

# Helping teachers to use assessment for learning in inquiry-based science

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## Main points

- Why use assessment to help learning in inquiry-based science?
- What does it involve?
- What skills do teachers need?
- What is the relationship with assessment for other purposes?

# Inquiry-based learning

- Enables students to build scientific understanding
- Starts from the ideas and skills students have
- Helps students revise and reconstruct their ideas and skills to become more scientific
- Puts the students at the centre of the learning process

# The role of assessment for learning in inquiry-based science

Inquiry-based learning requires that teachers:

- Find out where students are in relation to the goals
- Decide what are appropriate next steps in learning
- Help students take these next steps
- Involve students in these decisions

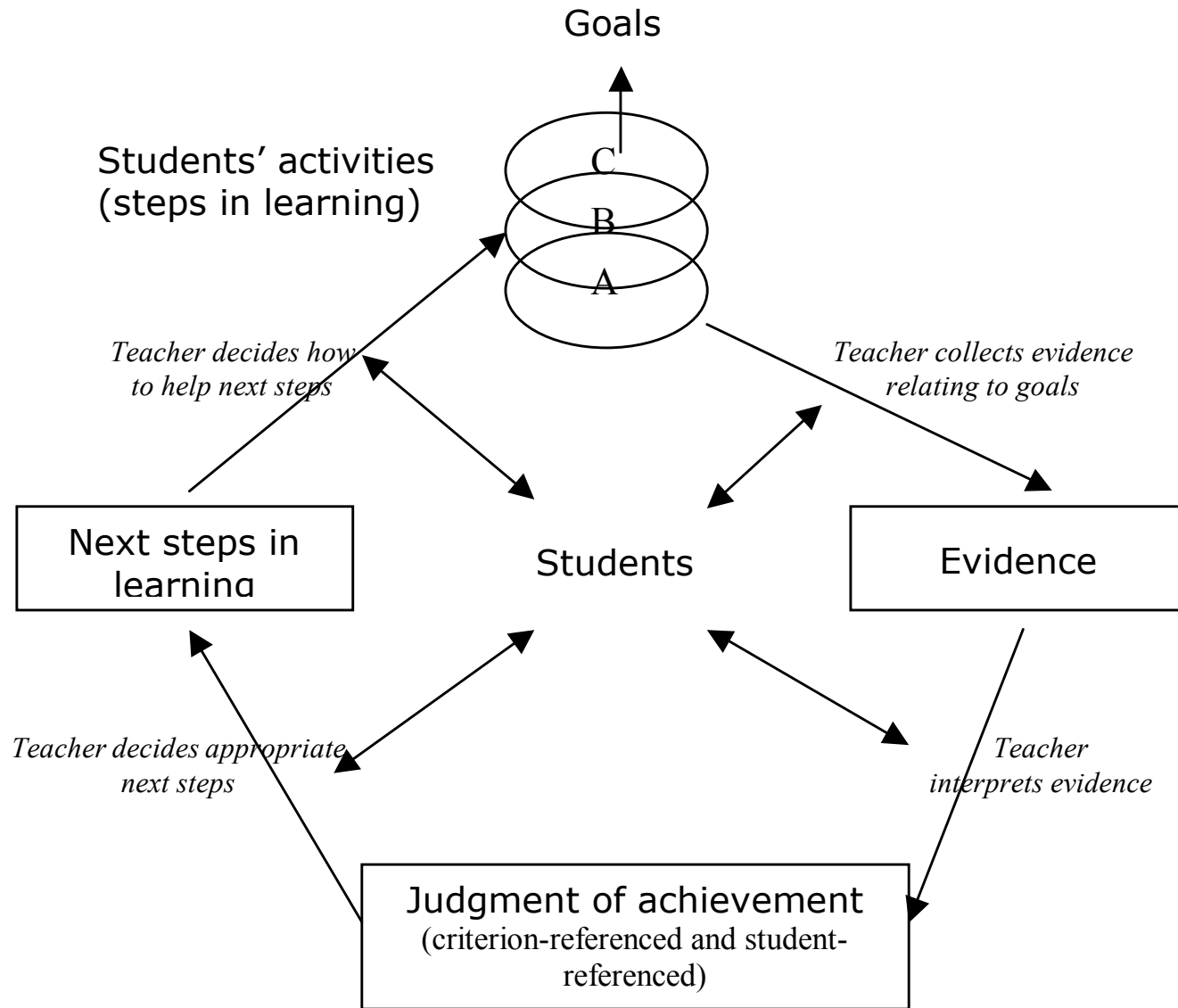
This is exactly what using assessment for learning means

# Definition of formative assessment or assessment for learning

The process of seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go and how best to get there.

(Assessment Reform Group, 2002)

# Formative assessment cycle



# Some key features of formative assessment

- Teachers' questioning
- Understanding of progression
- Providing feedback to students
- Involving students in self- and peer-assessment

# Key points about questioning

- Question wording
  - Open and person-centred ('what do you think is the reason for...?' rather than 'what is the reason for...?')
  - Specific to purpose of the question ('what do you think...?' or 'what would you do to find out...?')
- Wait time
  - Wait before rephrasing or giving answer



## A teacher's experience

*Increasing waiting time after asking questions proved difficult to start with - due to my habitual desire to 'add' something almost immediately after asking the original questions. The pause after asking the questions was sometimes 'painful'. It felt unnatural to have such a seemingly 'dead' period, but I persevered. Given more thinking time students seemed to realise that a more thoughtful answer was required. Now, after many months of changing my style of questioning I have noticed that most students will give an answer and an explanation (where necessary) without additional prompting.*

*(Quoted in Black et al , 2002, p 6)*

# Some key features of formative assessment

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# Things students do that indicate development of planning scientific investigations

- Suggest a useful approach to answering a question or testing a prediction by investigation, even if details are lacking or need further thought
- Make suggestions about what might happen when certain changes are made
- Identify the variable that has to be changed and the things which should be kept the same for a fair test
- Identify what to look for what or measure to obtain a result in an investigation
- Select and use equipment and measuring devices suited to the task in hand
- Succeed in planning a fair test using the support of a framework of questions or planning board
- Spontaneously structure a plan so that variables are identified and steps taken to make results as accurate as possible.

# Feedback useful for learning

- Non-judgmental feedback
  - gives information, focuses on the task, not the person;
  - encourages students to think about the work, not about how 'good' they are
  - proposes what to do next, gives ideas for how to do it.
- Feedback that is judgemental:
  - Focuses on how well the student has done instead of how well the work was done;
  - gives a judgement that encourages students to label themselves;
  - provides a grade or mark that students use to compare themselves with each other

# Involving students

- Communicate goals of the work
  - Make clear what the main purpose is
- Share criteria used in judging the quality of the work
  - Involve students in identifying what is 'good work'
  - Discuss examples of work, identifying aspects that are important
- Set up situations where students assess each others' work

## A teacher's experience

*As well as assessing and marking (through discussion and clear guidance) their own work they also assess and mark the work of others. This they do in a very mature and sensible way and this had proved to be a very worthwhile experiment. The students know that homework will be checked by themselves or another girl in the class at the start of the next lesson. This has lead to a well-established routine and only on extremely rare occasions have students failed to complete the work set. They take pride in clear and well-presented work that one of their peers may be asked to mark. Any disagreement about the answer is thoroughly and openly discussed until agreement is reached.*

(Teacher in a girls' secondary school).

# Can formative assessment be used with large classes?

- Changes in questioning, feedback, understanding progression etc do not depend on class size.
- Engagement of students in their learning does not require 'individualized instruction'.
- Group discussion of what they have to learn and how to go about it is the key to engagement and taking responsibility.
- Of course it is easier with small classes but small classes don't themselves improve learning.

# Assessment for other purposes

- Formative (assessment for learning)
- Summative (assessment of learning)
  - internal use (reporting to parents, etc),
  - external use (certification, selection, etc)
- Evaluative (assessment for accountability – can become 'high stakes )



# Impact of 'high stakes' tests on teaching methods and the curriculum

- Teachers teach to the test (and can do this very effectively!)
- This has the effect of constricting the curriculum
- When there are 'high stakes' a great deal of time is spent practising for tests
- Teachers' own assessments become more summative in style; formative assessment is driven out
- Teaching methods restricted; little inquiry.

# How high stakes testing fails

- Does not provide information about about the full range of educational goals, just those that can be easily and reliably tested
- Inhibits formative assessment
- Less reliable than assumed
- Has negative impact on motivation
- Encourages transmission modes of teaching

# Reconciling assessment for different purposes

- We need both formative assessment and summative assessment
- It is not a competition; they serve different purposes
- Problems arise when summative assessment, given 'high stakes', squeezes out formative assessment
- We need to conduct summative assessment in a way that avoids its potential negative effects

# Further information

Some documents relating to formative assessment, and links to other sources, can be obtained from the website:

[www.assessment-reform-group.org.uk](http://www.assessment-reform-group.org.uk)

Details of implementing formative assessment in science in

Harlen (2005) *Teaching, Learning and Assessing Science 5-12*. 4th revised edition (Sage)