

Information sheet

From 'Passive' to 'Active' Learning – an example from mathematics

“ In many of the mathematics lessons where learning is unsatisfactory one or more of the following characteristics are evident:

- **students are given low-level tasks which are mechanistic and can be completed by imitating a routine or procedure without any depth of thought**
- **students are mainly receivers of information, and have little opportunity more direct participation in the lesson and the exploration of different approaches**
- **insufficient time is allowed for students to develop their understanding of the mathematical concepts being taught**
- **students have too little time to explain their reasoning and consider the merits of alternative approaches”**

(Ofsted, 'Mathematics in secondary schools', in Ofsted Subject Reports, London, 2002, HMSO.)

1.1 From 'passive' to 'active' learning

Teaching does not always result in learning. This may seem self-evident but, as inspection reports tell us, most teachers of mathematics continue to use 'chalk and talk', while learners continue to adopt passive learning strategies. In our own survey * of about 750 learners of mathematics from over 30 FE and sixth-form colleges, learners described their most frequent behaviours in the following ways:

“I listen while the teacher explains.”

“I copy down the method from the board or textbook.”

“I only do questions I am told to do.”

“I work on my own.”

“I try to follow all the steps of a lesson.”

“I do easy problems first to increase my confidence.”

“I copy out questions before doing them.”

“I practise the same method repeatedly on many questions.”

For these learners, mathematics is something that is 'done to them', rather than being a creative, stimulating subject to explore. It has become a collection of isolated procedures and techniques to learn by rote, rather than an interconnected network of interesting and powerful ideas to actively explore, discuss, debate and gradually come to understand.

1.2 From 'transmission' to 'challenging' teaching

Traditional teaching methods are sometimes called 'transmission' approaches; methods are explained to learners one step at a time. Teachers only question learners in order to lead them in a particular direction to check they are following the taught procedure. Learners are expected to achieve fluency through practising these methods on lists of graded exercises.

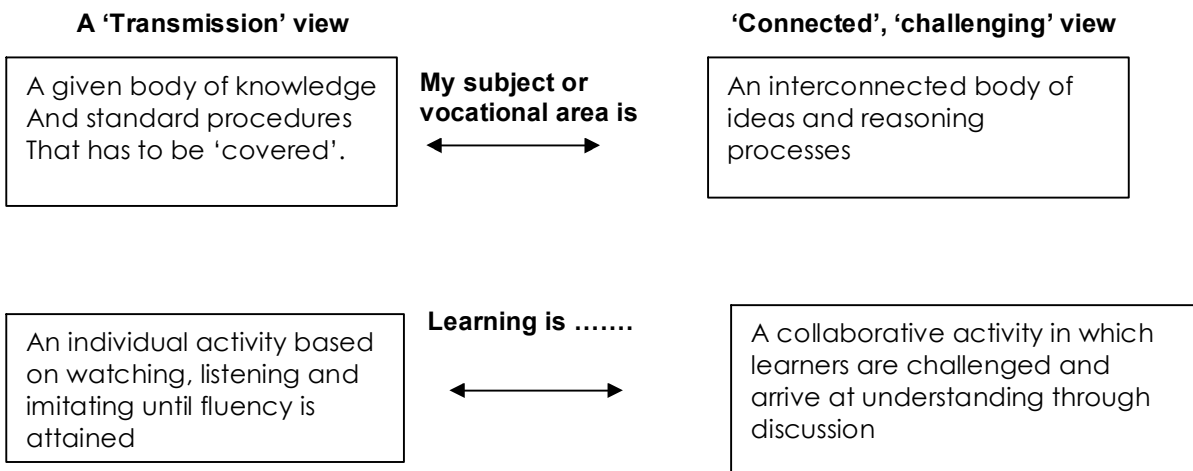
Transmission approaches can appear superficially effective when short-term recall is required, but they are less effective for longer-term learning, because they:

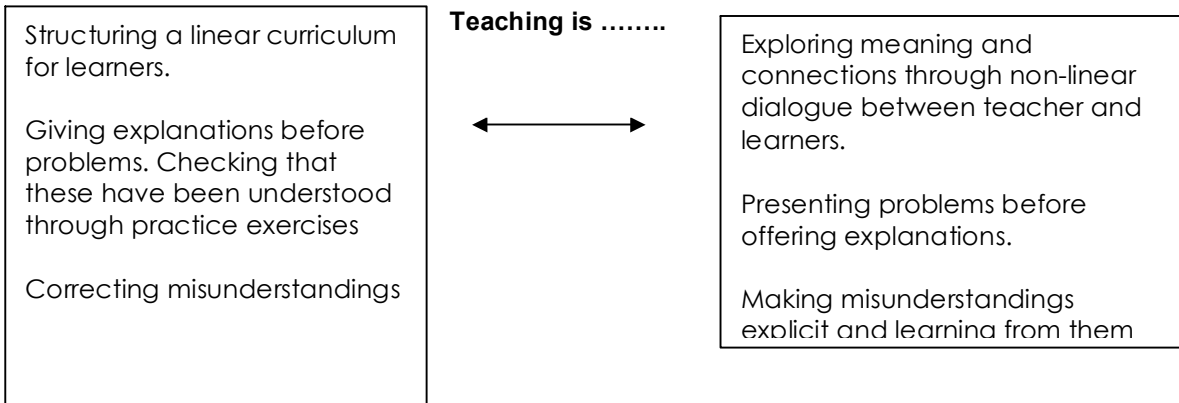
- Encourage the rote memorising of disconnected rules, which are often misapplied and quickly forgotten;
- Take no account of learners' prior knowledge (and misunderstandings);
- Encourage a passive attitude among learners, who feel that they have nothing to contribute. "Just tell me what to do";
- Encourage learners to measure their success by how many questions they have done, rather than by what they have understood.

Our view of teaching and learning is 'connectionist' [1,2,3], because it emphasises the interconnected nature of the subject, and it is 'challenging' [4] because it confronts common difficulties through careful explanation rather than attempts to avoid them. It begins from a different set of beliefs about learning and teaching, summarised in Figure 1.

Our model of learning should not be confused with that of 'discovery' teaching, where the teacher simply presents tasks and expects learners to explore and discover the ideas for themselves. We see the teacher as having a much more pro-active role than this.

Figure 1





The teacher's role in our model is to:

- Assess learners and make constructive use of prior knowledge;
- Choose appropriate challenges for learners;
- Make the purposes of activities clear;
- Help learners to see how they should work together in profitable ways;
- Encourage learners to explore and exchange ideas in an unhurried, reflective atmosphere;
- Encourage the discussion of alternative methods and understandings, examining their strengths and weaknesses;
- Remove the 'fear of failure' by welcoming mistakes as learning opportunities rather than problems to avoid;
- Challenge learners through effective, probing questions;
- Manage small group and whole group discussions;
- Draw out the important ideas in each session;
- Help learners to make connections between their ideas.

*Research undertaken as part of the Standards Unit work. Standards Unit,
Improving learning in mathematics, DfES August 2005

1. Askew M., Brown M., Rhodes V., Johnson D. and Williams D., *Effective Teachers of Numeracy*, report of a study carried out for the Teacher Training Agency, London, 1997, King's College, University of London.
2. Bell A., '*Some experiments in diagnostic teaching*', *Educational Studies in Mathematics*, vol.24, no.1,1993, pp.115-117.
3. Swan M., '*GCSE mathematics: challenging beliefs and practices*', the *Curriculum Journal*, vol.11, no.2, 2000, pp.199-233.
4. Wrigley A., '*Models for mathematics teaching*', in Bloomfield A. and Harries T. (eds), *Teaching and learning mathematics*, 1994, Association of Teachers of Mathematics, pp.22-25.