Using peer assessment to deliver content in Science

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Aims of the project

- To improve pupil engagement with learning and reduce the extent of low-level disruption in lessons
- To develop pupils' understanding of national curriculum levels through the use of peer assessment and to enhance their ability to set targets
- To use peer-assessed assessment for learning activities as a means of delivering content

Dimensions of the study

The study was carried out at the Anglo European School, a state comprehensive and specialist language college. There are approximately 1300 pupils on roll, of whom roughly one third are drawn from the local catchment area: the remaining two-thirds have elected to come from outside catchment on account of the school's international ethos.

Summary of the main findings

The main findings included:

- pupil engagement in tasks improved, with fewer students failing to complete tasks;
- low-level disruption was reduced; and
- peer-assessed AfL activities were an effective resource for teaching content.

Background and context

The aims of the study were linked to a school-wide initiative to improve the use of AfL and peer assessment, and my own role within the school Science department, which was to lead on the development of AfL.

Over the preceding 18 months, the department had implemented a number of changes to improve the use of AfL, including the routine sharing of lesson objectives with the class as key questions, think time before questions and no-hands-up questioning. A number of peer-assessed AfL activities are routinely used in the department, especially at Key Stage 3. These are primarily drawn from the Essex Grid for Learning or from a commercially produced scheme of activities produced by Badger Publishing. However, I was aware that many Science teachers saw AfL in limited ways, for example:

- AfL activities were good for teaching investigative skills (SC1 or How Science Works skills), but that a lot of the science curriculum consisted of facts, concepts and terminology which simply have to be learnt, and for which AfL is inappropriate;
- AfL activities were good summary or revision activities for tacking on to the end of a unit of work as an additional or alternative summative assessment; and
- in a crowded curriculum, there is insufficient time to cover the work required whilst making regular use of AfL activities: teachers who expressed this view tended to view AfL activities as an 'additional activity'.

Consequently, I aimed to develop AfL activities as teaching processes for the delivery of the 'substantive content' of the Science curriculum, i.e. the facts, concepts and terminology referred to above. During previous peer assessment activities, pupils had shown confidence in assigning levels to each others' work, according to criteria based on National Curriculum level or GCSE level descriptors. They were also confident with giving reasons for ascribing grades to particular pieces of work. However, when asked to set each other targets for improvement they tended to set non-specific targets such as 'use more scientific terms' or 'explain more'. I therefore investigated means of improving the nature of the targets set in peer assessment activities.

Teaching processes and strategies

Initial activities were designed using activities from the alternative assessments on the Essex Grid for Learning and adopting the Badger Level-Assessed Activities as a model. Subsequent activities were developed using ideas drawn from Black *et al* (2003). General instructions to the class were provided via a Power Point presentation, in each case.

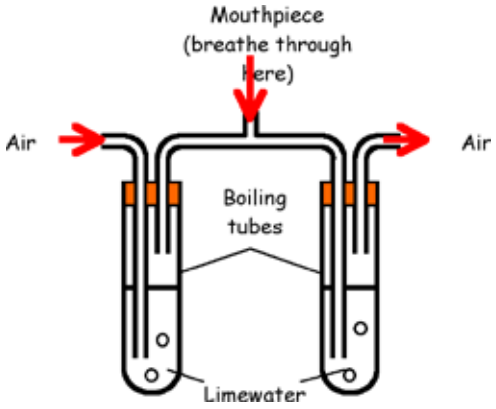
Example 1: Assessing answers to an open question using a prepared mark scheme – Variation and Natural Selection (Year 10): *What is variation and why is it important for natural selection?*

- After I shared objectives with the class, I directed pupils to read an extract from their textbook and answer three short, preliminary questions (Define the term species. To which species do you belong? Explain why horses and donkeys are different species.) The aim of these questions was to encourage students to focus on the text and to ensure that they had a couple of important, but relatively low-level, facts in their notes
- After reviewing the answers to the preliminary questions, pupils were directed to review the relevant grade descriptors which were pasted inside the back cover of their exercise books, and to reread the given section of their textbooks
- Pupils were given the open question (see title of example)
- Pupils 'snowballed' key points to include in their answers: individual students prepared a three-point list, then in pairs they produced a list of five points to include in their answers
- Students were given 15 minutes to write up their answers
- After swapping and reading each others' answers, pupils were provided with a marksheet containing a list of points which could be included in an answer and the corresponding GCSE level, e.g:
  - 'Living things differ from each other' (E-F)
  - 'Some causes of variation may be inherited' (D-C)
  - '*Mutations* can increase the amount of (genetic) variation in a population' (B-A*)

- Pupils then ticked any points on the sheet that were in the answer they were marking. They then used this to assign a grade and set a target for improvement
- For homework, pupils were directed to make improvements to their answers, in line with the targets set

Example 2: *Levelling pre-prepared statements (Year 8)*

Pupils were asked to explain their observations of using the *Huff 'n' Puff* apparatus (see diagram, below.)



A full explanation would require pupils to demonstrate an understanding of gas exchange in the lungs and respiration. The task included the following aspects:

- After sharing objectives with the class, they were directed to read through their previous notes and highlight any relevant keywords
- After a demonstration of the apparatus, students carried out the practical, making a note of their observations
- Pupils 'snowballed' (as above) points to include in an explanation of the Huff 'n' Puff apparatus, before being given 10 minutes to write up
- After swapping and reading each others' answers, pupils were provided with a set of general level descriptors and some unlevelled points which might be included in an answer. Examples included:
  - 'The liquid in one of the boiling tubes turned cloudy'
  - 'The limewater in the OUT boiling tube turned cloudy first'
  - 'The air breathed in and the air breathed out are different because oxygen is exchanged for carbon dioxide in the lungs'
- They were given ten minutes to level these statements
- After a class discussion about which levels applied to which statements, pupils were asked to compare the model statements with their partners' answers. Again students were asked to assign a grade and set a target for improvement

Example 3: Considering and improving exemplar answers – Competition and Food Webs (Year 10): *A new disease kills many of the insect-eating birds. How will this affect the rest of the organisms in the food web?*

- The start of the lesson followed the same form as in Example 1. However, after providing pupils with a question to consider, they were given an exemplar answer to grade:

'If a disease killed the insect-eating birds, there would be more aphids and spiders and shrews and fewer sparrowhawks and seed-eating birds.
The owl would have to eat more voles and stuff or die'.

- Following a discussion of what grade pupils would give the exemplar answer, pupils were asked to snowball three improvements which could be made to turn it into an A*. These were written on A4 sheets. Each pair was then asked to suggest one improvement, which was taped up on the board
- Pupils were then given 10 minutes to write an A* grade answer, after which they then swapped and read each others answers
- Pupils traffic-light graded each others' answers – green if they had included all the points for improvement previously discussed, amber if most of the points were included or red if there were serious omissions or mistakes. Targets were again set for improvement

For both classes, early during the teaching sequence, I marked one of the exercises after peer assessment and set targets for the individual pupils. The aim was to give pupils further guidance on how to write targets.

The findings

Content

Peer-assessed AfL activities were an effective resource for teaching content. It was possible to replace notes delivered as structured activities with pupil-generated notes produced in open-ended tasks, and still cover the same amount of content, in the same depth, in the allotted curriculum time.

Engagement

Pupils showed a high level of engagement with the tasks set. Having given pupils time to think about and discuss what should be included in their answers, when they were asked to write their answers up in full, the room generally fell silent. Pupils generally wrote more, and included more detail, than they have done when answering a set of questions from a double-page spread in their textbooks.

A couple of students from the Year 10 group, who had been identified as a cause for concern due to their general lack of effort across the school, wrote considerably more than they would otherwise do, whilst complaining about the amount of work they were doing!

A third student in the Year 10 group who generally showed a high level of engagement with and understanding of the work covered but who had dyspraxia, had previously produced very scant written work. Again, the AfL activities used increased the volume of, and level of detail in, his written work. This may be because, having thought through his answer in advance, he could then concentrate on the writing task.

Low-level disruption was reduced during these activities. This may be partly because less time was spent addressing them as a whole class. Also, the way the activities were structured meant that the lessons were effectively chunked, which may have made them more manageable for the pupils.

Target setting

Initial targets set as a result of activities following the model used in Example 1 tended to produce rather vague, non-specific targets. On one occasion, having set the making of improvements as a homework, one student failed to do so because the targets he set were so vague as to make it unclear what he needed to do.

During the course of the project, the targets set by pupils in peer assessment activities improved in terms of specificity. In part, this may be due to pupils becoming better practised at target setting as such activities were repeated. However, consideration of exemplar answers did give pupils the opportunity to discuss as a group what constitutes a good target for improvement, whilst at the same time developing their understanding of what is required for each grade or level.

Attainment

Attainment on the unit covered (Respiration and Digestion) for the Year 8 class was compared with that for another top set Year 8 class which I had taught two years previously. Mean score, distribution of levels and distribution of levels relative to pupil targets were compared. In each case, there was no statistically significant difference. However, because of the period of time involved and the possibility of other hidden variables this evidence remains tentative.

This might be considered a disappointing result. Nevertheless, it does possibly suggest that peer-assessed AfL activities can be used to deliver content to pupils effectively, improving engagement and understanding of targets but without requiring additional curriculum time.

With regard to the Year 8 group involved in the current project, in subsequent lessons, pupils appeared more likely than usual to refer back to material covered in the Respiration and Digestion, suggesting that they might have better long-term retention of the material covered. Structuring activities so that pupils had the opportunity to consider their responses in advance improved the quality of written work.

Research methods

Data collection was aimed at assessing the level of pupils' engagement involved, through:

- teacher observation of pupils during the lessons, and
- analysis of the work produced.

Attainment for the Year 8 class was assessed using the department's standard test, which immediately followed the completion of the unit. This consisted of questions from past National Curriculum tests. Mean test scores were compared using a *t*-test, whilst distribution of levels was compared using a χ^2-test.

Conclusions

Considering exemplar answers in order to set questions may improve the quality of targets set in peer assessment activities. At the same time, it is a useful resource for assessing pupils' understanding of what is required for different grades or levels.

Reducing the amount of time that pupils are required to listen to teacher-exposition, and giving students the time and opportunity to discuss their work can increase pupils' engagement with the work and reduce low-level disruption.

As the project continued, I found myself using such activities more frequently with other classes. The reduced time spent on whole-class teaching and the reduced low-level disruption made the lessons more pleasurable to deliver. Whilst lessons initially required some extra preparation time, time was saved in marking exercise books, so that the changes in teaching style did not increase workload.

References

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National Teacher Research Panel
engaging teacher expertise