FaSMEd

Raising Achievement through
Formative Assessment
in Science and Mathematics
Education

Designing Candy Cartons: Solving 3D problems

Subject:	Mathematics
Age of students:	11-14 years
Hardware:	iPad minis (1 per class or one for each student)
Software:	Socrative or Classflow, Apple airserver, OR Showme and Reflector software
Functionalities:	Sending and displaying
Time:	3 hours
FaSMEd partner:	Newcastle University
Short Abstract:	This lesson is intended to help you assess how well students are able to: • Select appropriate mathematical methods to use for an unstructured problem. • Interpret a problem situation, identifying constraints and variables, and specify assumptions. • Work with 2- and 3-dimensional shapes to solve a problem involving capacity and surface area. • Communicate their reasoning clearly.

1. Content

Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

2. Activity

2.1 Aims

Students will make sense of problems and persevere in solving them. Construct viable arguments and critique the reasoning of others. Model with mathematics

2.2 Structure / Methodology

This activity will take at least two (possibly more) lessons. The lessons are structured in the following way:

• Before the first lesson, students tackle the problem individually. You review their work and write questions to help students improve their solutions.

• At the beginning of the first lesson, students respond to your questions. They are then grouped into pairs and work collaboratively to produce better solutions to the same task, and use their designs to make two cartons.

• To launch the second lesson there is a whole-class discussion. Then in small groups students evaluate and comment on sample solutions, followed by a whole-class discussion about the work. Finally, students review and evaluate their work on the problem.

2.3 Technology

A PC and projector is used to show slides of sample work for students to critique, the interactive whiteboard and Promethean software allows students to annotate the sample solutions. A mini iPad is used by the teacher who takes pictures of students' solutions. Then 'Showme' software allows the photo of the student work to be projected for the whole class to view (with Reflector software which allows the iPad to communicate with the projector via the PC). The Showme software also allows the student to annotate their work from their desk (using the iPad) to emphasise particular aspects of their thinking. Classflow software and Apple airserver are also available to support this process.

Teachers have observed that while the process of critiquing other sample solutions is a valuable element of the formative process, the knowledge that their solutions can be displayed for other students to view also has an impact on the quality of the students' work.

2.4 Aspects of Formative Assessment

- Clarifying/ Understanding/ Sharing learning intentions and criteria for success.
- Engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding.
- Providing feedback that moves learners forward.
- Activating students as instructional resources for one another.
- Activating students as owners of their own learning.

The technology supports these strategies through sending and sharing information for the whole class.

Further Information

Teachers' comments:

Is paired work is only really taken seriously when a paired solution is required?

Change the initial brief so that it is more specific:

- Must fit 18 sweets
- Be relatively cheap to produce – will lead students to the idea of size of box
- I will use fruit pastilles in my future versions of the slides and encourage others to find a physical object that could represent the sweets.

These activities really do need to be on consecutive days. Thurs-Fri was excellent with student motivation outstanding. By Tuesday, some had forgot what they were doing, others couldn't remember the brief etc. On reflection, could this be why the paired work phase didn't go so well rather than my comments about not making a joint solution?

3. References

Original materials from: http://map.mathshell.org/lessons.php?unit=6300&collection=8

Reflector software: http://www.airsquirrels.com/reflector/

Showme software: http://www.showme.com

Classflow software: https://classflow.com