



# FaSMEd

Raising Achievement through  
Formative Assessment  
in Science and Mathematics  
Education



## Developing a sense of scale: Proportional relationships

<b>Subject:</b>	Mathematics
<b>Age of students:</b>	11-14 years
<b>Hardware:</b>	iPad minis (1 per class or one for each student)
<b>Software:</b>	Socrative or Classflow, Apple airserver, OR Showme and Reflector software OR Plickers
<b>Functionalities:</b>	Sending and displaying, Processing and Analysing
<b>Time:</b>	2 – 3 hours
<b>FaSMEd partner:</b>	Newcastle University
<b>Short Abstract:</b>	<p>This lesson unit is intended to help you assess whether students recognize relationships of direct proportion and how well they solve problems that involve proportional reasoning. In particular, it is intended to help you identify those students who:</p> <ul style="list-style-type: none"><li>• Use inappropriate additive strategies in scaling problems, which have a multiplicative structure.</li><li>• Rely on piecemeal and inefficient strategies such as doubling, halving, and decomposition, and have not developed a single multiplier strategy for solving proportionality problems.</li><li>• See multiplication as making numbers bigger and division as making numbers smaller.</li></ul>



## 1. Content

Students solve problems concerned with scaling.

## 2. Activity

### 2.1 Aims

Students should: analyze proportional relationships and use them to solve real-world and mathematical problems; reason abstractly and quantitatively; look for and express regularity in repeated reasoning.

### 2.2 Structure / Methodology

Before the lesson, students work individually on a task designed to reveal their current levels of understanding and difficulties. You review their solutions and write questions to help students improve their work.

- During the lesson, the students first work in pairs or threes on the same task. Then working in the same small groups, they analyze work produced by other students on the task.
- In a whole-class discussion, students compare and evaluate the methods they have seen and used.
- In the final part of the lesson, students review their initial, individual solutions and use their learning to complete a new task.

### 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

This lesson is based on the one designed by the Mathematics Assessment Project, which can be found at <http://map.mathshell.org/lessons.php?unit=7210&collection=8>

### 4. References

Bell, B., & Cowie, B. (2001). The characteristics of formative assessment in science education. *Science Education*, 85(5), 536-533.

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in education*, 5(1), 7-74.