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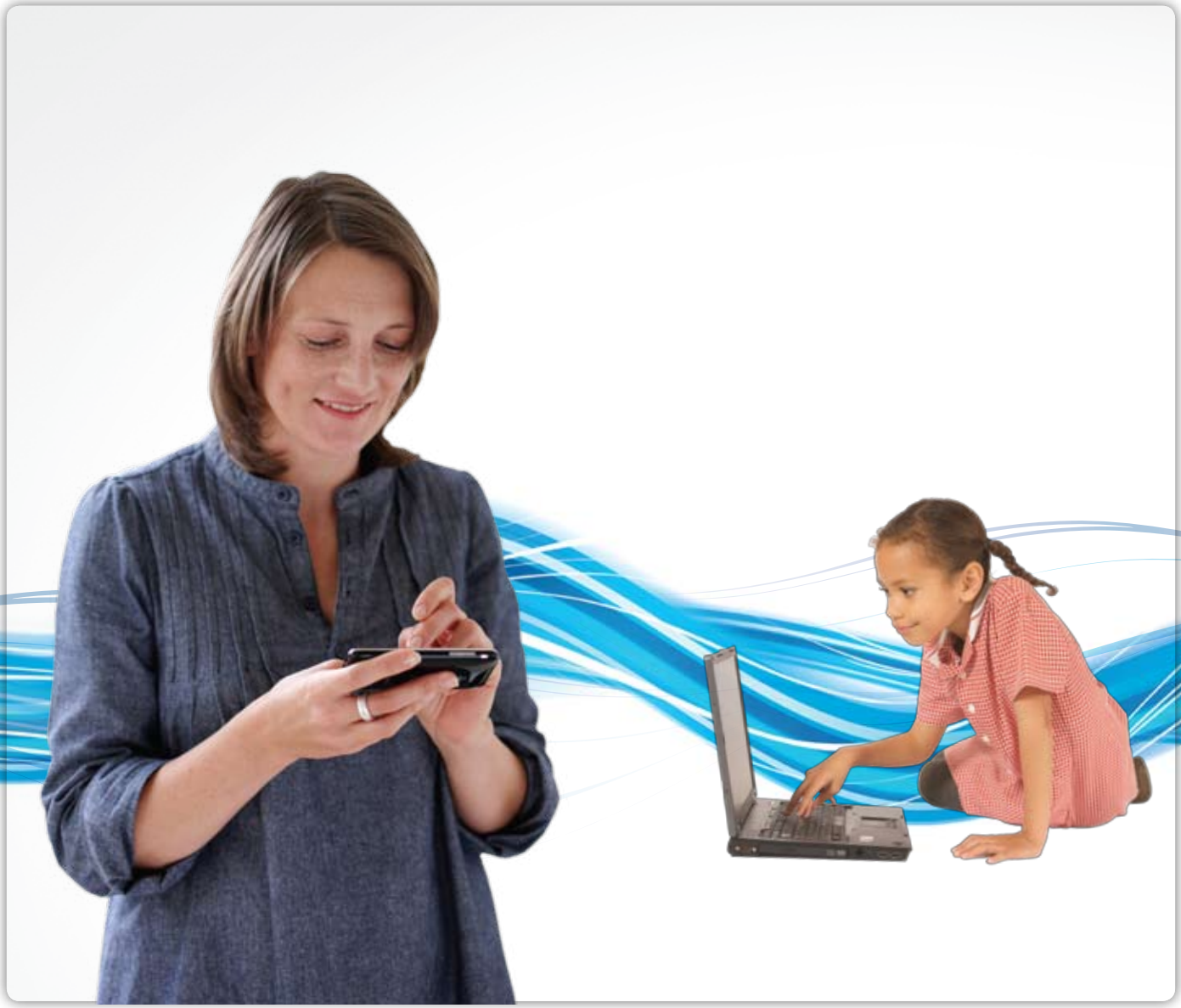

# The 21st century teacher: mathematics

## Using technology to enhance mathematics teaching

This publication offers insight into how technology can be used by teachers of mathematics, highlighting opportunities to extend subject pedagogy and ICT skills. Other publications in the series offer the opportunity to see how technology is used in other subjects and the cross-fertilisation of ideas and practice.

# Using technology to enhance mathematics teaching

As technology becomes a greater part of everyday life, it is only natural that it becomes a central and essential part of 21st century learning. Learners already engage extensively with technology and they expect it to be used in school.

## How do teachers benefit from the integration of technology into all aspects of their role and enhance the learning experience of young people?

21st century teachers of maths use technology for numerous activities in a similar way to the teaching of other subjects. They embed technology throughout the curriculum, ensuring that the technology supports the learning and teaching of the subject.

**Like all teachers they will employ technology to:**

### 1. Enhance teaching and learning by:

- using a range of technologies to cater for different learning styles
- using technology to enable learners to collaborate with peers and with partner schools.

### 2. Improve administration and planning:

- for learning and teaching: for instance, by using the technology to re-use and adapt documents
- by using technology to share information and enhance their personal knowledge of maths, as well as develop their understanding of professional issues around the subject.

### 3. Improve assessment and reporting by:

- recording learner achievement and attainment electronically, tracking pupil progress and using this information in assessment for learning
- communicating with parents electronically through email and the school learning platform.

The above are just a few examples and are not meant to be a comprehensive list. The following pages give some practical advice on how teachers of maths (primary and secondary) use technology.

# Learning and teaching

Teachers of mathematics use ICT in a variety of ways to make their teaching more effective.

## Bringing maths to life with a mix of technologies

The 21st century teacher of maths brings the outside world into the classroom through the use of digital photographs and video clips as the basis for discussion, measurement and modelling. They also encourage students to contribute their own images.

Students are encouraged to share and test conjectures, for instance, by using the interactive whiteboard with **3D geometry software** (to identify right-angled triangles). Watch the video on the Teachers TV site.

Teachers of maths use the outside environment to make recordings using measuring instruments, dataloggers and digital cameras. For instance, they might take students to a playground to record data about slides, swings and roundabouts, then analyse their findings back in the classroom. **Teachers TV** has examples.

## CASE STUDY

### Outdoor trigonometry Year 10

One way to tackle trigonometry with GCSE pupils is to get away from traditional textbook teaching by taking them out of the classroom.

The students' challenge was to estimate the height of the four highest points around the school campus. They then worked in teams to take the measurements needed to calculate their heights using trig ratios.

continued overleaf

## CASE STUDY

An introductory session in the classroom using the interactive whiteboard showed visually what the students needed to do. This established the task and the element of competition, tight time-checks and clearly defined roles kept the pupils on-task. Back in the classroom it was a race to match the calculations to the estimates and see which group came closest.

The pupils enjoyed looking at trigonometry in this more visual and practical way.

**Watch the video on the Teachers TV website.**

## CASE STUDY

### Using ICT to teach ratio and proportion in Year 4

Using technology can help pupils develop mental images of ratio and proportion to help them understand the difference between these two concepts.

The teacher introduced the idea of proportion showing Leonardo da Vinci's Vitruvian Man on the interactive whiteboard. She explained Leonardo's theory that the distance from the top of the head to the bottom of the chin is one-eighth of a person's height. Pupils then set out to test the theory.

They took digital photographs of one another and used photo editing software to compare the length of their head with their height. They could quickly see that Da Vinci's proposition was correct, based on their own findings.

Relating an abstract topic to the real world, improves their understanding. This approach appeals to both visual and kinesthetic learners.

**For further details, watch the video on the Teachers TV website.**

One of the advantages of using technology is that it can offer instant feedback. For instance, primary pupils might benefit from the feedback given by floor robots to develop their understanding of angles. **Teachers TV** has details of this example. Also, the instant feedback provided by calculators and spreadsheets can support pupils' trial and improvement methods while deepening their understanding of number. **Primary mathematics with ICT: A pupil's entitlement to ICT in primary mathematics** has further information on taking this approach.

Teachers who are making the most of ICT use mathematical software tools, which display graphs, tables and algebraic expressions and use these to model data entered manually. Teachers TV has video examples, including **Year 7 students investigating algebraic expressions using an interactive number line**. The site also has examples showing **secondary teachers using a variety of resources** in the classroom.

## Relating maths to other subject areas

The 21st century maths teacher collaborates with teachers of other subjects. They share data and plan activities that support data analysis and modelling in mathematics. For instance, science teachers might collect data on food content for a healthy eating project, which can be used by maths teachers. Planned ahead, sports lessons might offer video data on basketball throws that can be used in the maths classroom. The Association of Teachers of Mathematics has **resources** on this, but registration is required. Teachers TV also has **examples**.

## Encouraging independent learning

Teachers use of the variety of **interactive teaching programs** (ITPs) that are available from the **National Strategies** website to encourage pupils to explore concepts within mathematics.

For example, **Becta's Primary mathematics with ICT: A pupil's entitlement to ICT in primary mathematics** shows how pupils might use the National Strategies number grid ITP to investigate the properties of multiples and explore patterns involving numbers.

In another instance, teachers might use the **polygon ITP** to carry out an investigation into the number of diagonals in any polygon. Teachers TV has examples of how teachers are using these **ITP resources**.

## Administration and planning

21st century teachers of mathematics co-operate with colleagues to ensure their skills are up-to-date and that the available facilities are being put to best use. They participate in whole-school planning for ICT policy to ensure that specific needs of mathematics are articulated before decisions are made. They share responsibility with colleagues for keeping themselves up-to-date on ICT resources to support mathematics teaching.

Modern teachers collaborate with colleagues, ensuring that up-to-date information about the school's mathematics curriculum, qualifications, timetable and resources is available online to staff, parents and pupils.

Teachers provide for, and respond to, electronic feedback from parents and pupils. They also keep themselves up-to-date via the internet and digital media about the kind of materials with which their pupils are engaging. They look for opportunities to make connections with the mathematics programmes of study, providing stimulating resources to enliven their teaching. They use networks, such as those provided by NCETM (National Centre of Excellence in Teaching Mathematics) to keep in contact with other mathematics teachers and share good practice. They use networks such as **Twitter** to keep in contact and to track role models. They review teaching resources from websites such as **Teacher-Tube**.

## Assessment and reporting

The 21st century teacher of mathematics contributes to the school learning platform, which informs parents and learners about the work that takes place in the classroom. This also connects to useful resources that learners might use at home.

Teachers use a variety of means to gather information about pupils' learning and progress, which they use to inform their teaching. They ensure that assessment demands include opportunities for students to use ICT both to carry out mathematical tasks, and to present reports on their results, along with reflections on their achievement. For example, in a cross-curricular **STEM project on bath bombs**, teams of pupils produced their own marketing plans in mathematics and made presentations based on these. The Teachers TV site has details. Students and staff are encouraged to use the **Jing project** resources to record their work in video clips.

# Are you a 21st century teacher of mathematics?

## ABOUT YOU

Consider what you do towards developing your range of professional teaching skills with technology.

| | Regularly | Sometimes | Not at all |
|---|---|---|---|
| Do you use technology to access and share information and enhance your personal knowledge of mathematics and understanding of professional issues around the subject including the use of ICT to enhance teaching and learning? | ○ | ○ | ○ |
| Do you use technology to access mathematics in real world contexts? | ○ | ○ | ○ |
| When teaching mathematical concepts use ICT for simulations, analysis and modelling, enabling the model to be investigated by changing variables? | ○ | ○ | ○ |
| Do you use technology to access and share information and enhance your personal knowledge of mathematics and understanding of professional issues around the subject including the use of ICT to enhance teaching and learning? | ○ | ○ | ○ |
| Do you use ICT to record, manipulate and present data in ways which support students in formulating and teating hypothesis based on them? | ○ | ○ | ○ |
| Do you audit the range of resources, software and hardware used in the teaching of mathematics and identify and gaps in provision? | ○ | ○ | ○ |
| Do you extend learning by providing mathematical activities and resources on the learning platform or website? | ○ | ○ | ○ |

# Discover more online

For further help and ideas on how to turn your checklist into actions, try reviewing some of these resources.

**National Centre for Excellence in the Teaching of Mathematics (NCETM)** CPD, communities and lots more **Workshop CPD resources for secondary mathematics departments**, **T-MEDIA project and free resources**

**Associations: The Mathematical Association (MA) and The Association of Teachers of Mathematics (ATM)**
Support, journals and resources for teachers of mathematics.

**Ictopus** (ICT online primary user support)
A free support service for primary education offering free good quality lesson ideas and teaching suggestions using technology in maths.

**National Strategies:**
**ICT and mathematics references (Secondary)** and **mathematics ICT resource library (Primary)**

**Teachers TV Mathematics: (Primary and Secondary)**
Explore ways to get the message across and bring mathematics to life.

**Mathematics in Education and Industry (MEI)**
Advice on the use of ICT in the teaching and learning of mathematics.

**NRICH**
A source of enrichment material (Problems, Articles and Games).

**Teachernet**
Primary mathematics resources.

**Maths Investigations**
Ideas for mathematics investigations with software to support the investigation.

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