JRST
Journal of Research in Science Teaching
Research Brief
VOL. 61 NO. 5, PP.1134-1180 (2024)

Enhancing Self-Regulation of Intuitive Thinking in The Context of Evolution

Tim Hartelt, Helge Martens

OVERVIEW: We investigated to what extent two self-regulatory and metacognitive instructional approaches can enable students to become aware of and self-regulate their intuitive thinking in the scientific context of evolution.

AUDIENCE: Instructional designers, K-12 science teachers, Secondary science teachers, Biology educators

KEY POINTS

- Most students have non-scientific, intuitive conceptions of evolution prior to instruction.
- These intuitive conceptions largely remain when instruction only focuses on the scientific concepts of evolution.
- Self-regulatory and metacognitive instruction that explicitly addresses students' intuitive thinking can decrease inappropriate intuitive conceptions and increase scientific conceptions.
- Self-assessing one's intuitive and scientific conceptions and receiving instruction on the context-dependency of intuitive thinking has been found effective in enhancing students' evolutionary understanding.

INTRODUCTION: Students' intuitive thinking (e.g., goal-directed thinking) often proves helpful in different contexts, such as everyday life, but can be an obstacle to learning about science (e.g., evolution). Since intuitive thinking is pervasive and persistent, enhancing students' scientific understanding (esp. their evolutionary understanding) is often challenging. Consequently, it is necessary to explicitly address students' intuitive thinking to support students in self-regulating their intuitive thinking in contexts where it is inappropriate (e.g., as it is frequently in the context of evolution). Two self-regulatory and metacognitive instructional approaches are hypothesized to reach this goal: (a) a self-assessment of one's intuitive and scientific conceptions and (b) instruction on the context-dependency of intuitive thinking.

FINDINGS: Both instructional approaches improved the students' evolutionary understanding. Students receiving one or both instructional approaches used less intuitive conceptions and/or more scientific conceptions of evolution afterward than those whose conceptions were not addressed during the intervention. The self-assessment resulted in a higher use of scientific conceptions of evolution. The instruction on the context-dependency of intuitive thinking led to a higher use of scientific conceptions of evolution, a lower use of intuitive conceptions, more reported thought processes relating to inhibition of intuitive thinking, and a better ability to identify inappropriate phrasing based on intuitive thinking. There were also positive long-term effects on students' evolutionary understanding in a follow-up test.

TAKEAWAYS: The results show that students can be taught to become metacognitively aware of and self-regulate their intuitive thinking in the scientific context of evolution. Furthermore, they show the effectiveness of two specific self-regulatory and metacognitive instructional approaches: (a) a self-assessment of one's intuitive and scientific conceptions and (b) instruction on the context-dependency of intuitive thinking. Explicitly addressing students' intuitive thinking through these approaches proved more effective than solely teaching the scientific concepts. Thus, we suggest that science educators implement these approaches in their teaching to improve their students' understanding of evolution.

Full Title: Influence of Self-assessment and Conditional Metaconceptual Knowledge on Students' Self-regulation of Intuitive and Scientific Conceptions of Evolution