Science of Learning in Action in STEM: Self-explanation, Distributed Study, and Embedded Questions to Promote Student Learning

Learning Issue:
Introductory biology Professor wanted students to arrive at class having completed the assigned textbook readings.

Prompted Self-Explanation

Concepts to learning strategy
- Review new material
- Relate information to prior knowledge
- Provide concrete examples based on new understanding
- Generate questions based on new understanding
- Mechanism: identification of gaps in learning
- Helps modify flawed, existing mental models

Does background ability matter?
Yes – students with brier academic ability, as measured by SAT-Verbal, benefited from using prompted self-explanation while reading the test booklet assignments. Students who used this strategy performed as well as their higher ability peers.

Selection Bibliography:

Learning Issue:
Introductory biology Professor wanted students to study and learn a number of facts and basic concepts prior to exam.

Distributed, Retrieval Practice

Space, repeated study over a number of study occasions
- Waiting a period of time between study sessions when there is no immediate repetition generates a new learning event
- Retrieval practice (pausing) during study promotes learning

- Indirect: Learn from feedback
- Direct: Active retrieval from memory

Does background ability matter?
No – students at all academic abilities, as measured by SAT-Total, benefited from spaced practice over massed practice.

Selection Bibliography:

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Learning Issue:
Professor wanted students to engage in active learning during class in an effort to promote learning.

Embedded Questions During Lecture

Retrieval practice (pausing) during lecture promotes learning
- Indirect: Learn from feedback
- Direct: Active retrieval from memory

Does background ability matter?
No – students at all academic abilities, as measured by SAT-Total, benefited from spaced practice over massed practice.

Selection Bibliography:

Did class content matter?
Study 2: Controlling for content
- Clicker presentation randomly selected for each question. All three clicker question presentations used each day.

Selection Bibliography:

What we found:
- No difference in performance on exam transfer questions between the CTC and CDC conditions. Performance on the TDT transfer questions was significantly higher than both the other two conditions.

Selection Bibliography: