Embedding formative assessment in 11-14 physics teaching

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Overview

In this session:

• the importance of formative assessment
• strategies for using questions to improve learning
FORMATIVE ASSESSMENT
Why is formative assessment important?


“There is a body of firm evidence that formative assessment is an essential feature of classroom work and that development of it can raise standards.”

(Inside the black box p.19)
What are the characteristics of formative assessment?

The research indicates that improving learning through assessment depends on five, deceptively simple, key factors:

• the provision of effective feedback to pupils;
• the active involvement of pupils in their own learning;
• adjusting teaching to take account of the results of assessment;
• a recognition of the profound influence assessment has on the motivation and self-esteem of pupils, both of which are crucial influences on learning;
• the need for pupils to be able to assess themselves and understand how to improve.

What is formative assessment?

‘Formative assessment involves getting the best possible evidence about what students have learned and then using this information to decide what to do next’

Formative assessment

also described as

‘Responsive teaching’

(Chris Harrison, 2015)
However

‘In 50 of the 131 accepted studies, providing feedback actually lowered performance.

(Kluger & DeNisi, 1996)’

(p104)

*Embedded formative assessment*
Bloomington, IN. Solution Tree Press.
Feedback

“It was only when I discovered that feedback was most powerful when it is from the student to the teacher that I started to understand it better.

When teachers seek, or are at least open to, feedback from students as to what students know, what they understand, where they make errors, when they have misconceptions – then teaching and learning can be synchronised and powerful.”

(Hattie, 2009, p. 173)
COLLECTING FEEDBACK
Throwing a ball in the air

Kim throws a tennis ball straight up into the air for a short distance and catches it when it comes down again.

In the diagrams below, the ball is on the way up.

Which diagram best shows the total force on the ball?
Throwing a ball in the air

Kim throws a tennis ball straight up into the air for a short distance and catches it when it comes down again.

In the diagrams below, the ball is right at the top of its flight.

Which diagram best shows the total force on the ball?
Throwing a ball in the air

Kim throws a tennis ball straight up into the air for a short distance and catches it when it comes down again.

In the diagrams below, the ball is **on the way down**.

Which diagram best shows the **total force** on the ball?
TASK

Which diagrams best shows the total force on the ball?

What do you think is a very common (wrong) answer?
Throwing a ball in the air

Correct: ADG

Common error: BFG

Can you explain why BFG is a common answer?
Diagnostic questions

• Not only do they tell you which students have some understanding of the idea..........

...............they also give you some information about the ideas of those who do not understand.

• Useful at the beginning of a sequence of teaching to find out where learners are in their understanding, or to check on progress during a lesson.
Kicking a Football

Ryan kicks a football across a level pitch. It rolls to the point X and then stops.

Think about the football when it is in the middle and still moving.
The pictures below show the possible direction of the forces acting on the football while it is moving.

Which picture best shows the direction of the forces acting on the moving football?
The pictures below show the possible direction of the forces acting on the football while it is moving.

Which picture best shows the direction of the forces acting on the moving football?

A  B  C  D

J  K  M  O

A  B  C  D

TASK

Which do you think is the most common answer amongst KS3 students?
The pictures below show the possible direction of the forces acting on the football while it is moving.

Which picture best shows the direction of the forces acting on the moving football?

- J: 13.7%
- K: 35.5%
- M: 3.0%
- O: 23.9%
KS3 responses: Football

<table>
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<th>Frequency</th>
<th>Percent</th>
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<tr>
<td>C</td>
<td>2</td>
<td>1.0</td>
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<tr>
<td>F</td>
<td>22</td>
<td>11.2</td>
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<td>G</td>
<td>5</td>
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<tr>
<td>I</td>
<td>2</td>
<td>1.0</td>
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<tr>
<td>J</td>
<td>27</td>
<td>13.7</td>
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<tr>
<td>K</td>
<td>70</td>
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<td>M*</td>
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<tr>
<td>N</td>
<td>3</td>
<td>1.5</td>
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<tr>
<td>O</td>
<td>47</td>
<td>23.9</td>
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<tr>
<td>Total</td>
<td>197</td>
<td>100.0</td>
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</table>

The pictures below show the possible direction of the forces acting on the football while it is moving. Which picture best shows the direction of the forces acting on the moving football?

- A
- B
- C
- D
- E
- F
- G
- H
- I
- J
- K
- L
- M
- N
- O

Forces in the horizontal plane

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<td>6.6</td>
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<tr>
<td>both directions</td>
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<td>73.1</td>
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<tr>
<td>no horizontal forces</td>
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<td>1.0</td>
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<tr>
<td>just forwards</td>
<td>38</td>
<td>19.3</td>
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<tr>
<td>Total</td>
<td>197</td>
<td>100.0</td>
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</table>
KS4 responses: Football

The pictures below show the possible direction of the forces acting on the football while it is moving. Which picture best shows the direction of the forces acting on the moving football?

So a question worth asking.
STRATEGIES FOR USING DIAGNOSTIC QUESTIONS
What happens when a second bulb is added?

What do you think will happen to the reading on the ammeter when switch S is closed?

A  The ammeter reading will increase
B  The ammeter reading will stay the same
C  The ammeter reading will decrease
D  The ammeter reading will go to zero

TASK

What is this question assessing?

What do you think is a very common (wrong) answer (and why)?

How could you make best use of the question in a lesson?
**Talking heads**

**Ali:** It goes to zero because all the current goes through B₂ because it is nearer the battery.

**Ben:** It goes down because the current splits in a parallel circuit.

**Callum:** It increases because there is more current when you add lamps in parallel.

**Di:** It stays the same because it still has the same voltage across it.
Confidence grids

What do you think will happen to the reading on the ammeter when switch S is closed?

A. It goes to zero because all the current goes through B₂ because it is nearer the battery.

B. It goes down because the current splits in a parallel circuit.

C. It increases because there is more current when you add lamps in parallel.

D. It stays the same because it still has the same voltage across it.
What happens when a second bulb is added?

Predict
What do you think will happen to the reading on the ammeter, and the brightness of bulb $B_1$, when switch $S$ is closed?

Explain
Explain the reasons for your prediction

Observe
Describe what happens

Explain
If your prediction was **not** correct, can you now explain what you have observed?
Diagnostic questions – for teachers

“‘I think my understanding of the topic has improved as a result of going through the questions...........

...........consequently I will become better at dealing with it in the future, at whatever level it happens to be. Because I think, even science teachers have the same misconceptions’”

(Millar & Hames, 2003)
Diagnostic questions

“These helped teachers to identify more precisely, and to focus teaching more strongly on, the key ideas that are at the heart of an understanding of these science topics, and which provide a basis for further learning.”

(Hames & Millar, 2003)
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<td>1957</td>
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<tr>
<td>C</td>
<td>1968</td>
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<td>D</td>
<td>1989</td>
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In which year did a male athlete first set a world record for the 100 m of less than 10 seconds?

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<th>I think this is wrong</th>
<th>I think this is right</th>
<th>I’m sure this is right</th>
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</thead>
<tbody>
<tr>
<td>A</td>
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In which year did a male athlete first set a world record for the 100 m of less than 10 seconds?

Share 100 points between the four answers.

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A useful strategy for students working together on multiple choice questions for revision.
I put some questions together to make a short test. Each student wrote their answers – so I was able to give them personal feedback.

I projected a question on to the whiteboard. A show of hands told me how many were choosing each answer option. It’s a good way to see the range of ideas in the class.

I gave each group the same question to discuss. They had to agree on the answer and everyone in the group had to be able to explain the group’s answer to the class.

Instead of telling students the right answer, I turned the question into a practical activity – so they could find out the right answer for themselves.
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