FaSMEd

Raising Achievement through
Formative Assessment
in Science and Mathematics
Education

Security Cameras: Optimising

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 OR Plickers
Functionalities:	Sending and displaying, Processing and Analysing
Time:	2 – 3 hours (1 week)
FaSMEd partner:	Newcastle University
Short Abstract:	This lesson unit is intended to help you assess how well students are able to: • Analyse a realistic situation mathematically. • Construct sight lines to decide which areas of a room are visible or hidden from a camera. • Find and compare areas of triangles and quadrilaterals. • Calculate and compare percentages and/or fractions of areas.

1. Content

Understand ratio concepts and use ratio reasoning to solve problems. Solve real-world and mathematical problems involving area, surface area, and volume.

2. Activity

2.1 Aims

Students are challenged to:

Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Construct viable arguments and critique the reasoning of others. Model with mathematics.

2.2 Structure / Methodology

The lesson is structured in the following way:

Before the lesson, students attempt the *Security Cameras* task individually. You review their responses, and formulate questions for students to consider in order to improve their work.

At the start of the lesson, students think individually about their responses to the questions set.

Next, students work in small groups to combine their thinking and work together to produce a collaborative solution to the *Security Cameras* task, in the form of a poster.

In the same small groups, students evaluate and comment on sample responses, identifying the strengths and weaknesses in these responses and comparing them with their own work.

In a whole-class discussion students compare and evaluate the methods they have seen and used.

In a follow-up lesson, students spend ten minutes reflecting on their work and what they have learned.

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.

3. Further Information

Here you find statements of teachers, who taught this lesson:

The class was asked to work independently and I didn't prompt them in any way. I was able to ascertain that all the class had not figured out that a wall would get in the way and hadn't been able to visualize the line of sight. For a small number in the class it was clear because of the lack of responses that they weren't really sure what there were looking at. There didn't realize that the circles represented people for example.

Technology was used for students to demonstrate their paired "best" answers. The responses were shared with the whole class and students used this information to help further improve their answers.

Instead of filling out the form, I sent each group the questions on Socrative and collected the answers. Displaying the results on the whiteboard and talking through them really helped the class discussion and students were much more positive about the benefits of working together and were happy about what they achieved.

4. References

Full set of materials: http://map.mathshell.org/lessons.php?unit=6305&collection=8

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

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

Classflow software: https://classflow.com