Mathletics

Teaching Mathematics with High Impact

White Paper

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3P Learning
Better ways to learn

Contents

Introduction

In the evolving field of mathematics education, the goal is to nurture learners who are independent, capable and motivated. This ambition is best achieved through evidence-based teaching strategies that are grounded in educational research, such as those proposed by John Hattie in his meta-analytic High Impact Teaching Strategies (HITS) (2009). These strategies have consistently demonstrated effectiveness in enhancing student learning outcomes. The design of Mathletics New Courses, alongside the existing Activities Courses, is a reflection of this commitment to evidence-based education.

The unique advantage of Mathletics lies in its ability to provide immediate feedback and support, a feature akin to the benefits of one-on-one tuition but delivered through an accessible online platform. This immediacy of response is pivotal in reinforcing learning concepts and addressing misconceptions in real time, thereby fostering a deeper understanding of mathematical principles.

The journey of mathematical mastery in Mathletics begins with developing fluency in new concepts. This is a cornerstone of the Activities Courses, where students receive prompt feedback on their grasp of new concepts, fostering a path towards independent learning and growth. This feature has made the Activities Courses a popular choice of both students and educators, as it aligns with the foundational stage of mathematical learning: the acquisition and reinforcement of new skills and concepts.

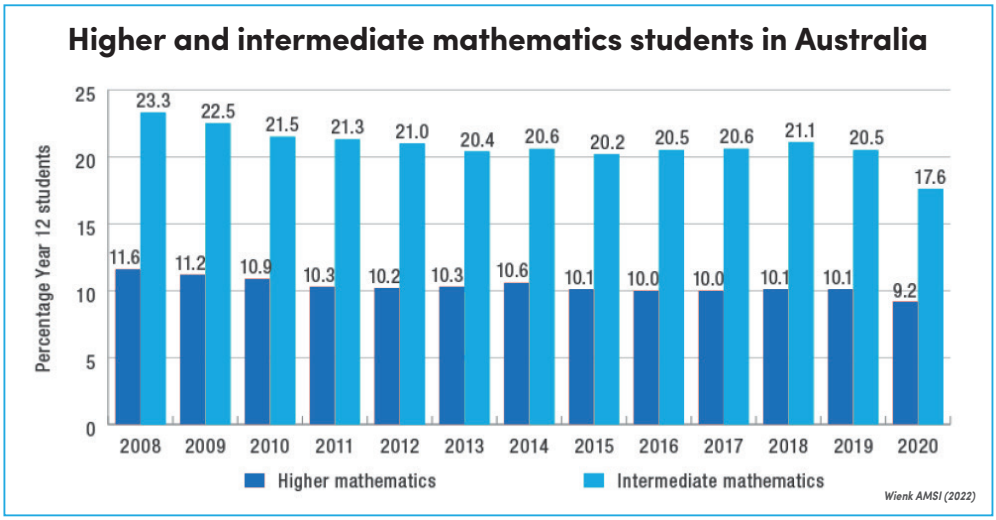
Skill Quests provide opportunities for students to further develop their fluency skills, as these sets foster greater flexibility, deepen conceptual understanding, and enhance the practical application of mathematical skills. They offer students engaging opportunities to refine their mastery of various skills and concepts, going beyond basic fluency. Teachers can differentiate by assigning tasks that are relevant for students, based on their individual needs, which are fully aligned to curriculum standards.

Advancing from fluency, students encounter non-routine problems that require them to identify, reason and implement solutions. This stage marks a critical shift towards deeper mastery, where learners demonstrate their ability to apply mathematical concepts in varied contexts. Mathletics addresses this through Problem Solving and Reasoning tasks, which include tasks from Depth of Knowledge levels 2–4 (Webb, 2002). At level 2, students are faced with non-routine problems and at level 3 more strategic planning, reasoning and decision-making is required. Students reach the pinnacle of the Mathletics learning journey with level 4 questions, where they are engaged with open-ended, abstract and real-world problem-solving tasks.

In addition, the Mathletics resource library contains rich tasks, including some created in partnership with Dr Marian Small and some based on Dan Meyer's Three-Act Task format (Myer, 2017). These challenges and rich tasks encourage creative and flexible thinking, demanding significant interpretation and reasoning skills.

The Mathletics New Courses are designed to streamline the process of understanding a student's position in their learning journey while actively promoting growth. They function as both an ongoing formative assessment tool and a source of motivational and developmental opportunities, aiding students in navigating their path towards mathematical mastery.

The need for such innovative educational solutions is underscored by concerning trends in mathematics education. Research from the Australian Mathematical Sciences Institute (AMSI) reveals a decline in student enrolment in advanced mathematics courses, with participation dropping from approximately 72% to 66% (Wienk, 2022). This trend, observed across Australian secondary schools, highlights the urgent need for engaging and effective mathematics education strategies like those offered by Mathletics.



Continuing from the discussion of educational strategies and their impact, a response adopted by many schools is deeply rooted in research on achievement, notably John Hattie's work from 2009. Hattie's HITS constitute a set of principles that are both straightforward and supported by extensive research and meta-analysis. These strategies serve as a guide for teachers, helping them focus their professional development on methods with documented evidence of effectiveness. Understanding which pedagogical approaches are most effective allows teachers to make meaningful and impactful improvements in their teaching.

Furthermore, these strategies gain additional strength from the working relationship and rapport that teachers build with their students. Research, including Hattie's 2009 study, has demonstrated that teachers who are skilled in empathy, care and positive regard for their students can significantly impact the learning environment and student outcomes.

Exemplary mathematics teaching practices can be effectively supported by both HITS and a strong working relationship within the classroom. This combination fosters an environment where students feel understood and supported, which is crucial for their academic success.

Mathletics New Courses have been meticulously designed to incorporate many of the HITS, enabling teachers to implement measurable improvements in their teaching programs immediately. The courses leverage a self-marking system that provides teachers with valuable data on student performance. This data allows teachers to identify areas where students excel and areas where they need additional support. By analysing this data, teachers can respond promptly with necessary interventions.

The ten-question design of the Mathletics New Courses takes students on a learning journey encompassing fluency, reasoning and problem-solving. This progression encourages students to strive towards achievement and growth. Additionally, a motivating rewards system within the courses engages and motivates students, making the learning experience more memorable and enjoyable.

This paper delves deeper into the research-backed design of Mathletics New Courses. It highlights how the courses align with evidence-based teaching practices and contribute to effective learning experiences in mathematics.

Strategy 1: Structured lessons

Effective learning is facilitated by programs that follow a logical sequence of skill development. The optimal lesson structures combine explicit teaching, student practice through targeted learning experiences, and regular revision.

Research insights on structured lessons

1. **Formative learning cycle** (Moss & Brookhart, 2012): These researchers advocate for a "formative learning cycle" in lesson design. This cycle involves the teacher modelling and explaining the concept, followed by guided student practice to demonstrate understanding ("performance of understanding"), teacher feedback, and then further student practice to improve upon initial performance.
2. **Background information** (Marzano, 2007): Marzano emphasises the importance of "critical input experiences" for effective new learning. These experiences, delivered efficiently and engagingly, provide students with the necessary background to comprehend new content. Formative assessments can serve as an efficient method to recap information and prepare students for new lessons.

How Mathletics supports structured lessons

Mathletics is designed to provide structured lessons and effective learning experiences through its units and lessons, ensuring a logical progression and comprehensive understanding for students.

1. Initial assessment and goal-setting

Begin with a formative assessment activity, such as the Mathletics "Are you ready?" diagnostic, a completed Mathletics New Courses set, or a short formative assessment task. Based on the outcomes of the formative assessment, teachers set learning goals. Utilising the formative results, teachers make instructional decisions (Wiliam, 2011). Mathletics simplifies this process, as each topic set includes learning goals. For example, if a significant number of students struggle with a particular question in a Mathletics set, this indicates an area for focused teaching.

2. Logical sequencing of learning experiences

Each Mathletics New Courses unit is logically structured, beginning with a review of prior learning. This helps to reinforce prior knowledge and creates a solid foundation for introducing new concepts. The units then progress to cover more advanced material, systematically extending the application of these new concepts.

Mathletics New Courses employs a deliberate approach in its question set design to enhance learning:

Foundation building: The first five questions in each set establish basic fluency in the concept, ensuring that students have a strong grasp of the fundamentals.

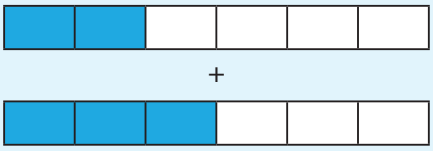
Development of reasoning: Questions six to eight focus on the application of mathematical reasoning and strategy selection. This stage encourages students to think critically and apply their knowledge in more complex scenarios.

Problem-solving skills: The final two questions in each set are problem-solving questions. These questions often incorporate abstract thinking or real-world applications, providing a higher level of challenge that stimulates students' problem-solving abilities.

This structured approach in question set design ensures a balanced progression in difficulty, effectively challenging students. It caters to different learning stages within a single lesson, promoting a deeper understanding of mathematical concepts.

3. Explicit teaching

In Mathletics, explicit teaching is supported through Concept Refresh Video explanations and worked solutions for all questions. Alternatively, teachers can use the results of the formative assessment as a basis for creating their own worked examples. For example: Calculate the following:



$\frac{}{6} + \frac{}{6} = \frac{}{}$

Teacher explanation:

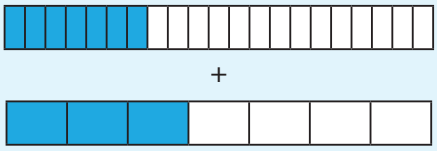
These two shapes are both divided into 6 equal parts, so they both represent sixths.

$$\frac{2}{6} + \frac{3}{6} = \frac{}{}$$

The question is "how many sixths do I have after adding two sixths and three sixths together?" I have five sixths altogether.

$$\frac{2}{6} + \frac{3}{6} = \frac{5}{6}$$

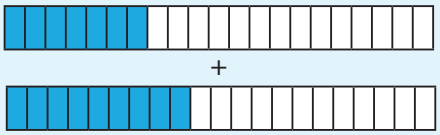
When the denominators are the same, I can add the numerators.



$\frac{}{21} + \frac{}{7} = \frac{}{}$

Teacher explanation:

One way to solve this problem is to divide the second shape into the same number of smaller rectangles as the first, so they both have the same denominator.



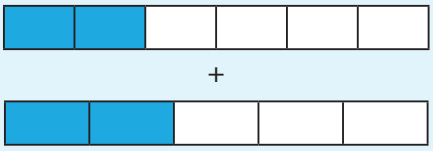
To do so, I cut each of the pieces of the second shape into 3 equal, yet smaller, pieces.

$$\frac{7}{21} + \frac{3 \times 3}{7 \times 3} = \frac{}{}$$

$$\frac{7}{21} + \frac{9}{21} = \frac{}{}$$

There is a total of 16 smaller shapes. This is equal to 16 out of 21.

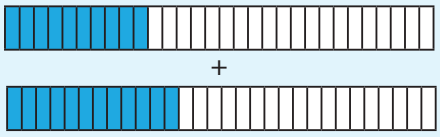
$$\frac{7}{21} + \frac{9}{21} = \frac{16}{21}$$



$\frac{}{6} + \frac{}{5} = \frac{}{}$

Teacher explanation:

One way to solve this is to try and divide each shape equally, such that they match up with each other and have the same denominator. Cut each piece of the first shape into five equal pieces and the second shape into six equal pieces.



$$\frac{2 \times 5}{6 \times 5} + \frac{2 \times 6}{5 \times 6} = \frac{}{}$$

There is a total of 22 out of 30.

$$\frac{10}{30} + \frac{12}{30} = \frac{22}{30}$$

There is also another answer to this question, where the denominator is bigger than 6 but smaller than 30. What is it?

4. Practising new skills

This can be done either individually or collaboratively. In Mathletics, the learning process is structured to support both approaches.

Individual practice in Mathletics

After viewing the Concept Refresh Video, students in Mathletics are presented with a set of ten questions. This design allows for a progressive deepening of understanding:

1. **Initial proficiency:** The first five questions are geared towards helping students gain fluency in the new concept. This initial set of questions provides a foundation upon which more complex skills are built.
2. **Increasing complexity:** As students progress through the set, the questions gradually increase in difficulty, challenging them to apply their knowledge in more complex scenarios.
3. **Detailed support:** Each question is accompanied by a detailed written worked solution and, in some cases, an additional worked solution video. This feature ensures that students have a reference point to understand the approach and methodology for solving each problem.

Teacher-facilitated individual tasks

Teachers can leverage Mathletics to set short, achievable tasks that allow students to check their progress independently. This approach can be tailored to the results of the formative assessment:

1. **Varied task levels:** Assignments can be pitched at different levels, corresponding to the three tiers identified in the formative assessment.
2. **Flexible assignment:** Teachers can either assign specific tasks to students based on their assessed needs or allow students to choose tasks at their discretion.
3. **Solution-based learning:** Providing solutions for students to check their answers promotes self-assessment and helps them understand where they need to focus their efforts.

Collaborative learning approach

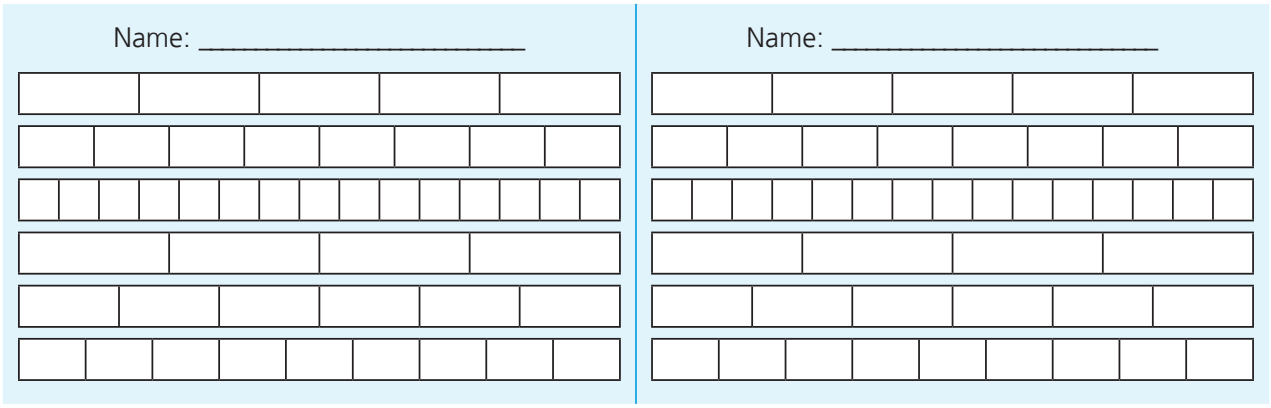
Alternatively, Mathletics can be used to encourage collaborative learning:

1. **Shared problem solving:** Students could work in pairs or small groups to solve problems. This method can foster a deeper understanding through discussion and peer learning.
2. **Divided task handouts:** An innovative approach could involve giving two students different parts of a handout related to the same problem. Each student works on their part before collaborating to piece together the full solution.

   Together, they need to create the following fractions by shading the bars:

   $$\frac{4}{5} \quad \frac{5}{9} \quad \frac{3}{4} \quad \frac{1}{2}$$

   Once found, students find as many other combinations that result in the same answers as they can and write the additions as number sentences.



A summary assessment and reflection could be completed on paper, e.g.

Calculate the following:

$\frac{1}{8} + \frac{3}{8} = —$	$\frac{7}{15} + \frac{2}{5} = —$	$\frac{1}{7} + \frac{4}{6} = —$	$\frac{1}{3} + — = \frac{8}{12}$
Correct? ☐	Correct? ☐	Correct? ☐	Correct? ☐

Which learning goals did I meet today?

- ☐ To add fractions with the same denominators.
- ☐ To add fractions with one denominator a factor of the other.
- ☐ To add fractions with different denominators by finding the lowest common multiple.
- ☐ To develop efficient strategies for addition of fractions dependent on scenarios.

3. **Strategy sharing:** Students should be encouraged to share the different ways they approach the harder questions, so that students are learning from each other.

   This blend of individual and collaborative practice in Mathletics allows for a flexible and comprehensive learning experience. It caters to different learning styles and promotes both independent problem-solving skills and cooperative learning competencies.

5. Formative and summative assessment

Formative assessments in Mathletics New Courses

As students work through Mathletics New Courses, Skill Quests, Activities or Problem Solving & Reasoning tasks, both teachers and students have access to immediate results and feedback, which provides an opportunity to reflect on progress, gaps in understanding, and plan next steps in the learning process. In Mathletics New Courses, students are also able to use a quick self-assessment tool to indicate their level of understanding and confidence in concepts covered.

Summative assessments in Mathletics New Courses

Summative assessments play a crucial role in evaluating student learning, and the Mathletics New Courses units are designed to incorporate this important element effectively.

1. **Levels of difficulty:** Each unit in the Mathletics New Courses includes summative assessments that are available at three distinct levels of difficulty. This tiered approach ensures that assessments are appropriately challenging for students of varying skill levels.
2. **Comprehensive evaluation:** The purpose of these summative assessments is to provide a comprehensive overview of student achievement. They serve as a tool for both progress monitoring and reporting, giving a clear picture of each student's learning journey.
3. **Identifying areas of strength and need:** A key feature of these assessments is their ability to highlight areas where students have achieved mastery, as well as pinpointing aspects that require further improvement. This detailed breakdown is invaluable for informing future teaching strategies and individualised learning plans.

Strategy 2: Setting goals

Setting achievable goals is crucial in optimising student learning, as it provides clear direction and motivation. Goals can be both short-term, focused on individual lessons, and long-term, spanning across entire educational units or courses.

Research insights on setting goals

1. **Improves motivation and engagement** (Locke & Latham, 1990): Specific and challenging goals lead to higher performance than easy or vague goals ("do your best"). Setting clear and defined goals helps students focus, increases their persistence, and enhances their motivation to learn.
2. **Enhances self-efficacy** (Bandura, 1986): Goal setting can improve students' belief in their own abilities (self-efficacy). When students set goals and achieve them, they build confidence in their capabilities, which, in turn, positively affects their future performance.
3. **Facilitates self-regulation** (Zimmerman, 2002): Goal setting is a critical aspect of self-regulated learning. It helps students become more self-aware, strategic and self-reflective in their learning processes, leading to improved academic outcomes.
4. **Promotes a growth mindset** (Dweck, 2006): Goals that focus on learning and mastering skills (growth mindset) rather than just talent (fixed mindset), encourage students to embrace challenges, persist in the face of setbacks, and view effort as a path to mastery.
5. **Increases academic achievement** (Latham & Locke, 2006): Research has consistently found that setting specific, challenging yet attainable goals is associated with higher levels of academic achievement. When students have concrete targets to aim for, they are more likely to exert the effort needed to achieve them.
6. **Improves feedback effectiveness** (Hattie & Timperley, 2007): Goals provide a framework for feedback. When teachers align their feedback with students' goals, they become more relevant and actionable, thereby enhancing the learning process.
7. **Encourages self-monitoring** (Schunk & Zimmerman, 1998): Setting goals encourages students to monitor their own progress. This self-monitoring, which involves regularly assessing one's performance against their goals, is key to effective learning and adjustment of strategies as needed.

How Mathletics facilitates goal setting

Mathletics aids in goal setting through several key features:

1. **Diagnostic assessments:** At the beginning of each unit, Mathletics presents students with an "Are you ready?" diagnostic assessment. This assessment evaluates the necessary prior knowledge for the topic at hand. The results offer both students and teachers insight into individual and class strengths and weaknesses, highlighting specific learning gaps that need to be addressed.
2. **Learning intentions and success criteria:** Each question set or concept within a unit is accompanied by clearly defined learning intentions and success criteria. This approach allows students to understand the specific objectives and targets for their learning. These goals are crafted to be:
   - *Manageable:* Achievable within a single lesson, ensuring that students can attain them without feeling overwhelmed.
   - *Measurable:* Designed so that learning progress is visible and can be assessed by the end of the lesson.

- *Made-first:* The goals drive the class activity, ensuring that learning activities are purposefully aligned with these objectives.
- *Curriculum-aligned:* In line with Lemov's principles (2015), these goals adhere strictly to the curriculum, ensuring that they are relevant and contribute to overall educational objectives.

3. **Personalised learning paths:** Teachers can create personalised learning paths in Mathletics based on a student's performance. This adaptation addresses the immediate learning needs of the student and encourages them to reflect on their learning journey, recognising patterns in their understanding and areas for improvement.

   Through these features, Mathletics supports a structured and goal-oriented learning environment. By setting clear, achievable and curriculum-aligned goals, Mathletics not only provides direction for students but also empowers them to take ownership of their learning journey. This strategic approach to goal setting is integral to fostering a productive and focused classroom environment.

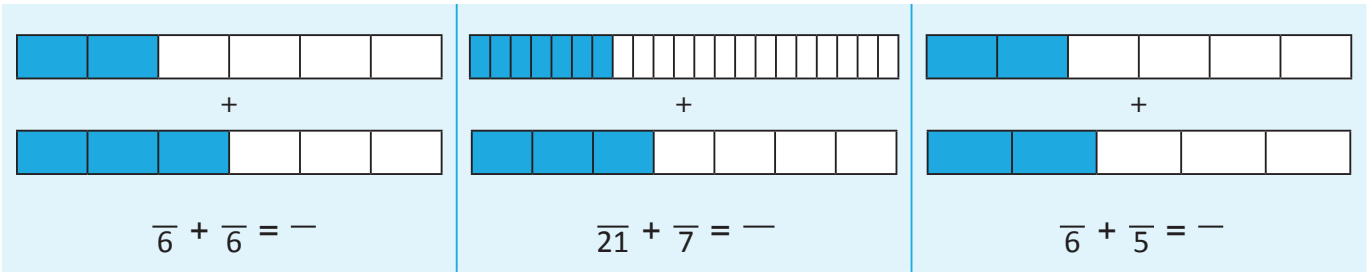
Practical application in the classroom

In recognising the diversity of student abilities and learning paths, it's essential to tailor learning goals to meet each student's unique needs. This individualised approach ensures that all students are set on a trajectory for success, regardless of their starting point.

Consider a mathematics lesson focused on adding fractions with different denominators. A practical approach to cater to varied student needs could be as follows:

1. **Diagnostic assessment:** The lesson can start with a diagnostic assessment, like a "Do Now" activity (Lemov, 2015). The responses from this assessment will help identify the different levels of understanding among students, informing tailored learning intentions.

   Calculate the following:



2. **Differentiated learning goals:** Based on the assessment, the teacher can establish distinct, achievable goals suited to different levels of student achievement. These might include:
   - learning to add fractions with the same denominators.
   - learning to add fractions where one denominator is a factor of the other.
   - mastering the addition of fractions with different denominators by finding the lowest common multiple.
   - developing efficient strategies for the addition of fractions, tailored to different scenarios.

3. **Inclusive goal setting:** By setting four specific and achievable goals, it's more probable that every student will be able to meet at least one of these objectives. This approach ensures that all students, regardless of their current understanding, have a clear and attainable target to strive towards. When using Mathletics New Courses, these learning goals are already prepared and written in age-appropriate language.

Strategy 3: Explicit teaching

Effective learning, especially in mathematics, often hinges on clear, step-by-step and age-appropriate explanations of new concepts, supplemented by worked examples.

Research insights on explicit teaching

Explicit teaching is most effective when it involves:

1. **Clear instruction** (Rosenshine, 2012): The core of successful mathematics lessons is clear and explicit instruction. This clarity is crucial in helping students grasp complex concepts.
2. **Logical sequencing** (Archer & Hughes, 2011): Effective explicit teaching involves sequencing skills, strategies and concepts logically. This helps in building a strong foundation for understanding more complex ideas.
3. **Breaking down complex skills** (Rosenshine, 2012): Complex skills and strategies should be broken down into smaller instructional units. This makes learning more manageable and understandable for students.
4. **Deliberate practice** (Ericsson et al., 1993): The concept of deliberate practice emphasises the importance of focused, goal-oriented practice activities. In the context of explicit teaching, this involves structuring learning activities in a way that requires students to consciously engage with and apply new concepts.

Explicit teaching in Mathletics

Mathletics New Courses stand out for their effective implementation of explicit teaching, using a range of methods to ensure clarity and comprehension:

1. **Concept Refresh Videos:** A central element of Mathletics New Courses, these videos offer clear, step-by-step explanations of new concepts. They often utilise examples that mirror the problems in the question sets, enhancing their relevance and aiding in concept clarification.
2. **Correct and approachable terminology:** The videos are careful to use accurate mathematical terminology, which is essential for precise learning and understanding. This terminology is delivered in a warm and engaging tone, making it more accessible and less intimidating for students. This approach helps in demystifying complex terms and concepts, making them more digestible for learners of all levels.
3. **Detailed worked solutions:** Each question is accompanied by worked solutions that break down complex problems into manageable steps. These examples provide students with a clear model of how to approach similar problems, thereby reinforcing the learning process.
4. **Problem-solving activities:** Mathletics includes activities that encourage students to apply the concepts they have learned. These problems reinforce new information and provide an opportunity for students to practise and solidify their understanding.
5. **Targeted practice activities:** Mathletics includes a variety of activities that are specifically designed to target different skill levels and areas of mathematics. These activities require students to focus on refining specific skills. This aligns with the principle of deliberate practice, which emphasises practising with a purpose.
6. **Adaptive learning algorithms:** Activities Courses use adaptive learning algorithms that adjust the difficulty of tasks based on the student's performance. This ensures that students are always practising at the edge of their capabilities, a key aspect of deliberate practice.
7. **Assessment:** Assessments help teachers evaluate student understanding and adjust instruction accordingly.

By incorporating these explicit teaching methods, Mathletics offers a comprehensive learning experience that caters to the diverse needs of students, ensuring they grasp new concepts effectively and build a strong foundation in mathematical understanding.

Practical application in the classroom

In a classroom using Mathletics:

1. **Using Concept Videos:** Teachers can utilise Concept Videos at the end of an activity, allowing students to consolidate their understanding of the lesson. This approach can reinforce the concepts learned and provide a comprehensive overview.
2. **Example in practice:** For instance, in a lesson on multiplication, students learn to partition larger integers to simplify the multiplication process. Here, a Concept Refresh Video can effectively demonstrate this technique, providing clear and explicit instruction on how to approach the problem. For example, a lesson can begin with involving students in selecting some favourite numbers.

   "What are some favourite numbers?"

   "2, 117, 3, 98, 40, 10, eleven billion…"

   From there, select numbers to make a story problem.

   "Great! Well, I happen to know Old McDonald, the farmer. He got his farm from his mother, Gold McDonald. And she got the farm from her father, Bold McDonald. That farm has been around for 98 years. Every year, they get 20 cows, 30 sheep and 10 chickens. What I want to know is, how many cows, sheep and chickens did the family farm look after during those 98 years?"

   You could use manipulatives or diagrams with students. Methods: find how many of each they have after ten years, then repeat that pattern. Or find 100 years' worth of animals and two years' worth of animals and then find the difference. Once students have had a chance to explore this problem, you can complete the explicit teaching of partitioning using the examples. This can be done showing the appropriate Concept Video on Mathletics.

Strategy 4: Worked examples

Effective learning, especially in mathematics, is significantly enhanced by the use of well-explained worked examples that students can emulate and practise.

Research insights on worked examples

1. **Cognitive Load Theory and worked examples** (Sweller, 1988, 2006): Cognitive Load Theory emphasises the crucial role of worked examples in learning, particularly in mathematics. Sweller's studies suggest that well-designed worked examples can reduce cognitive load for learners. His later work (2006) elaborates on how these examples should be integrated into the learning process, not just as demonstrations but as tools for students to apply in their own learning.
2. **Depth of processing** (Craik & Lockhart, 1972): Students need to deeply engage with the learning material. In the context of worked examples, this means students should actively process and understand the rationale behind each step, rather than just observing the final solution. This deeper engagement leads to better retention and understanding.
3. **Dual coding theory** (Paivio, 1986): Learners process visual and verbal information through separate channels. In the context of worked examples, combining verbal explanations (e.g. step-by-step reasoning) with visual representations (e.g. diagrams or animations) can lead to a more robust and integrated understanding. This multimodal approach enhances the retention of information.

Worked examples in Mathletics

Mathletics incorporates worked examples in several ways:

1. **Concept Videos:** These videos feature annotated worked examples with step-by-step explanations that are shown both verbally and visually. They are designed to introduce the types of questions found in the question sets, allowing students to immediately apply what they have learned.
2. **Inclusion in question sets:** Each question in a set comes with either a written or video-based worked solution, which often include visual models. These solutions demonstrate various teaching techniques and approaches to solving the questions.
3. **Structured assistance:** Worked solution videos are strategically placed at the beginning of each new level of difficulty within the ten-question set (i.e., at questions one, six and nine). This placement helps students transition smoothly into different stages of complexity.

Practical application in the classroom

To make worked examples more relatable and effective:

1. **Relevance and connection:** Worked examples should be presented in a way that students can connect with and find relevant.
2. **Variety in examples:** Providing a series of varied "surface stories" in problems can deepen understanding and show how to apply skills in different contexts (Quilici & Mayer, 1996).
3. **Creating engaging contexts:** For instance, in teaching division, use a "surface story" that engages students. Incorporating students' favourite numbers or interests can add a spontaneous and relatable element to the problem.

   "A guinea pig farmer has 216 guinea pigs that she wants to sell to all the local pet stores. What is the greatest number of pet stores she can sell guinea pigs to if all the stores get the same number of guinea pigs (a number greater than 2)?"

Then, the worked example can be shown using fraction bars.

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Once the first worked example is completed, reducing the number of steps in subsequent worked examples (a technique known as "fading") is shown to be more effective than repeating the explanation (Crissman, 2006).

Strategy 5: Collaborative learning

Collaborative learning is a crucial pedagogical approach by which students enhance their understanding and skills by working together to solve problems. This method leverages the diverse perspectives and abilities of peers, fostering a richer learning experience.

Research insights on collaborative learning

1. **Problem-solving and peer learning** (Gillies & Boyle, 2010): Collaborative learning is particularly effective in problem-solving contexts. Research highlights that while it can be challenging to manage, due to issues like time management and socialising, the benefits in terms of enhanced learning and social skills are significant.
2. **Diverse thinking and error correction** (Chi & Wylie, 2014): Collaborative learning encourages students to share different approaches and perspectives, which can lead to a deeper understanding of mathematical concepts. Students learn to respect and consider different viewpoints, enhancing critical thinking skills.
3. **Enhanced engagement** (Johnson & Johnson, 1978): Research on collaborative learning suggests that such an approach leads to higher student engagement, improved group problem-solving, and higher achievement.

Collaborative learning using Mathletics

Mathletics offers several features that can be utilised for collaborative learning:

1. **Flexible grouping:** Teachers can control which students are assigned specific question sets, allowing for ability grouping within the classroom. This enables students at similar levels to work together, whether they are more advanced or require additional support.
2. **Encouraging peer interaction:** Encourage peer discussions and questioning. For instance, the "ask three before me" principle encourages students to consult each other before seeking help from the teacher, promoting peer-to-peer learning.

Practical application in the classroom

In a classroom, students are grouped to collectively work on a challenging problem or project. This collaborative approach allows them to use their existing knowledge and engage in trial-and-error testing, enhancing their problem-solving skills and understanding of the concept.

In pairs, draw a series of different shapes (regular, irregular or compound) that each have an area of 64 square centimetres. No two shapes can share the same dimensions, but dimensions can be repeated within the same shape. How many can be designed?

This open-ended problem means students have to discuss strategy with each other. One possible strategy could be to list factors of 64: 1, 2, 4, 8, 16, 32 and 64. Then create shapes accordingly: e.g. a rectangle with a width of 1 cm and a length of 64 cm; a triangle with a base of 12.8 cm and a height of 10 centimetres. Another strategy could be to use dot grid paper and construct compound shapes.

Strategy 6: Multiple exposures

Effective learning often occurs when students are exposed to new concepts multiple times, each in varied forms and contexts. This repetitive engagement helps in transferring information from working memory to long-term memory, making it less likely for the material to be forgotten.

Research insights on multiple exposures

1. **Multiple exposures** (Nuthall, 2000): Students need three to four interactions with relevant information to retain it long-term. Diverse experiences with the content strengthen the neural pathways from working memory to long-term memory.
2. **Spacing effect** (Ebbinghaus, 1885): Ebbinghaus's research on memory and learning found that information is more easily recalled if exposure to it is spread out over time, rather than concentrated in a short period. This spacing effect suggests that multiple exposures to material over spaced intervals can significantly improve long-term retention.
3. **Desirable difficulties** (Bjork, 1994): Bjork's concept of "desirable difficulties" suggests that introducing certain challenges in the learning process, such as varying the conditions of practice, can improve long-term retention and transfer of skills. By encountering a concept in different forms and contexts, students are more likely to develop a deeper and more adaptable understanding.

Multiple exposures in Mathletics

Mathletics supports learning through multiple exposures in several ways:

1. **Sequenced question sets:** The question sets in Mathletics are carefully sequenced and increase gradually in difficulty. This approach exposes students to different aspects and applications of the same topic, enhancing their understanding.
2. **Repeated attempts with variation:** If a student struggles with a particular question, Mathletics offers additional attempts with slight variations, such as different numbers. This method reinforces learning while keeping the challenge fresh.
3. **Differing formats:** Mathletics enriches the learning experience by offering a variety of formats to engage with the same topics. This diversity is evident in the Activities Courses, Skill Quests, and Mathletics New Courses available on the platform. Each of these components presents the material in a different context, which is crucial for the multiple exposure strategy. By encountering the same concepts through different modes of presentation and types of activities, students are more likely to consolidate their understanding and retain information.
4. **Revision:** Skill Quests are an excellent source of revision question sets, as once students have completed Activity sets, they can revise using a completely new set of questions. This approach to revision aligns with the principle of multiple exposures, allowing students to reinforce and deepen their understanding of the concepts in a fresh and engaging manner. Skill Quests provide a different perspective and challenge, which is essential for effective learning and retention.
5. **Supportive resources:** Printable workbooks provide another way to engage with the material, and these exist for all topics and year levels. Additionally, Mathletics New Courses include engaging, printable Mystery Units for each unit, offering problem-solving experiences that complement digital learning and reinforce key concepts.

Practical implementation in the classroom

Consider the concept of multiplication:

1. **Visual aids:** Use diagrams and arrays to visualise multiplication. E.g., with rows of three dots, how many rows are needed for twelve dots?
2. **Musical integration:** Incorporate music, such as using beats in a bar to understand multiplication. E.g., in twelve bar blues with four beats per bar, how many beats in total?
3. **Physical activities:** Engage students in physical games like Groups Of, connecting it to division and multiplication.
4. **Recall challenges:** Implement fun activities like multiplication races to enhance quick recall of facts.
5. **Real-life applications:** Pose challenging problems that apply multiplication in real-world scenarios. E.g., if there are three bags with eight lollies each, how many lollies are in thirty bags?

   While not all mathematical concepts need direct real-life applications, providing multiple opportunities to explore problems in various contexts makes abstract concepts more graspable and engaging. This approach ensures that students are less likely to struggle with understanding and retaining complex mathematical ideas.

Strategy 7: Questioning

Effective questioning techniques are essential in education, as they challenge and extend students' understanding. Teachers play a crucial role in employing questioning strategies that clarify misconceptions and foster a deeper understanding in a supportive learning environment. High-quality practice questions also contribute significantly to this process.

Research insights on questioning

1. **Link between questioning and student achievement** (Marzano et al., 2001): A high frequency of questions, especially those that require application, analysis and evaluation, is associated with higher student achievement.
2. **Balancing lower- and higher-order questions** (Wilen, 1991): Effective questioning involves a mix of both lower- and higher-order questions. Lower-order questions check understanding, while higher-order questions stimulate further thought and discussion.
3. **Complexity and specificity in educational goals** (Bloom et al., 1956): Effective questioning aligns with different levels of complexity and specificity, as outlined in Bloom's Taxonomy. Higher-level questions that involve analysis, synthesis and evaluation are particularly effective in promoting critical thinking.
4. **Questions as fundamental teaching tools** (Dillon, 1988): The type of questions asked in the classroom significantly influences the level of thinking students engage in, with open-ended questions encouraging deeper and more creative thought.
5. **Questions in providing effective feedback** (Hattie & Timperley, 2007): Good questions play a crucial role in providing effective feedback, guiding students to understand their performance and how to improve.
6. **Accountability and participation** (Lemov, 2015): Lemov's "No Opt Out" philosophy emphasises that all students should participate and be accountable in the learning process. Effective questioning ensures that every student engages with the content.
7. **Questioning and problem posing as crucial skills** (Costa & Kallick, 2009): Teaching students to ask thoughtful, analytical and reflective questions is vital for effective learning.

Effective questioning in Mathletics

There are many ways that Mathletics reinforces effective questioning techniques:

1. **Varied and high-quality question sets:** Mathletics New Courses offer a diverse array of questions that cater to different learning styles and levels of understanding. These question sets are meticulously crafted to include a range of problem types, from basic recall and application to higher-order thinking questions that require analysis, synthesis and evaluation. This variety ensures that students are not only repeatedly exposed to core concepts but are also challenged to apply their knowledge in different contexts, deepening their understanding and critical-thinking skills.
2. **Using Concept Refresh Videos:** Teachers can utilise Mathletics Concept Refresh Videos in class to prompt comprehension and understanding questions. Asking questions like "Why did the presenter separate the dots?" or "Why did they write 2 down there?" can enhance students' grasp of the concepts.
3. **Guided hints in question sets:** The Hints feature in Mathletics New Courses guides students towards effective methods and thought processes for problem solving. Teachers can use these question sets post-lesson to gauge understanding and address any challenging areas.
4. **Formative assessment:** The use of Mathletics New Courses sets as formative assessments

can provide immediate feedback on student performance. This allows teachers to identify common challenges and address them through targeted questioning.

Implementing effective questioning in the classroom

1. **Preparation:** Informing a student in advance that they will be asked a question. E.g., "Rami, I'm going to ask you a question about this problem soon."
2. **Introducing the question:** Reading the question aloud and discussing key terms. E.g., "This question says: Find the median number in the set below."
3. **Connecting to prior knowledge:** Relating the concept to familiar terms or previous lessons. E.g., "The word 'median' is used in phrases like 'the median strip'. What do you think 'median number' might mean in this context?"
4. **Encouraging strategy discussion:** Asking the student to explain their thought process. E.g., "How might you go about finding the median number?"
5. **Clarification and enforcement:** Asking students to clarify their responses helps solidify their understanding and provides clear strategies for their peers.

By incorporating these questioning techniques, teachers can significantly enhance student learning. This approach not only aids in understanding the material but also encourages critical thinking and active participation, creating a more dynamic and engaging learning environment.

Asking students to clarify their responses makes strategies clearer to other students and strengthens their own understanding. For example:

Teacher: *"Rami, with that first question, what is the median number?"*
Student: *"7."*
Teacher: *"Great, what did you do first to get that answer?"*
Student: *"I put the numbers in order."*
Teacher: *"What sort of order?"*
Student: *"Smallest to largest."*
Teacher: *"Could you have done largest to smallest?"*
Student: *"I'm not sure."*
Teacher: *"Great, we'll try that later. So, the numbers are ordered from smallest to largest. Then what?"*
Student: *"I found the number in the middle."*
Teacher: *"How?"*
Student: *"I moved my finger along and found the middle."*
Teacher: *"Great. Eleanor, could you write the numbers from largest to smallest in your book, please. I will ask you a question in a moment. Did anyone have a different way of finding the middle number? Yes, Terri."*
Student: *"I divided the number of numbers by two."*
Teacher: *"There are 11 numbers. Dividing that by 2 equals 5.5. But the answer is 7?"*
Student: *"What I mean is that the middle number is, like, five and a half from the beginning… it's hard to explain."*
Teacher: *"You're doing well, Terri. So, you moved five and a half from the beginning, you ended up here in the set."*
Student: *"And since it was, like, point 5, I moved along to the next number 7."*
Teacher: *"Great. I wonder if this is the same if there's an even number of numbers in the set? But before we try that, Eleanor, I got you to write the numbers from largest to smallest. Is 7 still the median number?"* and so on.

Questioning can help students clarify concepts that can be difficult to explain. This way, the rule has more meaning and students grasp the concept quickly.

Strategy 8: Effective Feedback

Effective feedback is a crucial teaching strategy and is known to have one of the highest positive impacts on learning outcomes in classrooms (Hattie, 2009).

Research insights on effective feedback

1. **High impact of feedback** (Hattie, 2009): Feedback has been identified as having one of the highest impact sizes in educational research. Its positive impact is maximised when it is constructive, helpful and timely.
2. **Mindsets and feedback** (Elliot & Dweck, 2005): Students generally adopt either a performance-oriented mindset (focusing on results) or a mastery-oriented mindset (focusing on competence). The effectiveness of feedback can vary based on these mindsets.
3. **Variation in teacher–student relationships post-feedback** (VandeWalle et al., 2001): The relationship dynamics between teacher and student can shift following feedback. Mathletics facilitates this by providing simple and effective feedback, rewarding students for their efforts.

Effective feedback in Mathletics

Mathletics excels in providing immediate, judgment-free feedback:

1. **Instant feedback:** Students receive immediate feedback on their answers. If an answer is incorrect, the correct answer is displayed.
2. **Worked solutions and videos:** For deeper understanding, students can access worked solutions and explanatory videos, especially if they are unsure where they went wrong. This allows them to learn from mistakes — a powerful learning strategy.
3. **Positive reinforcement:** Mathletics consistently reinforces student efforts positively. Whether completing activities, sets or assessments, students receive visual symbols of success, like climbing a mountain, earning stars and accumulating points, helping them visualise and celebrate their progress.

Effective feedback delivery in classrooms

1. **Oral feedback during learning:** Oral feedback on students' attempts can be impactful, though care should be taken to avoid it being perceived as personal criticism.
2. **Private feedback:** Feedback provided privately, such as through a computer system, can be effective without causing embarrassment and allows for quick, efficient progress checks.
3. **Use of developmental rubrics or success criteria:** Strengthening feedback by explicitly defining the required skills in a unit, through tools like developmental rubrics or success criteria, is beneficial. Mathletics New Courses includes Learning Intentions and Success Criteria for each question set, allowing students to measure their results against expected outcomes, aiding in setting clear expectations and recognising achievements.

In summary, effective feedback in Mathletics and in classroom settings plays a pivotal role in enhancing student learning, guiding their progress and boosting their confidence and motivation to learn.

Strategy 9: Metacognitive strategies

Students achieve optimal learning when they use strategies that help them understand their own learning processes; this is known as "thinking about thinking". Providing explicit methods and pathways enables students to develop effective problem-solving skills.

Research insights on metacognitive strategies

1. **Examining own thinking** (Gourgey, 1998): Metacognitive strategies involve students reflecting on their own thought processes. Gourgey notes that students with advanced metacognitive skills can transfer their experiences to new situations more effectively.
2. **Beyond seeking answers** (Güner & Erbay, 2021): Studies observe that many students focus solely on finding answers, often overlooking the validity of their solutions. Metacognitive strategies help in evaluating the reasoning behind answers.
3. **Eliciting student explanations** (Branigan & Donaldson, 2020): Encouraging students to explain their mathematical thinking can significantly enhance learning outcomes.
4. **Role of self-reflection** (Flavell, 1976): Flavell's work emphasises the importance of self-reflection in learning. Encouraging students to think about their understanding and problem-solving strategies can strengthen their metacognitive skills.
5. **Developing mental frameworks** (Bartlett, 1932; Slavin, 2015): Schema theory underscores the significance of building mental frameworks for organising information. Repeated exposure to concepts in varied contexts aids in developing and refining these schemas.

Metacognitive strategies in Mathletics

Mathletics aids in the development of metacognitive strategies through:

1. **Self-assessment tools:** Mathletics includes features that allow students to assess their own understanding and performance. Self-assessment tools enable students to reflect on what they know and identify areas where they need more practice or understanding.
2. **Demonstration of alternative solutions:** Mathletics New Courses include written solutions and video explanations that not only complement each other but also provide alternative approaches to problem-solving.
3. **Interactive problem-solving:** The platform offers interactive problem-solving activities that challenge students to apply their knowledge in new situations. This form of active learning encourages students to think critically about how they approach a problem, enhancing their problem-solving strategies.
4. **Progress tracking:** Tools within Mathletics that allow students to track their progress over time can help them reflect on their learning growth, understand their learning habits, and identify effective strategies.

   By incorporating these features, Mathletics supports the development of metacognitive strategies in students, helping them become more aware of their learning processes, and enabling them to take more control over their educational experiences.

Developing metacognitive strategies in the classroom

Teachers can foster metacognitive skills by encouraging students to share and analyse their existing techniques and apply these skills in new contexts. One effective method is through open-ended tasks:

Open-ended tasks: These tasks encourage students to apply their knowledge in new and varied ways, promoting deeper understanding and reflection.

Example: An open-ended task could involve solving a real-world problem that requires students to apply multiple mathematical concepts and strategies. This not only tests their knowledge but also encourages them to reflect on their choice of strategies and their effectiveness.

By incorporating these approaches, teachers can significantly enhance the metacognitive capabilities of their students, leading to more thoughtful, reflective and effective learners.

"On your birthday, you receive $100 from a very generous family member. They then give you the following options:

- *Next week (Week 2) you can receive 10% more. Then the week after that (Week 3) 10% of Week 2's total.*
- *You can receive $15 each week.*
- *You can receive 50% of $100 next week, then 49% of $100 the week after, then 48% of $100 the week after that.*

Which offer should you accept?"

There are many different answers to this problem. Do we value immediate gain or long-term gains? How long will we be saving this money?

Metacognitive skills can be built by writing out strategies. If a student can explain why they got positive results, then they are likely to remember these strategies in future.

Strategy 10: Differentiated teaching

Differentiated teaching is most effective when educational content is tailored to students' developmental stages, ideally within their zone of proximal development. This approach challenges students at an appropriate level, extending their learning while accommodating their individual needs.

Research insights on differentiated teaching

1. **Setting individual learning goals** (Zimmerman, 2008): Research supports the idea of setting individualised learning goals coupled with high expectations. This approach allows for personalisation in learning, catering to the unique needs and abilities of each student.
2. **Designing inclusive tasks** (Boaler & Dweck, 2016): The "low floor, high ceiling" principle is essential for differentiated teaching. This principle ensures that tasks within lessons are designed to be accessible to all students, regardless of their ability levels, while also providing ample opportunities for extension and challenge.
3. **Zone of proximal development** (Vygotsky, 1978): Vygotsky's theory suggests that learning occurs most effectively in the "zone of proximal development", where students are challenged just beyond their current level of competence. Multiple exposures to a concept at increasing levels of difficulty can help keep students within this zone, optimising their learning.

Differentiated teaching in Mathletics

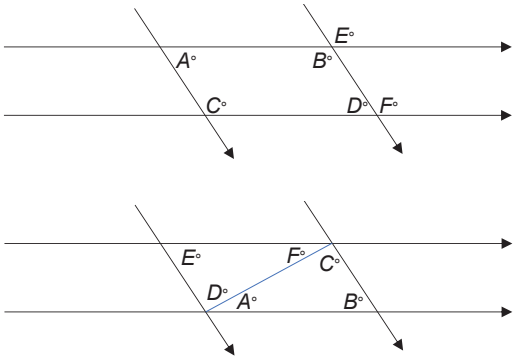
Mathletics is designed to cater to the diverse needs of students:

1. **Scaffolded question sets:** Mathletics New Courses offer scaffolded question sets that allow students to engage with content at a level appropriate to their current abilities. This scaffolding ensures that all students can find an accessible starting point.
2. **Low floor, high ceiling tasks:** Mathletics New Courses aligns with the "low floor, high ceiling" concept, providing question sets that allow all students to begin (low floor) but also extend to challenge the most capable learners (high ceiling).
3. **Reward system:** Mathletics features a reward system that acknowledges students' efforts and progress, motivating them to engage with the material and strive for improvement.

   Differentiated teaching, as facilitated by Mathletics, is critical in meeting the diverse needs of students. By providing scaffolded tasks that cater to a range of abilities and promoting individual learning goals, Mathletics helps create an inclusive and challenging learning environment. This approach is in line with contemporary educational research and best practices.

Developing differentiated teaching strategies in the classroom

For example, consider a geometry lesson on angles. Students use rulers and pencils to create the figure opposite.
The low-floor aspect to this activity has students rule lines and measure the different angles with protractors; examine the similarities and differences between angles; then, define angles such as vertically opposite angles and make the link between angles and the size of a straight-line angle.



Students can then be introduced to other angles, such as alternate, corresponding and co-interior (Level 7). Students who are already familiar with this can begin the next part: drawing more lines like the figure opposite.

Students explore angles within triangles. Are the two triangles similar or congruent?

Conclusion

The High Impact Teaching Strategies (HITS) provide a robust framework for effective teaching, encompassing a broad spectrum of methodologies that have demonstrated significant impacts on student learning.

Within this context, Mathletics has established itself as a pioneering platform, offering meticulously designed programs that are not only straightforward for teachers to implement but also deeply engaging for students, addressing a wide array of needs and abilities.

Key to Mathletics' success are its Activities Courses, which are expertly crafted to build fluency in fundamental mathematical concepts. These courses focus on reinforcing basic skills through repeated practice and interactive challenges, laying a solid foundation for more complex learning. The Activities Courses are instrumental in ensuring that students develop a strong grasp of essential skills, paving the way for more advanced cognitive processes.

Mathletics New Courses take the learning journey a step further by incorporating advanced thinking skills, particularly in reasoning and problem-solving. These courses are designed to stretch students' understanding and application of mathematical concepts, moving beyond basic fluency. The Mathletics New Courses foster higher-order thinking by presenting students with challenging problems, encouraging them to apply logical reasoning, analyse complex situations, and devise innovative solutions.

Together, the Activities and New Courses in Mathletics represent a comprehensive approach to mathematics education. They successfully integrate the principles of HITS, ensuring that students not only acquire and practise fundamental skills but also develop the ability to think critically and solve problems creatively. This holistic approach ensures that students are prepared for academic success but are also equipped with the cognitive tools necessary for real-world problem-solving. This reflects Mathletics' commitment to fostering well-rounded, competent learners.

HITS and Mathletics New Courses

High-Impact Teaching

Better by design, Mathletics New Courses are grounded in research-based pedagogy, harnessing the proven power of High Impact Teaching Strategies and Explicit Teaching. New Courses are also highly interactive and motivating, rewarding students throughout their learning journey.

Strategy 1: Structured lessons

Well-structured units of work

At the Unit level, New Courses enables students to systematically build their knowledge and skills with a well-structured learning pathway, each set building knowledge and skills in a clear progression. Each unit of work starts with an 'Are you ready?' diagnostic test. These 10 question tests check a student's recall of the essential skills and understandings they need to move forward with this Unit of work.

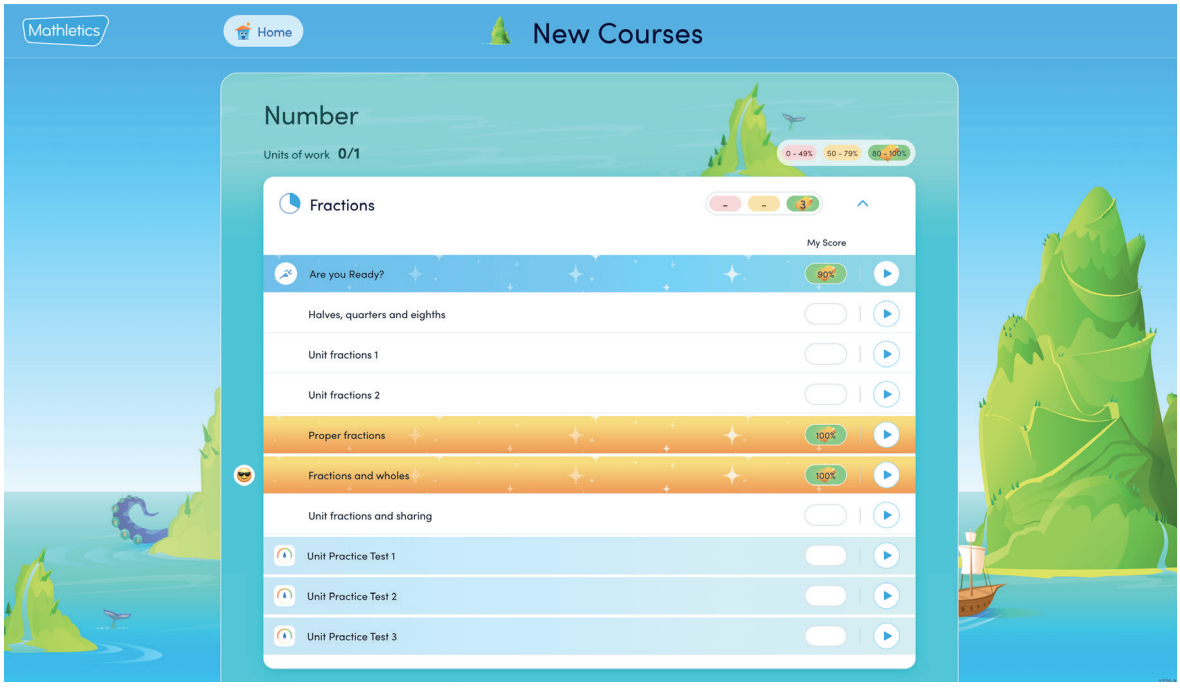
Well-structured 10-question sets

Within each 10-question set, the structure is always the same: a fluency section followed by reasoning questions and then two problem-solving questions.

Students work through these questions in each set:

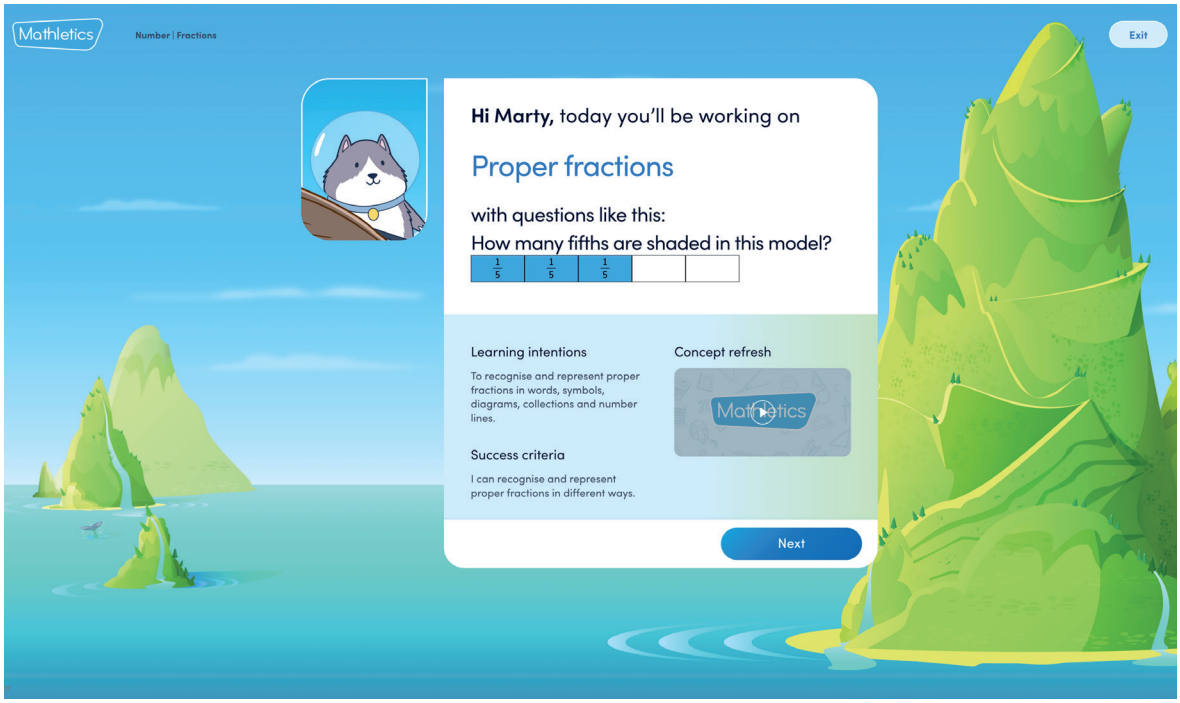
- **5 fluency questions** encourage students to recall new concepts and skills, and calculate efficiently.
- **3 reasoning questions** focus on analysing, proving, evaluating and explaining.
- **2 problem-solving questions**, where students develop the ability to interpret, formulate, model and investigate problem situations.

Each set is accompanied by a Concept Refresh Video, and every question has a hint and a worked solution, which all provides **a structured, supportive and predictable learning experience.**



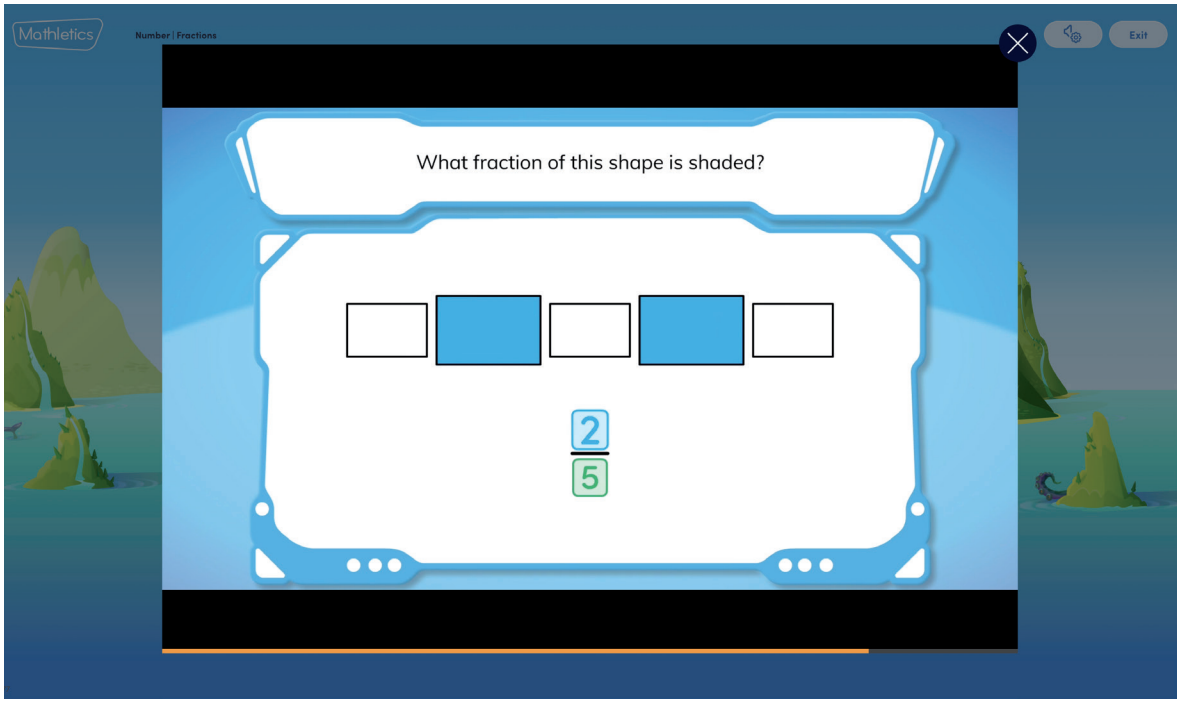
Strategy 2: Setting goals

The initial screen of each set displays a sample question, the Learning Intentions and Success Criteria, and clear and specific learning outcomes that prepare students by providing clear expectations.



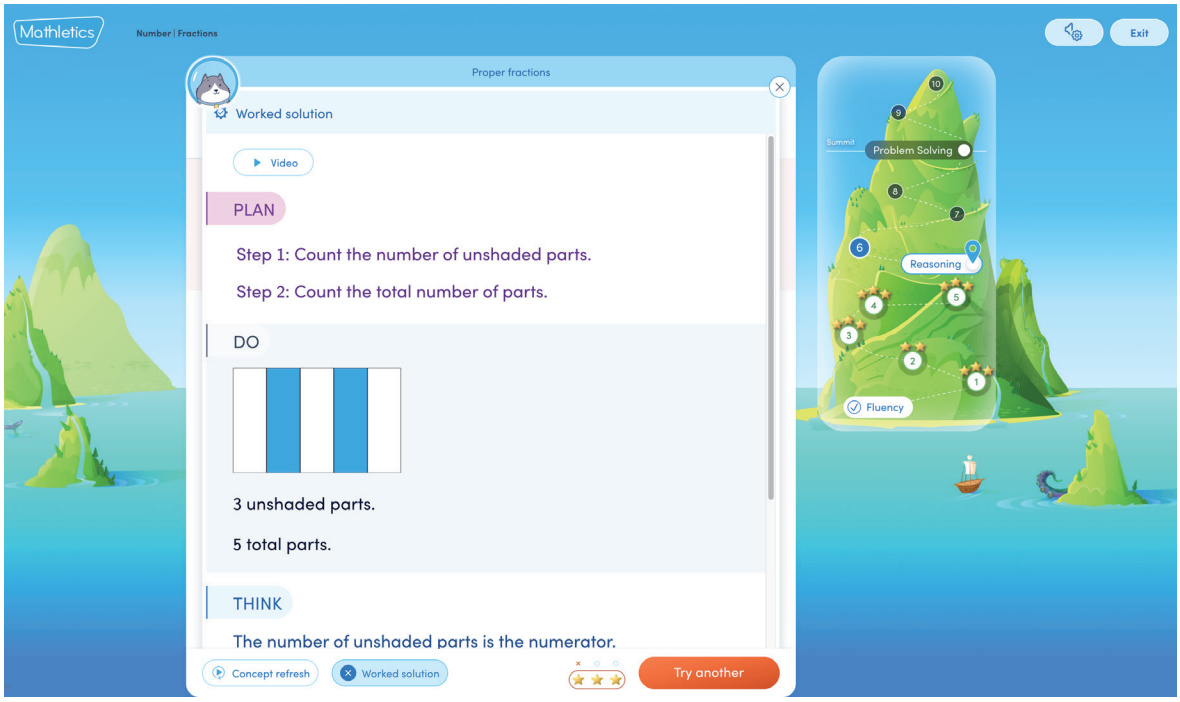
Strategy 3: Explicit teaching

New Courses sets include a Concept Refresh teaching video that explicitly teaches the skills, knowledge and processes students need. These take students through an explanation followed by a demonstration of a worked example. Hints and worked solutions add more help for students when they need it most.



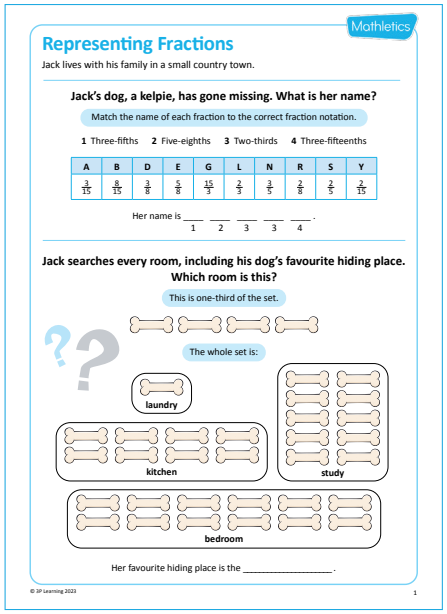
Strategy 4: Worked examples

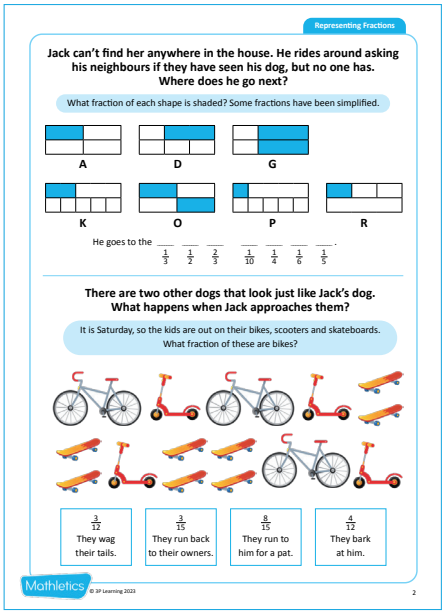
Every question in New Courses comes with *a Hint* and a *Worked Solution*. All worked solutions use the same clear structure: PLAN, THINK, DO, so that students can use this well organised structure whenever they approach a challenging question or problem.



Strategy 5: Collaborative learning

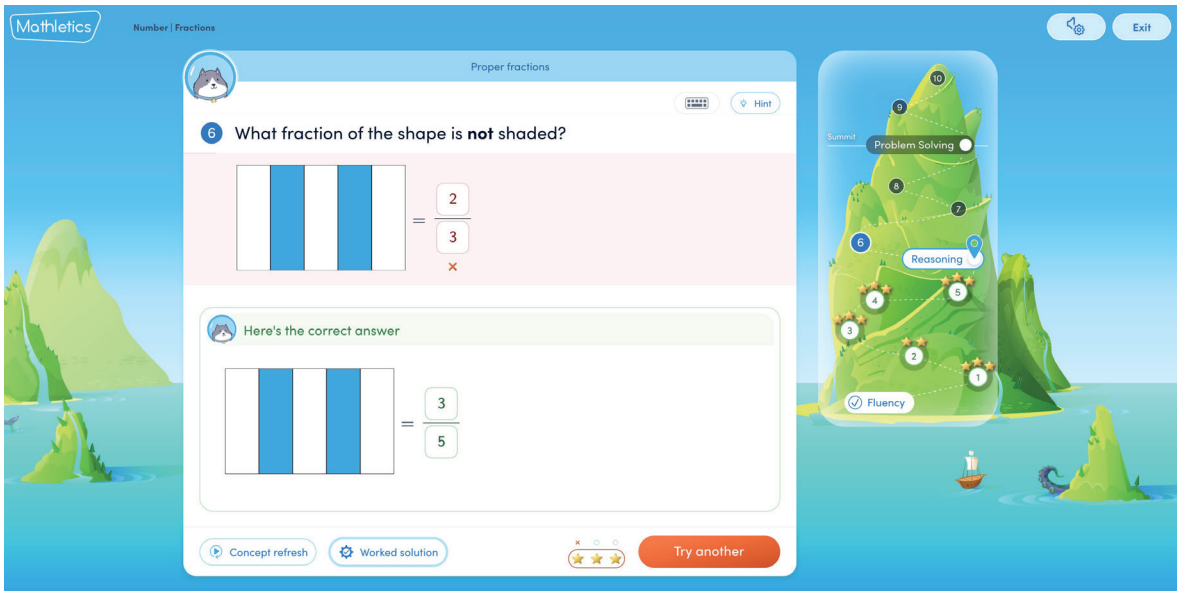
New Courses provide plenty of opportunities for collaboration within a classroom. Small groups can be tasked with solving the Problem Solving questions in a set if they were a challenge. Successful students can articulate the strategies they used, and this sharing of ideas can provide the energy needed for many more to be successful. The New Courses Mystery Units can also be used as part of the collaborative learning experiences in your classroom.





Strategy 6: Multiple exposures

Within the New Courses sets, students have three chances to answer each question correctly. When an incorrect answer is provided, students can review the correct answer and a worked solution before attempting an alternate version of the same question. This fosters learning, persistence and higher levels of success, which increases overall confidence.

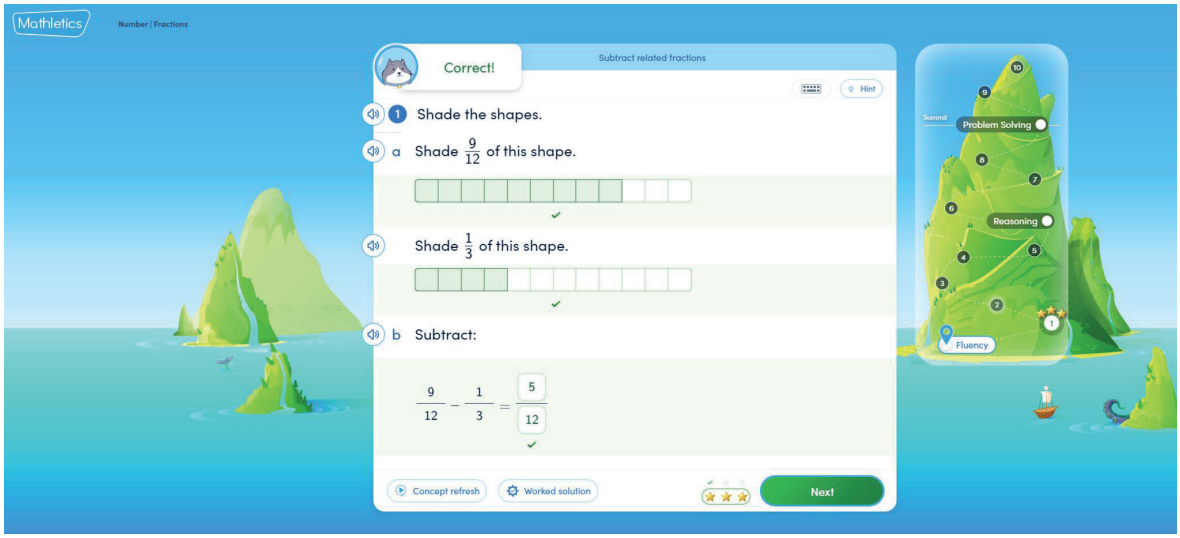


Strategy 7: Questioning

Beyond fluency: New Courses covers more than fluency. These sets take students beyond the basics and further into reasoning and problem solving through carefully crafted and sequenced question sets.

Students work through these questions in each set:

- **5 fluency questions** encourage students to recall new concepts and skills, and calculate efficiently.
- **3 reasoning questions** focus on analysing, proving, evaluating and explaining.
- **2 problem-solving questions**, where students develop the ability to interpret, formulate, model and investigate problem situations.



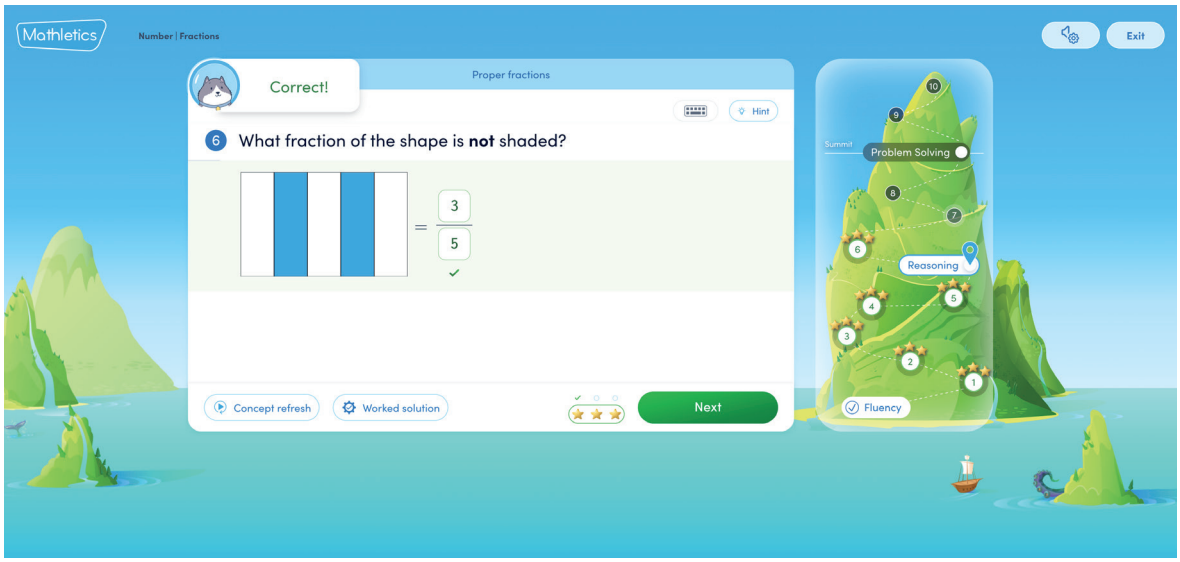
Strategy 8: Effective feedback

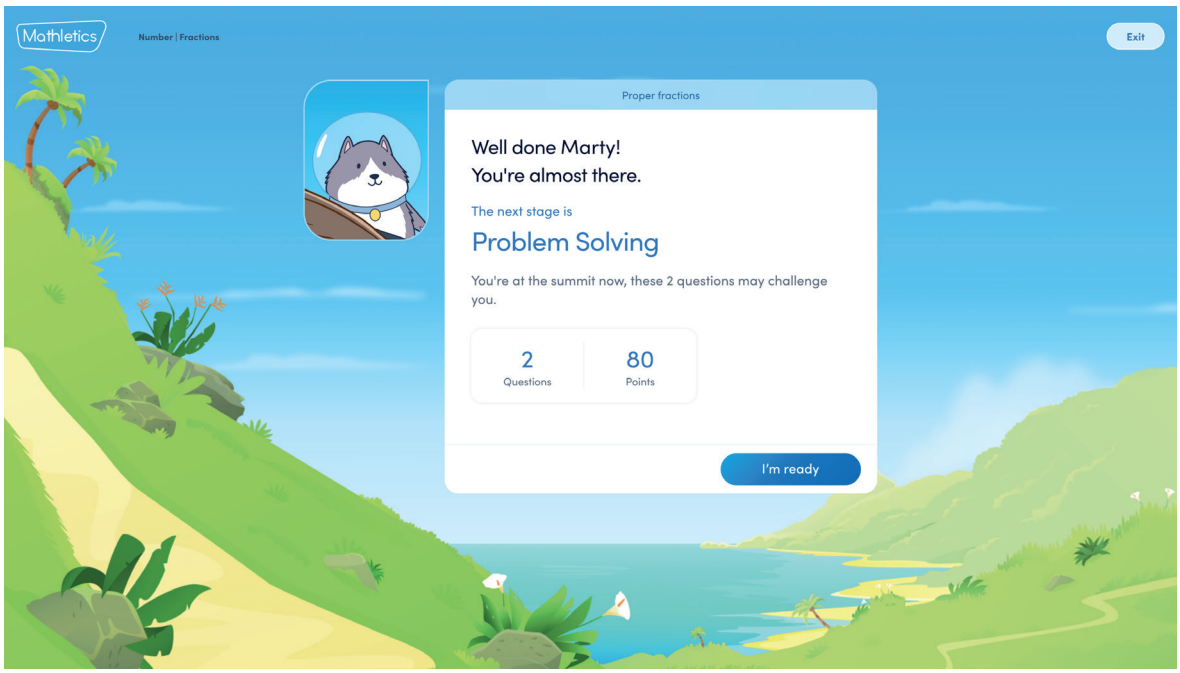
Mathletics New Courses are highly responsive and engaging, where every student action receives immediate feedback. There are sound effects, animations and a variety of question types to maintain constant interest and engagement.

Customisation options: Students can choose to have questions read aloud in their preferred accent or language, making the content more accessible and personalised.

New Courses instant feedback: Students immediately see the correct answer when they make a mistake. Students can then access the Worked Solution and the Concept Refresh Video, which provides the essential help that students need to help them move forward. This enables students to learn from their mistakes, correct any misconceptions, and make real progress in their learning journey.

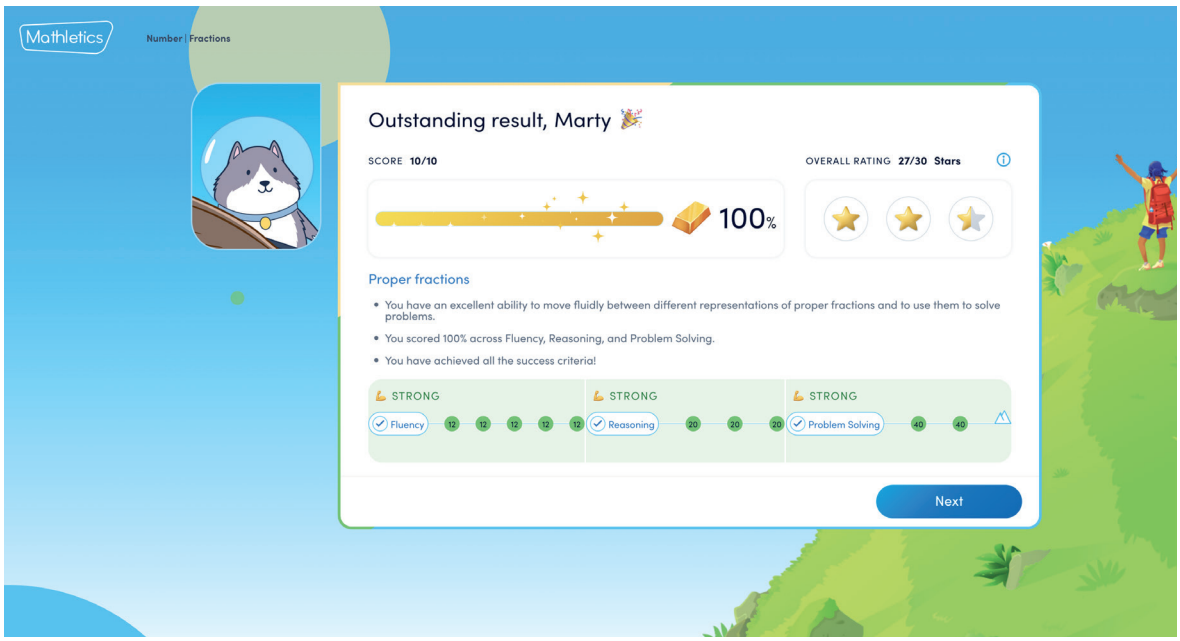
New Mathletics student console: Points this week, avatar, certificates and achievement levels provide layers of additional positive feedback, motivational elements and rewards that are highly effective at increasing student engagement.

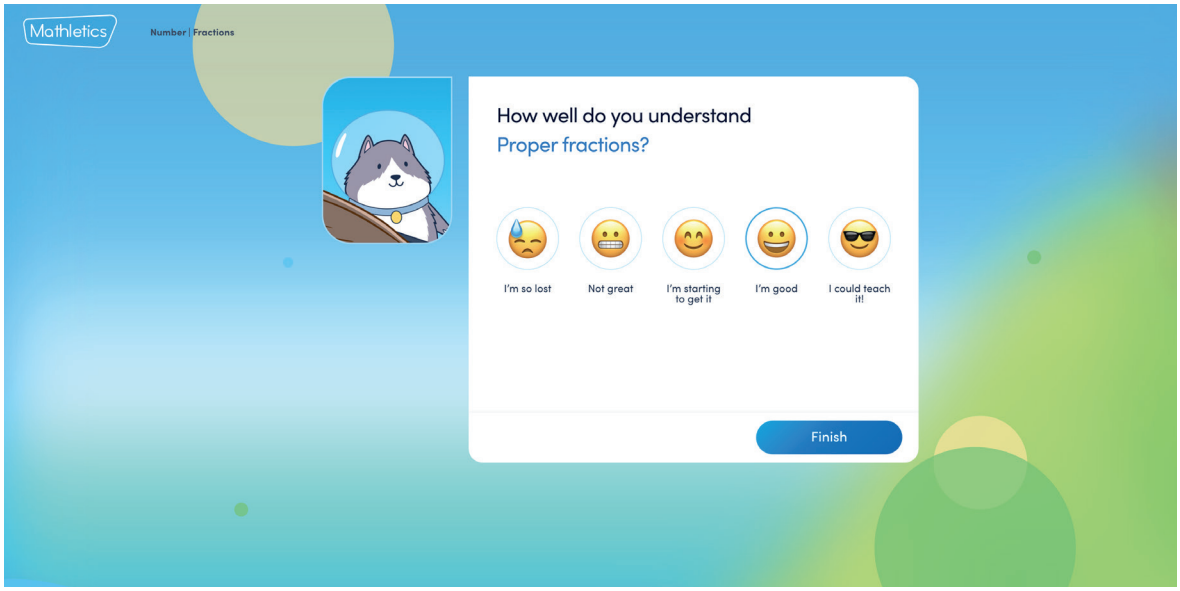




Strategy 9: Metacognitive strategies

Students can visually track their progress, as animated stars twinkle on the mountain with an encouraging sound effect for each correct answer, enhancing their overall sense of achievement and motivation. Each question set concludes with a summary, highlighting the student's successes and areas that need extra attention. Students are then asked to think about how well they understand this topic. All of this contributes to students having an increased understanding of where they stand in their learning and how they can improve.



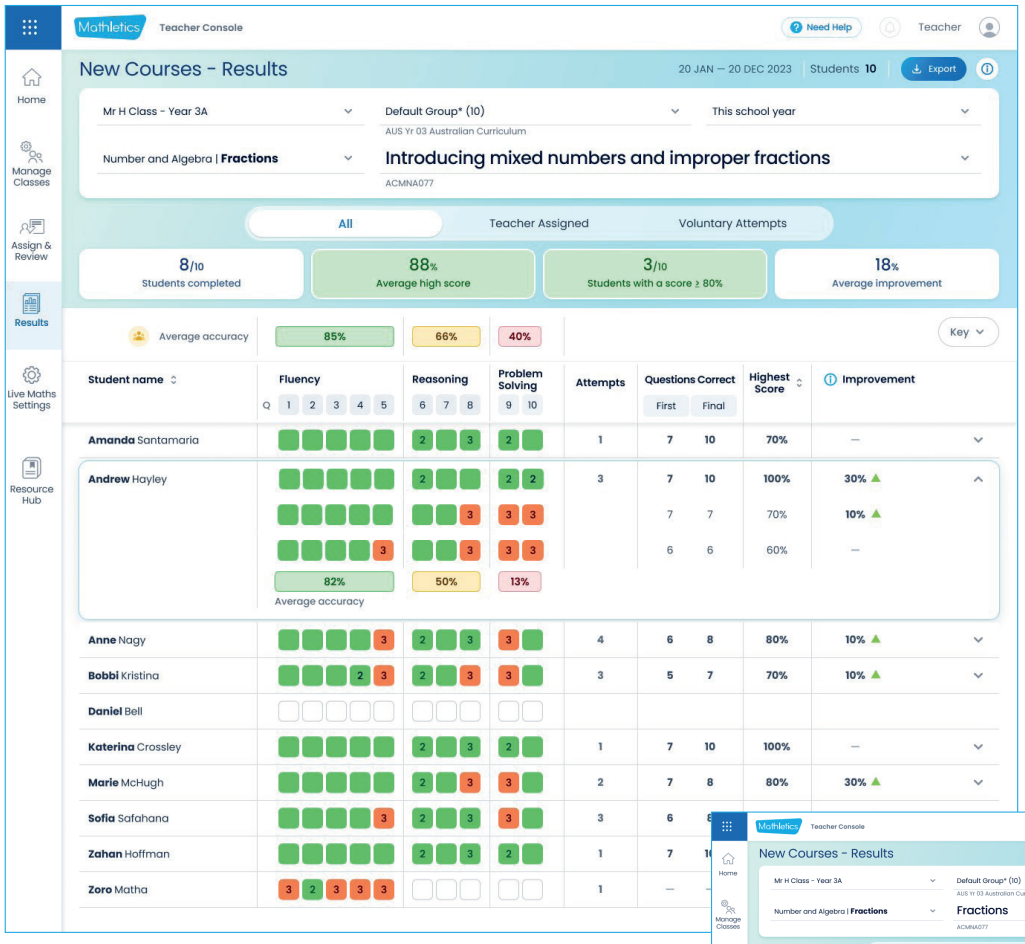


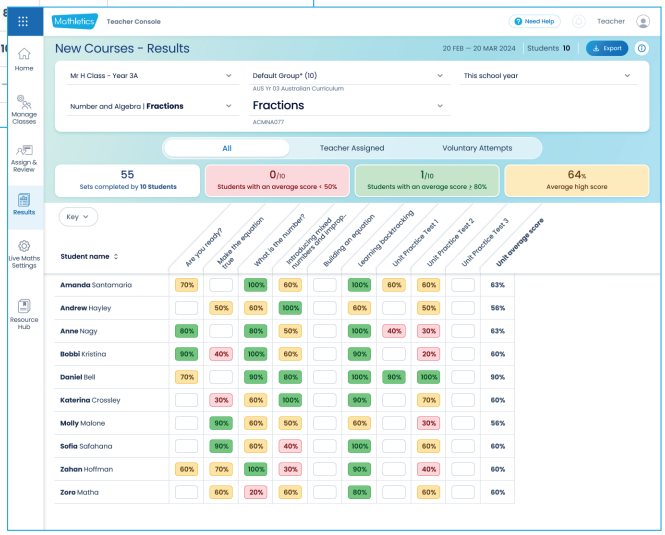
Strategy 10: Differentiated teaching

New Courses offers teachers immediate real-time insights into their class with the NEW Results Report. This provides teachers with actionable insights into students' understanding of each new skill, as well as their level of understanding of fluency, reasoning and problem-solving skills.

For teachers, these courses provide you with the detail you need to teach more effectively. After teaching a topic, assign the matching New Courses set to your class and you can quickly see what your students do and don't understand.

The New Courses Results report shows you where you should focus your teaching. You can instantly see which students are persisting, learning and making progress, and which students need more assistance. This Results report gives you a better understanding of your class on this topic, today, when you need it.





At a Unit level, you can see the results across topics and students. The three Unit Practice Tests are graded tests, with Test 3 set at a challenging level. These 20 question tests do not include answers, and are only marked at the end. This provides students with the same experience as in a real test.

New Courses is available in the *Learn* area of the Student Centre and in the Teacher Console via *Assign and Review*.

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