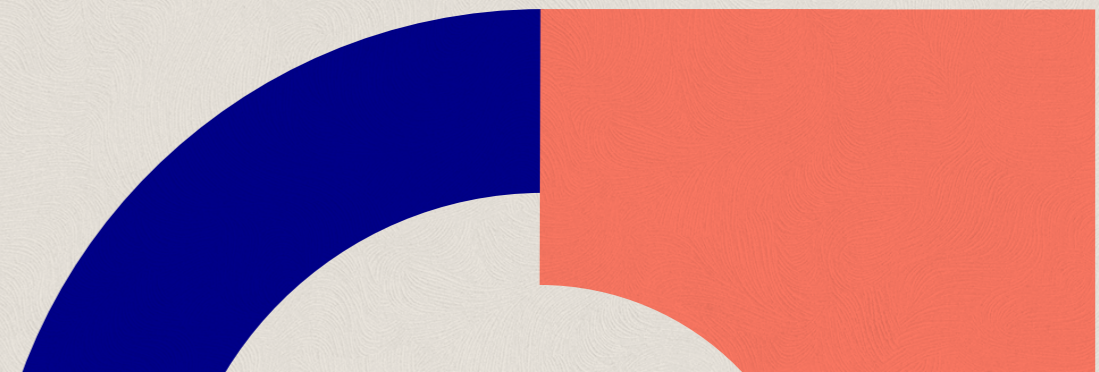
Lecture notes, recordings and work can be stored electronically for review at any time and shared easily with tutors, and other students.

Meeting initial challenges

The iPads allow lecturers to present slides to students who are working remotely, using the Apple Pencil in conjunction with sharing platforms to annotate documents in real time. These sessions can also be recorded, allowing students to watch the lecture later to consolidate understanding. Lecturers have also found that creating short videos for mathematical concepts is quick and easy to do with the iPads. Whilst learning remotely it is important that students feel they have the same connection with teaching staff as they would do normally. Students can share their work with their tutor via the iPads, who can in turn provide feedback through notations written directly

onto the document at the point of need. Tutors have found it helpful to supplement feedback with audio recordings where issues require further discussion or explanation. Feedback can be stored on the iPads so that both student and tutor have a record to refer to.

“Having an iPad has helped students to communicate with one another. We can easily help out during class if one of us is stuck.”



Discovering new ways to learn, engage and interact

In addition to the specific challenges the department needed to solve, students and lecturers discovered several benefits to using the iPads which supported remote learning.

What's more, the transition to online learning has highlighted new resources which will continue to enhance teaching and learning in the department in both online and face-to-face settings.

Through iPad both students and lecturers have access to a wide range of apps such as graphing calculators, geometry packages and coding environments — all of which enrich taught content and make the learning experience more interactive.

One such example is the use of Augmented Reality to explore 3D calculus. Traditionally taught by sketches on blackboards, AR allows abstract mathematical objects to be digitally sent into students' own rooms. Constructed accurately by CGI, the objects can be interactively explored by the group through the iPads, providing an engaging learning experience.

Collaborative tools such as MS Whiteboard and Miro enable group thinking and discussion to take place on the screen whilst students are working remotely.

Though initiated in the remote learning environment, lecturers have found that live problem-solving in this way has also brought about better collaboration in face-to-face settings.

“Having an iPad has changed the way we design learning sessions and how we promote engagement and collaboration. It is an essential tool for staff and students.”

“I am now doing things in class that I have always wanted to do but have lacked the technology to do.”



Impact

Not only did the iPads help to solve the challenges faced during the pandemic, but they are now proving to be a vital element in enhancing learning experiences in face-to-face settings.

“It has helped make virtual learning run smoother and is helping to create as close to a face to face learning experience as possible.”

A contemporary approach to teaching

The iPads allow teaching staff to take different approaches to sessions, whether delivered remotely or in person. The interactive, visual resource which the iPads provide mean that lecturers can focus on exposition and context rather than describing every detail of the material.

The interactive nature means that lecturers can, in real-time, model students' ideas in the document, allowing the group to explore different approaches and outcomes collaboratively.

Not only are lecturers able to electronically give handwritten feedback on students work, they can also see students' working in real-time as they interact with the session content. This enables the tutor to identify any struggles the student may be experiencing, allowing them to assist at the exact time of need.



“I am now able to show my work during classes and get feedback right at the moment that I need to help me understand the concepts of the topic we are learning.”

Enhancing the student experience through technology

With the iPads, sessions are recorded and stored electronically, providing a resource for students to return to whenever they need to. This reduces the need for students to take detailed notes in lectures - allowing them instead to focus on the content being taught. Lecturers have found that the online platform has encouraged less confident students to put forward their ideas in collaborative forums, who may not have previously done so if required to annotate a board or speak up in a physical room. Tutors now have at their disposal more ways to illicit

responses from students who have different learning styles and preferences.

Tutors have also noticed that students appear more engaged in collaborative learning when using the iPads. Technology provides a contemporary and relevant way for students to learn. Having the iPads also provides the opportunity for students to collaborate and share ideas outside formalised sessions.

“The iPads have provided an alternative that works and is a more contemporary learning and teaching approach.”

Equality through technology

The iPads have helped to promote equality within the community of students involved, by providing everyone with the same access to tools and applications to support their learning. Sessions can be designed using technology and apps, with the knowledge that all the students will be able to access them. The iPads also give the students the opportunity to explore specialised mathematical apps that could improve their learning, and share them with other students and tutors.

“Students all have the same tech now and so this is a great step forward. When designing assessment, you can be sure they have the right equipment to complete the tasks.”



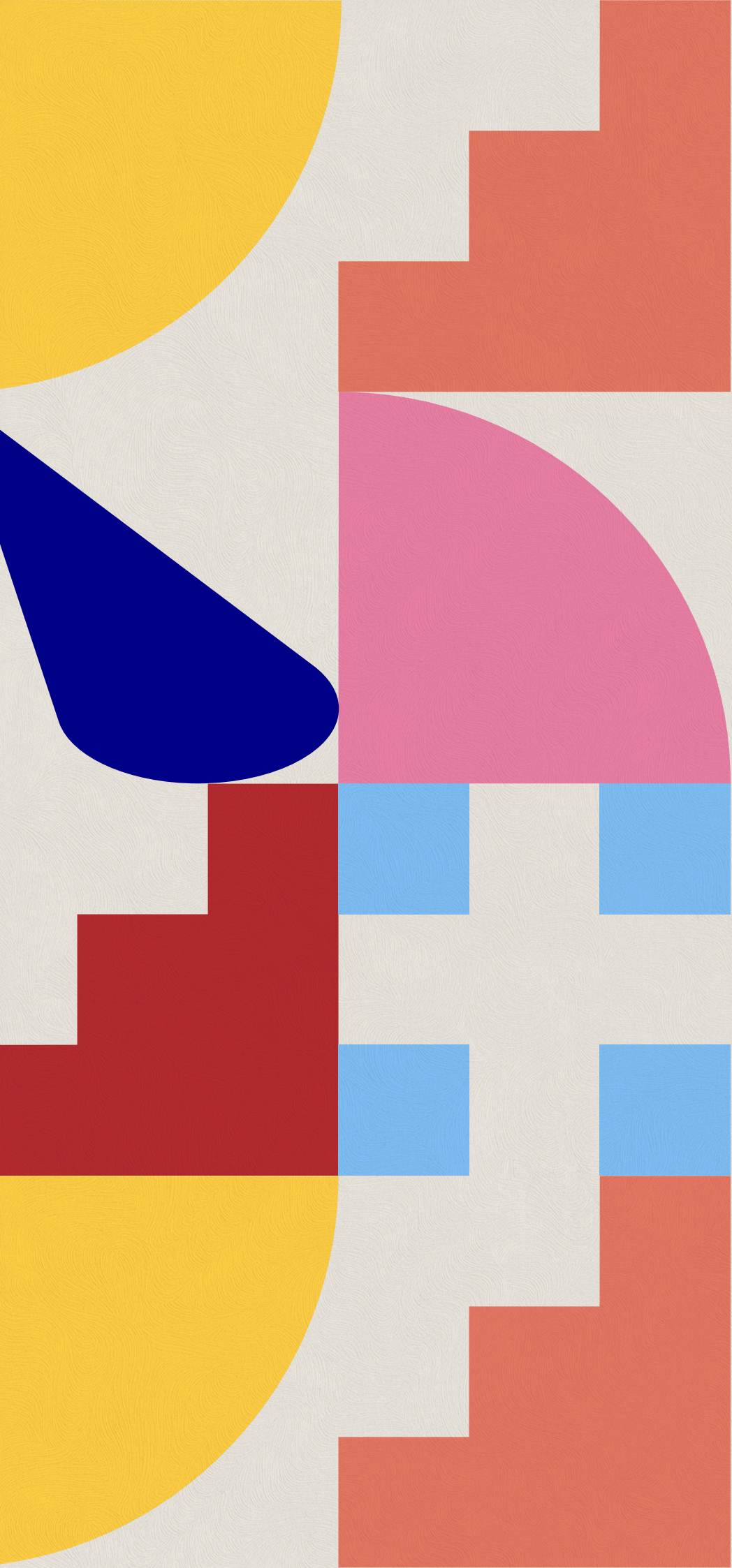
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