Two interventions that enhance the metacognition of students with disabilities:

Cognitive cue cards and correspondence training

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ABSTRACT
This paper outlines and reviews two types of interventions used with students with learning disabilities. Cognitive cue cards are regarded as a form of cognitive intervention and correspondence training is regarded as a behavioural intervention. It is concluded that both kinds of interventions are valuable and result in improvements in the metacognitive capabilities of learners with learning disabilities.

Practice paper
KEYWORDS
Metacognition, learning difficulties, cognitive techniques.

Over the past 25 years a number of educators have developed strategies for improving learning based upon the concept of metacognition (our "thinking about our thinking") popularized by cognitive theorists such as Robert Sternberg (1985). There has been considerable associated research which has tended to show that fostering metacognition does improve the learning of students. This research includes studies that demonstrate the impact of metacognitive interventions on ordinary learners (for example Desoete, Roeyers and De Clercq, 2003). It also includes a number of other studies showing that metacognitive interventions can benefit learners with learning difficulties (for example Borkowski, 1992, Mason 2004).
The first part of this paper considers a strategy for fostering metacognition utilised in several recent metacognitive intervention studies. The second part of this paper outlines correspondence training methods (derived from applied behaviour analysis) and considers the possible cognitive effects of this approach. The purpose of the paper is to draw attention to the similarity between the two approaches and to emphasise the value of such interventions as means of developing metacognitive awareness amongst students with intellectual disabilities

COGNITIVE CUE CARDS FOR DEVELOPING COGNITIVE CONTROL

Metacognitive interventions often take the form of lists of memory cues in the form of lists of learning step cues on cards. These have been termed "cognitive credit cards" by Edmonds (2000) which have their value in fostering students' metacognitive development. To design the cognitive credit card cues, Edmunds suggests that the teacher or assistant gets the child to answer the following questions:

What do you need to get started?

What is the next step?

How will you know if you have remembered the next step?

How will you check if your thinking is working?

A cognitive credit card could be as simple as the one shown in Figure 1 to cue a child in finding a place near the front of a class. Advocates of cognitive cue cards suggest that learners benefit by having such cards providing exact cognitive instructions, as they facilitate the process of students thinking about their thinking and monitoring their cognitive steps. However, there is nothing especially new or clever about the use of such cards, nor indeed does the utilisation of cognitive credit cards indicate the psychological persuasion of the user. The great behaviourist psychologist B.F. Skinner in his later life advocated the utilisation of cue cards similar to the cognitive credit cards to help free up some space in his great mind as he experienced diminished performance due to aging.

FIGURE 1. A SIMPLE COGNITIVE CREDIT CARD.

Find a place to sit down.

Have I found a place?

Is the place free?

The cognitive credit card suggestion of Edmonds is similar to the metacognitive approach taken by Jitendra, Hoppes, and Yan (2000) to enhance students ability to obtain the main theme in text comprehension. They provided cue cards such as that below and had their subjects tick off when the required strategies had been retrieved and carried out. The cue card indicates the cognitive outcome that is being sought at a particular step and the student had to check it to indicate:

1. That they had read the paragraph.
2. That they used the cue card to recall the strategy.
3. That they applied the strategy.
4. That they had written down the result of the strategy.

Jitendra, Hoppes, and Yan (2000) found that having cue cards such as that in Figure 1 along with monitoring instructions helped students learn to extract main ideas.

FIGURE 2. FINDING THE MAIN IDEA CUE CARD.

FINDING THE MAIN IDEA

Does the paragraph tell:

What or who the

Subject is?	*Action is?*
(Single or Group)	*(Category)*

Why – something happened?

Where – something happened?

When – something happened?

How- something looks or is done?

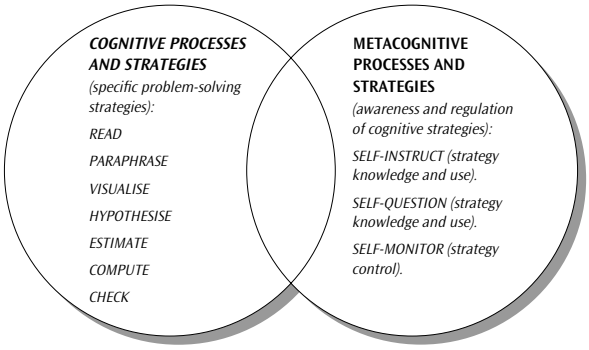
Note: Some paragraphs may contain a sentence or two that don't tell about the main idea.

They had some suggestions about why students were assisted:

> *"Results also provide support for student's positive attitudes toward strategy and self-monitoring instructional procedures used in the study. Although students did not indicate the desire to retain the prompt card following the study, the use of the permanent prompt during self-monitoring seemed to help the student in two ways. First it provided them with access to cues for recalling the strategy, thus reducing memory demands often placed on students with learning disabilities (McIntyre, Test, Cook & Beattie, 1991). Second, the prompt enabled students to focus on strategy application rather than on strategy recall." (p. 136).*

Both approaches discussed above are similar to the Say/Do/Check intervention which has used by Montague, Warger, and Morgan (2000) and has found to benefit students' mathematics learning. In this intervention students go through the steps of stating in their own words the cognitive strategies that they will use (cued by instructions), they question themselves on whether they have indeed used the strategy, and monitor whether the strategy is working (to produce the desired outcome). Thus, metacognitive processes are brought to bear to regulate cognitive processes as exemplified in Montague (1992).

FIGURE 3. OVERLAP OF COGNITIVE AND METACOGNITIVE PROCESSES AFTER MONTAGUE (1992).

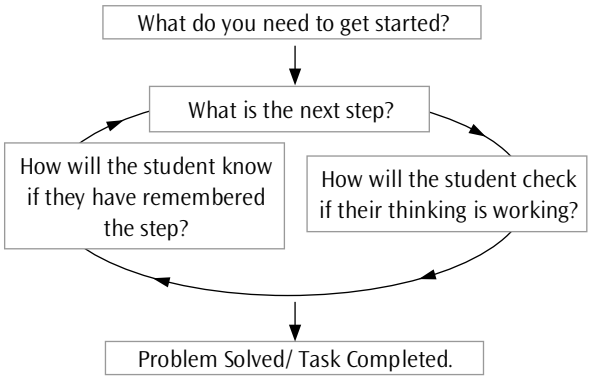


PREPARATION OF A COGNITIVE CREDIT CARD

The research we have reviewed indicates that a well designed cognitive cue card will improve the efficiency of student information processing, help the learner become more familiar with their thinking processes, encourage their independent learning.

Designing cognitive cues for interventions such as those in the reviewed research involves a process like that outlined in Figure 4. In order to develop a plan containing both cognitive and metacognitive elements the designers iterate through the questions contained in the figure.

FIGURE 4. THE ITERATIVE PROCESS OF DESIGNING A COGNITIVE CREDIT CARD.



The actual development of a cognitive credit card requires flexibility. Initially a cognitive credit card may contain quite strong procedural hints as the strategy steps for solving a problem may be quite new to the student. Over time, the card may be modified because students are now able to accurately state the next procedural step without elaborate cuing and only the self-monitoring steps are required.

The card format itself can be varied. For example Scott and Vitale (2003) describe a "writing wheel" for cuing writing in which only currently relevant cues are to be seen on the wheel at a particular point of time. In the example to be found in Appendix I , the number and nature of cues might suggest that a series of separate cards be constructed because there may be too much information for just one card. Utilising pictures on a cognitive credit card may be advantageous for many children with intellectual disabilities and who may have difficulties with text-based instructions.

In practice developing a cognitive cue card can be achieved by having the student interact with the instructor over the academic problem being considered. The steps for the card are best if they emerge from a teaching situation containing reflection, self-statement and humor. One approach that I have found useful is in involving the child in a form of reciprocal teaching. I have found that when I take on the role of "dumb" adult. Children are all too happy to scaffold my attempts to carry out a task by telling me what I should do at any step (it is a low anxiety situation when another is the bumbling fool). Where the task is one that is not familiar, sometimes it takes a very clever "dumber than dumb" instructor to allow the child to develop in their own words the sequence of steps involved in the performance task (and in the monitoring of task performance). When the student has been actively involved in the construction of their cognitive credit card, then that in itself is an opportunity for the child to reflect on their metacognitive processes. What they have written on their card should seem familiar and indeed cue them through their task or problem.

UTILISING A COGNITIVE CREDIT CARD

In utilising a cognitive credit card students are cued by the card through the cognitive steps towards obtaining an academic goal and as part of each step they:

- SAY self-instructions of what to do before and while performing actions.
- ASK questions to stay on task, regulate performance, and verify accuracy.
- CHECK by self-monitoring that everything is done correctly throughout.

The steps are listed on the card and the student ticks off the card as they go through their cognitive and metacognitive steps.

CORRESPONDENCE TRAINING APPROACHES FOR CHILDREN WITH DISABILITIES

Risley and Hart (1968) working with young children, developed a correspondence training approach that involved rewarding students for accurately matching what they say they will do with what they actually do. Correspondence training interventions involve components of "Say", "Do", and "Report" required of the child. Some studies are more "Say-Do" studies emphasising the correspondence of prior statements and actual behaviour. Other studies emphasise "Do-Say" matching of what actually occurs with what is reported. Bevill, Davis, Clees, and Gast (2004) review the effectiveness of correspondence training in studies over the past 35 years and report that while the intervention has a long history of effectiveness, its potential for use for young children with disabilities remains largely unrealised.

Correspondence training with reinforcement contingent upon "say, do, report" having been successfully completed has been found effective as intervention for increasing the verbal behaviour of socially withdrawn children (Osnes, Guevremont, & Stokes, 1986), as well as a range of other social behaviours in children with social skills deficits (Guevremont, Osnes & Stokes, 1986). Odom, Brown, Frey, Karasu and Smith-Canter (2003) cite Shearer Kohler, Buchan and McCullough (1992) and note their introduction of self-monitoring to autistic children as an instance of a successful intervention involving correspondence training. This training resulted in young children with autism to monitoring their own social interactions and increased their interactions with peers.

For children with language disabilities the "say" and the "report" cannot always occur only via verbal communication and instead for these children there must be other forms of communication. In spite of this limitation, applications of correspondence training have been used in studies of children with language disabilities. Luciano-Soriano, Molina-Cobos and Gomez-Becerra (2000) used correspondence training with subjects with very limited language where part of the "say" and "report" communication involved pointing to drawings of desired behaviours. Stokes, Cameron, Dorsey and Fleming (2004) demonstrated that correspondence training could be used as an intervention for teaching complex skills to nonverbal subjects in a study involving acquisition of ten step personal hygiene skills.

Anecdotally, the author introduced a form of correspondence training to the task of having his son, a 9-year-old male with cerebral palsy, intellectual disability and language impairment, learn to accurately "point Percy at the porcelain" (urinate without spraying on the floor). A series of one word language cues were devised which included:

- Lift (the toilet seat)
- hold (your penis)
- point (at the water)
- flush (flush)
- wash (your hands).

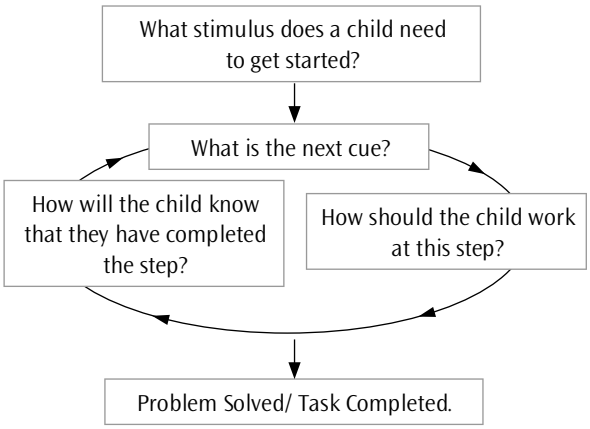
The first phase of the training involved familiarisation with the word cues and social reinforcement occurred for remembering the sequence. Following this phase, there was training emphasising the congruence of saying, doing, and accurately reporting. Again social reinforcement was used. At this point of the training, there was a dramatic improvement in accurate performance of the task.

Perhaps the most impressive aspect of the intervention was witnessing the vocalisation of the cues at each step as my son was at the toilet and not aware of being observed. My very strong impression was that he felt that having these cues and verbalising them was helping him at this task (and that he was monitoring his task progress through the cues).

PREPARATION OF CORRESPONDENCE TRAINING CUE SEQUENCES

The design of correspondence training involves consideration of several cues. There needs to be consideration of the cuing of "say" elements, the cuing of "do" actions, and the development of an understanding of the appropriate cues to "report" successful completion of a desired behaviour. Thus, the design of a correspondence training cue sequence has much in common with the approach to designing a cognitive credit card outlined above. Figure 5 below shows the questions involved in designing a correspondence training sequence for a complex task such as that described by Stokes et al (2004). It is very similar to the process for the design of cognitive cue cards outline in Figure 4 in that what is involved is iteration through the task steps in order to develop a plan containing both stimulus cues, task step processing and monitoring elements.

FIGURE 5. THE ITERATIVE PROCESS FOR A CORRESPONDENCE TRAINING PLAN.



As with cognitive cue cards, the basic sequence of identifying a step, carrying it out, and checking the success of the operation still holds in correspondence training but the following differences need to be considered. Low functioning children with limited language require a different approach to foster metacognitive development through cognitive cues and self-monitoring.

1. There may be the need to spend more time in designing the step sequence by the teacher so that it corresponds to steps within the capabilities of a low-functioning child. (A detailed and ecologically valid task analysis).
2. The step sequence will need to be conveyed visually utilising pictures, graphics, or icons for learners who have difficulty with text-based instructions. (c.f. Luciano-Soriano, Molina-Cobos, Gomez-Becerra, 2000). The value of visual stimuli for cuing student with cognitive disabilities is well recognised by those developing programmes for such students (e.g. Adams, 1997).
3. The encoding of what to do at each step may not be in the form of oral or written language, but via recollection of modelled procedures.
4. Rather than using cognitive cues in the form of a list which the child refers to, because the child may lose their place and become confused, there may be use of a flip card sequence (or alternatively a velcro list from which completed steps can be removed).
5. For nonverbal children another way of communicating satisfactory accomplishment by the child is essential. Modelling the utilisation of a thumbs up signal, or the pressing of a Big Mac saying "done" could be the way to develop signalling that self-monitoring of the outcomes success has been achieved.

A CORRESPONDENCE CUE CARD SEQUENCE FOR A NONVERBAL CHILD

An example of a correspondence cue card system for putting shoes on is contained in Appendix II. In utilising a cue card sequence with self-monitoring instructions, students are cued by the card through the steps towards obtaining a goal and at each step they monitor performance. The operations described above now become:

- LOOK to the relevant cue before and while performing actions.
- PROCESS to stay on task, regulate performance, and verify accuracy.
- REPORT by self-monitoring that everything is done correctly throughout and signaling step completion.

Each step is carried out in order to get to the next card. The child can "tick off the step" as they turn the card or signal that it should be turned. They can receive reinforcement at that point if there is correspondence.

The approach is dependent on the development of some level of self-initiated communicative behaviour. In particular Autistic students who are not currently self-initiating responses may only benefit from utilising self-monitoring (correspondence training) after they have shown a development in their ability to self-initiate communicative behaviour. For such students getting them past stage one of PECs would set them up for success at this more demanding procedure.

CONCLUSION

The research indicates that students with learning difficulties can be helped by design of cognitive cues (cognitive cue cards), which they can refer to and compare as they carry out task steps and report. As well as being cognitive cues, the value of such cards is in the child's development of self-monitoring and their metacognitive capabilities. What is more controversial is the assertion that correspondence training works in a similar way for low functioning students. The conclusion advanced here is that correspondence training results in students with learning disabilities becoming more aware of the influence of their cognition on the outcomes of their behaviour thus developing greater metacognitive awareness.

This conclusion is disputed by some with strong behaviourist orientations. For example Lattal and Doepke (2001) demonstrate that a homologue of correspondence training can be set up for a pigeon by rewarding the pigeon for matching their intial choice of colour in the next keypeck. This result they claim does not require a cognitive mediation explanation, but rather they suggest that correspondence training is just another example of conditional stimulus control of an operant by a compound stimulus. However, others studying animal behaviour strongly support the notion of metacognition as being involved in animal cognition and behaviour. Smith, D.J., Shields, W.E. and Washburn, D.A. (2003) in seminal research have shown that when there is the opportunity to signal uncertainty about a perceptual judgement by pressing key, monkeys and dolphins will take that option rather than making a costly mistake. Thus in effect, the suggestion is that other species "know when they know and also know that they don't know".

This paper has outlined some of the research associated with two valuable approaches which practitioners can use. Cognitive cuing or cognitive credit cards are easy to develop and address metacognitive deficits that many learners with disabilities may have. For students with more profound cognitive or language deficits, correspondence training can be used to establishing verbal or symbolic mediation of behaviour. I have suggested that that the success of correspondence training is partly because it lends itself to the development of the student's metacognitive skills, especially the skill of self-monitoring.

As practitioners seeking generalisation across time and settings, it is not just change in behaviour which we seek, but also a change in how the student we are helping initiates and maintains that behaviour. It should be regarded as a right for every student with a disability to develop their metacognitive awareness around all functions in their academic and social lives. Cognitive cue cards and correspondence training are two important interventions for realising that end.

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AUTHOR PROFILE

Dr Garth Ritchie is a psychologist working with Group Special Education, Hamilton. He owes much to his eleven-year-old son for his involvement in Special Education as it was through him that he developed a commitment to inclusive education. Previuosly he was a lecturer at the University of Waikato.

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APPENDIX I: A SCHEMA UNDERLYING A COGNITIVE CREDIT CARD FOR WRITING A STORY

The table below illustrates the schema underlying a series of Cognitive Credit Card cues.
(The capitalised text could be included on the card.)

SAY (SELF-INSTRUCTION)	ASK (SELF-QUESTION)	CHECK (SELF-MONITOR)
What do I need to get started? "I NEED PEN AND PAPER" "I NEED TO FIND THE MAIN TOPIC IN THE STORY. SOMETHING THAT I REALLY WANT TO WRITE ABOUT."	How will I know if I have remembered to do the step? HAVE I WRITTEN A NAME THAT I COULD USE FOR MY STORY?	Check that my thinking is working: IS IT A COOL NAME THAT HELPS ME WRITE?
What is the next step? "I BRAINSTORM SOME OF THE WORDS IDEAS WHICH WILL BE IN THE STORY BY DRAWING A MIND MAP."	How will I know if I have remembered the step? HAVE I IDEAS AND WORDS FOR THE STORY IN THE MINDMAP?	Check that my thinking is working: CAN I SEE SOME GOOD IDEAS FOR THE STORY IN MY MINDMAP?
What is the next step? "I TALK TO MYSELF TO CONNECT SOME OF THE WORDS IN THE MIND MAP."	How will I know if I have remembered the step? HAVE I TALKED TO MYSELF AND CONNECTED SOME OF THE WORDS IN THE MIND MAP?	Check that my thinking is working: ARE THERE LINKS BETWEEN THE MINDMAP WORDS IN MY TALK?
What is the next step? "I SAY A SENTENCE WHICH HAS SOME OF THE WORDS IN IT."	How will I know if I have remembered the step? HAVE I SPOKEN A SENTENCE THAT CAN BE IN MY STORY?	Check that my thinking is working: IS WHAT I SAID IS LIKE WHAT IS COULD BE IN A STORY?
What is the next step? "I WRITE DOWN THE SENTENCE THAT I HAVE TALKED ABOUT."	How will I know if I have remembered the step? HAVE I WRITTEN A SENTENCE ON WHAT I WAS TALKING ABOUT?	Check that my thinking is working: DOES MY SENTENCE MAKES SENSE TO ME (AND MY FRIENDS)?
Repeat previous two steps.	Repeat previous two steps.	Check that my thinking is working: Repeat previous two steps. Then: ARE MOST WORDS IN MY SENTENCES?
What is the next step? "REARRANGE THE SENTENCES INTO A STORY ORDER."	How will I know if I am remembering the step? HAVE I REARRANGED THE SENTENCES IN MY STORY FROM FIRST TO LAST?	Check that my thinking is working: CAN I TELL WHEN SOMETHING IN MY STORY HAPPENED FROM THE ORDER OF MY SENTENCES?
What is the next step? "CHECK THE SPELLING OF MY WORDS"	How will I know if I am remembering the step? HAVE I FOUND AND CORRECTED THE WORDS WHICH ARE NOT THE SAME AS IN MY DICTIONARY?	Check that my thinking is working: ARE ALL THE WORDS THE SAME AS IN MY SPELLING DICTIONARY?
What is the next step? PUBLISH MY STORY?	How will I know if I am remembering the step? HAVE I PUT MY STORY INTO A DOCUMENT FILE?	Check that my thinking is working: CAN I PRINT OUT A COPY OF MY STORY?

APPENDIX II: A SCHEMA UNDERLYING A CORRESPONDENCE CUE CARDS TO PUT ON SHOES.

The table below illustrates the schema underlying a series of correspondence training steps.
(The pictures could be those in the first column.)

CUE CARD (SELF-INSTRUCTION)	**DO (PROCESS)**	**REPORTING CONDITION (SELF-MONITOR)**
What do I need to get started?	Procedure:	Check that thinking is working:
SHOES PICTURE.	GET SHOES.	REPORT IF THERE ARE SHOES LIKE THE CUE
	Demonstrate procedure by modelling.	*(like the picture)?*
If correspondence and signal, turn over cue card (plus reinforce).		
What is the next step?	Procedure:	Check that my thinking is working:
PICKING UP A SHOE PICTURE.	PICK UP A SHOE.	REPORT IF I HAVE A SHOE IN MY HAND
	Demonstrate procedure by modelling.	*(like the picture)?*
If correspondence and signal, turn over cue card (plus reinforce).		
What is the next step?	Procedure:	Check that my thinking is working:
SHOE ON A FOOT PICTURE.	FOOT IN SHOE	REPORT IF I PUSHED MY FOOT INTO THE SHOE
	Demonstrate procedure by modelling.	*(like the picture)?*
If correspondence and signal, turn over cue card (plus reinforce).		
What is the next step?	Procedure:	Check that my thinking is working:
THE VELCRO STRAP IN HAND PICTURE.	HOLD STRAP	REPORT IF I AM TOUCHING THE STRAP
	Demonstrate procedure by modelling.	*(like the picture)?*
If correspondence and signal, turn over cue card (plus reinforce).		
What is the next step?	Procedure:	Check that my thinking is working:
CONTACTED VELCRO PICTURE	CONNECT STRAP	REPORT IF I CAN LET GO THE STRAP
	Demonstrate procedure by modelling.	*(like the picture)?*