Strategies to Promote Higher-Order Think in Asynchronous Virtual Chemistry

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Early College Alliance at Eastern Michigan University
INITIAL VIRTUAL CHEMISTRY COURSE

1. VIDEO TUTORIALS
2. PRACTICE PROBLEMS
3. WEEKLY QUIZ
TEACHING IN 2020...
Questions

What are students thinking?

Are students aware of what they are thinking?
OVERVIEW

01
Asynchronous Learning?

02
Higher Order Thinking?

03
Strategy #1: Self-Quizzing

04
Strategy #2: Video Think Alouds
ASYNCHRONOUS LEARNING

Learning according to your own schedule
ASYNCHRONOUS LEARNING

Benefits:
1. Convenient
2. Cost-Effective
3. Collaborative
ASYNCHRONOUS LEARNING

Higher-Order thinking skills are necessary:
1. Metacognition
2. Critical Thinking
3. Time Management
4. Effort Regulation

HIGHER-ORDER THINKING

Bloom’s Taxonomy

- **Remember**
  - Recall facts and basic concepts
define, duplicate, list, memorize, repeat, state

- **Understand**
  - Explain ideas or concepts
classify, describe, discuss, explain, identify, locate, recognize, report, select, translate

- **Apply**
  - Use information in new situations
execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch

- **Analyze**
  - Draw connections among ideas
differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test

- **Evaluate**
  - Justify a stand or decision
appraise, argue, defend, judge, select, support, value, critique, weigh

- **Create**
  - Produce new or original work
design, assemble, construct, conjecture, develop, formulate, author, investigate

Image Credit: The Center for Teaching at Vanderbilt University
## 2001 Revised Bloom's Taxonomy

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<tr>
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Aware of their own cognition (METACOGNITION)

Able to reflect on their learning progress (SELF REGULATION)

HIGHER ORDER THINKERS
Left to their own, students tend towards the bottom of Bloom’s


Higher-order thinking is difficult... but more possible with appropriate support

Vygotsky, L. (1933). Play and its role in the mental development of the child.
METACOGNITIVE STRATEGIES FOR ASYNCHRONOUS VIRTUAL CHEMISTRY

Video Think Alouds

Embedded Self-Assessments
Enhances problem solving by verbalizing internal thinking and problem solving steps
VIDEO THINK ALOUDS

1. Individual’s thinking is enhanced
2. Other students evaluate other problem solving methods
3. Misconceptions are exposed

VIDEO THINK ALOUDS

Flipgrid.com

An educational video social networking app
VIDEO THINK ALOUDS
Choose one of the Practice Learning Check problems and create a video to explain how to solve it.

There is a 5 minute time-limit on your video, so make sure you practice! One way to make a video is to set your phone camera so that it is pointing down at a piece of paper. Then you can write on the paper and explain how to solve the problem.

I look forward to learning from you!

P.S. -- Watch Mr. Kenney's video if you want an example.
VIDEO THINK ALOUDS

Think Aloud Template

Your task is to create a short video explaining how to solve one of the problems from the practice quiz, as if you are teaching someone who doesn’t know what to do. Your explanation should follow the following template:

1. Planning
   a. Read the problem word for word. Then, rephrase the problem in your own words, stating very clearly, what you are trying to find out.
   b. Describe the given information that is essential for obtaining the answer (omit the unnecessary information)
   c. Before you begin solving the problem, describe your plan to get to the answer. (i.e. what given information will you start with? Which conversion factors will you use? etc.)

2. Monitoring
   a. Solve the problem and talk about each step as you perform them. As you explain each step, focus on their purpose for moving toward the answer.
   b. Make sure you explain where each conversion factor or piece of information comes from (e.g. if you need to calculate a molar mass of a compound, show the mass of each element on the periodic table and the calculation for the total molar mass of the compound).

3. Evaluation
   a. Once you have completed the problem and solved for the correct answer. Summarize the method to obtain the answer and briefly explain why that answer makes sense.

VIDEO THINK ALOUDS

1. Student errors are easily addressed
2. Students watch the other videos
EMBEDDED SELF-ASSESSMENTS

Challenges of Learning from Videos...

1. Don't know if students learned
2. We can’t help students regulate their learning
Self-Quizzing is one of the best learning strategies for distant learning.

EMBEDDED SELF-ASSESSMENTS

Short 5-Question quizzes to check understanding

EMBEDDED SELF-ASSESSMENTS

Low Stakes

Allow multiple attempts

Prompt relearning after incorrect responses

Question 1

A sample of copper has a mass of 6.93 g. How many moles of copper atoms are in this sample?

- 0.109 mol
- 0.0645 mol
- 9.17 mol
- 1.09 mol

Rewatch the video tutorial section on converting between mass and moles.
METACOGNITIVE STRATEGIES FOR ASYNCHRONOUS VIRTUAL CHEMISTRY

Video Think Alouds

Embedded Self-Assessments