Chapter 1
Changes in Students' Cognitive and Metacognitive Strategy Use over Five Years of Secondary Schooling

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ABSTRACT

As students progress through school, we expect that their knowledge about the various subject matters, such as biology or maths, becomes more extensive, well structured, and readily available for application in diverse contexts. This chapter reports the authors' enquiry about whether students' cognitive and metacognitive knowledge and strategies do grow during secondary school. Questionnaires were administered to students in three South Australian secondary schools in each of five consecutive years. Hierarchical linear modelling was used to investigate changes in students' responses over time. Results showed little change in students' reports of their cognitive and metacognitive strategy use. The disappointing growth trajectories suggest that cognitive and metacognitive strategies for learning are not subject to the explicit teaching and evaluation processes applied to other school subjects. Questions are raised about whether schools and teachers value and recognise the importance of cognitive and metacognitive strategies for good quality learning across subject domains.

INTRODUCTION

A number of authors have highlighted the importance of self-regulation to support effective learning (Schraw, Crippen, & Hartley, 2006; Schunk & Zimmerman, 1989; Zimmerman, 2002). Conceptual frameworks for self-regulated learning have been formulated by authors such as Boekaerts and Corno (2005), Efklides (2011), Hadwin & Winne (2012), Schunk and Zimmerman (2013) and Sitzman and Ely (2011). Typically self-regulated learning is defined as, "the modulation of affective,

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cognitive, and behavioral processes throughout a learning experience to reach a desired level of achievement" (Sitzman & Ely, 2011, p. 421). In Schunk and Zimmerman's model, the three major phases of self-regulation involve forethought (e.g., motivation, beliefs, task analysis, planning), performance (e.g., monitoring, self-instruction, attention, elaboration) and self-reflection (e.g., self-evaluation, attributions, affective reactions). These phases incorporate the motivational, cognitive and metacognitive components of learning discussed by Mayer (1998). Schraw et al. (2006) proposed that good self-regulators learn more with less effort, and Schwonke et al. (2013) explained that self-regulation requires learners to employ motivational, cognitive and metacognitive strategies. The focus of this chapter is upon students' cognitive and metacognitive strategies for learning.

The Beneficial Effects of Cognitive and Metacognitive Strategies

A generation ago, Weinstein and Mayer (1986) provided an overview of useful strategies to enable students to learn subjects, such as biology and maths, efficiently and effectively. Cognitive strategies can include generating questions, taking notes, making mental images, and drawing concept maps (Kiewra, 2002; Novak, 1990). Meanwhile, metacognitive knowledge (declarative, procedural, conditional) and regulation (planning, monitoring, evaluation) directs the use of cognitive strategies (Schraw et al., 2006). In other words, higher-order metacognitive processes monitor and regulate lower-order cognitive processes (Nelson, 1996). By way of example, Veenman and Veenman (2011) explained that drawing inferences is a cognitive activity, but the self-induced decision to initiate such activity is metacognitive.

Shortly following the Weinstein and Mayer (1986) overview, Klauer (1988 p. 351) argued that "teachers should be qualified not only to teach the respective subject matter but also to teach students how to learn this subject matter". Since then, a wealth of studies has demonstrated the beneficial effects of cognitive and metacognitive strategies for good quality learning. For example, Roebers, Cimeli, Röthlisberger and Neuenschwander (2012) proposed that declarative metacognitive knowledge directly and substantially influences students' academic outcomes, having been shown, for example in PISA studies, to have a long-term impact on school careers and a short term impact on test performance. Similarly, Roebers et al. argued, metacognitive monitoring and control processes account for individual differences in test performance, controlling for psychometrically tested intelligence. Hattie's (2009, pp. 297-300) meta-analysis overviewed a range of effect sizes (Cohen's *d*) for study skills instruction involving cognitive, metacognitive and affective components, revealing an average effect size of 0.59, with a higher average effect of 0.69 for metacognitive strategy instruction. Hattie argued that study skill instruction can be effective on its own for acquiring surface level information, but is more effective when embedded within the subject matter domains in order to assist with deeper levels of understanding.

The Development of Cognitive and Metacognitive Strategies

Models of the development of expertise have suggested that subject matter knowledge, and cognitive and metacognitive strategy knowledge, develop in concert with each other. For example, Alexander, Jetton and Kulikowich's (1995) model of domain expertise proposes concurrent rises in knowledge, interest and learning strategies as learners maintain their engagement with an area of study. Similarly, Chi (1985) argued that both subject-matter knowledge and strategy knowledge are essential components of developing expertise.

Van der Stel and Veenman's (2010) study of the development of early adolescents' metacognitive skills found a continuous growth of metacognitive