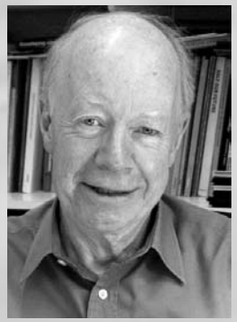
Useful assessment for design & technology: formative assessment, learning & teaching



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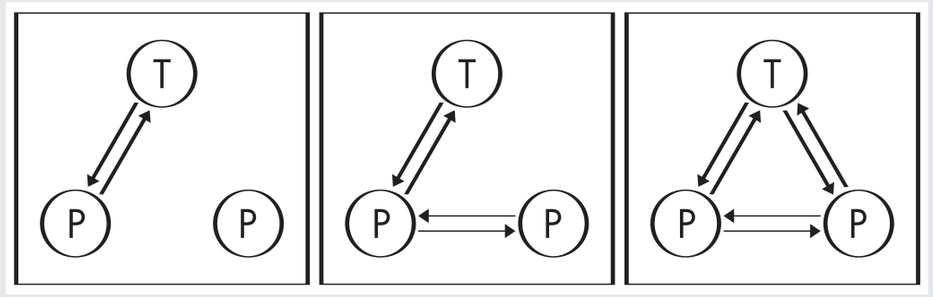
Background history

In 1998 Paul Black and Dylan Wiliam produced a small booklet entitled "**Inside the Black Box**" (Black and Wiliam, 1998a). It is now widely known, having sold over 50,000 copies, and the ideas have had a wide influence. One reason for this impact was that the authors based their arguments on a thorough review of research which revealed that there was a great deal of rigorous evidence to indicate that formative assessment could raise pupils' attainments (Black and Wiliam, 1998b).

However, whilst their booklet made many practical recommendations, Black and Wiliam knew that they had to work with a group of local teachers to find out whether, and how, these ideas would work in practice in the normal life of today's schools. So with colleagues at King's College - Chris Harrison, Bethan Marshall, and Clare Lee - they set up a two-year project with a group of forty teachers from six secondary comprehensive schools to explore the practical applications of formative assessment. Many practical ideas were developed in this work; at the same time almost all of the teachers were positive about the project's effects for them, and there were significant gains in test performance for the classes involved. The King's team summarised their findings in a second short booklet "**Working inside the black box**" published in 2002 and more fully in a book written for teachers and schools "**Assesssment for Learning: putting it into practice**" published in 2003.

Since then, formative assessment has become a central feature of several national and regional initiatives. One finding of the King's team, who have now worked with teachers in all subject areas, is that formative assessment has both generic features, which apply to learning across all stages and all school subjects, and also features which are specific - to primary teachers and to individual secondary subjects.

In this chapter we first discuss the meaning and implications of formative assessment. We then examine its application to teaching and learning in design & technology. After these introductory sections, we discuss in detail various classroom practices, namely dialogue in learning, feedback on the range of types of work that pupils might produce, the development of peer- and self-assessment, and the formative use of summative tests; these discussions will be illustrated by examples. The last main section presents a brief discussion to relate the ideas to the summative assessment practices and pressures within which teachers have to work. A closing summary reviews the principles, of learning, motivation, and collaboration which should underlie and guide formative practices.



01 Effective learning interaction.
T= teacher.
P= pupil.

02 The four specialisms in design & technology.

Materials technology	Electronics & communication technology
Textile technology	Food technology

The meaning and implications of formative assessment

As the ideas have become more widely known, the terms *'formative assessment'* and *'assessment for learning'* have been more and more widely used, often with different and diverse meanings. It is not surprising that confusions and misunderstandings have arisen. A key point here is that effective learning demands interaction, started by the teacher to evoke the pupil's ideas, leading to feedback, from pupil to teacher and from pupil to pupil and then back again to the pupil, along lines and at levels determined, not by some pre-ordained plan, but by the needs revealed through the pupil's response. The teacher has to use this feedback to modify the teaching plan, so that new vocabulary and structures can be introduced through challenging activities that extend pupils' learning. This dynamic interaction can be illustrated as shown in the diagram above.

AfL - What exactly is it?
Here are three descriptions of Assessment for Learning:
- Are they all saying the same thing? or
- Do they usefully complement one another? or
- Do they contradict one another?

'Assessment for learning is any assessment for which the first priority in its design and practice is to serve the purpose of promoting pupils' learning. It thus differs from assessment of learning designed primarily to serve the purposes of accountability, or of ranking, or of certifying competence' (Black and Wiliam, 1998a).

'Assessment for Learning (AfL) is 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).

'An assessment activity can help learning if it provides information to be used as feedback, by teachers, and by their pupils in assessing themselves and each other, to modify the teaching and learning activities in which they are engaged. Such assessment becomes "formative assessment" when the evidence is actually used to adapt the teaching work to meet learning needs' (Black et al., 2003).

These processes implement two principles of learning. The first is that one must start from where the learner is, rather than to present strange new ideas to overlay the old and so cause confusion. The second principle is that learning cannot be done *for* learners, it has to be done *by* them, albeit with the teacher supporting any new input.

The context of design & technology teaching

The distinctive contribution that design & technology makes to the curriculum is clearly stated in National Curriculum (NC) documentation (Department for Education and Employment/ Qualifications and Curriculum Authority, 1999) and the revisions to be introduced in September 2008 (Qualifications and Curriculum Authority, 2007).

In design & technology the level descriptors show progression in each of the three aspects of
- generating, developing, planning and communicating ideas,
- working with tools, equipment, materials and components to make quality products,
- evaluating processes and products,

whilst specifying knowledge and understanding that will support attainment in each of these three aspects. Curriculum 2000 restated the need for a balance of teaching and learning activities in which capability was achieved through activities which developed designing and making skills, at the same time as knowledge and understanding. Most recently, the Qualifications and Curriculum Authority (2007) has restated this position: *'The NC specifies the activities through which design & technology should be taught: product analysis, focussed practical tasks and design and make activities. These differing activities all provide teachers with ideal opportunities to combine a range of assessment strategies to ensure that assessment is integral to their teaching and the pupils' learning'* (Ofsted, 2003).

There has been a great deal of focus on the holistic nature of capability in design & technology. The Design and Technology Association (2006) suggests that this may *'…lead to an over-emphasis on summative assessment and insufficient attention being given to formative assessment'*. They go on to explain that one of the reasons for this is that attainment in design & technology tends to be expressed primarily in terms of process. This use of process as a vehicle for assessment is understandable when one considers the nature of the activity being assessed and the unwieldy breadth of skills, knowledge and understanding that would have

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03

03 Interaction between teacher and pupils.

to be specified to cover the four specialisms (see previous table) encompassed in the design & technology curriculum.

We believe that this concentration on a holistic and summative view of assessment is neither necessary nor appropriate. There are many ways that process can be effectively assessed formatively, thereby providing learners with an understanding of how to improve their ongoing process whilst giving teachers insight into specific knowledge, skills and understanding that learners require to support that process. It is also often the case that summative assessment provides (formative) feedback that would have been a more appropriate learning tool for the pupil if it had been provided earlier. For example rather than at the end of a design project, formative feedback during the project regarding, for instance, a lack of three-dimensional modelling at the development of the chosen idea stage could lead to a better understanding by the pupil of its value in decision-making. It may also highlight a lack of knowledge about appropriate, quick modelling materials.

Questioning and dialogue in classrooms

The essential two-way interaction between teachers and pupils can be achieved in several ways, but the crucial ingredients are:

- questions to encourage open discussion;
- challenging activities;
- strategies to support participation by all learners.

A good example of such interaction, in the context of design & technology, can be found in "Good Assessment Practice" (Ofsted, 2003):

'Year 9 pupils discussed and justified their design ideas in small groups. The teacher listened to the discussion and invited individual pupils to explain to the class how they were solving specific aspects of the design task. He quizzed them about their decisions on the materials and processes that they were using. Pupils were encouraged to try ideas and research possibilities, with no guarantee of success and links between pupils with related ideas were fostered. After the lesson the teacher jotted short notes on the record cards of some pupils, identifying those that had made significant progress or had encountered problems in the lesson' (Ofsted, 2003:1).

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If questions are to serve a formative purpose in the design & technology classroom, it is necessary to focus attention on how well they serve this purpose - which factual questions usually fail to do. Why do you think this is?

Collaboration between teachers to exchange ideas and experiences about good questions can be very valuable. It could be part of professional development to reconsider questioning techniques and develop skilful 'laddering' and spiralling from simple to complex questions. Questions could be designed that would allow for factual responses, for imaginative and speculative ones and for developing pupils' competence in asking meaningful questions themselves.

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Promoting discussion

Here are some examples of types of questions which you might ask to help encourage further discussion in class. Can you think of others?

- What can we add to Yagnesh's answer?
- Do you agree with Suzie's suggestion?
- Can someone improve on Jack's solution?
- Dean said…and Monica thought…How can we bring these ideas together?
- Do you think Sarah's idea will work or not? And why do you think so?

Any of these might work, but sometimes they might not

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- how might you follow up if they failed to produce or sustain further participation?

However, the central role of teachers in a formative approach is to promote thinking by encouraging pupils to express and then reflect on their ideas, leading them through such interactions to develop and change their thinking. Well thought-out questions can help both start and keep alive such 'thinking talk'. For example, in a scenario concerning designing a lantern for a religious festival, the teacher could challenge the pupils with such questions as *'Where will your lantern be used?'* and *'What safety aspects do you need to consider?'* and *'If we are to use a tea-light candle, how will you hold it safely in place inside the lantern?'*

Challenging activities

Questions play an important role in opening up and sustaining thoughtful discussion, but they can be most fruitful if they are 'built-in' to a challenging activity, i.e. an activity which challenges pupils to both think and perform. The test is whether or not an activity helps the teacher to find out what pupils understand and/or can do, rather than just what they know and can recite from memory. In design & technology this can be achieved in all design and make tasks, for example when pupils are asked to design and make a pop-up calendar with constraints that it must pack flat and fit into a certain envelope size.

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04 Pupils looking for a suitable place to site a litter bin in a playground.

Low-order cognitive questions	
Recall	What is the name of this type of saw?
Comprehension	Why do we use that type of saw for this type of work?
Application	If we are going to cut this complicated shape in this piece of hardboard, which saw should we use?
High-order cognitive questions	
Analysis	To make this pull-along toy I need to cut out the different parts. What would be the best sequence to do that so that I can make sure they all fit together?
Synthesis	What will happen to the head of the pull-along duck if we use this cam and this rod together?
Evaluation	You've heard the different ideas from the different groups. Explain to me which of the suggested combinations of cams and rods you think will be most robust to work together to control the head and wings.

05 Example of low-order and high-order questioning.

Using the example of designing and making a pop-up calendar can you make a list of
- What pupils should understand,
- What pupils should be able to do,

in order to tackle the process successfully and produce a creative outcome for their pop-up calendars?

Challenging activities can take many forms and can include both individual and group work, with the aim of the latter being to encourage pupils to co-operate in planning, to share responsibility, to learn to allocate tasks and to foster teamwork. In design & technology using, for example, the context of sustainability when designing a litter bin for use in school, the teacher could start by asking the pupils to discuss with one another where in the school a litter bin would be useful. The next round of questions from the teacher could ask which recycled materials could be used, leading to the pupils devising their own questions concerning how they could cut, join or finish the materials they propose. At each stage, pairs or groups could be asked to present their ideas and compare one another's in a whole class discussion before going ahead to the next stage.

Strategies to support participation by all learners

Through formative questioning, the teacher hopes to collect rich evidence of the pupils' understanding. It's the opposite of assessment of learning, where we try only to find out what pupils already know, for the aim is not simply to find out what they know but also what they don't know and possibly, more importantly, what they partly know. Teaching is about helping youngsters realise this and then guiding them to upgrade their part-knowledge to a fuller understanding. To achieve these aims any activity and its associated questioning must have the potential to stretch and deepen the thinking of the pupils.

Frank Banks writing in 2002 talks about closed and open questioning and the cognitive level required of pupils to answer them. The above table is based on his idea of illustrating the differences using, as an example, a project on making a mechanical toy. Try to use this to generate a set of lower-order and higher-order questions, which would be relevant for a project appropriate to your own design & technology specialism.

Demanding questions require time for the learner to work out an answer, so the teacher ought to wait for some time before expecting a response. Mary Budd Rowe writing in the "Journal of Research in Science Teaching" in 1974 reported that the wait time in primary science classes was very low, less than 1 second. In the secondary classrooms Paul Black and his colleagues reported in 2003 that teachers could, with practice, increase their wait time to around 3-5 seconds and that this had dramatic effects on the involvement of pupils in classroom discussion. Their research showed that:
- longer answers were given than previously;
- more pupils were electing to answer;
- fewer pupils refused to answer;
- pupils commented on or added to the answers of other pupils;
- more alternative explanations or examples were offered.

Even when wait time is increased, some learners are reluctant to offer answers. To overcome this some teachers adopt a 'no hands up' strategy, taking the view that if sufficient wait time is given, everyone should be expected to answer, so they select individuals to answer. Such techniques can remedy the unsatisfactory situation of the quick thinkers with hands shooting up either dominating or feeling unacknowledged because they are ignored.

However, pupils often are reluctant to commit to an answer because they feel they may reveal their inadequacies. The teacher's role here is to act as a facilitator, a provider of scaffolding when necessary whilst encouraging pupils both to try to answer and to listen carefully to the answers from their peers; after all, wrong or imperfect answers can be essential guides to the ways in which peer interaction or teacher intervention might best be used.

Planning scaffolding that may be required before a question and answer session is important. This scaffolding will be different for pupils of different ages and/or ability. What scaffolding do you think is needed for a question and answer session regarding the mechanical advantage achieved by various levers
- with less able pupils meeting this concept for the first time?
- with a top set of key stage 4 pupils?

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06

06 Classroom dialogue.

Peer discussion plays an essential part in creating such an environment. If pupils can first discuss their tentative responses to a question within a small group, they can explore, articulate and check ideas before they reveal their group's combined effort to the whole class.

Taking a design task appropriate to your specialism, identify at least four separate instances where peer discussion could be advantageous to the pupils' learning.

Underlying these ideas about challenging activities and questions is the principle that we all learn as much from discussion as from reading and writing. Indeed, it is partly because they put this principle into practice that formative methods improve pupils' learning. So the underlying aim is to promote dialogue in the classroom as a key component of effective learning.

In his book "Towards Dialogic Teaching" (2006) Robin Alexander stresses the poverty of much classroom dialogue:
'Clearly, if classroom talk is to make a meaningful contribution to children's learning and understanding, it must move beyond the acting out of such cognitively restricting rituals'.
and explains why improvement is essential:
'Children, we now know, need to talk, and to experience a rich diet of spoken language, in order to think and to learn'.
(Robin Alexander, 2006)

He classifies classroom dialogue under the following five headings:
1. Rote;
2. Recitation;
3. Instruction/exposition;
4. Discussion;
5. Dialogue.

Try to describe the difference between them.
Which of them are you, or your colleagues, using most frequently?
Does it matter?

Feedback on pupils' work, as writing or as a designed or constructed product

Research by Ruth Butler (1988) and Carol Dweck (2000) into the motivation and self-esteem of learners has explored different kinds of feedback specifically on written work although the connection between their conclusions and design & technology project work is easy to see. One kind of feedback gives only marks or grades. This is a judgement on the work and helps to develop 'ego-involvement' in pupils; its effects on both motivation and on subsequent test attainment are negative. It discourages low attainers, but also makes high attainers reluctant to tackle tasks if they cannot be sure of success, for failure would be seen as bad news rather than as an opportunity to learn. The second kind gives only comments on what needs to be done to improve. Ruth Butler found that comment-only develops what she called *'task-involvement'*. She found that its effects are positive for it can encourage all pupils, whatever their past achievements, that they can do better, and that they can learn from their mistakes. Furthermore it also produces better test results. If feedback provides both marks and comments, the negative effects follow because pupils tend to ignore the comments and attend only to the marks. Thus, marks give no formative feedback and emphasise competition rather than personal improvement, whereas comments can be formative and so ensure that they contribute to learning.

Effective Comments
Questions are useful ways of framing comments. Compare these two comments on a pupil's work when designing a poster about recycling:

'A nice sketch but you need to add more detail.'

'Your poster catches my eye but I am wondering why I should really want to recycle my rubbish! Can you persuade me? How about some imperatives? Some statistics that might encourage me to take action! What can I do? What should I do?'

If you were the pupil which would you find more useful?
Can you explain why?
We think the second comment initiates thinking immediately, enabling the learner to discuss their thoughts either with the teacher or a peer, whilst the questioning nature also encourages the pupil to initiate improvement. The first comment simply describes the deficit in the piece. Do you agree?

Targets can form part of helpful comments, and the more focussed the target is, the better. General statements, as in the first example, should be avoided. Points that need to be considered next time may be useful but comments that prompt and guide immediate action are better. It may help if the feedback comment relates to success criteria or to a description of quality that might be shared with or devised by the pupils, so that they can learn to consider the criteria as their work progresses. For example, if pupils are asked to create an attention-catching poster about conservation

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07 Using post-its on design sheets can cut down on writing time for teachers and also overcome the problem of teachers not wishing to write or draw on pupils work.

and recycling, then what is required is:
- facts and figures to 'persuade', using strong qualifiers;
- suggestions about what individuals can/should do using, e.g. modal auxiliaries;
- visual interest.

The second example relates to these criteria in an effective way.

Creating the improving classroom

The opportunity to respond to comments is essential, for learners need to see that the teacher really wants the work improved and that improvement is being monitored.

This might mean providing opportunity in lesson time for learners to read comments on their work and to discuss with their teacher or with peers the necessary improvements.

One simple way to achieve these aims is to record comments on a sheet of paper each time a piece of work is comment-marked: the learner slips this between the appropriate pages of his/her folio/workbook. The sheet then contains an accumulation of comments and allows both learner and teacher to recognise where improvements have been made or where specific problems keep arising. An example of such comments are the following:
'On your drawing of your chair design you need to specify the angle of the back cushion so that it supports a person comfortably when they are sitting using a laptop computer.'

The teacher (T) had written the above comment on the sheet in a design folio; the pupil (P) responded with the following comment which pinpointed the learning difficulty that she was having:
'I do not know what angle that should be. Where can I find out?'

Or it could have been:
T: *'You could make your box using the vacuum-former rather than gluing lots of pieces of plastic together.'*
P: *'I have never used the vacuum-former so I do not know what forms I can achieve.'*

?

If learners could be this precise and open about their uncertainties, then teaching would be much simpler. What do you think? We would suggest that this level of recognition by the learner initiates the desire to sort out uncertainty; in this way, feedback drives formative action.

The use of post-its on design sheets can cut down on writing time for teachers if thereby they no longer have to explain which design sheet they are referring to on their feedback sheet before they can start to add their comment. It can also overcome the problem of teachers not wishing to write or draw on pupils' work. Or pupils not wishing to have the presentation of their work spoiled! Using a permanent pen on the plastic wallet-type portfolios that are popular for holding design sheets can also achieve the same objective, allowing corrections or suggestions for improvements to be applied at the relevant point.

Another useful formative assessment tool to assist pupils to develop drawing skills is to use tracing paper on top of design sheets to illustrate corrections to drawings. This enables pupils to improve both their understanding of perspective drawing and also see how to improve the communication of their ideas without the teacher having made marks on their actual work. The speed of giving feedback in this way is also a plus point for the teacher in that 'a picture is often worth a thousand words'.

It is not necessary for teachers to mark every page of a design folio, theory workbook or practical task - and there can be advantage in having some work checked by peer assessment. This latter method can also begin to move the responsibility for assessment onto the shoulders of the learners.

Self- and peer-assessment

Developing effective self-assessment is an essential part of managing one's own learning. It requires the pupil to have a clear picture of the learning targets, understanding of what would count as good quality work that meets them, an idea of where one stands in relation to those targets, and a means to achieve them. Pupils often lack this clear picture, are not aware of the rationale behind specific tasks, and cannot find their way to attain their individual targets.

?

Taking a suitable design and make task appropriate to your specialism:

1. Design a formative assessment sheet that you could give pupils at the start of the project. This must provide:
   - a list of the learning targets for the project;
   - a method of indicating where pupils stand in relation to achieving each learning target.
2. What teaching aids could you use to provide them with an understanding of what counts as good

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08 09

08 Traffic light icons in use.

09 Pupils discussing folio work, with reference to assessment sheet.

quality work?

3. What skills, knowledge and understanding would you need to teach pupils in order that they could meet the learning targets you have specified?

The overall aim is to achieve meta-cognition, which is the power to oversee and steer one's own learning so that one can become a more committed, responsible and effective learner. Work with teachers has shown that peer-assessment helps pupils develop their self-assessment skills. Pupils can be taught to recognise both quality and inadequacies in other pupils' work even if their own level of competence is different from the level of the work being scrutinised. Discussion focussed on criteria for quality can develop pupils' awareness of successes and problems in pieces of work thereby enabling them to assess their own work with greater clarity and to see how small changes, or different ways of approaching parts of the work, can easily raise its quality.

Schemes of work might well be reassessed by teachers to ensure that there are sufficient numbers of peer-assessments reasonably spaced throughout each project. For example peer-assessment could be carried out at the end of the main research collection stage, when early 3D modelling has been produced, during the detailing of the chosen idea and again at the end of the process. This makes the marking load more manageable whilst also giving pupils time for work on improvement before the next detailed feedback is due. Peer-assessment that requires several paragraphs, rather than one word or a single sentence, can provide a richer source of evidence to help the teacher appraise the learning of individual pupils and so provide individually useful advice.

A primary teacher gave her pupils a firm structure for assessing one another's work. She called it "**Two Stars and a Wish**". The 'two stars' are two pieces of positive feedback, identifying successful outcomes. The 'wish' identifies an aspect that could be improved in some way. The following is an example of star and wish peer feedback:

* *'You have identified all the ingredients that will be used in your chosen ready meal.'*
* *'You have explained what else you would serve with it.'*

Wish - *'You should include the nutritional values that Mr Smith asked us to talk about.'*

? This form of peer-assessment encourages pupils to give usefully targeted peer-assessment. Pupils can usually identify aspects that need improving; however by also commenting upon successes they will develop confidence to use that understanding on future occasions. Can you think of specific instances where you might use this method of assessment?

With assessment applied in such a way, pupils gradually acquire the habits and skills of collaborative learning from a very early age, and, through peer-assessment, develop the objectivity required for self-assessment.

The use of traffic light icons can also help develop self-assessment skills. Pupils could be asked to label their theory work for example in electronics, or food technology, green, amber or red according to whether they think they have good, partial or little understanding of the topic or concept. If many pupils use red, then the teacher can see that this work has to be revisited. Conversely, a plethora of greens indicates that the class is ready to move on. A mixture of reds, greens and ambers calls for different action; teachers could pair up green and amber pupils to help one another, leaving them free to deal with the problems of the red pupils.

Where pupils do not understand the meaning of a target, or have little idea of what a piece of work that will meet the target criteria would look like, it might help if they discussed existing examples. For instance, at the start of a project to design a teenager's disco 'handbag', teachers could find it beneficial to use existing solutions or bought examples to clarify the often difficult-to-understand abstract criteria, that will be used to judge the pupils' chosen solution.

? Taking the above example of a disco handbag or a project related to your own design & technology specialism can you make a list of the criteria you would use? Can you now highlight the more abstract criteria you believe will be difficult for pupils to understand and think of ways you could explain each of these to your pupils?

A combination of self- and peer-assessment during design activity can be very beneficial to the learner as well as providing the teacher with a better understanding of the learning requirements of individuals within a cohort. In this example the whole class assesses their own partially completed design activity against a set of appropriate criteria devised by the teacher in collaboration with the class.

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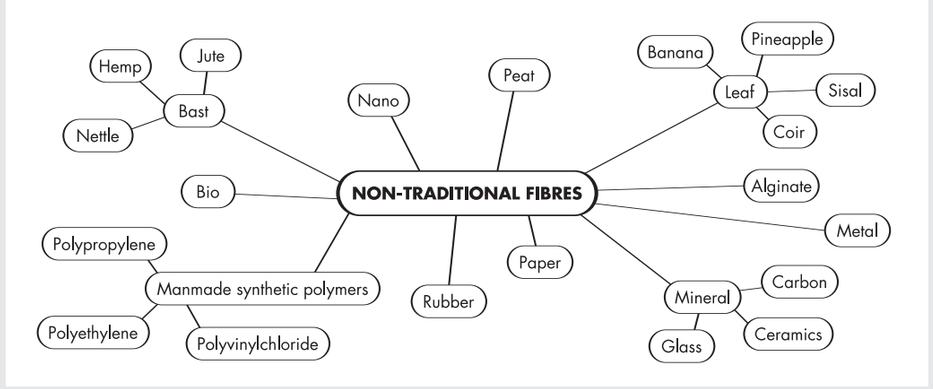

10 Mind map of non-traditional fibres in textiles.

11 Teachers moderating pupils' projects.

The assessment is carried out by ticking whether: *'very good progress'*, *'some progress'*, *'a little progress'* or *'no progress'* has been made against each criterion. The teacher then gets the class to work in pairs and to exchange their self-assessment sheets. They then take turns to choose an instance where one of the pair has said he/she has made *'very good progress'* and discuss whether there is explicit evidence of that *'very good progress'* to be found in the folio. They then swap over and repeat the activity with the other folio. The next stage is for them to look at where they have each made little or no progress and discuss why this may be. Then in a class session these problem areas can be discussed with the teacher who may be able to provide a quick solution or may become aware of a future learning need of a number of pupils or even a whole class. If this assessment method is used on several occasions throughout the project using the same self-assessment sheet it can build up to provide both pupil and teacher with a clear picture of where progress is being made and where stumbling blocks are occurring.

Formative use of summative tests

Preparation for a test can be a formative opportunity. Classes can use traffic light icons as a guide to their revision, applying them to test items or to examination syllabuses and then working in groups on common problem areas. Through these activities, pupils are able to plan their revision for high stake tests more effectively. Mind mapping is also a useful technique, for instance, during textile technology lessons pupils can map what they know about smart materials, then add to this as they increase their knowledge of the topic, so giving them a list of revision topics in a diagrammatical form to use during revision.

Another useful approach is to analyse test responses to see which questions are causing the main problems and then return the scripts to pupils, asking them to mark one another's answers to these questions, inventing the mark schemes themselves. This makes pupils think through what counts as a good answer. Teachers then use the time after marking to revisit problematic questions and to give pupils further examples to try. For test questions where only a few have answered incorrectly, pupils can ask successful peers to help them.

In the Black and Wiliam research (2003), one teacher decided to give his class the end-of-topic test in the first lesson of the topic so that results could inform him of what the class did or did not know, by pupils using traffic light icons to indicate their familiarity with the skills or the understanding required. The teacher could then plan to concentrate on the areas of unfamiliarity or difficulty.

Summative assessment

Given the emphasis of this chapter on the formative, only a few comments will be offered about summative assessments. Such assessments serve a different purpose from formative; nevertheless the same information can often be used for both, provided that it is interpreted appropriately, so that, for example, a modest design might both be recorded as such, whilst it may also be an occasion for feedback advice to guide future improvement. Often it may be fair to record a summative assessment after a pupil has had opportunity to improve in the light of feedback.

Summative assessments made within school and for internal purposes can have important effects on a pupil's progress, so it is essential to ensure the quality of the judgements made.

Ensuring quality in teachers' summative assessments

- Select tasks on which pupils can show their full potential.
- Have enough tasks to cover all criteria.
- Check and confirm agreement on the criteria being applied.
- Two or more teachers to mark samples independently.
- No marks on scripts to ensure independence.
- Compare and discuss results to secure consensus.
- Resolving differences can build shared understanding.

Short formal tests have very limited reliability; for a typical written paper used for Key Stage or GCSE testing the probability, even with question papers that are carefully set and marked, that any one pupil will be wrongly graded is about 30% (Black and Wiliam, 2006) - so exclusive reliance on such results is most unwise. The error arises because the sample of the pupil's attainments is too small in relation to their variability. Thus a variety of design & technology work collected over time, which might include results from tests and other assessments made en route, can give a more reliable result. The exchange and discussion between teachers of samples of pupils' work is essential to ensure equality of standards and as protection against bias (which can often be unconscious).

Conclusions

Principles of learning

At several points in this chapter we have emphasised that the practices described are based on well-established principles of learning. These are:

- Start from the learner's existing understanding;
- Encourage active involvement of the learner;
- Develop the learner's overview in terms of the aims and criteria of quality learning;
- Involve the learner in discussion to promote learning through social interaction.

In addition, it is essential to encourage self-esteem and motivation through feedback

which is focussed on improvement and not on judgement and competition.

Learning together: learning from others

Our experience shows that teachers taking on the development of formative assessment need to work in a team for mutual support in sharing ideas and resources. That team must have a plan that has support from the department and school, since some innovations may be, or may be seen to be, contrary to some aspects of departmental or school policy.

Strategy for change

It is not easy to put AfL ideas into practice. Teachers need mutual support and a commitment from their leaders to help sustain the process of change. Here are some ideas that might form a framework for making a departmental plan. Try to think of further headings or details that ought to be included in any plan.

Audit
To what extent are the four formative practices already well established?

Strategy
Involve all staff from the start, or should a small group take the lead?

Action
Try all the ideas together, or one at a time?

Support
How can the innovators be helped, e.g. given extra time to plan and reflect?

Reflection and evaluation
How could progress be monitored?
And experience shared with others?

See Black et al. 2003, chapter 7.

Our experience has shown us that most teachers have found this work very rewarding, but also challenging when adopting changes to the way they work with pupils and to the way that pupils take responsibility for their own learning. These do fit well within the current culture in design & technology where learners are required to exhibit independence, reflection, creativity and criticality in their work in order to achieve capability. However, assessment for learning often seems risky. Indeed, what is involved is best seen as a voyage of discovery, a journey into new territories of teaching and learning for pupils and teachers alike.

Further reading

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