

# **Evidence in Action** A K20 Center Research Brief

# Exploring the Effects of Adaptive Training on Metacognitive Knowledge Monitoring Ability in Computer-Based Learning

Tiago Roberto Kautzmann and Patricia A. Jaques 2019

#### Introduction

This intervention brief explores the research conducted by Kautzmann and Jaques (2019) on the effects of adaptive training on metacognitive knowledge monitoring ability in computer-based learning environments. The study is grounded in the literature that highlights the importance of metacognition in enhancing student learning outcomes. Metacognition, defined as the knowledge about one's own cognitive processes, has been shown to be crucial for effective problem-solving and learning. The authors reference several key studies that emphasize the role of metacognitive skills in educational technology and the need for explicit instruction to foster these skills. The research problem addressed in this study is the lack of adaptive metacognitive training in computer-based learning environments, which can hinder students' ability to monitor and regulate their own learning.

#### Methodology

#### **Research Design:**

The study employed an experimental design with pretest and posttest sessions to assess the impact of adaptive metacognitive training. The intervention involved the use of an animated pedagogical agent (APA) integrated into an intelligent tutoring system (ITS) to provide metacognitive instructions.

#### Sample:

The participants were 8th grade students (N=41), aged 13 to 14 years, who were divided into an experimental group and a control group. The experimental group received metacognitive instructions from the APA, while the control group received only hints and feedback.

#### Data Analysis:

Data were collected through pretest and posttest sessions to measure metacognitive knowledge monitoring ability and students' performance in solving first-degree equations. The analysis included paired t-tests, ANCOVA, and correlation analyses to evaluate the effectiveness of the intervention.



## Results

The results indicated that students who received metacognitive instruction from the APA showed significant improvement in their metacognitive knowledge monitoring ability compared to the control group. Specifically, the experimental group demonstrated higher KMA (Knowledge Monitoring Assessment) index scores in the posttest. Additionally, these students completed more equations correctly and spent less time on incorrect steps, suggesting that the adaptive training helped them become more efficient problem solvers. The study also found a positive correlation between metacognitive ability and academic performance, reinforcing the importance of metacognitive training in educational settings.

# **Application into Practice**

To replicate this intervention in a school context, educators can follow these steps:

- Integrate an Animated Pedagogical Agent (APA): Incorporate an APA into the existing computer-based learning systems. The APA should be designed to provide adaptive metacognitive instructions tailored to students' individual needs.
- 2. **Encourage Reflection:** Use the APA to encourage students to reflect on their prior knowledge, to think about previously solved problems, and to assess their understanding before attempting new tasks.
- 3. Validate Instructional Content: Ensure that the APA's instructional content is validated by teachers to align with classroom terminology and learning objectives.
- 4. **Monitor and Provide Feedback:** Regularly monitor students' progress and provide feedback through the APA to help them develop their metacognitive skills.
- 5. Adapt Instruction: Continuously adapt the metacognitive instructions based on students' performance and knowledge monitoring assessments..

### Work Cited

Kautzmann, T. R., & Jaques, P. A. (2019). Effects of adaptive training on metacognitive knowledge monitoring ability in computer-based learning. *Computers & Education, 129*, 92-105. https://doi.org/10.1016/j.compedu.2018.10.017.