Using a Bottom-Up Approach to Design Computers as Metacognitive Tools to Enhance Learning of History

Eric Poitras[1], Susanne Lajoie[1], & Yuan-Jin Hong[1]

McGill University[1]

[1]Department of Educational and Counselling Psychology, Advanced Technologies for Learning in Authentic Settings Research Group
Education Building, Room 614, 3700 McTavish Street, Montreal, QC, CA, H3A 1Y2
eric.poitras@mail.mcgill.ca

Abstract

A seminal study conducted by Greene, Bolick, and Robertson (2010) showed that learners do not always engage in appropriate metacognitive and self-regulatory processes while learning about history. However, little research exists to guide the design of technology-rich learning environments (TRLEs) as metacognitive tools in social sciences education. In order to address this issue, we designed a metacognitive tool using a bottom-up approach (Poitras, 2010; Poitras, Lajoie, & Hong, in prep). Thirty-two undergraduate students read an historical narrative text either with or without the benefit of the metacognitive tool. Results from process and product data suggest that learners had better recall because the metacognitive tool assisted learners to (a) notice that particular events are unexplained in the circumstances described in an historical narrative text, and (b) generate hypothetical causes to explain the occurrence of such events. We discuss the implications of these findings for the development of the MetaHistoReasoning Tool, a TRLE that assists learners' historical reasoning while they accomplish authentic tasks of historical inquiry.

1. Introduction

TRLEs use technology to assist learners to achieve learning objectives (Lajoie, Azevedo, 2006). Over the last twenty years, reviews of the literature on research and development of TRLEs in social studies show progress in aligning the design and implementation of technology with empirical evidence (Swan & Hofer, 2008; Lee & Friedman, 2009). However, research has yet to address the need to design TRLEs as metacognitive tools to enhance learning of history.

TRLEs can be designed as metacognitive tools to enhance learning and performance by means of prompting, supporting, and modeling learners' metacognitive and self-regulatory processes (Azevedo, 2005a, 2005b). Lajoie and Derry (1993) defined cognitive tools as any TRLE that assist learners to accomplish cognitive tasks by (a) supporting cognitive processes such as memory and metacognition, (b) sharing the cognitive load through supporting lower-order thought processes so that learners may focus on higher-order thought processes, (c) allow them to engage in thought processes that would otherwise be out of their reach, and (d) enable learners to generate and test hypotheses in the context of problem-solving. In addition to adhering to the definition of cognitive tools of Lajoie and Derry (1993), metacognitive tools are defined as any TRLEs that models, prompts, and supports learners to engage in key learning skills necessary for successful learning (Azevedo, 2005a).

TRLEs such as iStart (Graesser, McNamara, & VanLehn, 2005) and the MetaTutor (Azevedo, Witherspoon, Chauncey, Burkett, & Fike, 2009), among others, provide learners with a variety of different types of metacognitive tools to assist them as they learn about science topics. For instance, the MetaTutor trains students in using appropriate self-regulatory processes through modeling, and enables them to practice detecting and discriminating between good and poor self-regulatory processes (Azevedo et al., 2009).

However, little is known about the role of metacognitive tools in social sciences education, despite the pressing need to assist students in using appropriate metacognitive and self-regulatory processes as they learn about history. The problem addressed in this study was originally recognized as part of a pioneering study conducted by Greene et al. (2010). They found a relationship between self-regulated learning and the acquisition of declarative knowledge and historical thinking while using a hypermedia learning environments to learn about history. However, students' post-test scores obtained on measures of declarative knowledge and historical thinking were below average, suggesting the pressing need for providing support in using appropriate metacognitive and self-regulatory processes while learning about complex historical topics. In order to address this issue, we introduce the notion of a top-down and bottom-up approach to design metacognitive tools.

2. Using a Bottom-Up Approach to Design Metacognitive Tools in History Education

A Top-Down and Bottom-Up Approach to Design Metacognitive Tools

The terminology and assumptions underlying our theoretical framework is outlined bellow (see Figure 1; Poitras, 2010; Poitras et al., in prep). The term "top" refers to the higher-order metacognitive and self-regulatory processes that occur at the meta-level. While the term "bottom" refers to the lower-order cognitive processes that occur at the object-level. Furthermore, the term "down" relates to the design of metacognitive tools by means of a method of deductive reasoning. In contrast, the term "up" relates to the design of metacognitive tools by means of a method of inductive reasoning.

The top-down approach to design metacognitive tools is thus based on two assumptions. The first assumption asserts that a theory or model of metacognitive and self-regulated learning processes and their relationship to learning and performance guides the design of metacognitive tools. The second assumption affirms that design features that foster key metacognitive and self-regulatory processes can be deduced from such a theory or model. For instance, Greene et al. (2010) found that engaging in planning self-regulatory processes is predictive of better scores on the posttest measure of declarative knowledge. They deduced from these findings that metacognitive tools should be designed to scaffold learners' planning self-regulatory processes.

The bottom-up approach to design metacognitive tools is based on two albeit different assumptions. The first assumption maintains that a theory or model of cognitive processes and their relationship to learning and performance guides the design of metacognitive tools. The second assumption asserts that the design features that foster key metacognitive and self-regulatory processes can be inferred from such a theory or model. Using a bottom-up approach, we outline the rationale underlying the design of a metacognitive tool for enhancing learning and performance in the domain of history.
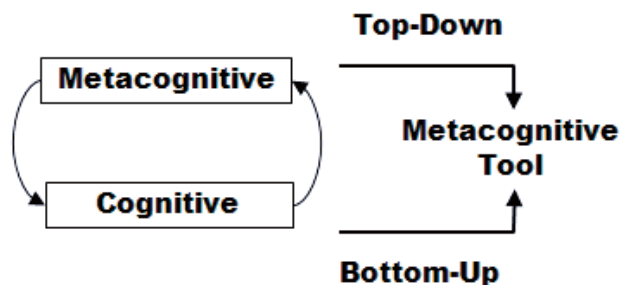

Figure 1. Top-Down and Bottom-Up Approach to Design Metacognitive Tools

First Assumption of a Bottom-Up Approach

The design features of metacognitive tools can be guided by a model of learners' cognitive processes and how they may lead to failure in attaining an instructional goal. The metacognitive tool can thus assist learners to (a) become aware of and (b) change their own cognitive processes in such a way as to attain the instructional goal.

Historical narrative texts are written accounts of past events where actions, events, and their consequences are interpreted and organized. Coherence, believed by professional historians to be the most important factor in judging the quality of a narrative (Carretero & Voss, 1994), is defined as the narrative's organization and focus on a central theme (Voss & Wiley, 2006). Causal coherence breaks occur when historical narrative texts fail to demonstrate that historical events lead to particular consequences (Linderholm et al., 2000; Vidal-Abarca, Gilabert, Gil, & Martinez, 2005). For example, an historical narrative text may mention the occurrence of the Second World War, but fail to suggest potential causes such as the lust for power and racism of Hitler, the tenuous political situation of Germany and the impoverished middle class workers (Carretero, Lopez-Manjon, & Jacott, 1997).

Causal coherence breaks interfere with learners' causal inferential processing and subsequently, their construction of a mental representation of the event (van den Broek, Young, Tzeng, & Linderholm, 1999). Using a discourse analysis method (see Trabasso, van den Broek, & Suh, 1989), researchers outlined principled methods for revising incoherent historical narrative texts by identifying and repairing causal coherence breaks (Linderholm et al., 2000; Vidal-Abarca et al., 2005). Assisting students in resolving coherence breaks through text revisions results in enhancing learning (Linderholm et al., 2000; Gilabert, Martinez, & Vidal-Abarca, 2005). We argue that in order for metacognitive tools to enhance learning of history, they should assist learners to (a) become aware of causal coherence breaks and (b) change their own cognitive processes in such a way as to attain the instructional goal.

Second Assumption of a Bottom-Up Approach

In order to assist learners to resolve causal coherence breaks and achieve better learning gains, we infer that a metacognitive tool should be designed to assist learners to (a) notice that particular events are unexplained in the circumstances described in an historical narrative text, and (b) generate hypothetical causes to explain the occurrence of such events. The design features of the metacognitive tool would then consist of elaborative interrogations. The elaborative interrogations should be designed in order to ask learners to explain the occurrence of events at the origin of causal coherence breaks.

Elaborative interrogations are "why" questions that trigger explanations based on learners' background knowledge and previously read sentences throughout the text (McCrudden & Schraw, 2007). For example, learners' could be asked to explain "why did the Second World War occur?", thereby leading them to suggest potential causes

for its occurrence. The process of answering why-questions through generating explanations, referred to as explanation-centered learning (Graesser, Baggett, Williams, 1996; Graesser et al., 2005), is described as inferring the missing cause of the queried event (Graesser, Singer, & Trabasso, 1994).

Elaborative interrogations enable learners to construct a more complete mental representation of the event (McDaniel & Donnelly, 1996) through the maintenance of information in short term memory while at the same time, linking it to information retrieved from long term memory (Ozgungor & Guthrie, 2004). Although elaborative interrogations have been embedded in TRLEs (Dornisch & Sperling, 2006), the effects of querying the occurrence of events at the origin of causal coherence breaks by means of elaborative interrogations have yet to be investigated.

Evaluating the Bottom-Up Approach to Design Metacognitive Tools

The objective of this study was to use a bottom-up approach to develop a metacognitive tool that assist learners in using metacognitive and self-regulatory processes while learning about complex historical topics. Specifically, we expected learners to (a) notice that particular events are unexplained in the circumstances described in an historical narrative text, and (b) generate hypothetical causes to explain the occurrence of such events. The research question addressed in this study was whether or not use of the metacognitive tool would enhance learning.

In order to answer this question, this research study followed a 2x2 independent groups design with a treatment condition, where learners had the benefit of the metacognitive tool, and a control condition, where learners did not have the benefit of the tool. Half of the learners in each condition performed think alouds (Ericsson & Simon, 1993) while the other half did not. Pretest scores obtained on a reading comprehension skill and prior knowledge measure were collected in order to statistically control for their mediating effects. Think aloud protocol data and answers to the elaborative interrogation prompts were analyzed in order to determine the nature of the metacognitive processes that occurred while reading the historical narrative text. The amount of material recalled and the accuracy of answers to comprehension questions were measured at posttest in order to compare learning gains across conditions.

The research hypotheses were as follows:

1. If the use of the metacognitive tool facilitates recall and understanding of the historical narrative text, then learners who have the benefit of the tool are expected to show a greater amount of information recalled and more accurate answers to comprehension questions at posttest while statistically controlling for the mediating effects of individual differences in reading comprehension skills and amount of prior knowledge.

2. If the use of the metacognitive tool fosters the key metacognitive monitoring and control processes, then the examination of the concurrent think aloud protocols converged with the answers to the elaborative interrogations will show that learners who had the benefit of the metacognitive tool monitored comprehension failures and generated explanatory inferences more frequently.

3. If engaging in the key metacognitive monitoring and control processes result in facilitating recall and understanding of the historical narrative text, then we expect a positive bivariate correlation between the dependent variables (i.e., amount of information correctly recalled and the accuracy of answers) with the independent variables (i.e., the frequency with which learners engaged in monitoring comprehension failures and generated explanatory inferences).

3. Methods

Participants

The sample, gathered through convenience sampling, consisted of 32 undergraduate students (6 men and 26 women). Participants were proficient in both reading and writing in English and were not enrolled in a university-level history related program. A pre-test free recall measure of amount of background knowledge related to the topic of the text showed that they were unfamiliar with its topic.

Materials

Text. The participants read a short excerpt (approximately 500 words) taken from an historical narrative text (see Levitt, 1970). The historical narrative text is used as part of an undergraduate-level introductory course in history at McGill University and is thus at an appropriate level of difficulty for the participants.

Discourse Analysis Method. The discourse analysis method of Trabasso et al. (1989) was used in order to represent the historical narrative text as a causal network (interrater agreement = 90%; see Poitras (2010) for detailed instructions). The historical narrative text contained eight causal coherence breaks that were either identified or introduced for the purposes of evaluating the metacognitive tool. For example, the text failed to mention the cause "the imperial defense planners wished the Dominions to contribute to a system of imperial defense" which lead to the consequent event "the colonies were contributing large amounts of money".

Design Features of the Metacognitive Tool. The historical narrative text was displayed in a TRLE. Eight elaborative interrogations, each corresponding to a causal coherence break, were created. For example, one elaborative interrogation asked learners: "why would the colonies contribute large amounts of money?". Each elaborative interrogation had a reference to the paragraph which contained the event at the origin of a causal coherence break. Participants wrote their answers in a textbox. They chose which elaborative interrogation to answer by clicking on the "previous" and "next" buttons. Whereas the participants in the treatment condition had the

benefit of the metacognitive tool displayed in the right margin of the TRLE, those assigned to the control condition did not.

Process Data. The process data consisted of the participants' answers to the elaborative interrogations stored in the log files and the concurrent think aloud protocols. Both data sources were converged according to the time at which each utterance or written answers were made. The data was then analyzed according to the following coding scheme (see Poitras, 2010): (a) associations, (b) backward inferences including connecting, reinstatement and explanatory inferences, (c) paraphrases/text repetitions, (d) comprehension monitoring including either successes and failures, and (e) other. Interrater agreement obtained for a randomly selected sample consisting of 10% of the total amount of utterances was substantial (Cohen's Kappa = .64; percentage of agreement = 72.2%). Disagreements were resolved through discussion.

Product Data. The product data consisted of both pretest (i.e., demographic questionnaire, free recall task, and reading comprehension test) and posttest (see Linderholm et al., 2002; i.e., free recall task and comprehension questions) measures. The pretest free recall task assessed learners' background knowledge related to the topic of the text. The reading comprehension test consists of the paper-based Form A adult version of the Wechsler Fundementals: Canadian (The Psychological Corporation, 2007). The posttest free recall task assessed learners' memory of the information mentioned in the text. The recall protocols were scored using the causal network representation of the text whereby a point is awarded for each event mentioned that matches with an event mentioned in the text. Interrater agreement obtained for a randomly selected sample consisting of 10% of the total amount of utterances was substantial (Cohen's Kappa = .63; percentage of agreement = 84.4%). Disagreements amongst judges were resolved through discussion. The posttest comprehension questions assessed understanding of the causal chain of events. The answers were scored using the causal network representation, whereby a point is awarded for each answer that matches with either the correct cause or effect to an event mentioned in the text. Interrater agreement obtained for a randomly selected sample consisting of 10% of the total amount of utterances was fair (Cohen's Kappa = .38; percentage of agreement = 80%). Disagreements amongst judges were resolved through discussion.

Procedure

Participants first completed a consent form and demographic questionnaire. The pretest free recall task was then administered. Participants were asked to write everything they knew about Wilfred Laurier and Henri Bourassa and the events surrounding the Imperialist Movement, the Boer War and the Foundation of the Canadian Navy. Before reading the text, the participants completed the reading comprehension test. They were asked to read the text once and answer to the questions without looking back to the text.

Half of the participants were trained to think aloud following the procedure outlined in Ericsson & Simon (1993). The instruction given to the participants was: "Please remember that it is very important to say everything that you are thinking while you are reading the text." The experimenter reminded participants to keep verbalizing when they had been silent for more than 3 seconds (e.g., "Remember to say what you are thinking as you read through the text").

Participants in both the experimental and control conditions were instructed to read the text at a rate that allowed them to not only remember it but to also understand it because they were to be later tested on both their recall and understanding. Participants in the experimental group were taught how to use the metacognitive tool (e.g., writing answers and changing the questions displayed).

After reading the text, participants were administered the posttest free recall task. They were asked to write everything they could remember from the text. Then, they completed the posttest comprehension questions. They were instructed to write an answer to each open-ended question.

4. Results

First Research Hypothesis

The multivariate analysis of covariance showed that the scores obtained on the two dependent variables differed as a function of the measurement condition, $F(2,26) = 3.92$, $p < .05$. A similar result was obtained on the univariate analyses of covariance in regards to the posttest free recall task and the comprehension questions measure, $F(1,27) = 7.03$, $MSE = 26.72$, $p < .05$, and $F(1,27) = 5.79$, $MSE = 1.35$, $p < .05$, respectively. Participants who performed a concurrent think aloud scored lower on both measures of amount of information recalled ($M = 8.81$, $SE = 1.30$, vs. $M = 13.75$, $SE = 1.30$) and accuracy of answers to comprehension questions ($M = 1.62$, $SE = .30$, vs. $M = 2.63$, $SE = .30$) compared to the participants who read silently. The effect size was small in regards to both free recall and comprehension questions measure ($\eta^2 = .21$, and $\eta^2 = .18$, respectively).

The univariate analysis of covariance showed that the scores obtained on the free recall task differed as a function of group, $F(1,27) = 5.37$, $MSE = 26.72$, $p < .05$. Participants who had the benefit of the metacognitive tool scored higher on the measure of amount of information recalled ($M = 13.44$, $SE = 1.30$) compared to participants who did not ($M = 9.12$, $SE = 1.30$). The effect of the metacognitive tool towards enhancing recall was small ($\eta^2 = .17$)

Second Research Hypothesis

The results obtained from the chi square tests as well as from the standardized residuals show that learners in the control group generated more associations ($M = 3.25$, $SD = 3.96$ vs. $M = 0.25$, $SD = 0.46$) than what would be expected due to chance, $\chi^2(1,16) = 4.00$, $p < .05$. However, the learners in the treatment group generated more reinstatement inferences ($M = 6.88$, $SD = 5.06$ vs. $M = 0.38$, $SD = 0.52$), explanatory inferences ($M = 5.88$, $SD = 4.49$ vs. $M = 1$, $SD = 1.20$), and monitoring comprehension failures ($M = 8.38$, $SD = 6.52$ vs. $M = 2.75$, $SD = 2.31$) than what would be expected due to chance, $\chi^2(1,16) = 16.00$, $p < .05$, $\chi^2(1,16) = 6.35$, $p < .05$, and $\chi^2(1,16) = 4.27$, $p < .05$, respectively.

Third Research Hypothesis

In order to address the increase in family wise error rate due to performing multiple comparisons, a Bonferroni correction was performed, setting the alpha value at $\alpha = .05/16 = .003125$. The results show a statistically significant relationship between the learning outcomes measure of free recall with the process measures of generating connecting inferences ($r(16) = .70$), reinstatement inferences ($r(16) = .81$), paraphrases and text repetitions ($r(16) = .74$), monitoring comprehension failures ($r(16) = .85$), monitoring comprehension successes ($r(16) = .76$), and explanatory inferences ($r(16) = .72$).

5. Discussion

The first research hypothesis is partially supported, since the use of the metacognitive tool facilitated recall but not comprehension. The incoherent text may have been too difficult to understand, especially for learners with low background knowledge related to its topic. This may explain why the instruction to think aloud interfered with the participants' performance on the learning outcome measures. Adding elaborating information to resolve the causal coherence breaks would have supported learners with low background knowledge in generating causal inferences (Gilabert et al., 2005). Ainsworth and Burcham (2007) also showed that the benefits of interventions such as self-explanation training are greater for coherent texts. Future research will explore this relationship further by looking at the influence of prior knowledge more directly.

The second research hypothesis is supported by the results, since the use of the metacognitive tool resulted in monitoring comprehension failures more frequently and generating explanatory inferences. Using a bottom-up approach, we were successful in developing a metacognitive tool to assist learners to (a) notice that particular events are unexplained in the circumstances described in an historical narrative text, and (b) generate hypothetical causes to explain the occurrence of such events. However, the operational definition of these key metacognitive processes used in this study did not consider their time of onset. More specifically, whether or not these key metacognitive processes occurred at the precise time when learners processed causal coherence breaks. Future research would need to develop more precise operational definitions of these terms as well as use the appropriate statistical analyses to account for time of onset of metacognitive processes.

The third research hypothesis is partially supported, since engaging in the key metacognitive processes was predictive of better recall but not of comprehension. Little is known about the range of metacognitive processes, as well as shifts in such processes, that are predictive of achieving better learning outcomes in history education. Greene et al. (2010) found that the amount of planning self-regulated learning processes was predictive of better learning outcomes. Future research needs to address this issue by using a top-down approach to design metacognitive tools.

Based on our findings, we will design the MetaHistoReasoning Tool, a TRLE that assists learners' historical reasoning while they accomplish authentic tasks of historical inquiry. The design of the MetaHistoReasoning Tool is guided by a theory of historical reasoning (van Drie & van Boxtel, 2008) in order to assist learners to (a) become aware of failures in understanding historical events, and then (b) achieve explanatory coherence through generating lines of historical reasoning. Future research will investigate whether using the MetaHistoReasoning Tool results in fostering historical reasoning, and thereby enhancing learning in history education.

References

Ainsworth, S., & Burcham, S. (2007). The impact of text coherence on learning by self-explanation. *Learning and Instruction*, *17*, 286-303.

Azevedo, R. (2005a). Computer environments as metacognitive tools for enhancing learning. *Educational Psychologist*, *40*, 193–198.

Azevedo, R. (2005b). Using Hypermedia as a Metacognitive Tool for Enhancing Student Learning? The Role of Self-Regulated Learning. *Educational Psychologist, 40*(4), 199-209.

Azevedo, R., Witherspoon, A., Chauncey, A., Burkett, C., & Fike, A. (2009). *MetaTutor: A Metacognitive Tool for Enhancing Self-Regulated Learning*. Paper presented at the Cognitive and Metacognitive Educational Systems: AAAI Fall Symposium.

Carretero, M., López-Manjón, A., & Jacott, L. (1997). Explaining historical events. *International Journal of Educational Research*, *27*(3), 245-253.

Dornisch, M. M., & Sperling, R. A. (2006). Facilitating learning from technology-enhanced text: Effects of

prompted elaborative interrogation. *Journal of Educational Research*, *99*(3), 156-166.

Ericsson, K. A., & Simon, H. A. (1993). *Protocol analysis: Verbal reports as data* (revised edition). Cambridge, MA: The MIT Press.

Gilabert, R., Martinez, G., Vidal-Abarca, E. (2005). Some good texts are always better : Text revision to foster inferences of readers with high and low prior background knowledge. *Learning and Instruction*, *15*(1), 45-68.

Graesser, A. C., Baggett, W., & Williams, K. (1996). Question-driven explanatory reasoning. *Applied Cognitive Psychology*, *10*, 17-32.

Graesser, A. C., Singer, M., & Trabasso, T. (1994). Constructing inferences during narrative text comprehension. *Psychological Review*, *101*, 371–395.

Graesser, A.C., McNamara, D.S., & VanLehn, K. (2005). Scaffolding deep comprehension strategies through Point&Query, AutoTutor, and iSTART. *Educational Psychologist, 40,* 225-234.

Greene, J.A., Bolick, C.M., & Robertson, J. (2010). Fostering historical knowledge and thinking skills using hypermedia learning environments: The role of self-regulated learning. *Computers & Education*, *54*(1), p. 230-243.

Lajoie, S.P., & Azevedo, R. (2006). Teaching and learning in technology-rich environments. In P. Alexander & P. Winne (Eds.), *Handbook of educational psychology* (2nd ed.) (pp. 803-821). Mahwah, NJ: Erlbaum.

Lajoie, S.P., & Derry, S.J. (Eds.) (1993). *Computers as cognitive tools*. Hillsdale, NJ: Erlbaum.

Lee, J., Friedman, A.M. (2009). *Research on technology in social studies education.* Information Age Publishing Inc.

Carretero, M., Voss, J. F. (1994), *Cognitive and Instructional Processes in History and the Social Sciences*. Hillsdale, NJ: Erlbaum.

Levitt, Joseph. (1970). *Henri Bourassa on Imperialism and Biculturalism, 1900-1918*. Copp Clark Pub Co. : Toronto.

Linderholm, T., Everson, M. G., van den Broek, P., Mischinski, M., Crittenden, A., & Samuels, J. (2000). Effects of causal text revisions on more- and less-skilled readers' comprehension of easy and difficult narrative texts. *Cognition and Instruction*, *18*, 525-556.

McCrudden, M. T., & Schraw, G. (2007). Relevance and goal-focusing in text processing. *Educational Psychology Review*, *19*(2), 113-139.

McDaniel, M. A. & Donnelly, C. M. (1996). Learning with analogy and elaborative interrogation. *Journal of Educational Psychology*, *88*(3), 508-519.

Ozgungor, S., & Guthrie, J. T. (2004). Interactions among elaborative interrogation, knowledge, and interest in the process of constructing knowledge from text. *Journal of Educational Psychology*, *96*, 437-443.

Poitras, E. (2010). A metacognitive tool to support reading comprehension of historical narratives. *Unpublished Thesis Manuscript*.

Poitras, E., Lajoie, S.P., Hong, Y.-J. (in prep). Theory-Driven Design of Metacognitive Tools : A Top-Down and Bottom-Up Approach. *Instructional Science*

Swan, K.O., & Hofer, M. (2008). Technology and social studies. In L. Levstik & C.A. Tyson (Eds.), *Handbook of research in social studies education* (pp. 307-326). New York: Sage.

The Psychological Corporation. (2007). *Weschler Fundementals: Academic Skills-Canadian*. Pearson Canada Assessment Inc.

Trabasso, T., van den Broek, P., & Suh, S.Y. (1989). Logical necessity and transitivity of causal relations in stories. *Discourse Processes*, *12*, 1–25.

van den Broek, P., Young, M., Tzeng, Y., & Linderholm, T. (1999). The landscape model of reading. In H. van Oostendorp & S. R. Goldman (Eds.), *The construction of mental representations during reading* (pp. 71-98). Mahwah, NJ: Erlbaum.

van Drie, J. y van Boxtel, C. (2008). Historical reasoning: towards a framework for analizing student's reasoning about the past. *Educational Psychology Review*, *20*, 87-110.

Vidal-Abarca, E., Gilabert, R., Gil, L., & Martínez, T. (2005). How to make good texts for learning: Reviewing text revision research. In Alea V. Mitel (Ed.), *Focus on Educational Psychology*. New York: Nova Science Publishers.

Voss, J. F. & Wiley, J. (2006). Expertise in history. In K. A. Ericsson, N. Charness, P. Feltovich & R. R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 1746-2424). Cambridge University Press.