THE UNIVERSITY OF MAINE

Transforming Teaching while Focusing on Learning

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UMS Board of Trustees
July 20 , 2020

face-to-face

on-site

online

online asynchronous

remote synchronous

hyflex

individualized

clinical/practica

….. and more

INSTRUCTIONAL MODALITIES

National Research Council. 2000. *How People Learn: Brain, Mind, Experience, and School: Expanded Edition*. Washington, DC: The National Academies Press. https://doi.org/10.17226/9853.

National Academies of Sciences, Engineering, and Medicine. 2018. **How People Learn II**: Learners, Contexts, and Cultures. Washington, DC: The National Academies Press.

Learning: Some Basics

- Humans actively seek information.
- Knowledge is constructed from prior knowledge, skills, and beliefs.
- Culture is critical in shaping how people learn.
- Mental models and metacognition are key to developing knowledge.
- Learning cannot happen without motivation.

Drawn from HPL I and II

Learner-Focused Instruction Examples

(independent of instructional modalities)

Example 1: Dr. Tim Boester, Assistant Professor of Mathematics; *Mathematics 122, Precalculus*

prior knowledge, skills, and beliefs influence ability to learn

Example 2: Dr. Melissa Maginnis, Assistant Professor or Microbiology; Dr. Sally Molloy, Assistant Professor of Genomics; and Dr. Melody Neely, Associate Professor, Molecular and Biomedical Sciences; *Honors 150/155 Phage Genomics*

metacognition

Example 3: Dr. Julia McGuire, Lecturer in Biology; *Biology 100, Basic Biology*

culture and motivation

Example 1: What is an angle?

Student responses:

- A unit of measurement for determining the difference in direction between 2 vectors that have the same origin.
- A measure of distance between two intersecting rays
- A space between 2 lines that is measured in degrees
- The measurement between two lines
- An angle is a measurement of the distance between two intersecting lines.
- The precise measurement between 2 corners

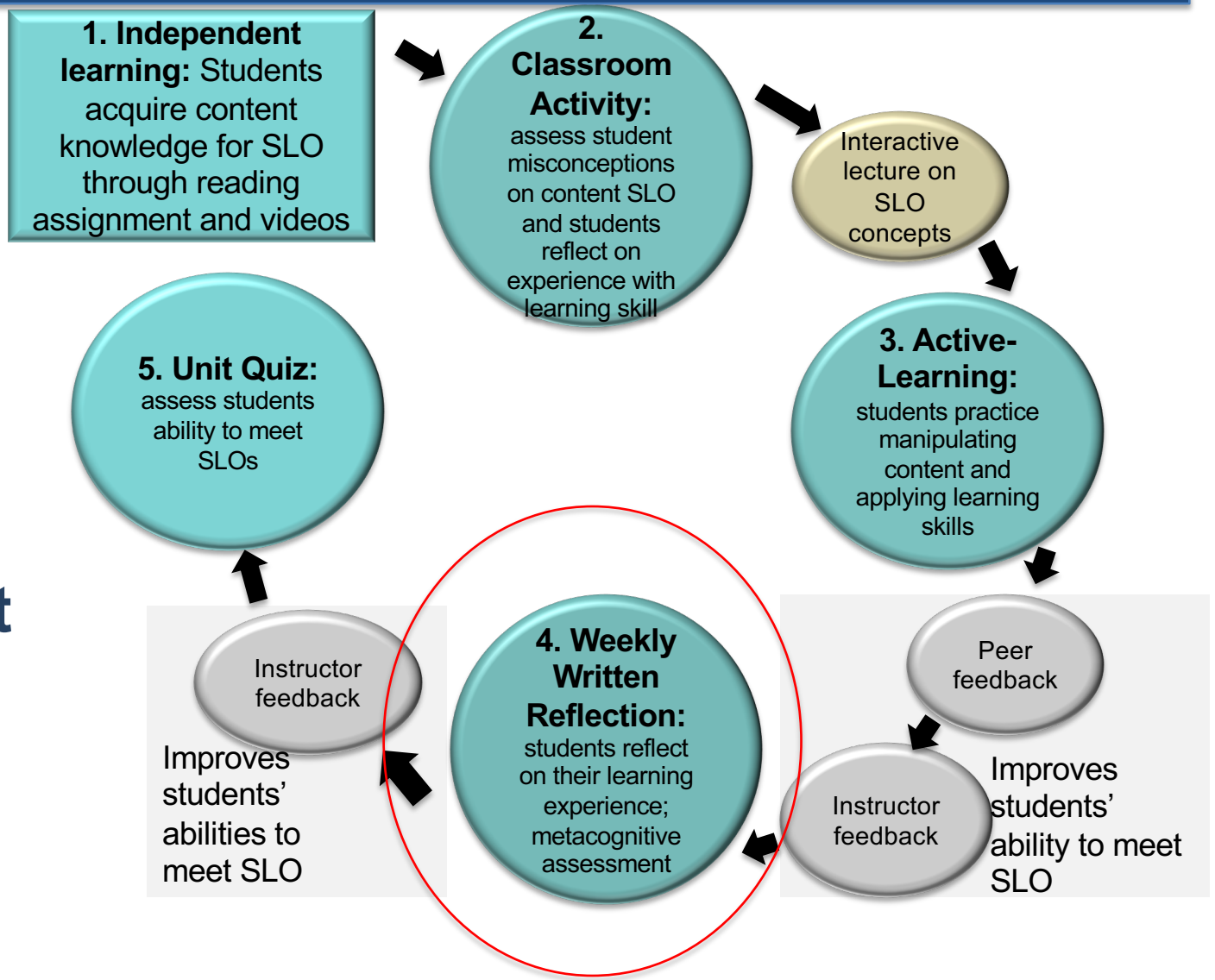
Example 1: What is an angle?

Student responses:

- When two straight lines intercept one another and have space between them
- The space between two lines that intersect
- Two rays going different directions that are connected at a point, or vertex.
- When two rays shoot out from the same point
- Space between two rays that connect at a vertex.
- It's a line that bends at a certain degree

Example 2: Understanding gene structure and transcription

Phage Genomics Course Learning Cycle Leads to Achievement of Student Learning Objectives (SLOs)



Slide courtesy of Melissa Maginnis & Sally Molloy

Example 2: Understanding gene structure and transcription

2. Classroom Learning Activity

Written student activity

- Students reflect on their own experiences to learn the skill
- Students use what they understand from reading assignment to answer a content question
- Students draw it to learn it

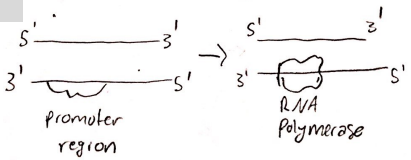
Let's get warmed up ☺

1. What strategy do you use when faced with a really difficult task or a question to which you do not immediately know the answer?

The best thing to do is break it down into pieces you know. Circle or highlight words that dictate what the question is looking for specifically. Also you can look at the basic concepts behind the question to help you understand the bigger, more difficult question.

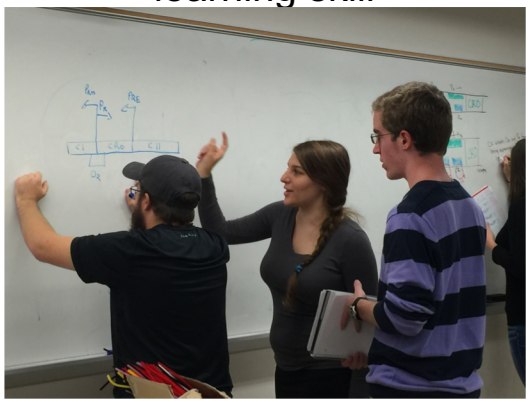
2. Using an illustration with text labels, describe your understanding of a bacterial promoter.

A bacterial promoter is a region on bacterial DNA that allows for RNA Polymerase to attach, leading to transcription. Promoters are important since they allow transcription to proceed.



Interactive lecture

Instructor helps students collectively outline approach to learning skill and students and instructor actively discuss content of SLO using that learning skill



Slide courtesy of Melissa Maginnis & Sally Molloy

Example 2: Understanding gene structure and transcription

3. Classroom Activity

I. Understanding Gene Structure and Transcription.

For the double stranded sequence below, identify or determine the following:

a. The −10 box
b. The −35 box
c. The +1 site
d. The start codon and coding region.
e. The template strand
f. The coding strand

Students Practice Learning Skill

- Applying knowledge to a new situation
- Demonstrate understanding of gene structure

```
CTTTTTTGTGCTCATACGTTAAATCTATCACCGCAAGGGA
GAAAAAACACGAGTATGCAATTTAGATAGTGGCGTTCCCTATTTATAGATTGTGGCACG


GTGTTGACTATTTTACCTCTGGCGGTGATAATGGTTGCATGTACTAAGGAGGTTGTATG
CACAACTGATAAAATGGAGACCGCCACTATTACCAACGTACATGATTCCTCCAACATAC


GAACAACGCATAACCCTGAAAGATTATGCAATGCGCTTTGGGCAAACCAAGACAGCTAA
CTTGTTGCGTATTGGGACTTTCTAATACGTTACGCGAAACCCGTTTGGTTCTGTCGATT
```

Slide courtesy of Melissa Maginnis & Sally Molloy

Example 2: Understanding gene structure and transcription

4. Classroom Learning Activity

Students reflect on the content (promoters) and their success applying knowledge to challenging problems

Number 3 was definitely the hardest problem in Activity 2. **My first approach was to look for the things that I understood; the start & stop codons and the template versus coding strands.** Even that proved to be difficult but I made some progress and I thought that I had a good grasp on it. **Then, our group met and it turned out that I had nothing written that looked like what they had. I had mixed up the coding and template strand, so the start codon that I had found was in fact not correct.** By working with them, I realized **that I definitely needed to look at transcription and focus on all the little parts that are crucial to looking at sequences, such as the -35 box and the +1 site. Just going off of my previous knowledge and the slight reading I had done was not even close to cutting it when it came to identifying the coding region or any of the other stuff. I was surprised about how hard it can be to attack a problem like this that you've never seen before.** In previous classes, all of the "critical thinking" questions were basically just for you to regurgitate knowledge back but you had to make sure to string together as much as you could. They never really asked us to apply our knowledge like this problem did.

Slide courtesy of Melissa Maginnis & Sally Molloy

Example 3: Understanding biology with ecological sampling across scales

"Meeting students where(ever) they are: After piloting this lab, we know we can. This spring we had several students who were, or had family who were immunocompromised. We were able to adapt this lab so students can sample from their windows and apply the same concepts—even from a 16th floor apartment building!"

Slide content courtesy of Julia McGuire.

Example 3: Understanding biology with ecological sampling across scales

The data they first collect along a line in their yard, (or a park, the woods, a street) are: latitude, longitude, agricultural zone, counts of abiotic (non-living) and biotic (living) things and observed interactions, and environmental conditions, like temperature, precipitation, and cloud cover.

After their first lab of general observations of living and non-living things along a line (transect) that they walk in their yard (or other location), students propose a question to study, find some previous research about it, and propose a hypothesis to test. These are all the data that they will add to the map each week of their study.

Slide content courtesy of Julia McGuire.

Example 3: Understanding biology with ecological sampling across scales

Week 1 - general observations

Current conditions at
Bangor, Bangor International Airport (KBGR)
Lat: 44.8°N **Lon:** 68.82°W **Elev:** 190ft.

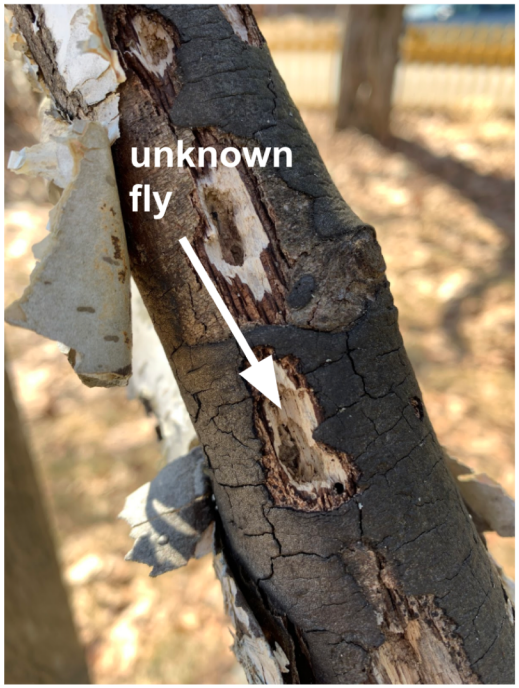
Fair
28°F
-2°C

Humidity	32%
Wind Speed	NW 15 G 23 mph
Barometer	30.70 in (1039.9 mb)
Dewpoint	2°F (-17°C)
Visibility	10.00 mi
Wind Chill	16°F (-9°C)
Last update	22 Mar 12:53 pm EDT

March 18, 2020
11am - 1pm
50 paces across my front yard

- Chilly, sunny, windy
- My yard is close to the river, and mostly bare with a little snow, covered in fall maple leaves and dead grass.
- Early plants species (n=18)
- Few animals species (n=8)

I **predict** that with each weekly transect, there will be more plants and animals, as spring onset begins, and plant resources are available for animal communities [1,2,3]. I will observe generally, and also do quadrat sampling. I will count plants and animals, and graph changes over time.



Slide courtesy of Julia McGuire.

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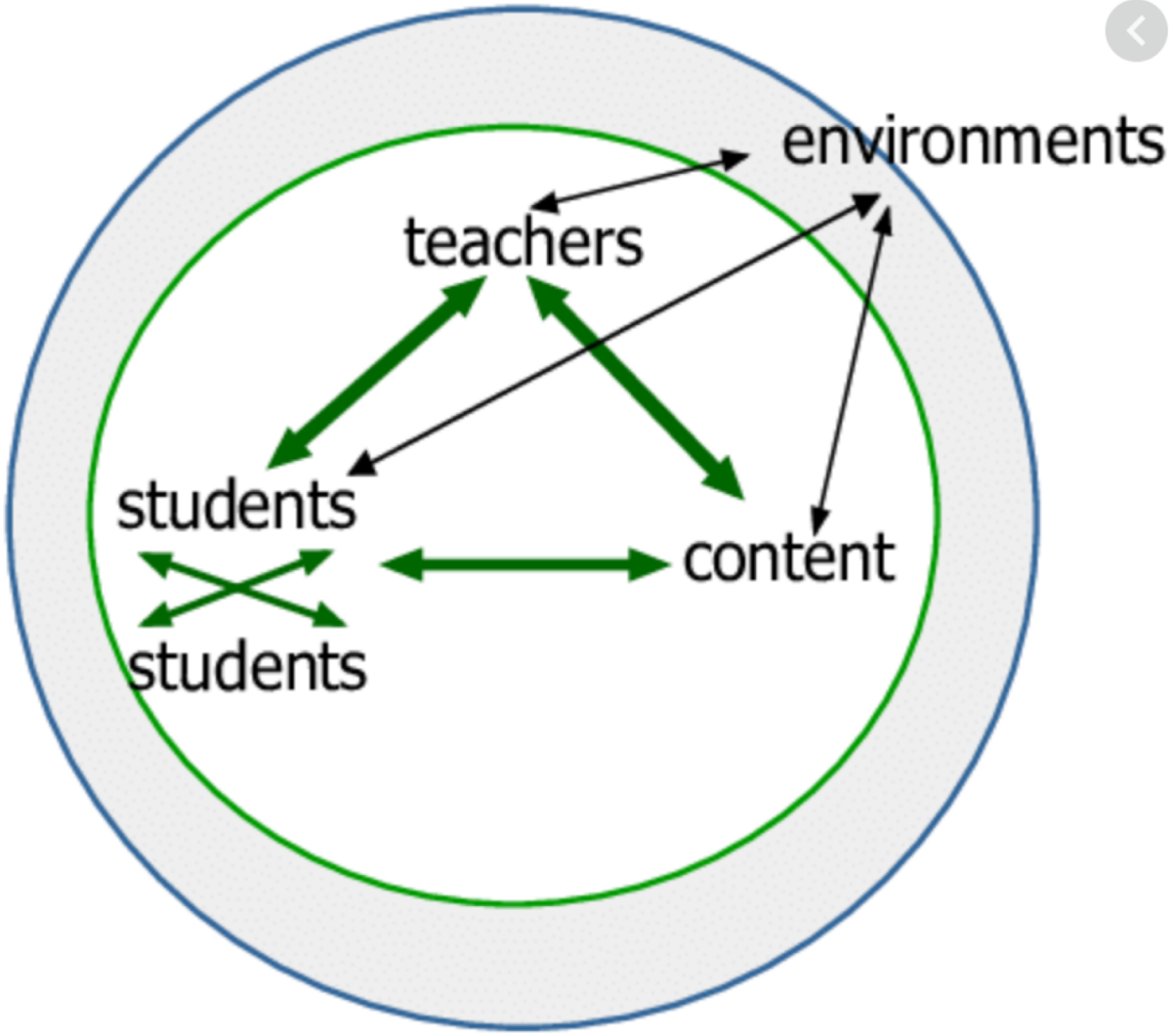

Cohen, D., Raudenbush, S., & Ball, D. (2003). Resources, instruction, and research. *Educational Evaluation and Policy Analysis, 25*(2), 119–142.