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The Instructional Features of An Effective and Practical Intervention for Significant Improvements in Reading Comprehension

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This presentation outlines the features of an effective instructional program in question-answering that has empirical support for statistically significant improvement in reading comprehension. The presentation overviews the features of effective instruction in terms of both lesson presentation and lesson content. Comparisons are made between the question-answering intervention and other programs used in classrooms and commercially available reading programs. The use of these instructional features increases the likelihood of successful learning by all students, including some students with special needs, within regular classrooms. More importantly, this instructional design increases the likelihood of errorless learning by many students. The potential effects of errorless learning on students' attitudes to learning and confidence are outlined. Future potential applications of this instructional design will be discussed.

Introduction

A colleague of mine, an assistant principal, was trialing my reading comprehension program with some students at her school. She had developed a concentration game where students matched paired cards with a question to cards with an appropriate matching answer. The year 4 students were playing this game, when the Principal of the school walked past. He noticed one of the students, who had been difficult to handle and had poor reading skills, concentrating on the game:

Principal:	That looks very hard?
Jason (year 4):	Yeah, it used to be.
Principal:	How come you can do this now?
Jason:	Well, it might look hard, but once you get into this, it's really very easy. I wish I could do my yellow book all the time!

Jason's attitude to learning had changed. Once, he was the student who always failed whatever reading activity the class was completing. Consequently, he had developed successful strategies for avoiding this failure: he behaved inappropriately during every reading lesson. From his perspective, he was a success; he didn't fail. From his teacher's perspective, Jason was not only a student with reading difficulties, he was becoming a student with significant behaviour problems, and he was only in year 4!

As a result of trialing a new type of instructional program, Jason was able to now succeed at learning how to understand what he read. As a person, Jason hadn't changed, he hadn't been reborn or taken on another personality. What had changed was the type of materials being used by his classroom teacher to teach question-answering, one critical reading comprehension skill (National Institute of Child Health and Human Development [NICHHD], 2000a; National Institute of Child Health and Human Development [NICHHD], 2000b). These materials were purposefully designed to provide errorless learning for all students when implemented by classroom teachers (Englemann, 1980; Englemann & Carnine, 1982; Thorley, 1987; Thorley, Hotchkis & Martin, 1991). The features built into these materials were more likely to guarantee effective learning by all students, even Jason. The purpose of this paper is to outline the design features of this question-answering program and compare these with regular classroom reading materials.

Rather than viewing reading comprehension, and by implication question-answering, as a personal response to a text that is individually constructed, the current intervention was conducted within the social context of a classroom. From this perspective, interactions between the teacher and students ensured common agreement existed between the personal perception of the student and the class teacher's understanding of the questions and the text. Such agreement was necessary in the interpretation of texts and the interpretation of questions and students' answers as acceptable by classroom teachers.

Sampling typical classroom reading instruction

Regular classroom reading instruction is typically varied by classroom teachers on a daily basis, and hasn't really changed from the late 1960s to the 1990s (Baumann, Hoffman, Duffy-Hester, & Ro, 2000). Recently, observations and documentation from four Year 5 classrooms of reading instruction showed that, during 30 reading lessons, teachers presented nineteen different comprehension skills that included question-answering, advertisements, written chapter summaries, letter writing, descriptions, maze activities, cloze passages, story maps, plot profiles, directions, retelling, vocabulary instruction, listening comprehension, illustrations,

poetry, research, grammar, character and cause and effect sequences (Brown, 2004). Consequently, during these regular classroom lessons, there were fewer opportunities to practise any single comprehension skill to the same level as experimental participants had practised written question-answering. Focussing on a single comprehension skill and paired with providing in-depth instruction has been recently recommended, rather than focusing on multiple comprehension skills as in Reciprocal Teaching (Williams, 2005). Further, these limited classroom observations, indicated that there was a large variation in both the amount of work completed by students within each class and in the success of different students in completing the classroom exercises.

The efficacy of the current intervention program suggested that these differential amounts of completed work were a direct result of the design features of the student materials (Brown, 2004). Consequently, the reported impact on posttest student performance was both statistically significant and resulted in an interaction effect, particularly favouring students with low pretest performance (Brown, 2005). The significant interaction effect showed that students with lower prestest performance in the experimental treatment group made significantly greater gains that students in the control group and also greater gains that students with higher pretest performance in the experimental group. Students, like Jason, were able to complete more examples successfully than ever. This increase in successful, completed work paid dividends in improving their student performance on a standardized reading comprehension measure, and anecdotally, in their confidence and willingness to learn (see following discussion, also Brown, 2004).

The Experimental Reading Intervention Program

The features of the effective intervention were based in information processing models (Aitkenhead & Slack, 1985; Anderson, 1993; Bransford, Brown & Cocking, 2000; Hasselbring, Goin, & Bransford, 1988; Newell, 1990; Sieck & Yates, 2001; Sorace, Heycock, & Shillcock, 1999). These models compare human cognitive processes to the software programs that run computer systems (Baddeley, Aggleton, & Conway, 2001; Kintsch, 1998; Miyake & Shah, 1999b; Newell, 1990; van Merrienboer & Paas, 2003). The intervention program involved two broad features: lesson implementation practices and the selection of specific teaching examples for each lesson. Effective lesson implementation has been explicitly discussed for almost two decades (Rosenshine and Stevens, 1986) and more recently (Swanson, 2001; Swanson & Deschler, 2003; Swanson & Howell, 2001). Yet, such explicit instruction is as difficult to observe in classrooms as it was in Durkin's classic (1978-9) study (Baumann et al., 2000). A clear focus of the current intervention program was the purposeful selection and sequencing of specific teaching examples. This focus on detailed teaching examples has been conspicuously absent from other reading materials (Gersten, Fuchs, Williams & Baker, 2001). Each of these broad features is discussed in more detail, with examples from the intervention program supported by theoretical models.

Lesson Implementation Features

Each lesson within the intervention had the same implementation format that applied the effective teaching cycle to question-answering (Rosenshine & Stevens, 1986; Swanson, 2001; Swanson & Deschler, 2003; Swanson & Howell, 2001). This lesson format included a review of the previous lesson, teacher demonstration of new concepts, completion of examples by the teacher and students together and independent completion of examples by students. Therefore, within each lesson, students were provided with explicit teacher modeling and reductions in support as

the lesson progressed. Despite recommendations in the literature for the gradual reduction in support for completion of comprehension skills (Fielding & Pearson, 1994; McNeil, 1987; Pearson & Dole, 1987; Pearson & Fielding, 1991), teachers have had significant difficulties in implementing this in their classrooms (Baumann et al, 2000). In contrast, the intervention program used written prompts within each lesson to assist teachers in implementing this desired lesson format (see Figure 1, below).

GENERAL LESSON PLAN

REVIEW - of previous teaching of the concepts and skills

PRESENTATION - DIRECT TEACHING of new concepts or types of examples - direct teaching and explanation, including modelling of the process is required with more than one example. This involves a lot of teacher input and explicit modelling of how to work through the steps of finding answers to questions.

GUIDED PRACTICE - where students complete some part(s) on their own but teachers still closely monitor for errors and correct where necessary. Error correction should be immediate at this stage and should involve some explanation

INDEPENDENT PRACTICE - where students complete the work virtually independently. This section should involve **very few errors**, and explanations should be given only where necessary

Figure 1. Effective teaching lesson format (Adapted in Brown, 2004, p.367 from Rosenshine & Stevens, 1986)

This lesson format provided opportunities for deliberate practice in the concepts and skills taught within the program to enable students to become independently competent in these skills. Research has clearly demonstrated the significant effects of deliberate practice over a substantial period of time (Ericsson & Charness, 1994; Ericsson, Krampe & Tesch-Romer, 1993). Newell's (1990) model of cognitive processes acknowledged the impact of environmental changes on performance over time. Earlier, Luria (1973) had proposed that, over time, separate cognitive processes were synthesized as a result of deliberate practice effects. Luria's model of cognitive processes suggested that environmental stimuli impacted on multiple component cognitive processes with ripple effects across a range of knowledge structures, including both declarative and procedural knowledge (Ward, 2002).

More recently, Langan-Fox, Armstrong, Balvin & Anglim (2002) included the impact of environmental changes on skill development and supported the effects of distributed practice over time established by previous research (Krug, Davis, & Glover, 1990; Sloboda, Davidson, Howe & Moore, 1996). Langan-Fox et al. suggested that even greater benefits resulted from distributed practice of complex

tasks. Therefore, the intervention program, with a focus on the complex skill of question-answering, applied the principles outlined in theoretical models and research findings in skill development.

The completion of a large number of examples within the intervention program supported the link between deliberate practice and increases in student performance at posttest (Brown, 2004). The lesson format enabled such practice during the independent practice section which was prompted in the student materials for classroom teachers. In addition, all other features of the effective teaching cycle were prompted within the materials.

The cognitive processes involved in question-answering, just like most reading comprehension skills, are covert in nature. These cognitive processing steps were made explicit within the program by the inclusion of a model of steps for answering questions. The explicit wording of these steps enabled consistent implementation across teachers and provided a completed cognitive model of task completion for both the students and teachers. The provision of completed examples and task completion steps has been recommended in the literature (De Corte, 2003; van Merrienboer & Paas, 2003). Whether these steps were used in exactly the same way by all students was not determined in the study, as this would have involved detailed individual assessments and was beyond the scope of the thesis.

STEPS FOR FINDING A RIGHT THERE ANSWER

1. Under line the words you need from the question. These words will be a part of your answer.

2. Circle the clue word that tells you what to look for.
(Use the table to help you eg "What", "Where")

3. Find a sentence in the story that has the words from the question. The sentence might be anywhere in the story.

4. Underline these words & the rest of the sentence.

5. Read the question and read the underlined sentence again.

6. Ask yourself: Does the sentence answer the question?
AND Is this the whole answer?
* If YES, then go on to the next step.
*If NO, look for information in another sentence(s).

7. CHECK: Ask yourself: Is this the whole answer?
For RIGHT THERE questions, this will be YES.

8. Write the sentence for your answer.

9. CHECK AGAIN: Read your answer and question again:
THINK: Is this the whole answer?

Figure 2. Strategy steps (Adapted in Brown, 2004, p.375, from Raphael, 1982)

Teaching Examples Features

Concepts used in question-answering are abstract and complex in nature. The intervention program presented an overview of question types, based on the source of the answer to the question (Pearson & Johnson, 1978; Raphael, 1982). These "big ideas" provided students with an over-arching framework that facilitated understanding an extended range of examples presented over the 30 lessons (Kame'enui & Simmons, 1990). The wording of these question types was designed to be age-appropriate for the participants in Year 5 and to assist with the strategy steps used for answering questions.

Research into skill development has supported the effects of both domain specific knowledge and general world knowledge in complex skill performance (Alberdi, Sleeman, & Korpi, 2000). Wisniewski and Medin (1994) reported that specific prior knowledge and general background knowledge were both important during category formation. The presentation of "meaningfully labelled exemplars" (Alberdi et al., 2000, p. 56) to students, using the question types, provided critical knowledge that enabled participants to categorise other examples according to question type categories (Wisniewski, 1995; Wisniewski & Medin, 1994). Once categorised, the questions were more likely to be answered correctly by all students. Wisniewski and Medin (1994) showed that subsequent examples that were presented were categorised based on the abstract features of each example type, rather than surface features. Their findings confirmed the effects of prior presentation of categories of concepts, question-answer relationships types in this instance, for improving student performance in complex tasks (see Figure 3, below; Raphael, 1982).

SOURCE 1: RIGHT THERE QUESTIONS

Right There Questions are those where the answer is **right there in one sentence.**

There is only **one correct answer** to a Right There Question.

SOURCE 2: THINK & SEARCH QUESTIONS

Think & Search Questions are where the answer is in **more than one sentence** or the answer uses **the story & your thinking together** to give a complete answer

There might be **more than one** complete and correct answer to a Think & Search question.

SOURCE 3: ON MY OWN QUESTIONS

On My Own Questions are where the answer requires you to think of the answer **on your own** - there are **few** (sometimes no) clues in the story.

You need to **think about what you already know about the topic and the story**, and write an answer that **fits in with both** the story and what you already knew.

There can be **more than one** answer to On My Own questions

Figure 3. Question-Answer Relationships (Adapted in Brown, 2004, p.367 from Raphael, 1982)

The intervention program presented examples with specific features that are critical to learning the concepts in queston-answering (Engelmann, 1980; Engelmann & Carnine, 1982; Howell & Nolet, 2000; Thorley, 1987; van Merrienboer & Paas, 2003). The program slowly increases the difficulty of examples across lessons. Earlier examples provide completed and easier models for more difficult examples presented later in the program (Sweller, van Merrienboer, & Paas, 1998; van Merrienboer & Paas, 2003). Gradual increases in task difficulty and concepts has been shown to be important in providing "part-task practice" and reducing the limitations of working memory (van Merrienboer & Paas, 2003, p. 11). Completed examples also provide multiple opportunities for the students to learn complex concepts and for the presentation of a complete range of examples (Engelman, 1980; Engelmann & Carnine, 1982). In addition, completed examples require a selection response, rather than a production response and therefore, more likely guaranteed successful completion by all students.

PART 3

Jane was getting out all her winter clothes. Jane was wearing lots of warm clothes in the cold weather. On her feet Jane was wearing warm woollen socks. Jane was wearing a red hat on her head. On top of her clothes Jane was wearing a thick black overcoat. Jane likes to put her hands into the coat pockets because it keeps them warm.

Questions and Answers

Q1. What was Jane getting out?
A1. Jane was getting out all her winter clothes.
(Does this answer the question?)____
(Is this the whole answer?)____

Q2. What was Jane wearing in the cold weather?
A2. Jane was getting out all her winter clothes.
(Does this answer the question?)____
(Is this the whole answer?)____

Q3.What was Jane wearing in the cold weather?

A3. Jane was wearing lots of warm clothes in the cold weather.
(Does this answer the question?)____
(Is this the whole answer?)____

Q4. What was Jane wearing on her feet?
A4. Jane was wearing black boots on her feet.
(Does this answer the question?)____
(Is this the whole answer?)____

Figure 4. Positive and negative examples (Brown 2004, p.377-8)

Effective instructional programs for concepts and skill development always included the presentation of positive and negative examples of concepts (Bruner, 1960; Engelmann & Carnine, 1982; Niedelman, 1991; Thorley, 1987; Thorley et al., 1991). Positive examples were selected to contain certain features while negative examples did not contain those features (Engelman & Carnine, 1982). Previous research reported that subjects searched for common features among positive and negative examples of common everyday concepts (e.g. "cow") into informal categories (e.g. a place where you get milk, an animal with a tail, a circus animal, cold things)(Korpi, 1988).

Alberdi et al. (2000) further supported Korpi's conclusions applied to both general background knowledge and specific domain related knowledge of experts. Alberdi et al. suggested that further research be conducted into the synthesis of specific knowledge, general knowledge and strategy use. They documented that participants made hierarchical links between function (e.g. places where milk is made) and higher order categories. This increasingly abstract nature of concepts was based on a foundation in concrete, real world examples (Engelmann, 1980; Engelmann & Carnine, 1982; Thorley, 1987). It was this initial connection to the real world (through simple, clear examples) that was gradually internalised, organised (into increasingly higher order concepts) and, over time, developed into the knowledge representations of experts (Ericsson & Charness, 1994; Ericsson et al., 1993; Newell, 1990). The hierarchical order was established using the concepts of sameness and difference, where concepts were included in hierarchically higher categories based on the inclusion of at least one common characteristic (Engelmann & Carnine, 1982).

LESSON 14

PART 1 - RIGHT THERE AND ON MY OWN QUESTIONS
THE MOTHER CAT
The mother cat is covered with soft, black and white fur.
The mother cat is purring softly.
The mother cat has four kittens.

QUESTIONS AND ANSWERS
Circle if the question is RIGHT THERE OR ON MY OWN?
Q1. What is the mother cat covered with?
A1. The mother cat is covered with soft, black and white fur.
(Is the answer in the story?)
RIGHT THERE ON MY OWN
(If ON MY OWN - where did the answer come from?)

Q2. Why is the mother cat's fur so soft?
A2. The mother cat's fur is so soft because she licks it clean.
(Is the answer in the story?)
RIGHT THERE ON MY OWN
(If ON MY OWN - where did the answer come from?)

Q3.What is the mother cat doing?
A3. The mother cat is purring softly.(Is the answer in the story?)
RIGHT THERE ON MY OWN
(If ON MY OWN - where did the answer come from?)

Q4. Why is the mother cat purring softly?
A4. The mother cat is purring softly because she has just had a drink of milk.(Is the answer in the story?)
RIGHT THERE ON MY OWN
(If ON MY OWN - where did the answer come from?)

Figure 5. Part-task practice of selection of question-answer relationship (Brown, 2004, p. 458)

More specifically, recent cognitive load research has recommended the use of cognitive scaffolds to support learners and reduce the effects of cognitive load (Sweller et al., 1998; van Merrienboer & Paas, 2003). Supporting Engelmann & Carnine's (1982) principles, van Merrienboer and Paas proposed "simple-to-complex sequencing of categories of learning tasks" and the presentation of multiple examples

with a range of features (p. 14). In addition, they suggested that cognitive learning tasks should be sequenced from easy to hard in order to gradually increase the cognitive demands on learners over a period of time. This work supported previously presented emphases on hierarchical, increasingly abstract task and stimulus features from information processing models (Anderson, 2002; Newell, 1990) and selection and sequencing of positive and negative examples from direct instruction research (Engelmann & Carnine, 1982).

Conclusions

The positive effects of such an instructional design on both student attitudes to learning and performance cannot be underestimated. This paper outlined some clear examples of the features of the instructional program that resulted in significant improvements in reading comprehension and question-answering in Year 5 students (Brown, 2004). This presentation applied the instructional features of implementation and lesson content to the complex cognitive task of question-answering, one skill critical in reading comprehension. The first author's intention was to outline how these principles of instructional design based on information processing models could be applied to classroom instructional materials for reading comprehension and math facts. Further applications of these design features, based on information processing models, will undoubtedly be evident in future research and classroom materials.

References

Aitkenhead, A. M., & Slack, J. M. E. (1985). *Issues in cognitive modelling*. Hillsdale, NJ: Erlbaum.

Alberdi, E., Sleeman, D. H., & Korpi, M. (2000). Accommodating surprise in taxonomic tasks: The role of expertise. *Cognitive Science, 24*, 53-91.

Anderson, J. R. (1993). *Rules of the mind*. Hillsdale, NJ: Erlbaum.

Anderson, J. R. (2002). Spanning seven orders of magnitude: a challenge for cognitive modelling. *Cognitive Science, 26*, 85-112.

Baddeley, A., Aggleton, J. P., & Conway, M. A. (2001). *Episodic memory: New directions in research*. Oxford, England: University Press.

Baumann, J. F., Hoffman, J. V., Duffy-Hester, A. M., & Ro, J. M. (2000). The first R yesterday and today: U.S. elementary reading instruction practices reported by teachers and administrators. *Reading Research Quarterly, 35*, 338-377.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience and school*. Washington, D.C.: National Academy Press.

Brown, G. (2004). The efficacy of question-answering instruction for improving Year 5 reading comprehension, Unpublished Doctoral Dissertation, University of Western Sydney, New South Wales.

Brown, G. (2005). Improving standardized reading comprehension: The role of question-answering, Australian Association for Research in Education Conference, December, Sydney, Australia.

Bruner, J. S. (1960). *The process of education*. Cambridge, MA: Harvard University Press.

De Corte, E. (2003). Designing learning environments that foster the productive use of acquired knowledge and skills. In E. De Corte, L. Verschaffel, N. Entwistle & J. van Merrienboer (Eds.), *Powerful learning environments: Unravelling basic components and dimensions* (pp. 21-34). Oxford, England, UK: Elsevier Science.

Dole, J. A., Duffy, G. G., Roehler, L. R., & Pearson, P. D. (1991). Moving from the old to the new: Research on reading comprehension instruction. *Review of Educational Research, 61*, 239-264.

Durkin, D. (1978-9). What classroom observations reveal about reading comprehension instruction. *Reading Research Quarterly, 14*, 481-538.

Engelmann, S. (1980). Toward the design of faultless instruction: The theoretical basis of concept analysis. *Educational Technology, 20,* 2, 28-36.

Engelmann, S., & Carnine, D. (1982). *Theory of instruction: Principles and applications*. New York: Irvington.

Ericsson, K. A., & Charness, N. (1994). Expert performance: Its structure and acquisition. *American Psychologist, 49*, 725-745.

Ericsson, K. A., Krampe, R. T., & Tesch-Romer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*, 363-406.

Fielding, L. G., & Pearson, P. D. (1994). Synthesis of research reading comprehension: What works. *Educational Leadership, 51*, 62-68.

Gersten, R., Fuchs, L. S., Williams, J. P., & Baker, S. (2001). Teaching reading comprehension strategies to students with learning disabilities: A review of research. *Review of Educational Research, 71*, 279-320.

Hasselbring, T. S., Goin, L.I., & Bransford, J. D. (1988). Developing math automaticity in learning handicapped children: the role of computerised drill and practice. *Focus on Exceptional Children, 20*, 1-7.

Howell, K. W., & Nolet, V. (2000). *Curriculum-based evaluation: Teaching and decision making* (3rd ed.). Belmont, CA: Thomas Learning.

Kameenui, E. J., & Simmons, D. C. (1990). *Designing instructional strategies*. Columbus, OH: Merrill.

Kintsch, W. (1998). *Comprehension: A paradigm for cognition*. Cambridge, England: Cambridge University Press.

Korpi, M. (1988). *Making conceptual connections: An investigation of cognitive strategies and heuristics of inductive categorization with natural concepts.* Unpublished doctoral dissertation, Stanford University, California.

Krug, D., Davis, T. B., & Glover, J. A. (1990). Massed versus distributed repeated reading: A case of forgetting helping recall? *Journal of Educational Psychology, 82*, 366-371.

Langan-Fox, J., Armstrong, K., Balvin, N., & Anglim, J. (2002). Process in Skill Acquisition: Motivation, Interruptions, Memory, Affective States, and Metacognition. *Australian Psychologist, 37*, 104-117.

Luria, A. R. (1973). *The working brain: An introduction to neuropsychology*. Ringwood, Victoria: Penguin Books.

McNeil, J. D. (1987). *Reading comprehension: New directions for classroom practice*. Chicago: Scott Foresman.

Miyake, A., & Shah, P. (Eds.). (1999b). *Models of working memory: Mechanisms of active maintenance and executive control*. Cambridge, England: Cambridge University Press.

National Institute of Child Health and Human Development. (2000a). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction* (NIH Publication No. 00-4769). Washington, D.C.: U.S. Government Printing Office.

National Institute of Child Health and Human Development. (2000b). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups* (NIH Publication No. 00-4754). Washington D.C.: U.S. Government Printing Office.

Newell, A. (1990). *Unified theories of cognition*. Cambridge, MA: Harvard University Press.

Niedelman, M. (1991). Problem solving and transfer. *Journal of Learning Disabilities, 24*, 322-329.

Pearson, P. D., & Dole, J. A. (1987). Explicit comprehension instruction: A review of research and a new conceptualization of instruction. *The Elementary School Journal, 88*, 151-165.

Pearson, P. D., & Fielding, L. (1991). Comprehension instruction. In R. Barr, M. L. Kamil, P. B. Mosenthal & P. D. Pearson (Eds.), *Handbook of reading research: Volume II* (pp. 815-861). White Plains, NY: Longman.

Pearson, P. D., & Johnson. (1978). *Teaching reading comprehension*. New York: Holt, Rinehart & Winston.

Pellegrino, J. W., & Goldman, S. R. (1987). Information processing and elementary mathematics. *Journal of Learning Disabilities, 20*, 23-32.

Raphael, T. (1982). Question-answering strategies for children. *The Reading Teacher, 36*, 186-190.

Rosenshine, B., & Stevens, R. (1986). Teaching functions. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (pp. 376-391). New York: Macmillan.

Sieck, W. R., & Yates, J. F. (2001). Overconfidence effects in category learning: A comparison of connectionist and exemplar memory models. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 27*, 1003-1021.

Sloboda, J. A., Davidson, J. W., Howe, M. J. A., & Moore, D. G. (1996). The role of practice in the development of performing musicians. *British Journal of Psychology, 87*, 287-309.

Sorace, A., Heycock, C., & Shillcock, R. (1999). *Language acquisition : Knowledge representation and processing*. Oxford, England: Elsevier Science.

Swanson, H. L. (2001). Searching for the best model for instructing students with learning disabilities. *Focus on Exceptional Children, 34*, 1-14.

Swanson, H.L. & Deschler, D. (2003). Instructing adolescents with learning disabilities: Converting a meta-analysis to practice. *Journal of Learning Disabilities, 32*, 124 – 134.

Swanson, H. L., & Howell, M. (2001). Working memory, short-term memory, and speech rate as predictors of children's reading performance at different ages. *Journal of Educational Psychology, 93*, 720-734.

Sweller, J. (1998). Can we measure working memory without contamination from knowledge held in long-term memory [Open Peer Commentary]. *Behavioral and Brain Sciences, 21*, 845-846.

Sweller, J., van Merrienboer, J. J. G., & Paas, F. (1998). Cognitive architecture and instructional design. *Educational Psychology Review, 10*, 251-296.

Thorley, B. J. (1987). *Learning and special education: Collected works*. Sydney, Australia: Macquarie University.

Thorley, B., Hotchkis, G., & Martin, M. (1991). Understanding and controlling learning operations in special education. *Educational Psychology, 11*, 169-179.

van Merrienboer, J. J. G., & Paas, F. (2003). Powerful learning and the many faces of instructional design: Toward a framework for the design of powerful learning environments. In E. De Corte, L. Verschaffel, N. Entwistle & J. van Merrienboer (Eds.), *Powerful learning environments: Unravelling basic components and dimensions* (pp. 3-20). Oxford, England: Elsevier Science.

Ward, L. M. (2002). *Dynamical cognitive science*. Cambridge, MA: MIT Press.

Williams, J. P. (2005). Instruction in reading comprehension for primary-grade students: A focus on text structure. *The Journal of Special Education, 39,* 6-18.

Wisniewski, E. J. (1995). Prior knowledge and functionally relevant features in concept learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21*, 449-468.

Wisniewski, E. J., & Medin, D. L. (1994). On the interaction of theory and data in concept learning. *Cognitive Science, 18*, 221-281.