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# Building a Better Blend: Research-Based Blended Course Design


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# Building a Better Blend

## Research-Based Blended Course Design

Central Pennsylvania Consortium Faculty Workshop  
9 November 2013

# Blended Learning

1. Students **receive feedback on learning** outside classroom through computer-based materials
2. Extra-classroom component alters or informs how instructor uses in-class time

# Research I'm Drawing On

## Our 40-college study of Blended Learning in a Liberal Arts College Environment

1. About the study (incl. courses taught):  
<http://nextgenlearning.blogs.brynmawr.edu/>
2. Conference archives:  
[http://repository.brynmawr.edu/blended\\_learning/](http://repository.brynmawr.edu/blended_learning/)
3. Blog (resources, how-to, etc.):  
<http://serendip.brynmawr.edu/exchange/blendedlearning/explore>

# Research I'm Drawing On

Literature on cognitive development and memory;  
“learning sciences” research

Scholarship of teaching and learning; education or  
pedagogical research

(Specific references included at the end)



Research-Based Course Design

# WHY DOES BLENDED LEARNING WORK?

# Why Does Blended Learning Work?

Hypothesis 1: Students spend **more** time on task

# Why Does Blended Learning Work?

Hypothesis 2: Students spend **better** time on task



# What is Formative Assessment?

Assessment where goal is gathering evidence in order to improve student learning

- At individual level
- At course, program, department level

# Examples in Blended Learning

## Explanation of wrong answer ...

*Your answer :*

The concentration of Fe in the compound, expressed as a percent.

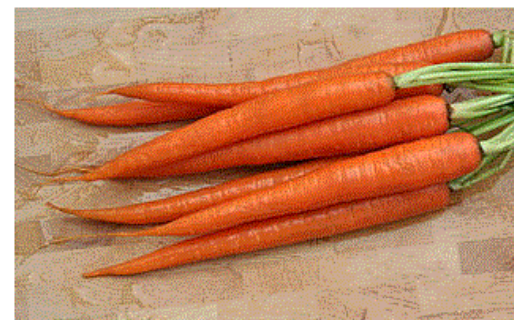
Not quite. 'Concentration' refers to mass or moles present per unit volume. Click on Continue to see an analogy that may help you understand what mass % means.

... and  
redirection  
to quick  
remedial  
lesson

### Mass Percent Review

To understand the concept of mass percent, it may help to first think of a more familiar example. Let's say you have a produce shipment of 50 kg of bananas, 40 kg of lettuce and 30 kg of carrots.

*What is the mass percent of carrots in that shipment?*



# Examples in Blended Learning

Data instructor can use to adjust approach, identify struggling students, etc.

## Question 2

aerobic met  
1  
not in animals  
0  
photosynthesis  
1  
produce ATP  
14

Mitochondria

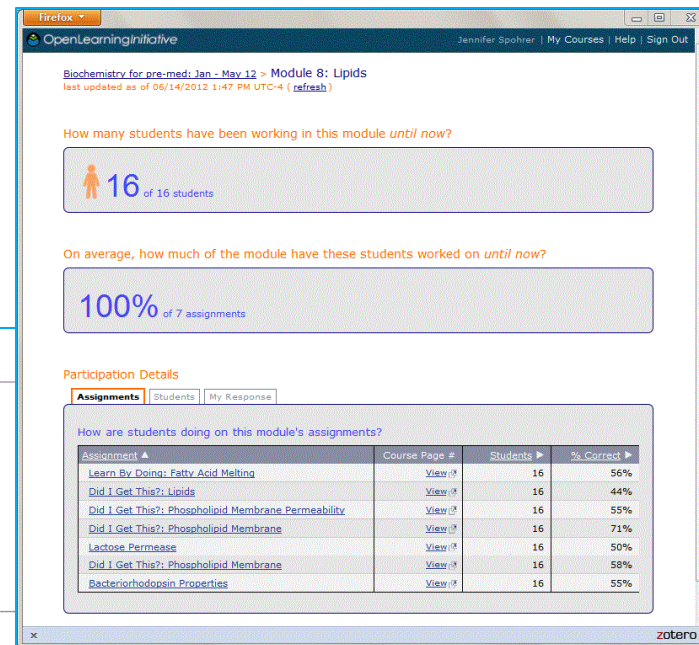
- A. ☐ play no role in aerobic metabolism  
B. ☐ are the site of photosynthesis in green plants  
C. ☐ oxidize fuel to produce energy (ATP).  
D. ☐ do not exist in animals

## Question 3

cell wall/membrane  
1  
endo ret/DNA rep  
5  
golgi/periplasmic sp  
0  
ribo/cell memb  
10

Which of the following are found in both prokaryotic and all eukaryotic cells.

- A. ☐ cell wall, cell membrane  
B. ☐ endoplasmic reticulum, DNA replication.  
C. ☐ golgi, periplasmic space  
D. ☐ ribosomes, cell membrane



16 responses, 62% correct


# Student Response

Enabled them to

- Ask better questions
- Get help *before* class moved on
- Practice and get feedback before it “counted”
- Better structure study time

Mozilla Firefox  
brynmawr.edu https://moodle.brynmawr.edu/mod/quiz/reviewquestion.php?state=8925&number=17

17  
Marks:  
1/1



Name the mineral:  
sillimanite ✓

Note: Case does not matter, but spelling does!

Consciously or unconsciously, we identify minerals using a few key characteristics that we associate with them. Name the two or three characteristics of this mineral that allowed you to name it:

zotero

# Faculty Response

Mozilla Firefox

brynmawr.edu https://moodle.brynmawr.edu/mod/quiz/reviewquestion.php?state=8925&number=17

Name the mineral:  
sillimanite ✓  
*Note: Case does not matter, but spelling does!*

Consciously or unconsciously, we identify minerals using a few key characteristics that we associate with them. Name the two or three characteristics of this mineral that allowed you to name it:  
radial, gray ✓  
*Note: You get credit for listing your criteria -- the green check mark does not mean they are correct!*

[Make comment or override grade](#)

**Correct**

Marks for this submission: 1/1.

History of Responses:

#	Action	Response	Time	Raw score
1	Grade	serpentine,	16:20:38 on 7/09/11	0.5
2	Grade	andalusite,	16:21:00 on 7/09/11	0.5
3	Grade	kyanite,	16:21:21 on 7/09/11	0.5
4	Grade	quartz,	16:21:50 on 7/09/11	0.5
5	Grade	amphibole,	16:22:03 on 7/09/11	0.5
6	Grade	pyroxene,	16:22:12 on 7/09/11	0.5
7	Grade	calcite,	16:22:51 on 7/09/11	0.5
8	Grade	epidote,	16:23:10 on 7/09/11	0.5
9	Grade	plagioclase,	16:23:23 on 7/09/11	0.5
10	Grade	sillimanite,	16:53:08 on 7/09/11	1
11	Grade	sillimanite, radial, gray	16:53:29 on 7/09/11	1
12	Close&Grade	sillimanite, radial, gray	16:53:29 on 7/09/11	1

zotero

- Students ask better questions

Faculty could:

- Get a real-time sense of student learning
- Give more targeted answers or help
- Teach more “agilely”
- Use class time for more engaging, active things

# Cognitive Science Research

“Testing” improves ...

- Retention
- Organization of knowledge
- Subsequent learning
- Application

Why? How?

# “Testing Effect”

Act of recalling information helps strengthen neural processing of it ...

... testing *produces new learning*

# Feedback also Helps ...

Helps students catch and correct misperceptions

Strengthens low-confidence, correct answers



# As Does Spacing Learning over Time ...

Periodically revisiting topics strengthens testing effect (short-term/long-term memory)

Counteracts students' tendency to fall behind and cram to catch up

# Improved Metacognition

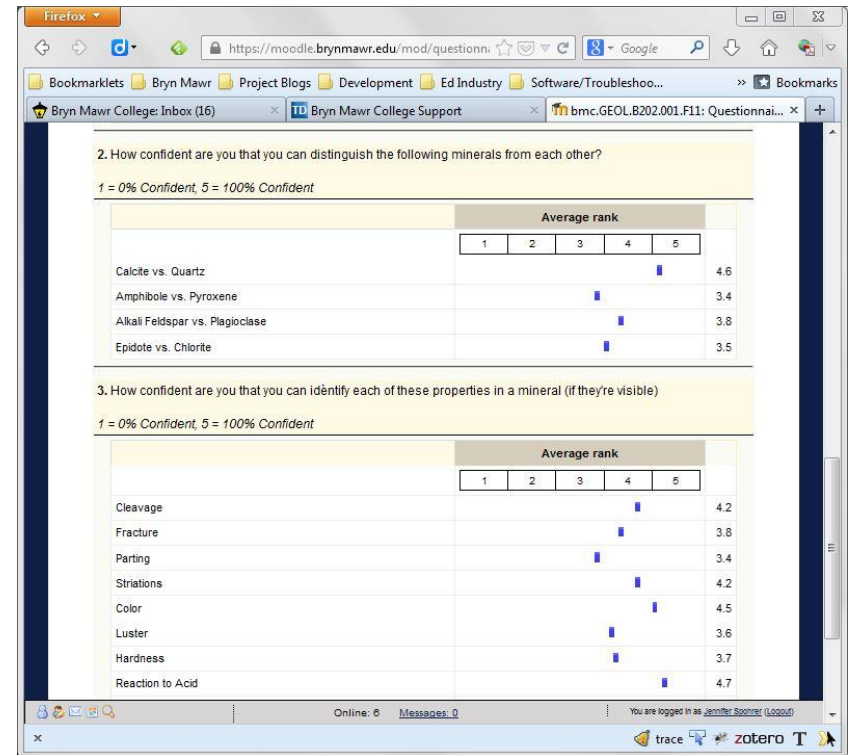
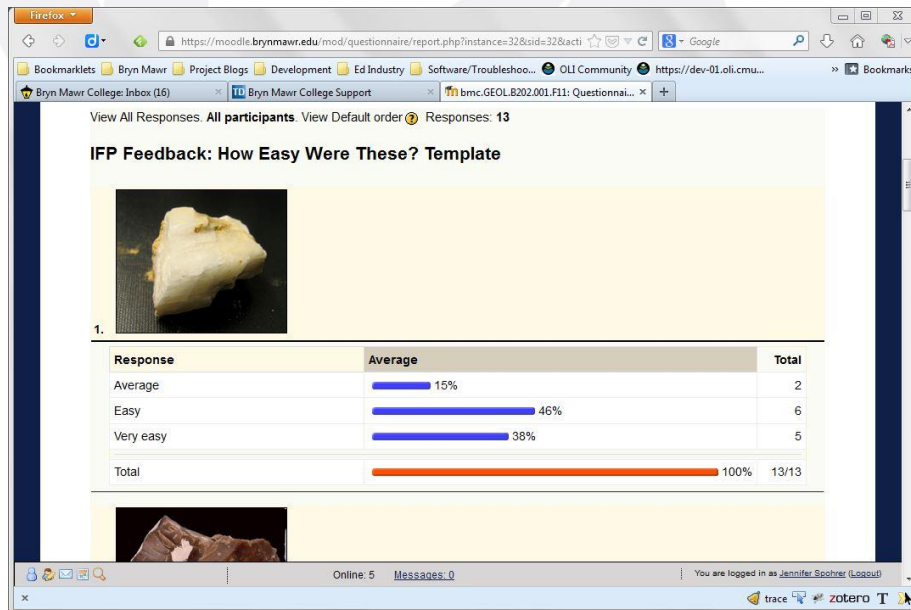
Expert learners have good metacognition; novices overestimate what they have understood.

Most of the time we are novice learners.

# Enhancing Metacognition

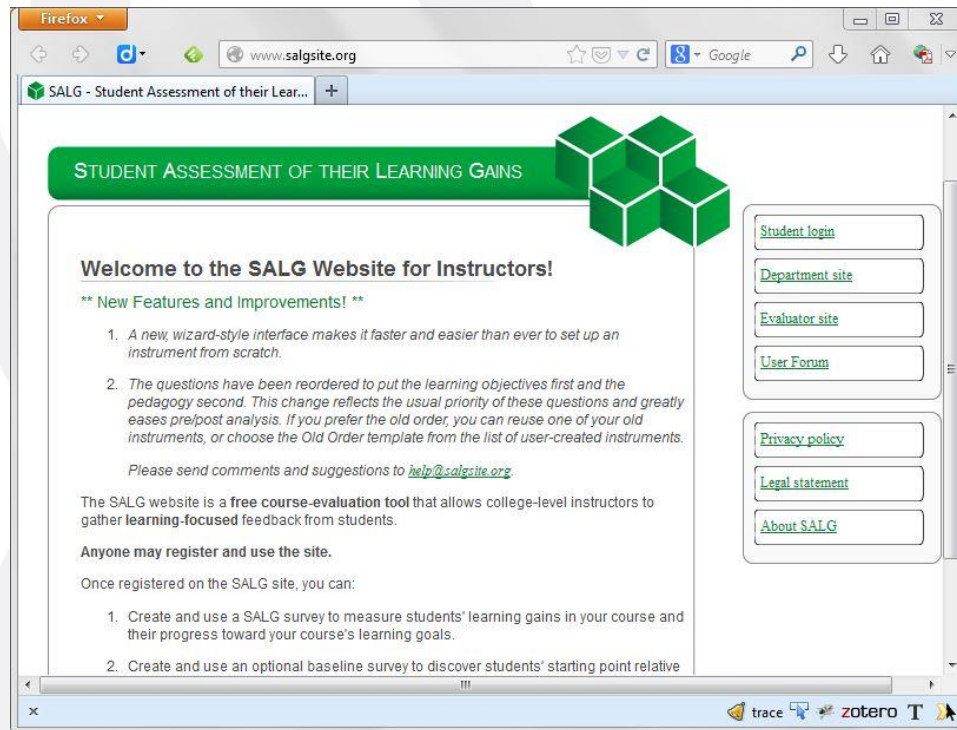
## Self-assessments

## Polls about activities/assessments



# Enhancing Metacognition

[www.salgsite.org](http://www.salgsite.org)



Or use adaptations of Classroom Assessment Techniques (CATs):

- Minute Paper
- Muddiest Point
- Application



Research-Based Course Design

**YOUR TURN ....**

# 1. Define Your Objectives

What is this course trying to achieve?

What are your “pain points”? What prevents you from achieving your course goals?

Can blended learning help? What could students learn through online materials? (in theory at least)

What opportunities could shifting some elements online give you?

## 2. Find/Evaluate Resources

Do they do what you need them to?

Can you use them to ...

- Track student learning?
- Give students detailed feedback?
- Help students periodically review topics?
- Help students develop metacognitive skills?

## 2. Find/Evaluate Resources

Are there technical issues that might waste so time that it overshadows benefits

- Long load/download/buffering times
- Other access or performance issues
- Difficult interface
- Difficult to enter answers in format program will recognize (esp. for math, chemistry, etc.)



# 3. Integration

What short-comings in the materials will you need to overcome? How will you do it?

How will you motivate students to complete without losing formative/mastery emphasis?

How will you close the loop? Students top complaint was disconnect between online and in-class ... how will you bring the two together?



Research-Based Blended Course Design

# REFERENCES

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# Blended Learning in the Liberal Arts

About the study (findings, course syllabi, etc):

<http://nextgenlearning.blogs.brynmawr.edu/>

Annual Conference info and archives:

[http://repository.brynmawr.edu/blended\\_learning/](http://repository.brynmawr.edu/blended_learning/)

Join us in 2014! May 20-21 is tentative date

Blog/Website (resources, how-to tips, etc.):

<http://serendip.brynmawr.edu/exchange/blendedlearning/explore>



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