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Metacognition And Educational Achievement

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Abstract: The theme "Metacognition and Educational Achievement" explores the profound impact of metacognitive processes on academic success. Metacognition, involving the awareness and regulation of one's own cognitive processes, has emerged as a critical factor in shaping learning outcomes and overall educational achievement. This theme delves into various aspects of metacognition, such as goal setting, strategic planning, task monitoring, and evaluation, highlighting its influence on problem-solving skills and adaptive learning strategies. It underscores the link between metacognition and self-regulation, motivation, and the awareness of diverse learning styles. The theme also discusses the role of metacognition in facilitating the transfer of knowledge across different contexts and reducing cognitive load for more effective learning. Ultimately, the exploration of "Metacognition and Educational Achievement" emphasizes its practical implications for educators, encouraging the integration of metacognitive strategies into teaching practices to enhance students' cognitive awareness, self-directed learning, and overall academic success.

Key words: Cognitive processes,learning outcomes, academic performance, self-regulation, problem-solving skills, critical thinking, reflective thinking, educational psychology, cognitive development, goal-setting, planning skills, academic success, learning strategies.

Several research studies have demonstrated an empirical link between metacognition and academic success. In one of the most provocative studies,

for example, Kruger and Dunning (1999) demonstrated that individuals who scored poorly in cognitive ability tests also showed low awareness of their abilities by overestimating their performance, and were therefore characterised as 'un-skilled and unaware of it' (this effect has become known as 'the Dunning-Kruger effect', see Dunning, 2011). Similarly, Minnaert and Janssen (1999) investigated the relationship between metacognition, intelligence and performance in Higher Education, finding main effects of both intelligence and metacognition on students' academic performance. The authors suggest that metacognitive regulative activities add value in explaining performance above the influence of intelligence alone.

Empirical links between metacognition and academic performance has also been demonstrated in research focusing on the primary school years. In an influential study, Swanson (1990) investigated both cognitive ability and metacognitive knowledge in relation to performance in problem-solving tasks. After being assigned to either high or low ability groups based on cognitive ability scores, nine- to eleven-year-old children completed a metacognitive questionnaire followed by two problem-solving tasks. For both tasks, there was a stronger relationship between metacognitive knowledge and performance than between cognitive ability and performance. These findings suggest that being highly metacognitive is related to positive performance in problem-solving tasks. Notably, the pattern of performance also demonstrated that metacognition added most benefit for problem solving performance when cognitive ability was low (Swanson, 1990).

More recently, Freeman, Karayanidis and Chalmers (2017) investigated the relationship between metacognition and performance in nine to ten-year-old children, finding that the accuracy of students' metacognition (as measured through the comparison of estimates of performance to actual performance) was positively related to students' academic performance. In a related study, Bryce, Whitebread and Szücs (2015) investigated the relationship between metacognitive skills, executive functions and achievement in young children finding that at five and seven years old, metacognitive skills were the greatest predictor for educational achievement in comparison to executive functioning. A recent meta-analysis indeed found that when controlling for intelligence, metacognition predicted academic performance (Ohtani & Hisasaka, 2018). Thus, evidence overall identifies metacognition as having significant beneficial

effects on academic performance, independent from cognition. Classroom-based methods

Observational methods have been developed as an alternative approach to experimental paradigms in the applied classroom setting. For example, Whitebread et al. (2009) observed metacognition in the everyday classroom activities of young students (three to five years old). By videotaping 'meaningful' activities elicited by the teacher, Whitebread et al. (2009) recorded both verbal and non-verbal indicators of metacognition using the

Children's Independent Learning Coding Scheme (C.Ind.Le). Several components of both metacognitive knowledge (of persons, tasks, strategies) and metacognitive regulation (planning, monitoring, control, evaluation) were observed, for example "explains procedures involved in a particular task" (Knowledge: Strategies) and "Sets goals and targets" (Regulation: Planning). Since its development, the C.Ind.Le coding scheme has become increasingly used in classrooms as a measure of metacognition, for example in the investigation of features of the learning environment that influence metacognition and selfregulation (Robson 2016a, 2016b).

The distinction between knowledge and regulation has also been evidenced by interviews with students, including through the additional support of prompts. For example, Lee, Teo and Bergin (2012) interviewed ten-year-old children about problem solving used whilst making every-day monetary decisions. Knowledge (procedural, conditional, and of self, parents, strategies) was highlighted, as well as components of regulation: planning (goal setting, fact finding), monitoring, and evaluation (strategies, alternatives, reflecting comparison). In another study, Wilson (1998) used 'action cards' containing metacognitive statements as prompts during interviews about solving maths problems. Ten action cards contained items related to awareness, evaluation and regulation. 'Upper-elementary school-aged students' indicated that they monitored and regulated their own problemsolving in many ways. For example, the most selected card was "I checked my answer as I was working" (evaluation). Although limited to the elements of metacognition stated on

the 'action cards', this research again highlights both knowledge and regulatory functions of metacognition.

Despite an increasing focus on applied studies of metacognition, many investigations employing qualitative methods within the classroom still

primarily measure components by coding excerpts using specific predefined categories or operational definitions. Indeed, most observational studies assess metacognition by observing video recorded scenarios of classroom activity and analysing them with structured checklists (Whitebread et al., 2009; Robson, 2016a, 2016b). Structured checklists retain a focus upon counting instances of metacognitive knowledge and regulation from pre-defined indicators, rather than allowing the identification of themes that emerge from everyday tasks.

Another key classroom-based approach for gauging metacognition within the classroom is the recording of observations using running records (based primarily on the work of Nancy Perry, 1998; Perry, VandeKamp, Mercer & Nordby, 2002). In comparison to other prominent observational tools that are based on coding video-recorded excerpts of classroom activity, running records allow 'real-time' recording of verbal and non-verbal behaviour (Perry, 1998). Such an approach is particularly valuable for characterising the metacognitive process in a minimally intrusive manner (Perry et al., 2002). To conduct running records, the researcher records all verbatim speech and observed behaviour as far as possible in a given task, also detailing of relevant supplementary information such as task content. Perry et al. (2002) investigated characteristics that influenced the promotion of self-regulation, and so analysis of running records included a list of pre-defined categories predicted to characterise low and high 'self-regulated-learning environments'. A strength of running records, therefore, is that they are a flexible tool that enables multiple forms of analysis, including 'top-down' analysis based on pre-defined codes, as well as the analysis of emerging themes (Perry et al., 2002).

Novel classroom-based methods have been developed to elicit children's understanding of their own thinking and learning through concept maps (Ritchhart, Turner & Hadar, 2009) and Pupil Views Templates (Wall, 2008; Wall, Higgins, Remedios, Rafferty & Tiplady, 2012). Pupil View Templates (PVTs) are visual tools to support students to describe their thinking and/or learning in a specific scenario. In PVTs, a cartoon scenario is presented to students, with empty thought and speech bubbles for students to document their thinking in a given (most commonly familiar) situation, such as a literacy lesson or numeracy lesson (Wall & Higgins, 2006; Wall et al., 2012). The inclusion of both thought and speech bubbles allow for exploration of the internal thought process and

the external processes respectively. As such, PVTs can be seen as a powerful tool for assessing metacognitive as well as cognitive domains (Wall & Higgins, 2006). Ritchhart and colleagues (2009) explored children's thinking about thinking using concept maps. Using a 'ground up' approach to analysis, results indicated that younger (grade three to four) students tended to provide more 'associative' comments in concept maps (i.e., they comment on people/places/items associated with thinking, but do not actually relate this to the thinking process itself). By contrast, older students (grades seven to eleven) tended to refer more to strategic aspects of thinking (i.e., comments related to an action described, either general or specific). The authors described no relationship between age and emotional responses (relating to emotional aspects of the thinking process, such as
'excited' or 'unsure') or meta-responses (relating to the experience of thinking more widely). Continuing analysis, Ritchhart et al. (2009) scored concept maps for
'sophistication', finding that younger students tended to provide less 'sophisticated' maps than older students, indicating that younger students focused more on cognitive strategies, with older students reflecting more self-regulatory and process-related strategies.

Critically, PVTs and concept maps can be used in discussion with students, as a tool to encourage students to provide deep reflections on their learning in specific contexts, rather than superficial reflections on the general content of learning tasks (Wall et al., 2012). As such, PVTs can be considered as pedagogical tools to support metacognition, as well as research tools to investigate metacognition (Wall & Higgins, 2006; Wall, 2008). One clear benefit of PVTs is that they can be subject to rich, context-specific qualitative analyses, as well as broader and larger scale quantitative analysis (Wall et al., 2012). Indeed, in their investigation of the use of PVTs, Wall et al. (2012) explored deductive and inductive approaches to analysing PVTs in research. Thus, PVTs provide an accessible and flexible approach that may complement other classroom-based methods such as observation.

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