FaSMEd

Raising Achievement through Formative Assessment in Science and Mathematics Education

Interpreting Distance-Time Graphs

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 is intended to help you assess how well students are able to interpret distance–time graphs and, in particular, to help you identify students who: • Interpret distance–time graphs as if they are pictures of situations rather than abstract representations of them. • Have difficulty relating speeds to slopes of these graphs.

1. Content

Construct a function to model a linear relationship between two quantities.

Describe qualitatively the functional relationship between two quantities by analysing a graph

2. Activity

2.1 Aims

Students will be challenged to:

- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.

2.2 Structure / Methodology

- The lesson unit is structured in the following way:
- Before the lesson, students work on a task designed to reveal their current understandings and difficulties. You review their work and create questions for students to answer in order to improve their solutions.
- A whole-class introduction provides students with guidance on how to work through the first task. Students then work in small groups on a collaborative discussion task, matching verbal interpretations with graphs. As they do this, they translate between words and graphical features, and begin to link the representations. Invite the students to use the polling software to share their responses.
- This is followed by a whole-class discussion about applying realistic data to a graph.
- Students next work in small groups, matching tables of data to the existing matched pairs of cards. They then explain their reasoning to another group of students. Ipads can be used to project their solutions for others to view.
- In a final whole-class discussion, students draw their own graphs from verbal interpretations. Sharing software can be used to display responses for the whole class to see. (Low tech tools such as mini whiteboards could be used here too.
- Finally, students return to their original task and try to improve their individual responses.

2.3 Technology

Socrative or Classflow or another ‘polling’ application such as ‘Plickers’ is used to gather students responses to the task of matching verbal interpretations to graphs.

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 are some statements from teachers, who taught this lesson using the described applications:

I started my lessons having spoken to some of the others in the department who had problems with the first lesson because they expected too much from the students so I decided to go slower, not push the students too fast at the beginning to get a certain task completed within one lesson – this did help, they had more time to explain their thinking and talk to each other and I think this was important and helped.

In the third lesson we started the lesson by asking the students to sketch graphs of the scenarios listed on our power point. They really enjoyed doing this so we decided to see if we could act the graphs out. We spent most of this lesson with students acting out one of the graphs and the class having to guess which one it was. Then one student made up story through acting and we tried to draw the graph. The students loved this.

I was surprised at the height of engagement of the groups and how much they immersed themselves in the task. Even some previously shy students 'came out of their shells'. Technology played a part in this; it gave students an access point to get involved. Reflector allowed some pupils to stay in their seats and explain which helps when they are shy.
I was also surprised at the deep understanding that they showed afterwards.
I was thrilled at their response and at the level of progress they had made. I also enjoyed the lessons much more than I thought I would.

4. References

Lesson plan: http://map.mathshell.org/lessons.php?unit=8225&collection=8

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

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

Classflow software: https://classflow.com