

# Promoting Self-Regulation in Science Education: Metacognition

Schraw et al. 2006

Presented by Stephen MacNeil

# Introduction

## Using active learning techniques

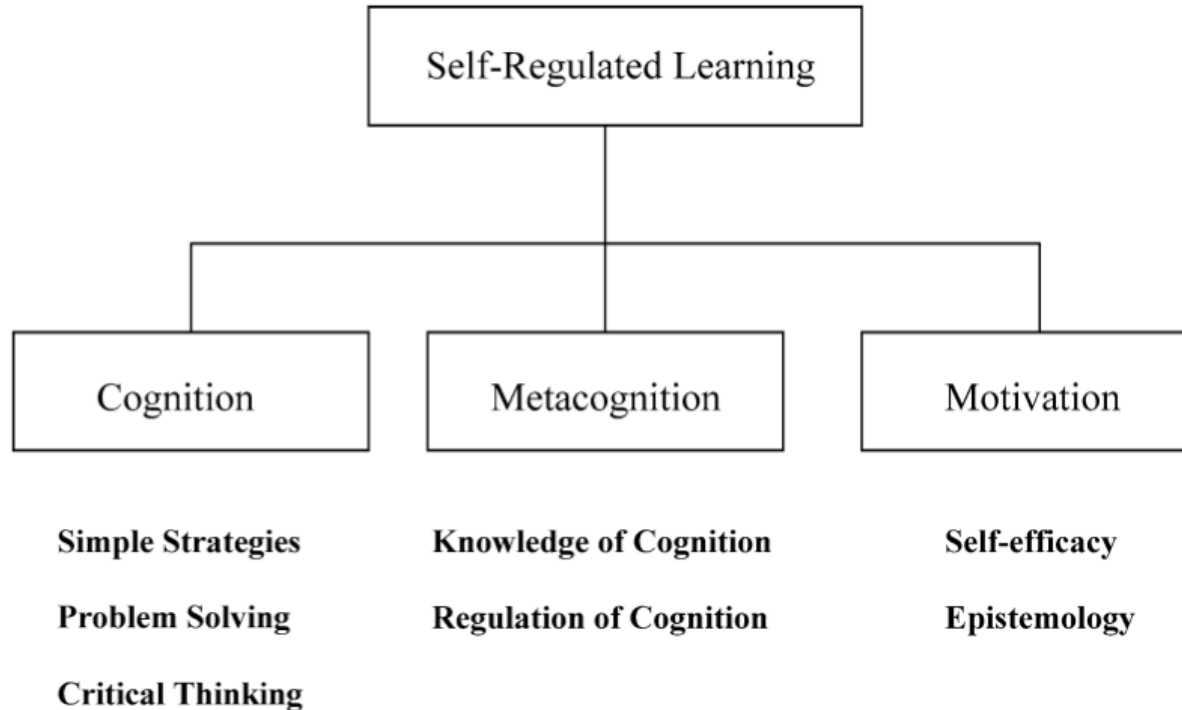
- flipped classroom learning
  - individuals required to be more responsible
  - individuals must be autonomous
- group projects

see a problem?

# Problems

- Flipped classrooms - have an individual component
- Group projects - students rely on others for grades
  
- Team-based learning is not all-powerful
  - the majority of learning is independent
    - individuals have different needs
    - difficulty finding teams to learn with (industry)

# Overview



# Self-Regulation

- set goals
- select strategies
- implement strategies
- monitor progress

(Schunk 1996)

Seems easy right?

# Steps to Self-Regulation

How should students move from being reliant learners to self-regulated learners?

hint: how might you scaffold it?

# Social Cognitive Steps

- observational - modeling
- imitative - guidance/feedback
- self-controlled - standards
- self-regulated - self efficacy and strategies

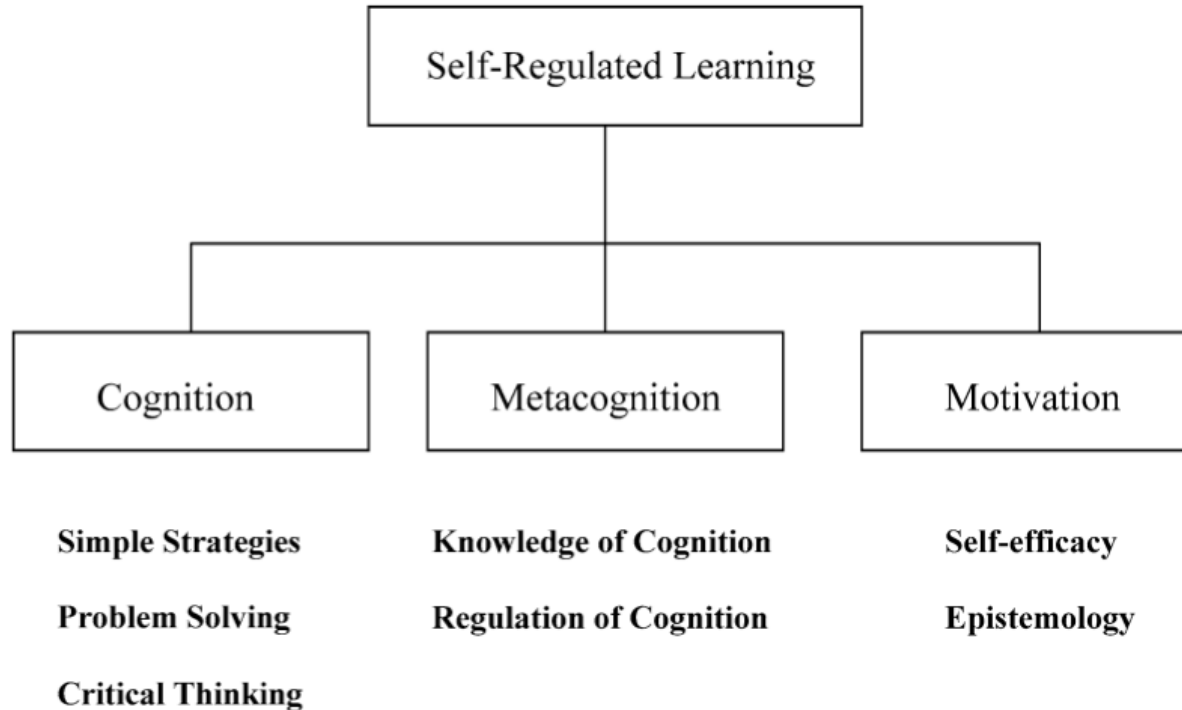
internal vs external

# Background for Self-Regulation

- Bandura's theory of reciprocal determinism
  - personal factors - beliefs and attitudes
  - environmental factors - quality of instruction
  - behavioral factors - prior performance
- Modern beliefs
  - interacting cognitive, metacognitive, and motivational (Butler & Winne, 1995; Zimmerman 2000)



# Revisit the overview



# Cognition: strategies

- student generated questions (Chinn & Brown 2002)
  - focus attention
- constructing graphs and tables (House 2002)
  - mental models
- cloze assessments (Koch 2001)
- predict observe explain (Rickey & Stacey 2000)
  - scaffolded problem solving

# Cognition: problem solving

- predict observe explain (Rickey & Stacey 2000)
  - scaffolded problem solving
- problem solving (Dhillon 1998)
  - composable parts
  - teachable

# Cognition: critical thinking

- identifying the source of information
- verifying the source of information
- reconcile the information with prior beliefs
- draw conclusions

(Linn 2000)

# Metacognition

- Knowledge of and regulation of cognition
- Types of knowledge
  - Declarative - knowledge about ourselves as learners
  - Procedural - knowledge of strategies
  - Conditional - when to use which strategy
- Metacognitive - late onset and need not be explicit (domain experts)

# Motivation

## Back to Bandura

- It doesn't matter if you don't think it works.
- Factors
  - social support
  - self talk and self belief (self-efficacy)
  - availability and strength of models

# Six Strategies for Improving (2/6)

Remember: cognitive, metacognitive, motivation

- inquiry-based learning (Anderson 2002)
  - critical thinking
  - explicit planning, monitoring and evaluation
  - expert modeling
- collaborative learning (situated learning - Lave 1991)
  - models strategies
  - models self reflection
  - social support, modeling own learning by others

# Six Strategies for Improving (4/6)

Remember: cognitive, metacognitive, motivation

- strategies
  - multiple (analogies, mnemonics ...)
  - develop conditional knowledge
  - improve self-efficacy
- mental models
  - explicit model to analyze
  - reflect and evaluate proposed method
  - promotes conceptual changes



# Six Strategies for Improving (6/6)

Remember: cognitive, metacognitive, motivation

- technology
  - provides models and simulates data
  - helps test, evaluate and revise models
  - provides collaborative support
- personal beliefs
  - modeling epistemological characteristics of experts
  - promotes personal change and reflection
  - increases engagement and persistence

# Thank you!

Remember to teach students to learn how to learn.