Early metacognitive abilities: The interplay of monitoring and control processes in 5- to 7-year-old children

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A B S T R A C T

The goal of the current investigation was to compare two monitoring processes (judgments of learning [JOLs] and confidence judgments [CJs]) and their corresponding control processes (allocation of study time and selection of answers to maximize accuracy, respectively) in 5-, 6-, and 7-year-old children (N = 101). Children learned the meanings of Japanese characters and provided JOLs after a study phase and CJs after a memory test. They were given the opportunity to control their learning in self-paced study phases and to control their accuracy by placing correct answers in a treasure chest and placing incorrect answers in a trash can. All three age groups gave significantly higher CJs for correct answers compared with incorrect answers, with no age-related differences in the magnitude of this difference, suggesting robust metacognitive monitoring skills in children as young as 5 years. Furthermore, a link between JOLs and study time was found in 6- and 7-year-olds, such that children spent more time studying items with low JOLs compared with items with high JOLs. In addition, 6- and 7-year-olds, but not 5-year-olds, spent more time studying difficult items compared with easier items. Moreover, age-related improvements were found in children's use of CJs to guide their selection of answers; although children as young as 5 years placed their most confident answers in the treasure chest and placed their least confident answers in the trash can, this pattern was more robust in older children. Overall, results support the view that some

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metacognitive judgments may be acted on with greater ease than others among young children.

Introduction

Metacognition can be defined as an individual's knowledge about cognitive processes (declarative metacognition; Lockl & Schneider, 2006) and the use of this knowledge to regulate or control the cognitive processes (procedural metacognition; Brown, 1978; Flavell, 1979). The current investigation focused on selected procedural metacognitive monitoring and control processes. In general, metacognitive monitoring processes are examined by asking individuals to explicitly assess a cognitive state before, during, or after completing a cognitive task such as perceptual discrimination (e.g., Lyons & Ghetti, 2011, 2013) or memory processes (e.g., Ghetti, Qin, & Goodman, 2002; Lockl & Schneider, 2002a; Roebers, 2002; Schneider, Vise, Lockl, & Nelson, 2000). Metacognitive control processes are assessed by examining whether participants adapt their behavior in response to the output of monitoring processes or respond strategically to optimize performance (Schneider & Lockl, 2008). Thus, when studying for an exam, we may introspect on our current progress toward learning the required material (i.e., metacognitive monitoring) and selectively study material or differentially allocate study time (i.e., metacognitive control). Later, when taking the exam, we may introspect on our confidence in the candidate answers we retrieved from memory, and if guessing is penalized, we may selectively report only those answers about which we feel highly confident.

These examples pertain to two metacognitive judgments that have been frequently examined in the metacognitive literature: *judgments of learning* (JOLs; e.g., Koriat & Ackerman, 2010; Lipko, Dunlosky, Lipowski, & Merriman, 2012; Metcalfe & Finn, 2013) and *confidence judgments* (CJs; e.g., Koriat, 2011; Lyons & Ghetti, 2011; Roebers, von der Linden, & Howie, 2007). JOLs refer to individuals' assessments of how well they have learned specific information and to the prediction of how many items will be recalled in a subsequent performance test and are usually elicited after a set study period. CJs refer to individuals' assessments of their certainty in the accuracy of information they have reported. These judgments have also been frequently paired with the opportunity to execute specific control behaviors; individuals' strategic allocation of study time to individual study items has been examined with respect to the JOLs given to those items, and their decisions to report or withhold answers have been examined with respect to the CJs given to those answers.

Metacognitive monitoring and control of ongoing cognitive activities play a key role in reading and listening comprehension (de Bruin, Thiede, Camp, & Redford, 2011; Nelson & Narens, 1994), memory performance (Hembacher & Ghetti, 2013; Krebs & Roebers, 2010; Lipko et al., 2009), and self-regulated learning in general (Boekaerts, 1996; Lockl & Schneider, 2002b). Yet, relatively little is known about the emergence and early development of these skills and the interplay between monitoring and control processes. Furthermore, as far as we know, no studies of early development have directly compared different metacognitive judgments during development. In the current research, we attempted to overcome this limitation and examine the early development of monitoring and control processes in the context of a task requiring children to learn paired associates. In the following paragraphs, we review evidence of early monitoring and control abilities and their developmental progression, followed by a brief review of literature about the monitoring–control relation.

How do children monitor their learning?

A number of studies have shown that young children tend to overestimate their performance, as reflected in JOLs and CJs at both the global level and the item level (Lipko et al., 2009, 2012). However, early competence has also been demonstrated during the preschool years, with children as young as 3 years giving higher CJs to correct answers compared with incorrect answers in perceptual discrimination tasks (Coughlin, Hembacher, Lyons, & Ghetti, 2014; Lyons & Ghetti, 2013) and providing