SLS Guide for Mathematics
Leveraging SLS to enhance Teaching and Learning of Mathematics

SINGAPORE Student Learning Space

Educational Technology Division
Ministry of Education

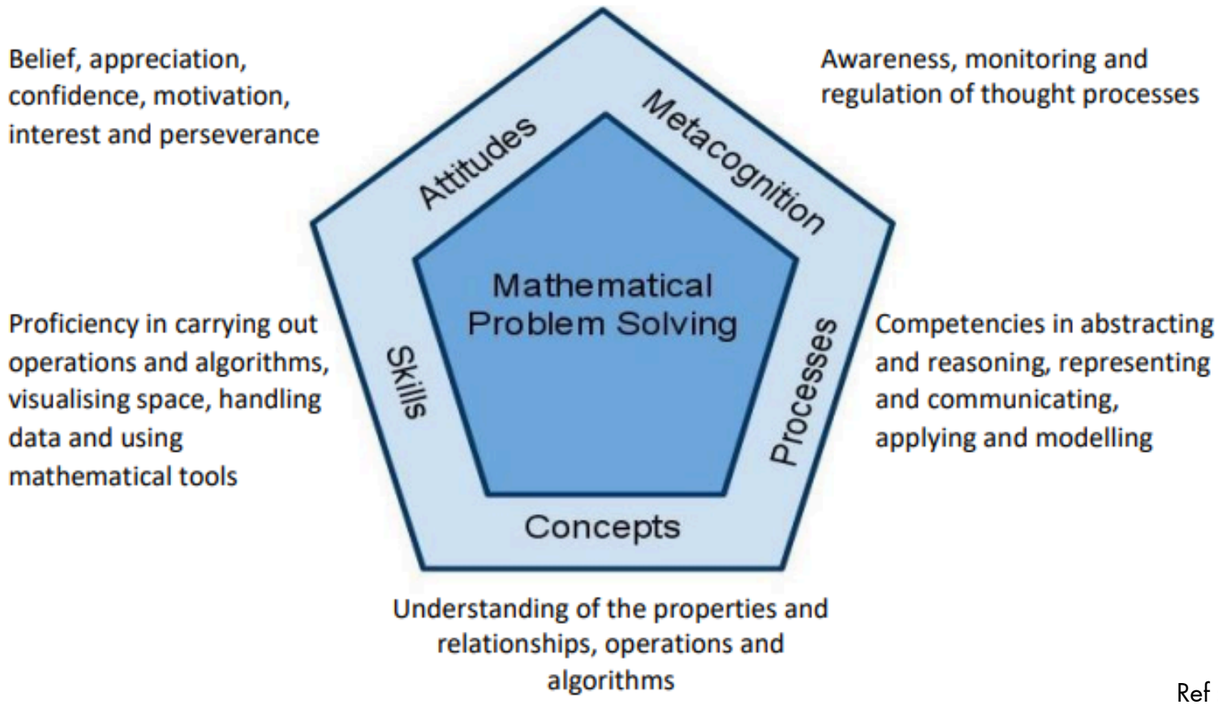
- The guide is developed by Educational Technology Division with input from the Academy of Singapore Teachers (AST) and the Curriculum Planning and Development Division.

- The guide demonstrates the potential of the Singapore Student Learning Space (SLS) to enhance the teaching and learning of Mathematics, featuring learning activities utilising SLS that are derived from different mathematics lesson examples. These activities actively foster and support the process of mathematics problem-solving.

- The guide encourages teachers to explore SLS features that can help them to overcome the challenges that mathematics teachers commonly face when teaching the process of mathematics problem-solving to students. Teachers can also leverage available resources on Community Gallery and MOE Library to complement lessons and reinforce key or challenging concepts.

Mathematics Curriculum Framework

The central focus of the Mathematics Curriculum Framework is the development of mathematical problem solving competency.



Ref : 2020 Mathematics Syllabus

Navigation Tips:

- Each segment addresses key challenges that teachers commonly encounter while teaching mathematics problem-solving. It highlights:
  - how teachers can harness the affordances of SLS to enhance their teaching approach,
  - the interactions among students, teacher and students, and/or students and content that foster engagement and learning, and
  - the pedagogical affordances of SLS features.
- Please note that the SLS features mentioned in the guide serve as suggestions to inspire teachers to explore possibilities and they are not exhaustive.
- For detailed technical information on each SLS feature, simply click on its embedded link. You will be directed to the relevant page within the SLS User Guide.

Mathematical Problem Solving
(e.g., metacognition, concepts)

How can I help my students in visualising and observing patterns so as to enhance their **understanding of abstract concepts**?

Teachers can insert media objects (e.g., videos and images) (Fig 1.1) to **spark curiosity** and help students **visualise and observe patterns for abstract mathematical relationships**. Teachers can also include a Poll (Fig 1.2) to focus on specific key questions before getting students to investigate.

Students can interact with the media object and **generalise by making a claim** based on what they have just viewed.

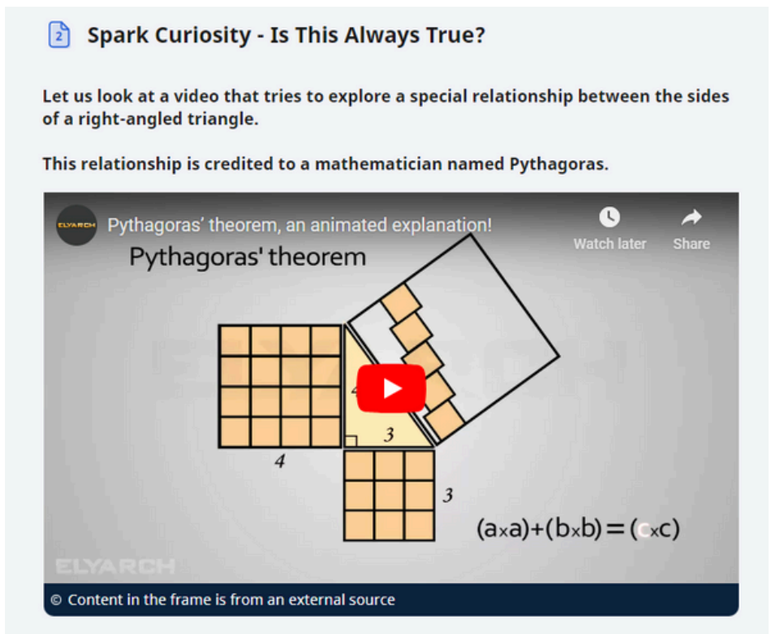


Fig 1.1

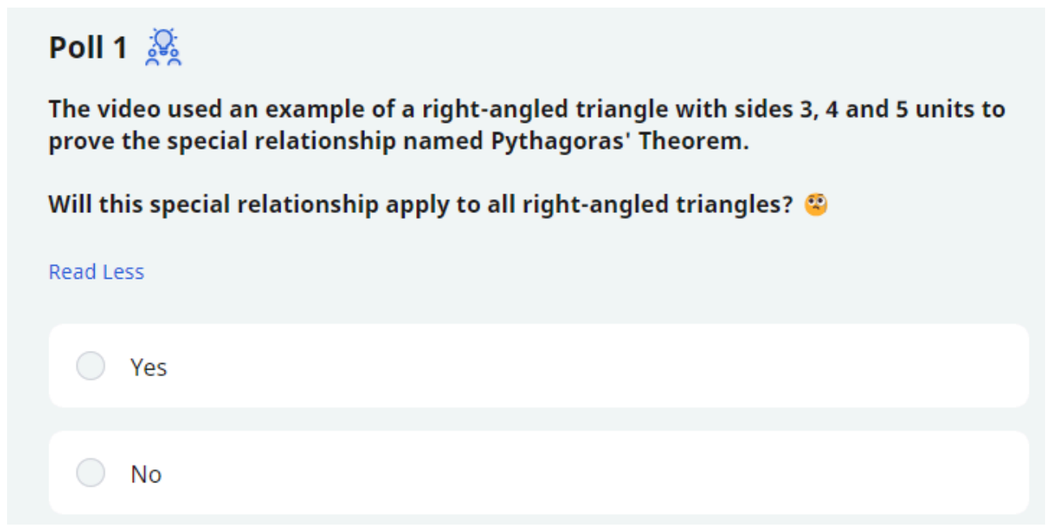


Fig 1.2

Click on the pictures for a larger view.

If you are interested in this activity, it is available here.

Teachers can use digital manipulatives for students to **investigate and analyse so as to justify their claims**. These manipulatives can be embedded in SLS (Fig 1.3).

Students can interact with the digital manipulatives, collaborate with their peers, and **record observations** in a pre-populated table provided in Interactive Thinking Tool (Fig 1.4). Students can then **reflect and articulate their understanding** of the relationship(s) between the different variables in a Free-Response Question (Fig 1.5).

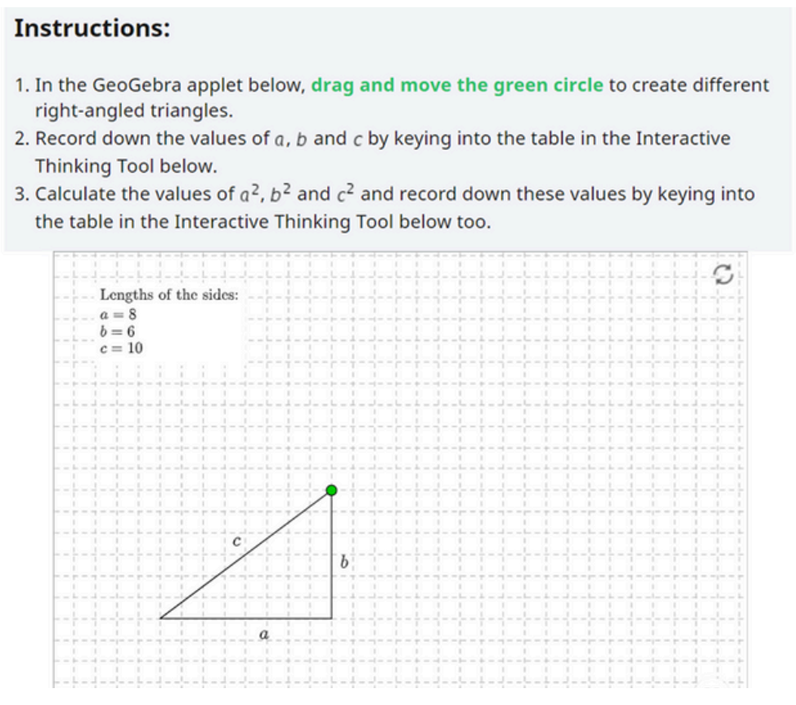


Fig 1.3

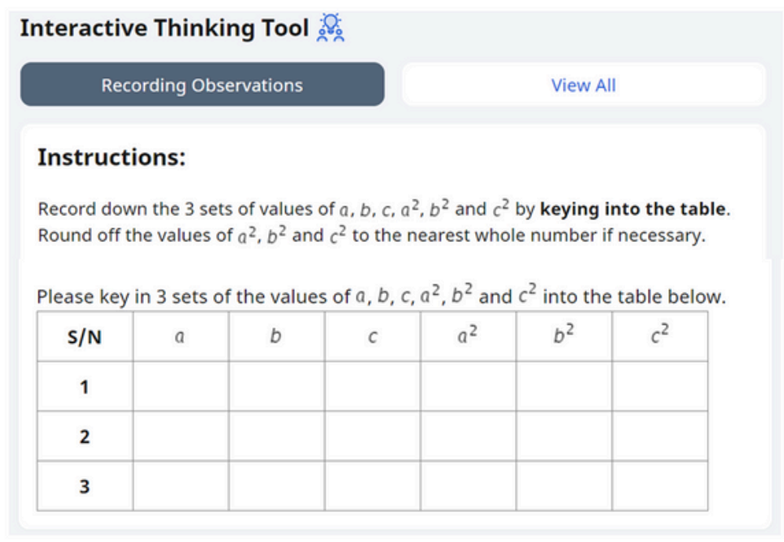


Fig 1.4

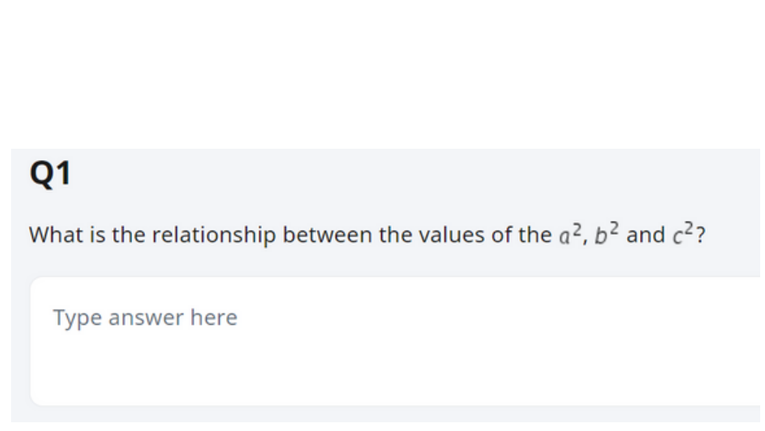


Fig 1.5

Click on the pictures for a larger view.

If you are interested in this activity, it is available here.

Teachers can use column display to include media objects (such as video or image) in the left hand column and include questions in the right hand column to help students **make connections** and **assess understanding** (Fig 1.6).

Students can **seamlessly move** between the media object and question.

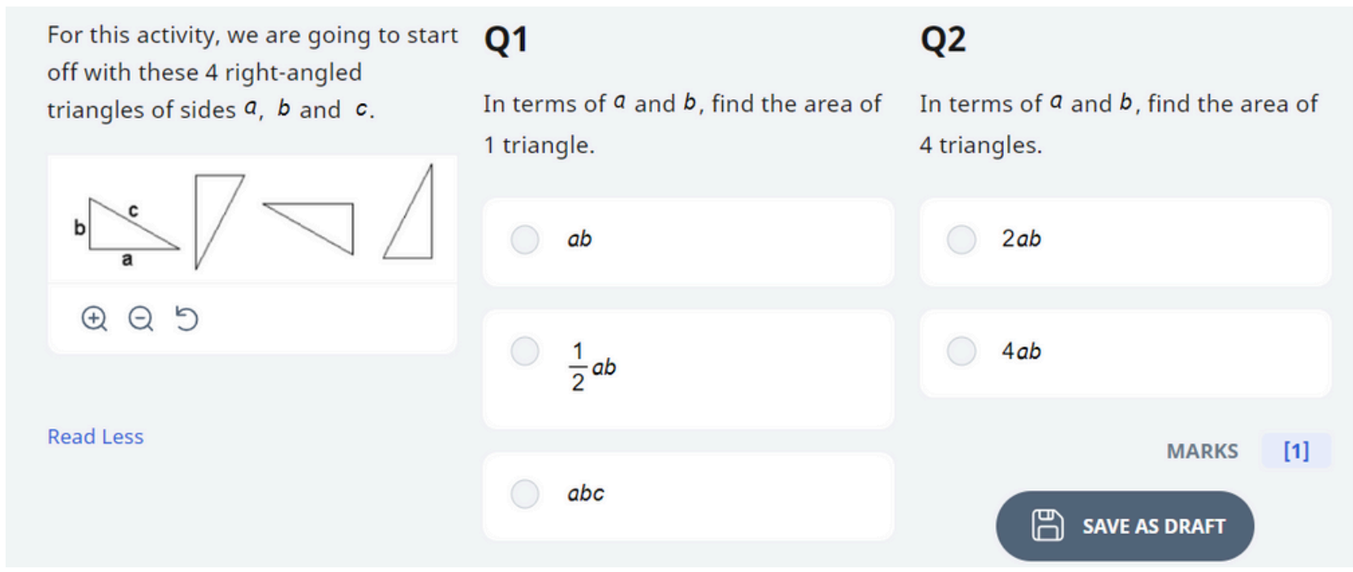


Fig 1.6

Click on the picture for a larger view.

If you are interested in this activity, it is available here.

PEDAGOGICAL AFFORDANCES:

- Showing different representations allows students to see similarities and differences so as to discern patterns. Getting students to make a claim helps the teacher support students to **externalise their current conceptual understanding** of the topic.
- Using digital manipulatives supports activity-based learning to guide students to **explore the concepts, manipulate variables and provide observable patterns** for them to compare and form relationships between the ideas and concepts.
- Presenting pictorial representations and abstract representations together allows students to seamlessly move between the two and thus, **compare and make connections easily**.

Mathematical Problem Solving
(e.g., skills, metacognition, processes)

How can I support my students in developing an awareness of their own thinking process so as to **reason and communicate** using the mathematic language?

Teachers can add Feedback Assistant - Mathematics (FA-Math) to Free-Response Questions to **automate the process of providing students with line-by-line feedback** on their workings. Hints are also available to scaffold students' attempts (Fig 2.1).

Students can use the line-by-line feedback to be **more aware of their mathematical reasoning** and **correct their mistakes promptly** in subsequent steps.

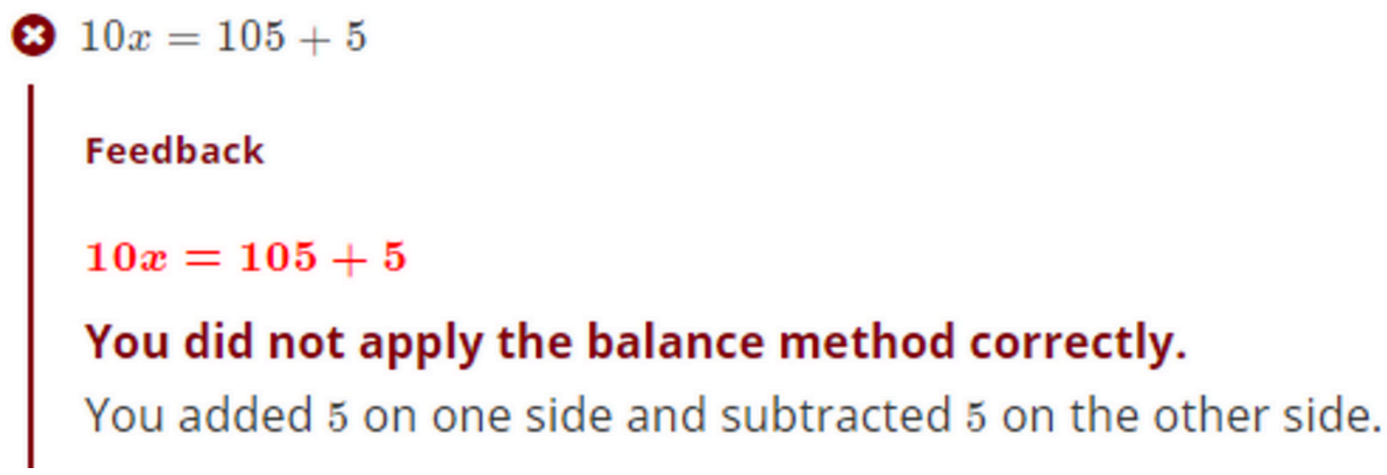


Fig 2.1

Click on the picture for a larger view.

- For more info on FA-Math, you may refer to the poster here.
- For video guides on FA-Math, you may find the playlist here.

Teachers can use Interactive Thinking Tool to engage students collaboratively, and Free-Response Question to allow students to **record their observations** and **consolidate their learning**. Teachers can also bookmark students' responses and facilitate discussions.

Students can upload files in different modes (such as audio, image, text, video) to explain their working or show the steps in working out a problem (Fig 2.2). Students can also **make their thinking visible** by highlighting and taking notes using the annotation feature.

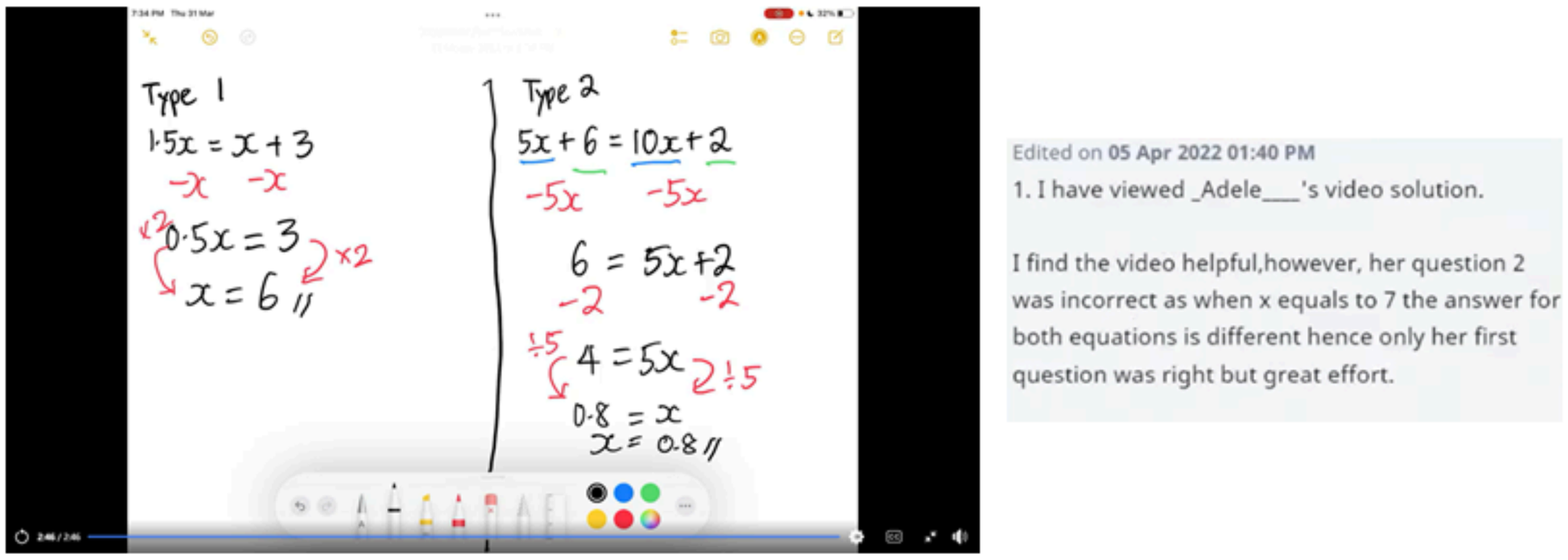


Fig 2.2

Click on the picture for a larger view.

Mathematical Problem Solving
(e.g., skills, metacognition, processes)

Teachers and students can use symbols and conventions to write mathematical equations to **communicate their ideas, solutions and arguments** using MathType (Fig 2.3). MathType supports handwriting input and handwritten mathematical content are auto-translated to computer notations.

Fig 2.3

Click on the picture for a larger view.

PEDAGOGICAL AFFORDANCES:

- The immediate feedback provided by FA-Math encourages the reinforcement of correct concepts and ensures that students are on the right track as they progress through the problem-solving process. It allows students to promptly correct any misconceptions or errors in their reasoning and **gain proficiency in carrying out operations.**
- Allowing students to choose their preferred mode to **express their ideas and argument** precisely, concisely and logically is an important process for solving problems.
- Enabling students to use mathematical notations as a writing system **facilitates the communication of mathematical ideas**.

Mathematical Problem Solving
(e.g., skills, attitudes)

How can I help my students to be successful when they **apply the appropriate concepts and skills** to solve problems?

Teachers can **help students who require more support** by providing them with scaffolds such as prompts, cues or key information using the tooltip (Fig 3.1) or accordion (Fig 3.2) to lower the barriers to success. Teachers can also provide different scaffolds to students of different levels of readiness by setting differentiated access.

Students can be further supported by embedding manipulatives from whitelisted websites in an accordion (Fig 3.2) to help them explore the simulations to **see relationships between the variables** for more complex tasks.

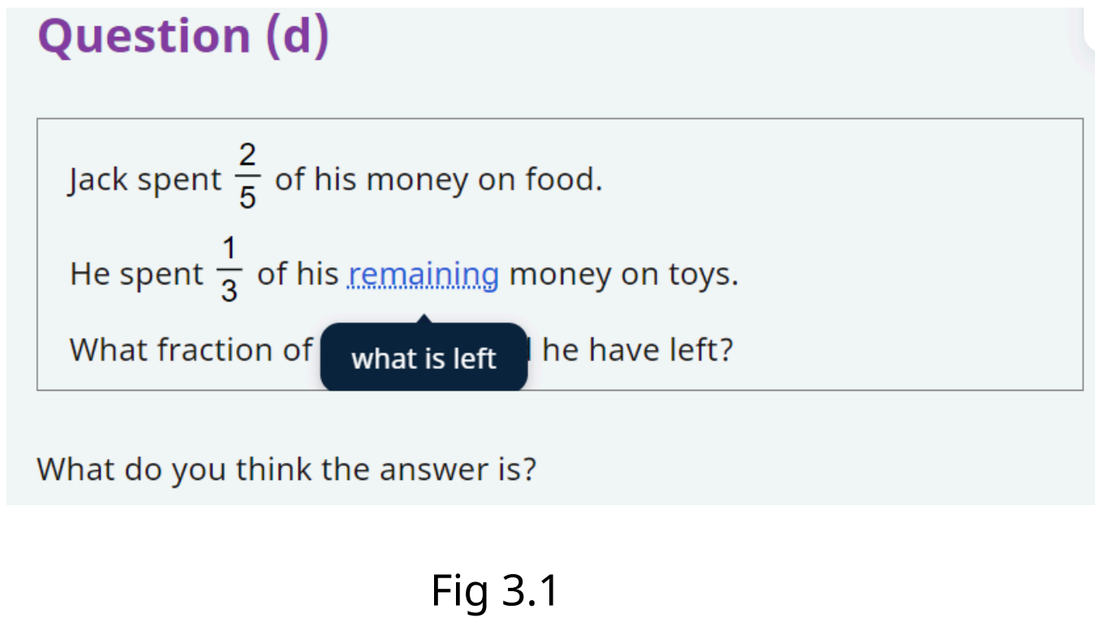


Fig 3.1

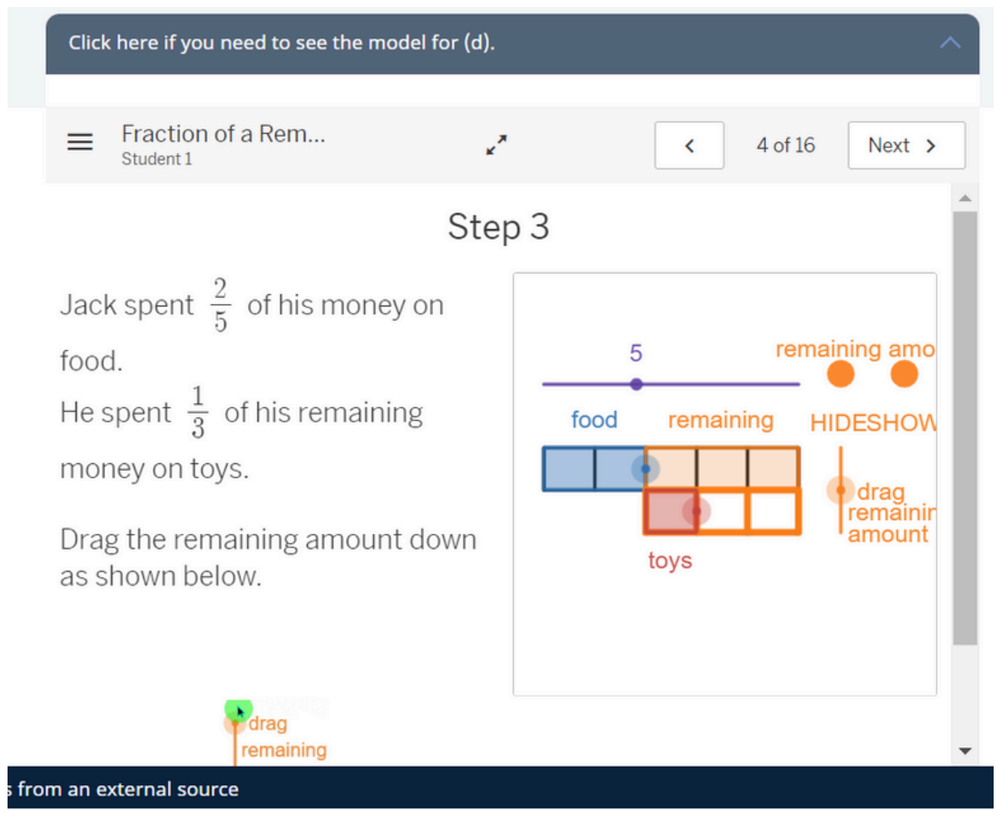


Fig 3.2

Click on the pictures for a larger view.

If you are interested in this activity, it is available here.

Teachers can gamify a lesson to provide a narrative to **contextualise real-life situations** (Fig 3.3).

Students can immerse themselves in the storytelling and at the same time, be awarded Experience Points (XP) and Game Badges at certain junctures in the lesson (Fig 3.4) to **build intrinsic and extrinsic motivation**.

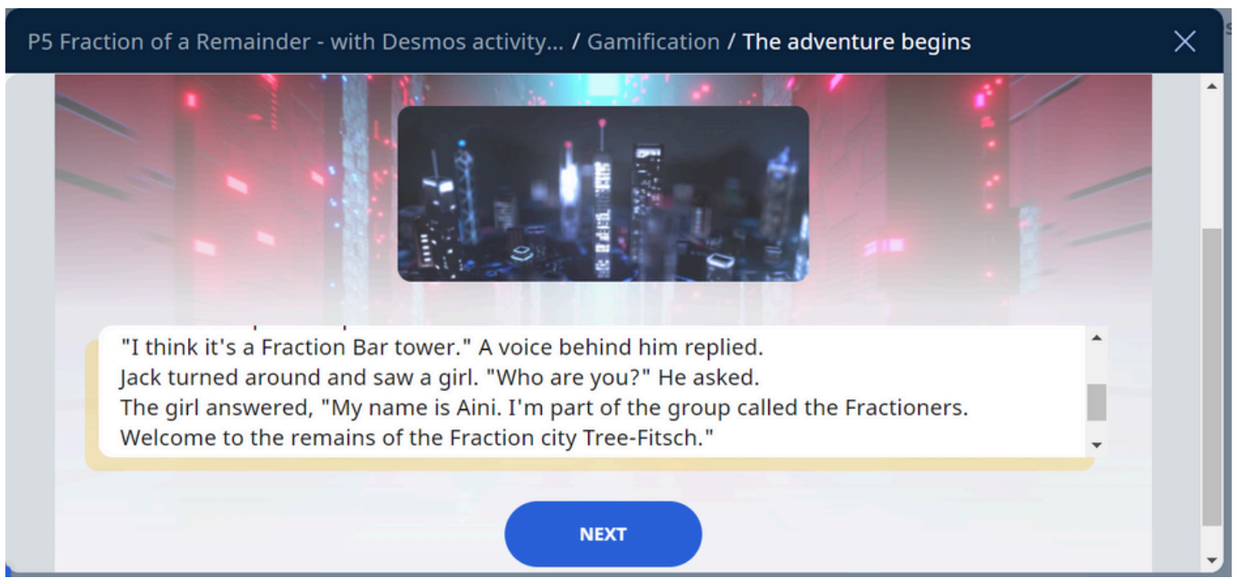


Fig 3.3

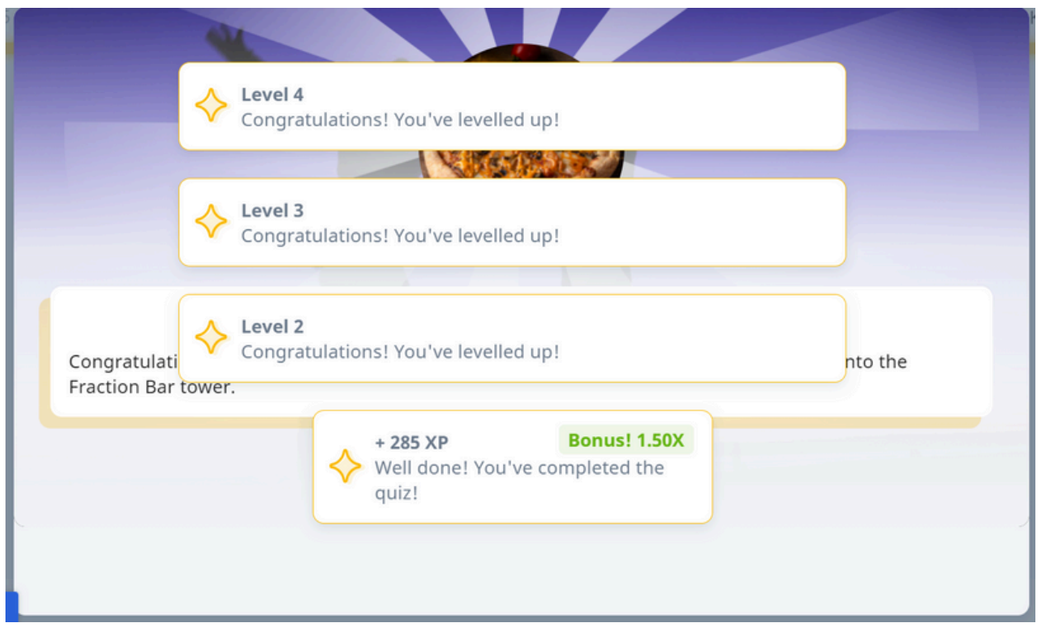


Fig 3.4

Click on the pictures for a larger view.

If you are interested in this lesson, it is available here.

Mathematical Problem Solving
(e.g., skills, attitudes)

Students can access Adaptive Learning System (ALS) for **self-directed learning**. ALS provides a personalised learning pathway for each student, recommending learning and assessment content based on how the student responds to the activities and his/her readiness (Fig 3.5).

Teachers can use the ALS Learning Progress Dashboard (Fig 3.6) to identify topics and subtopics where a student might be struggling and **provide personalised practice and support**.

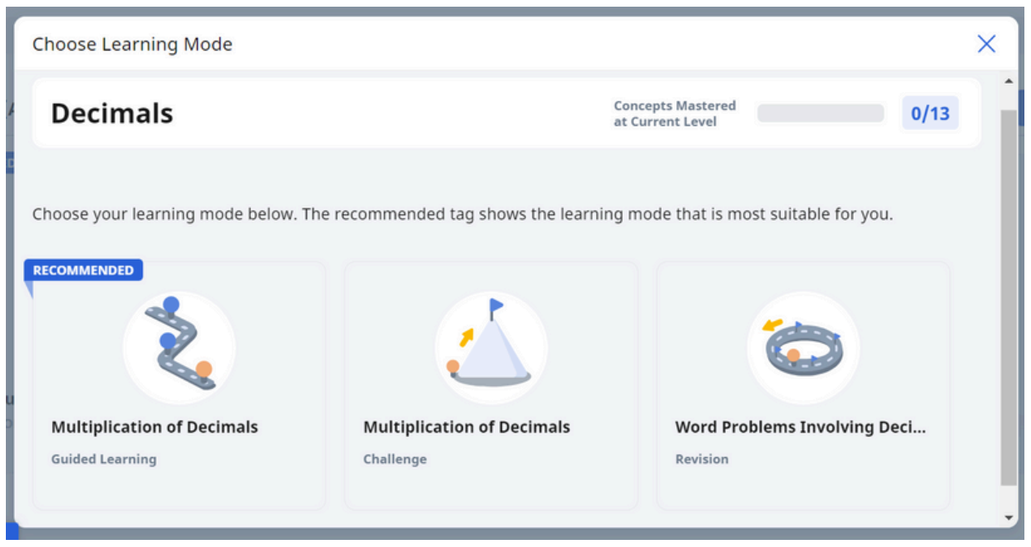


Fig 3.5

Fig 3.6

Click on the pictures for a larger view.

- For more info on ALS, you may refer to the poster here.
- For a detailed video walkthrough of how ALS works, you may refer here.

PEDAGOGICAL AFFORDANCES:

- Scaffolding entails offering support to students as they **learn, and build proficiency**. Providing scaffolds supports the learning so that students can experience success in understanding concepts.
- Gamification allows teachers to contextualise problems, making them relatable to students' lives, enhancing real-world application of learned concepts. Games' natural appeal **fosters student motivation and engagement** in the learning process.
- ALS makes learning recommendations that are customised for each student, based on how the student responds to the learning materials and activities. Students' learning is therefore enhanced through greater personalisation and they are **empowered to engage in self-directed learning**.