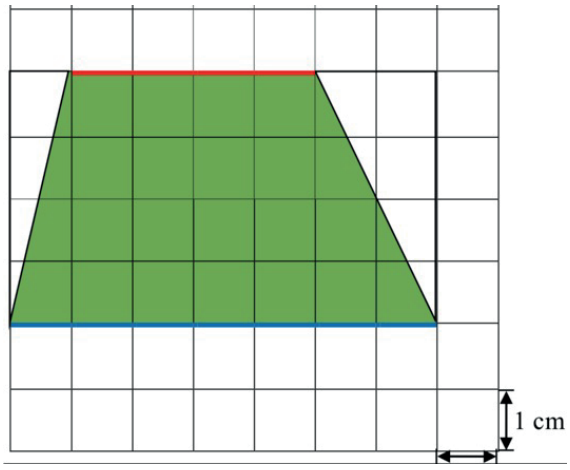
Finding the Area of Trapezium (P5 Area)

By DC Wang

BACKGROUNDS OF THE DESIGN

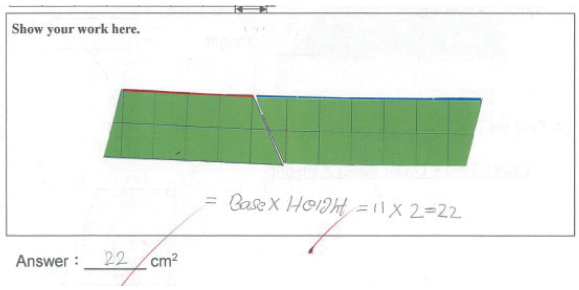
Teachers have discovered that some non-Chinese speaking (NCS) students are neither able to read nor speak English. These are the students who do not have much participation in class. Some of them lack previous knowledge in mathematics, and always feel shy to talk or express ideas in front of others. As a way to approach this issue through mathematics, a lesson was designed to provide multiple entry points for learning the area of a trapezium. Rather than giving students an area formula to memorize, apply and calculate, this lesson was designed with more open-ended questions which allow students to take different approaches to find the area of the trapezium by themselves. Open-ended questions subsequently provide a platform that enables all students to be working on the same problem while making the lesson both challenging and accessible to children with a range of abilities. Extra attention is given to students' background knowledge in addition to the language burden.



(figure 1)

DEPTH OF KNOWLEDGE AND UNDERSTANDING

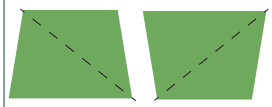
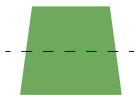
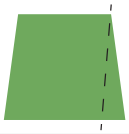
Students are required to restructure a trapezium to find its area. An important aspect of this exercise that is essential in acquiring an understanding of area is connected with the restructuring of shapes. The core of the idea is that children learn to understand that if part of a shape is cut off and then pasted back on, it does not change the area. In this lesson, students are provided with a picture of a trapezium (figure 1) and asked to develop methods for determining the area of the trapezium. It can be done by transferring it into one or more easy shape(s), such as by breaking the trapezium into pieces and re-arranging them using forms that they are already familiar with when focusing on area formulas. For example, transfer the trapezium into a parallelogram (see figure 2). While operating with shapes, children learn an important approach to problem solving – reducing the unknown to the known – in a very natural way.



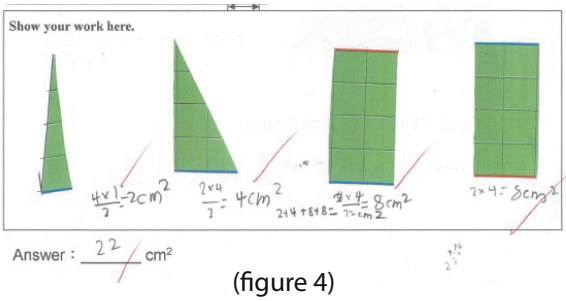
(figure 2)

GETTING ALL STUDENTS ENGAGED IN LEARNING

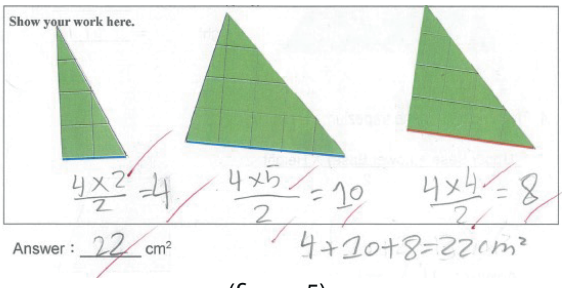
In order to get to a shape of which the area can be easily determined, students have to see which part of the trapezium has to be cut off and pasted on again. For students with little prior experience in fitting and dissecting shapes, this task is difficult. To address it, two levels of support are designed in this lesson. Firstly, let students explore the solution for real by cutting and pasting parts of the trapezium. Preprepared sheets with figures of the trapezium are provided for students to test different approaches of restructuring. Secondly, two hint cards are offered. One describes the shapes that the trapezium can be divided up into, and the other contains an image showing how the trapezium can be divided up. Students can choose whether they read the hints, and which hint they would like to read (see figure 3).

Cut it into two triangles	Cut it into two triangles 
Cut it into two trapeziums and form a parallelogram	Cut it into two trapeziums and form a parallelogram 
Cut it into one parallelogram and one triangle	Cut it into one parallelogram and one triangle 

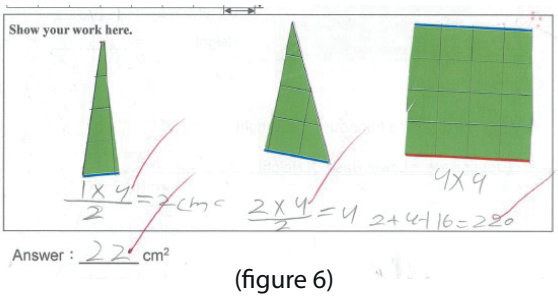
(figure 3)



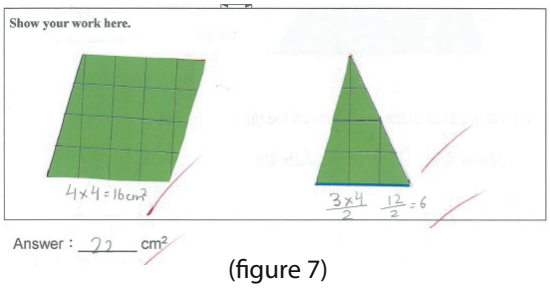
(figure 4)



(figure 5)



(figure 6)

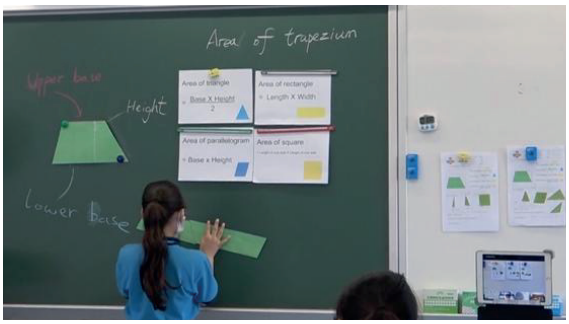


(figure 7)

Figures 2, 4-6 are different methods presented by students. Teachers can use this approach to facilitate a whole-class discussion, trying to involve as many students as possible. Students who solve the problem differently should be selected to show their work to their fellow classmates. It proves to not only be of value in terms of the students' contributions but also allows them to see that there are multiple ways to solve a problem. All methods are acceptable, and they can choose which method to use.

LANGUAGE SUPPORT

Language support is provided to reduce the language burden of students who learn mathematics in their secondary language. For example, paper-trapeziums are offered for students to cut and paste to explain their ideas.

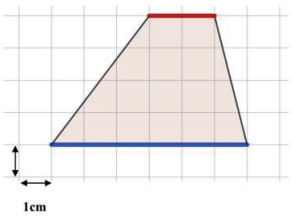


Teachers use visuals to explain in advance all the vocabulary that students are expected to learn. Upper base, lower base, and height of the trapezium are presented on the figure of the trapezium using different colours to strengthen visual representations.

Find the areas of the following trapeziums.

Area of trapeziums = $\frac{(\text{Upper base} + \text{Lower base}) \times \text{Height}}{2}$

1.



Upper base: _____cm

Lower base: _____cm

Height: _____cm

Area =