talking science

John Crossland continues his exploration of thinking skills and why thinking out loud is a good place to start

THINKING ABOUT METACOGNITION

Figure 1 Expressing thoughts out loud in collaborative group-work helps you as well as others to 'see' the thought processes at work

Key words:

Thinking skills

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Literacy

Learning depends on the effective use of basic cognitive processes such as memory and attention, but for optimal learning, learners also need to have awareness of, and control over, these cognitive processes. Flavell (1979), an American neo-Piagetian developmental psychologist, gave these thinking processes, or higher-level cognition, the name metacognition.

The literal meaning of metacognition is cognition about cognition or, more informally, thinking about your thinking: a good starting point for use with learners. Flavell also found that young learners are quite limited in their knowledge of their own metacognition and do relatively little monitoring of their own memory, comprehension and other cognitive processes.

Evidence of impact on standards

The Sutton Trust–Education Endowment Foundation (EEF) Toolkit (Higgins *et al.*, 2014) summarises the impact of metacognitive approaches:

The potential impact of these approaches is very high (+8 months progress compared to a control group).

This is a highly significant positive result and therefore one all schools should seriously consider implementing across the school. However, they also comment:

but can be difficult to achieve as they require pupils to take greater responsibility for their learning and develop their understanding of what is required to succeed.

Due to this high impact on achievement, metacognition must play a critical role in optimal learning, as well as being a very important lifelong learning skill. As a result, metacognitive skills are sometimes referred to as learning-to-learn skills. The sooner all learners are introduced to metacognitive skills, beginning in primary schools, the better for their future life chances.

The importance of talk

Because of the difficulties pointed out by the EEF Toolkit, teachers need to be provided with continuing professional development opportunities so that they develop the skills to teach their learners how to better apply metacognitive processes to their own and others' learning. Paired and small-group work is important because there is good evidence that novice learners of metacognitive processes make more accurate reports of the performance of others, compared to reports about themselves (Fleming, Dolan and Frith, 2012).

Metacognition occurs in all parts of a lesson as well as beyond the lesson. For example, during group-working a learner may pause, while the rest continue with the task, and reflect on his or her own progress by asking him/ herself things such as '*What can I do now that I couldn't do before?*' or '*I think the method is right but I'm not sure about the answer.*'

Metacognition usually takes the form of an internal conversation, that is, through working memory, so it is essential to explicitly encourage learners to outwardly express these thoughts so that they model the process for other

learners in their group (Figure 1). This group verbalisation is a central part of the exploratory talk in collaborative group-working, which is synonymous with Vygotsky's social construction of meaning (Crossland, 2010). Metacognition is not taught separately, but modelled alongside the teaching of other content. For example, as the teacher proceeds through the solution of a problem they deliberately pause and verbalise their thinking, perhaps expressing their interim process checks on their progress.

The EEF Toolkit website is correct in saying that implementing metacognitive skills into classroom practice is not easily achieved: '*There is no simple strategy or trick for this*'. They suggest a collaborative teacher development course as the most effective way forward and my own experience concurs with this. However, for implementing metacognition the only prerequisite is that the teachers, and their learners, must be used to working as collaborative groups as part of the lesson.

Developing collaborative work

When training teachers, an ideal learning group size is 8–10, supported by an external tutor. The group could be a whole school or a key stage, including teaching assistants, who have regular informal contact with each other. However, pairs or a triad of teachers can also experiment together and make progress. The following suggestions are for a typical time scale of about 6 months for a pair or triad of teachers to introduce the ideas. To embed the ideas, it is important that teachers carry out their own metacognition on the strategies they experiment with. This is most effective when a lesson is videoed

and reviewed through a peer-coaching process. Also, much of the development occurs during informal conversations at break times.

The easiest place in a lesson to start adding metacognition into the learning process is in a review (or plenary). There are two major components to metacognition: knowledge (awareness) about cognition and regulation (control) of cognition. The knowledge part naturally applies during a review when leaners can be asked to recall the outcome to a given task and also how they approached it (Box 1).

Bridging and visualisation

As a next step in the review part of the lesson, the learners can bridge (link through retrospective metacognition) the new learning from the current activity to previously learned experiences,

thus reinforcing an already developed neural network in the brain. This will improve any future recall of the new learning. The learners could also use the new learning to visualise (through prospective metacognition) a better performance in cognitive and non-cognitive skills in a future lesson, which prepares a neural network for transferring the learning beyond the current lesson to a future lesson. Bridging and visualisation may be both channelled through the hippocampus but they are processed in separate brain networks in the frontal lobes of the neo-cortex (Fleming and Frith, 2014), showing that they are separate thinking skills.

Introducing bridging and visualisation into a review is relatively easy as long as the teacher understands that the

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Box 1 Thinking Skills – Metacognition Framework

The questions in this framework are a starting point rather than a definitive list. They are intended to encourage pupil metacognition (a pause in the lesson/activity to reflect and think about thinking). The teacher or teaching assistant uses the questions with the purpose of encouraging more reflective answers and the learners will quickly begin to use the same types of questions with themselves and with each other.

During the introduction
- Where have you seen/heard/done something like this before?
- What is the main thing to find out?
- How can your group work better together?

For a struggling group
- What have you done so far?
- How else could you do/explain/describe this?
- Which parts do you not understand?
- Which parts can you do?
- How can someone else in the group help you with this?
- How confident are you in your answer/way of working?

For a group completing the task early
- What is the most important thing you have found out?
- When xxxxx is changed, what would be the result?
- How can the results you have be made into a more general conclusion or relationship?
- Are there any other ways of looking at the question/activity/outcome?

When preparing the report
- How and who will report the different aspects of your report to the class?
- Does your report reflect all the contributions within the group?
- What is the best way to describe/explain the most important thing you have found out?

During the review
- What is the most important thing you have found out?
- What helped you to arrive at your idea?
- How are your ideas different/similar to those in previous group reports?
- Where have you heard/seen/done something like this before?
- How would you do it better next time?

The questions are the result of extensive trialling by teachers and they have been checked for inclusivity of metacognitive knowledge, against Flavell's (1979) three variables influencing performance:

(1) Personal variables: knowledge about oneself as a learner, i.e. one's cognitive strengths, weaknesses, abilities.

(2) Task variables: knowledge of what kind of information is hard or easy to remember.

(3) Strategy variables: knowledge of how to use a strategy, what strategies are available, and how well a strategy works.

For a framework of skills to support and develop metacognition during collaborative group- working there is a free download available from the author's website.

Figure 2 **Putting a damp tea towel on a radiator is common practice, but why?**

Figure 3 **Make a note of any metacognition occurring when the children are engrossed in an activity so that you can prompt the learner's memory with a question afterwards**

learners to recall a similar experience, thus bridging previous learning to the current activity. For example, when introducing an investigation into the factors affecting drying clothes, one of the learners could recount about an adult putting a damp tea towel on the radiator to dry, leading to the proposition that heat must be one of the factors to be investigated (Figure 2). The pitfall to avoid when bridging in the introduction is that it often does not engage a high proportion of the learners, so for them this part of the lesson becomes too long and the pace of learning stalls as they 'switch off'. Often the time is better spent with these bridging examples being shared during small-group discussion.

The introduction is also a good time for learners to reflect on any visualisation of improved cognitive and non-cognitive skills brought forward from a previous lesson.

Monitoring and control

The most difficult metacognitive process for young learners is explicitly monitoring and controlling cognition during the process of solving an activity. They are engrossed in the activity itself and once they have completed it, the opportunity is easily lost to capture the thought processes that helped them to find the answer. One way forward with this is during collaborative group-working. When the teacher is class scanning and sees an example of explicit or implicit metacognition happening, rather than intervening in the process of learning at that time, the group member is quietly asked to include it in the group's report during the review. In case the learner forgets, it is a good idea for the teacher to make a report on a notepad or a phone audio recorder of the exact details so

that they can prompt the learner's memory with a question such as '*Tell the class what you were thinking when you said/did …*' (Figure 3). Sometimes this prompts an answer from another member of the group because they had evaluated the original learner's response in a metacognitive way.

Conclusions

The power of thinking about thinking should not be underestimated. As teachers it is our duty to employ successful evidence-based initiatives in our lessons. For metacognition, this is not an easy option. It takes time and a great deal of effort, as it requires teachers to move out of their comfort zones and learners to make the most of the new learning opportunities that introducing metacognition provides.

References

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learners provide an individual response and that not all learners will be successful each time. Asking some of those who are successful to describe the specific example can promote further social construction of meaning and metacognition amongst the learners. After about six lessons the teachers and learners become experienced at these metacognitive processes, resulting in the review evolving into a significant time element in the lesson. This will require the teacher to adapt future lesson timings to ensure there is sufficient time for this rich vein of learning. The benefits of providing the additional time required are far reaching and well worth the trouble in the long run.

Back to the beginning

The next stage of development for metacognitive processes takes place during the introduction of the lesson. Nearing the end of the introduction the teacher can ask '*Has anyone seen/heard/done anything like this before?*', or something similar. This will encourage some