Understanding Children's Monitoring in Science Text Comprehension

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Introduction

Students are known to be inaccurate monitors (e.g., Garcia et al., 2016). Attributions for their monitoring deficits are complex. To investigate means to enhance students' monitoring accuracy, a crucial step is to understand the factors that affect students' metacognitive judgments. Prior research has suggested that both internal (person characteristics) and external factors (task characteristics) affect students' monitoring accuracy (Dinsmore & Parkinson, 2013; Lin & Zabrucky, 1998; Pieschl, 2009). The current study focused on two specific attribution categories that represent internal (i.e., prior knowledge) and external (i.e., assessment level) factors to examine fifth graders' monitoring bias and accuracy. No prior investigation of this type has been conducted with school-aged children in science.

Theoretical Framework

The present study was guided by Schraw and Moshman's (1995) model of metacognition and Winne and Hadwin's (1998) model of self-regulated learning. Both models highlight the importance of monitoring during learning processes. Specifically, Schraw and Moshman conceptualized monitoring as the channel between knowledge of cognition (KOC) and regulation of cognition (ROC). Monitoring assists learners to perceive accurate task demands and facilitate effective strategy deployment. Likewise, Winne and Hadwin's (1998) four-phased model of self-regulated learning also emphasizes the centrality of monitoring, which functions recursively at each phase (i.e., task definition, goal setting and planning, strategy and tactic enactment, and tactic adaptation) with receiving information from cognitive (e.g., prior knowledge) and task (e.g., test items) conditions. These two models inform the conceptualization of monitoring used in the present study.

Method

Participants were 329 fifth graders (*M*age = 10.81, *SD* = 0.63). Students completed a set of psychological measures and a science prior knowledge test. They then read the science text and answered declarative and conceptual multiple-choice comprehension questions and rated their confidence for each item. Confidence bias and absolute accuracy, as indicators of monitoring, were computed by subtracting students' objective performance scores from their rated confidence scores. Smaller values indicated accurate monitoring.

Analysis

Table 1
Correlations among Prior Knowledge, Text Comprehension Performance, Confidence Bias, and Absolute Accuracy.

	M	*SD*	1	2	3
1. Prior knowledge	0.60	0.20	-		
2. Performance	0.48	0.21	.38**	-	
3. Bias	0.20	0.27	-.14**	-.65**	-
4. Accuracy	0.27	0.19	-.13*	-.55**	.66**

Note. * p < .05, ** p < .01. Performance, confidence, accuracy scores ranged from 0 to 1. Bias ranged from -1 to 1.

Table 2
Paired-Samples T-Tests for Declarative and Conceptual Items.

	Declarative items		**Conceptual items**				
	M	*SD*	*M*	*SD*	*t*	*p*	*d*
Performance	0.41	0.30	.53	0.25	-5.90	<.001	0.42
Bias	0.27	0.37	0.16	0.30	5.05	<.001	0.31
Accuracy	0.38	0.25	0.26	0.21	.66**	<.001	0.49

Note. Bonferroni correction was applied. Alpha was adjusted to .02. Performance, confidence, accuracy scores ranged from 0 to 1. Bias ranged from -1 to 1.

Table 3
Independent Samples T-Tests for Low Prior Knowledge and High Prior Knowledge Students.

	Low prior knowledge (*n* = 169)		**High prior knowledge (*n* = 157)**				
	M	*SD*	*M*	*SD*	*t*	*p*	*d*
Performance	0.43	0.18	0.55	0.21	-5.54	<.001	0.61
Bias	0.24	0.27	0.16	0.26	2.46	<.02	0.27
Accuracy	0.30	0.19	0.25	0.18	2.69	<.01	0.30

Note. Bonferroni correction was applied. Alpha was adjusted to .

Results

Overall, students' performance on the comprehension items was moderate and they were overconfident and inaccurate in their monitoring. Results also indicated that students' overconfidence and inaccurate monitoring were associated with lower performance. As expected, high prior knowledge was associated with high performance (See Table 1). Interestingly, paired-samples t-tests demonstrated that students performed better on conceptual items than on declarative items. Further, students had low values of confidence bias and absolute accuracy for conceptual items compared to declarative items (See Table 2). In addition, students with high prior knowledge performed significantly better on the science comprehension items and in monitoring than students with low prior knowledge (See Table 3).

Conclusions

The present study examined fifth graders' comprehension monitoring and considered students' personal and test characteristics. Findings suggest that complex knowledge assessment may activate students to both monitor and perform better on the task. Further, consistent with prior research (Jee et al. 2006), high-knowledge students demonstrated better monitoring. Future research should explore additional person and task characteristics that contribute to school-aged children's monitoring.

References

Dinsmore, D. L., & Parkinson, M. M. (2013). What are confidence judgements made of? Students' explanations for their confidence ratings and what that means for calibration. Learning and Instruction, 24, 4–14. https://doi.org/10.1016/j.learninstruc.2012.06.001

Garcia, T., Rodriguez, C., Gonzalez-Castro, P., Gonzalez-Pienda, J. A., & Torrance, M. (2016). Elementary students' metacognitive processes and post-performance calibration on mathematical problem-solving tasks. Metacognition and Learning, 11(2), 139–170.

Jee, B., Wiley, J., & Griffin, T. (2006). Expertise and the illusion of comprehension. In Proceedings of the Annual Conference of the Cognitive Science Society, 387–392.

Lin, L. -M., & Zabrucky, K. M. (1998). Calibration of comprehension: Research and implication for education and instruction. Contemporary Educational Psychology, 23(4), 345–391. https://doi.org/10.1006/ceps.1998.0972

Pieschl, S. (2009). Metacognitive calibration-an extended conceptualization and potential applications. Metacognition and Learning, 4(1), 3–31.

Schraw, G., & Moshman, D. (1995). Metacognitive theories. Educational Psychology Review, 7(4), 351–371.

Winne, P. H., & Hadwin, A. F. (1998). Studying as self-regulated learning. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), Metacognition in educational theory and practice (pp. 277–304). Erlbaum Associates.

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