The retrieval practice maths app that helps pupils retain the core skills needed to succeed at GCSE

SUITABLE FOR KS3 & KS4

"The application is excellent for retrieval practice and its educational value is priceless in terms of feedback and monitoring progress."

★★★★★

Educational App Store review

THE CHALLENGE

“As a teacher, I regularly re-taught the same topic to the same pupils year after year. On our scheme of work, the topic ‘straight line graphs’ coincided for all year groups and there was one occasion when I found that few pupils in any year group could remember what ‘gradient’ meant, let alone actually find one. So instead of moving on, we reverted to the basics. Of course, it wasn’t surprising given that it may have been a whole year since the pupils had seen it. I was a big fan of 10 quick questions at the start of the lesson, but I suspect ‘gradient’, like many other topics, rarely made it onto my questions of the day.

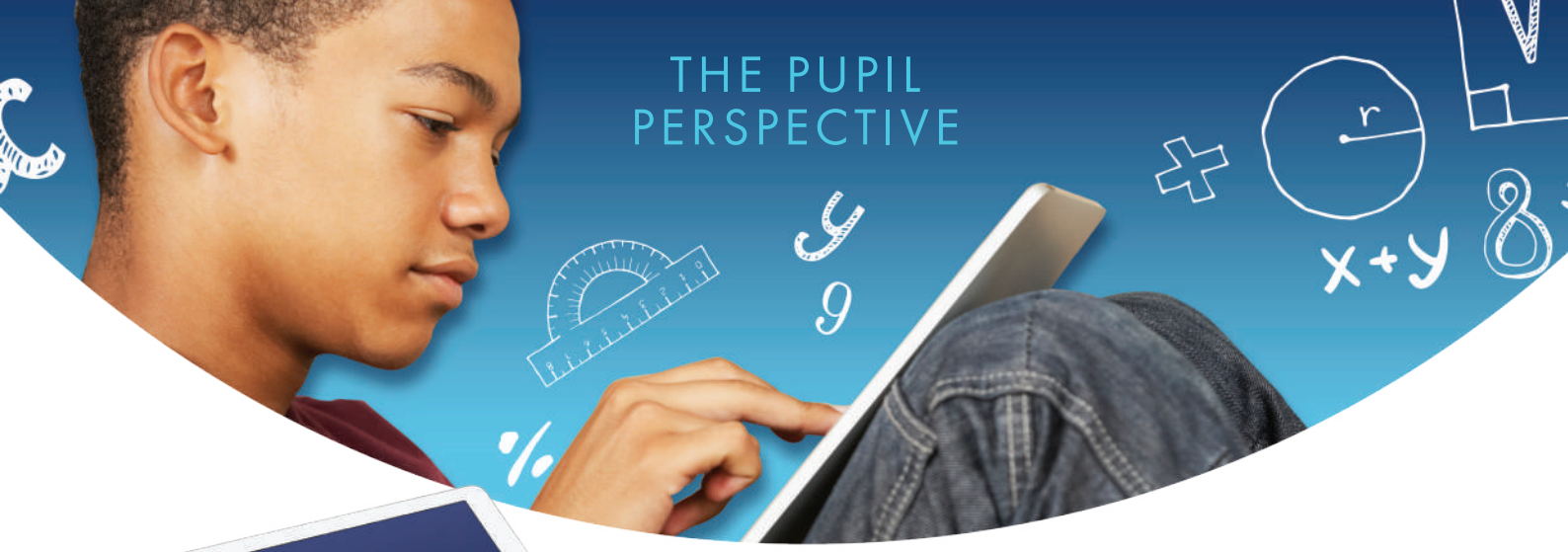
In 2014, iPads were introduced throughout our school and became a useful classroom tool, but I felt their potential significantly exceeded their use. At the same time, I was becoming increasingly aware of the educational discussions around memory and in particular the impact of retrieval practice on long-term memory. This was something that the iPads could administer far more effectively than I could. Furthermore, all the results could be recorded allowing spaced practice to be incorporated on a personalised basis. It struck me that the potential impact on progress was phenomenal.

The introduction of the new GCSE with a greater emphasis on problem solving also meant that it was imperative that teaching time was spent on these types of problem rather than recapping basic skills. Maths on our curriculum was moving to 4 hours a week, but I needed tools to teach more effectively, not just more time. I wanted an App that directly addressed the challenge of retaining prior learning.

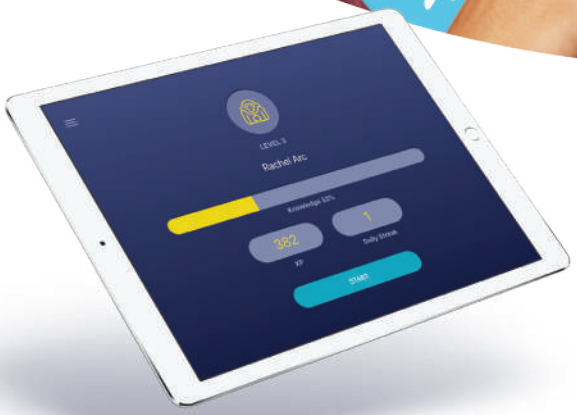
This is Arc Maths.

It has taken 2 years to develop and is the culmination of a project involving leaders in their technology field, award winning App developers, respected cognitive scientists and, most importantly, experienced maths teachers. Throughout the whole process, the overriding driver behind any decision has been educational impact.”

Rachel Dunsmore
Co-Founder, Arc Maths



THE PUPIL PERSPECTIVE



A PURPOSEFUL ACTIVITY

Arc Maths is a well-defined and contained task. The START button on the dashboard initiates a set of 12 questions. These are chosen specifically for each pupil.

Most questions require a written answer, but some questions require ordering, matching or selecting.

USER FRIENDLY INTERFACE

Written answers are entered directly on the screen using a finger or stylus. Indices, fractions and even complex mathematical expressions are converted into text using advanced hand-writing recognition technology supplied by MyScript®.

There is a pull-down screen for working out. Diagrams can be annotated as if they were on a worksheet or an exam paper.

FOCUSED PRACTICE

Feedback is given at the end of the 12 questions. For incorrect answers, pupils can see their own answer and the correct answer and then practise similar questions.

DESIGNED TO MOTIVATE

- The simple dashboard enables pupils to track their progress and effort
- There are 10 Levels - completing a level will unlock the next Avatar profile
- A session is a finite task and should take no more than 10 minutes

> "This app is ten times better, it's so much easier to use. The graphics are clear and I like being able to write my answers with my finger, it's so much easier not having a keyboard. The app has levels you can work towards and I find the space for working out my answer really helpful."
>
> Year 10 pupil

THE QUESTIONS

The entire KS3 and KS4 curriculum is broken down into 1550 slightly different skills and pieces of knowledge called Microtopics. Each Microtopic has a set of associated questions which test that particular skill or knowledge.

HOW ARE THE QUESTIONS CHOSEN?

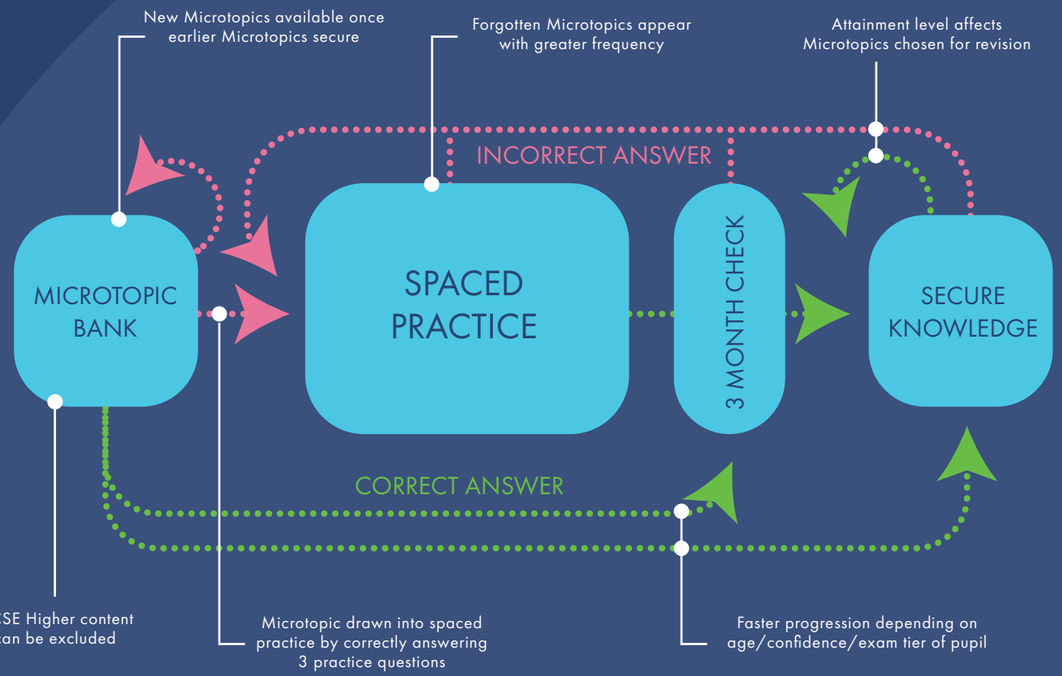
- The 12 questions in a session are chosen specifically for each pupil
- Question 1 is a times table multiplication and Question 2 is a times table division
- Question 3 and Question 4 are revision questions
- The schedule of Spaced Practice dictates what questions are selected for the remaining questions - forgotten Microtopics appear with greater frequency
- New Microtopics are introduced if space allows

THE LEVELS

EXAMPLE: BEARINGS

> One particular advantage of this app is that it is not only adaptive to the level of the individual student, it also takes the learning history into account.
>
> Dr Silke Goebel, head of the Numerical Cognition Lab at the University of York

HOW IS IT PERSONALISED?



THE TEACHER PERSPECTIVE

Many teachers already recap previous work within their lessons,
but there are several advantages to using Arc Maths in the classroom.

IN-BUILT DIFFERENTIATION

- Each session is specific to the attainment level of the pupil
- Individual weaknesses are addressed immediately and also subsequently
- "About you" settings allow pupils to progress at different rates

WORKLOAD REDUCTION

- Questions are chosen, created, delivered and marked by the App
- Follow-up practice questions self-generate
- Gaps in knowledge are recorded and tracked automatically
- Pupils create their own accounts so administration is kept to a minimum

DESIGNED FOR THE CLASSROOM

- A 10 minute activity - suitable as a lesson starter
- No instructions are needed
- Results screen is visible from across a classroom
- Monitor practice with the 'Pips' under question number
- Suitable for shared devices with automatic log out after 5 minutes

TRACK PROGRESS

- Create a reliable measure of attainment through regular use
- Demonstrate progress through changes in attainment measure
- Monitor engagement through session count
- Reward effort using XP, daily streaks, and Level completion

OUTSIDE THE CLASSROOM

As an intervention activity
In form time
For homework

Arc Maths is a targeted, complete activity in itself so can be overseen and supported by non-maths specialists.

> "Arc Maths is a fantastic way to interrupt students forgetting what they did in class yesterday, last week... last year! The questions are intelligently designed to pull out any misconceptions they have and build on their prior knowledge."
>
> Amie Coley - Lead Practitioner in Mathematics

THE COGNITIVE SCIENCE

Arc Maths is based on evidence that the retrieval of information is an effective learning tool in itself. This is achieved by what is often referred to as retrieval practice or high-frequency, low-stakes testing. The purpose of the testing is not to assess whether the knowledge is known but to strengthen the memory of that knowledge. A pupil doing a session of Arc Maths is undertaking retrieval practice, improving their long-term retention of knowledge and skills.

Spaced practice is another learning strategy that Arc Maths deploys. Research shows that spacing learning out over a period of time is more effective than massed practice in which the same skill is practised repeatedly in one sitting. The increased effort required to retrieve the information after a period of forgetting appears to help strengthen the memory. If a pupil forgets a skill or topic, the algorithm within Arc Maths ensures a similar question is presented to the pupil the next day and then with increasing time lapses until the knowledge has been retained over a 3-month interval, thereby helping to secure this information in long-term memory.

In Arc Maths, the question topics are mixed up. This is often referred to as interleaving and requires pupils to switch between topics. Whilst this approach can feel slower than massed practice, the evidence is clear that it has a greater impact on long-term retention. When using Arc Maths, a question on rounding may be followed by one on substitution so the pupil needs to identify what maths is required. This is a more demanding task than repeat practice and the increased effort needed to retrieve the knowledge or skill has a positive impact on the strength of retention.

The user interface of Arc Maths has been created in a way that minimises the extraneous cognitive load. Research has shown that adding unnecessary complexity to a task inhibits learning by overloading the working memory. The questions in Arc Maths are deliberately presented with minimal wording and without real-life context where possible. The interface is uncluttered and consistent so that the user can give their full attention to the maths.

REFERENCES

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VALUE FOR MONEY

Arc Maths is an annual school subscription service. The price is on a per pupil basis and offers great value for money. With regular term-time use, a session of Arc Maths is comparable to the cost of a single black-and-white photocopy - for which you get questions that are differentiated, chosen, set, marked, recorded, followed-up and that have a measurable impact.

WHAT NEXT?

- Talk to us - we have a friendly team of people here to answer your questions
- Trial Arc Maths - we can set you up with some free licences so you can see for yourself how good it is
- Request a demonstration - we can talk you through all the features of ARC Maths either in person or online
- Place an order - we can have you up and running today; just download the app, enter the code we give you and start creating accounts

CONTACT US

By phone: 01904 215677

By email: school@arceducation.co.uk

Via our website: www.arceducation.co.uk/contact-us

ARC EDUCATION

Arc Maths is compliant with the Age Appropriate Design Code

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