

# Flipping the book on Biology

Developing an interactive, open, online textbook to flip a large, lecture-based university course



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# **TODAY'S TOPIC – New Bio 171 Textbook**

UHM Biology Dept / DCDC partnership

Redesigned Bio 171 to use flipped model

Fall 2017 – Summer 2018

Increase student learning outcomes

Adapted an open textbook to accommodate the needs of  
flipped

# BIOLOGY 171

Introductory Biology class

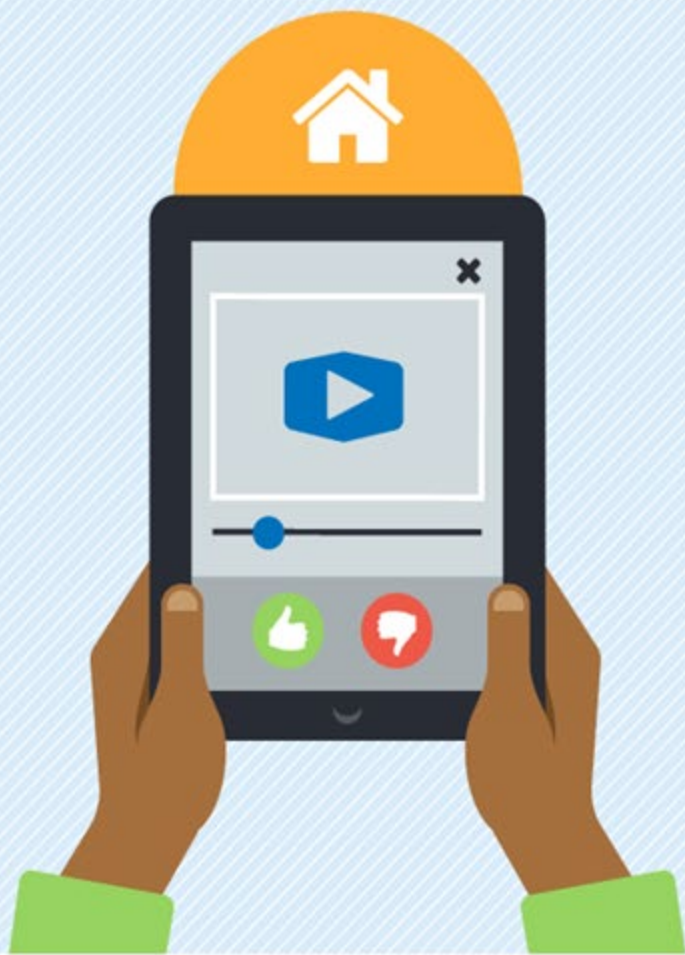
F2F, lecture-based

Large enrollments: 750 per semester

Up to 350 in one lecture hall

Hard copy, expensive required textbook

Critical for students moving on in natural sciences



Students consume content outside of class



Class time spent actively applying concepts

# Active learning in large lectures?

## Eric Mazur

Describes how he came to peer instruction



Peer instruction in action in large lecture



# FLIPPED CHALLENGES

Students fail to spend adequate amounts of time outside of class preparing for in-class activities

[\(Akçayır & Akçayır, 2018; Lai & Hwang, 2016\)](#)

## Engage students and keep accountable

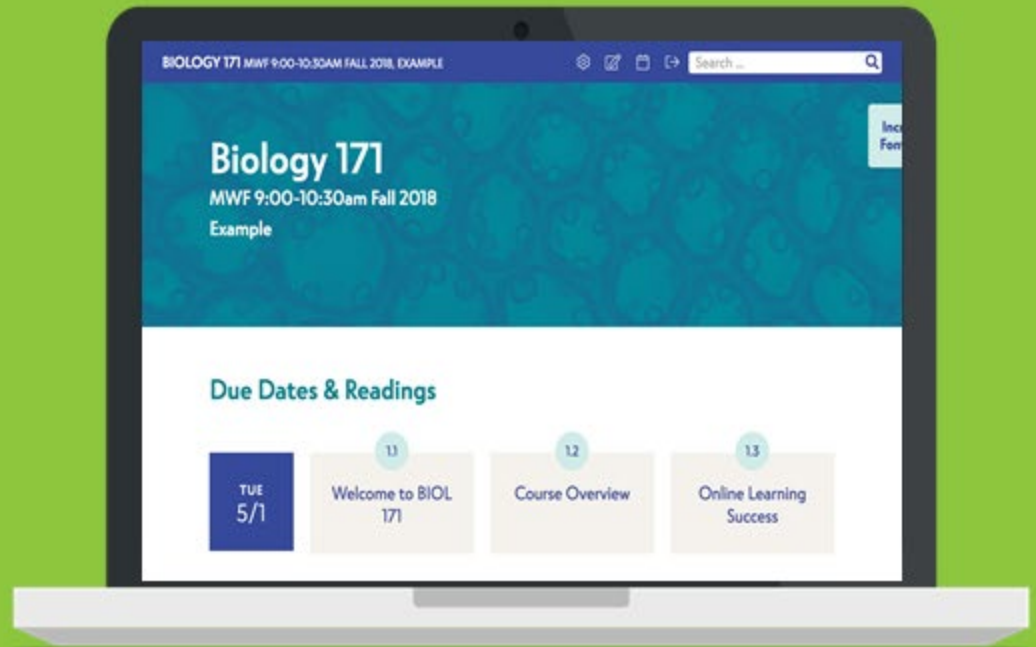
Instructors' inability to know if students have completed out-of-class work before they come to class [\(Fautch, 2015\)](#)

## Inform instructors, able to monitor progress



# Development Priority

Outside of class online  
resources



# DESIGN CONSIDERATIONS

Online - Accessible anywhere, time, any device

Editable by instructors

Free for students

Include enhanced content

Practice with content

Keep students accountable for outside of class work

Instructors able to monitor student activity

# BIOLOGY TEXTBOOK ADAPTATIONS

Adapted an open source, online Bio textbook from [OpenStax](#) of Rice University

Built on PressBooks platform

Added interactive quizzes & videos

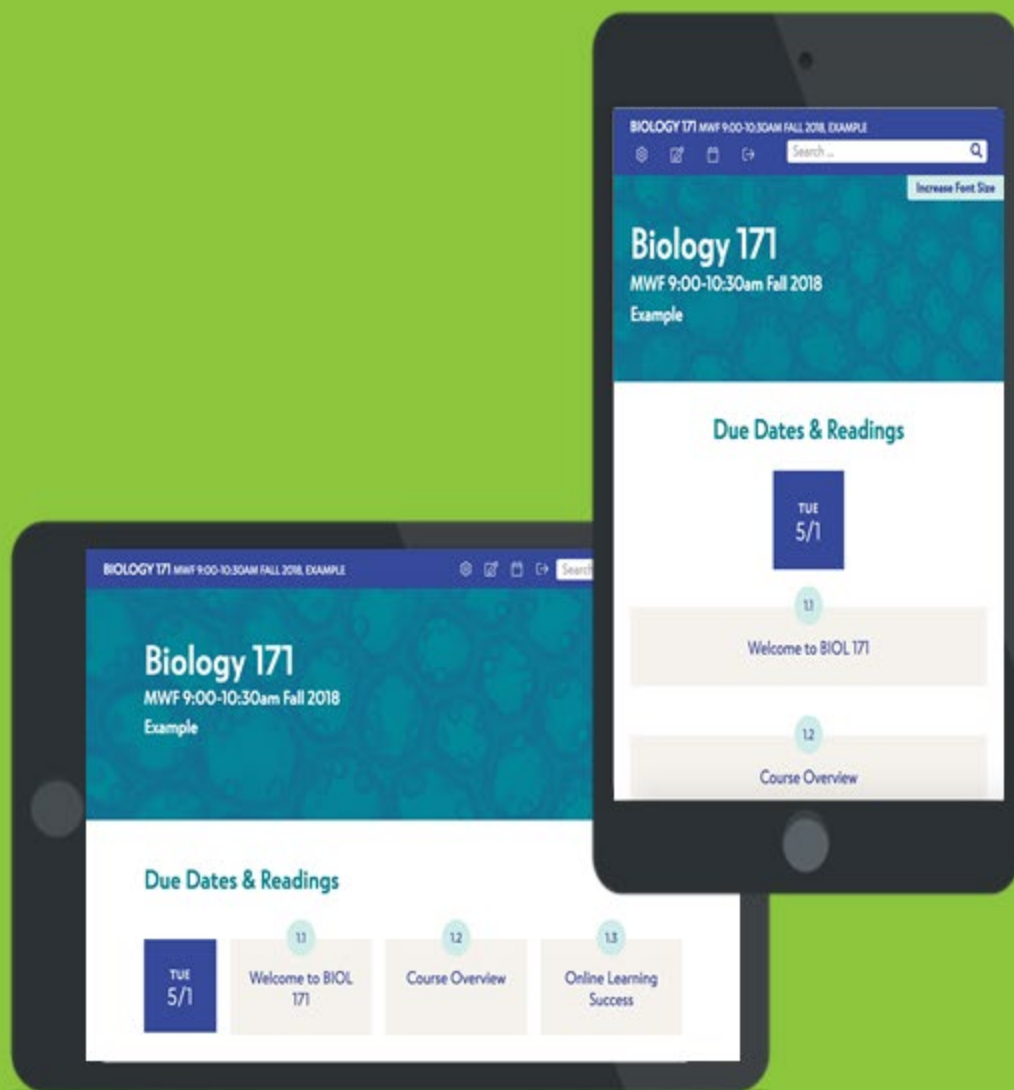
Instructor & student dashboards

New consistent theme for all materials and sites

# Online Textbook



# Mobile Friendly



# Biology 171

TTH 12:00-1:15pm Spring 2019

zenil-ferguson

## Chapter Due Dates

TUE  
1/15

1.1

Start Here: Textbook  
Orientation

1.2

Online Learning  
Success

2.1

Themes and  
Concepts of Biology



3.1

Atoms, Isotopes,  
Ions, and Molecules:  
The Building Blocks



THU  
1/17

3.2

Water



3.3

Carbon



TUE  
1/22

4.1

Synthesis of  
Biological  
Macromolecules



4.2

Carbohydrates



4.3

Lipids



THU

4.4

Proteins

4.5

Nucleic Acids

# Textbook

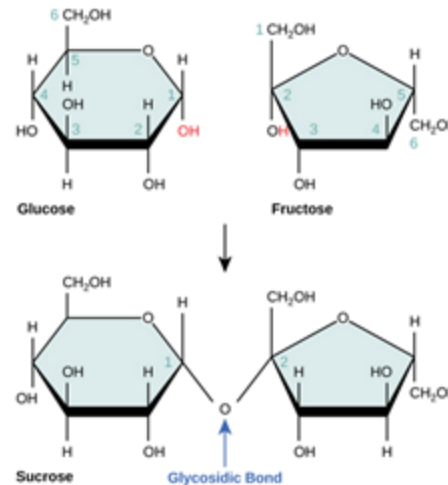
Chapters  
organized by  
due dates

# Textbook

## Chapter page

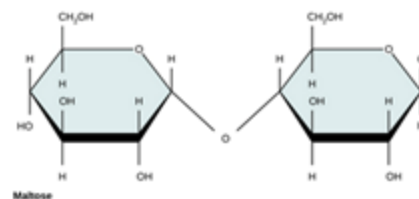
### Disaccharides

**Disaccharides** (di- = "two") form when two monosaccharides undergo a dehydration reaction (or a condensation reaction or dehydration synthesis). During this process, one monosaccharide's hydroxyl group combines with another monosaccharide's hydrogen, releasing a water molecule and forming a covalent bond. A covalent bond forms between a carbohydrate molecule and another molecule (in this case, between two monosaccharides). Scientists call this a **glycosidic bond** (FIGURE 4). Glycosidic bonds (or glycosidic linkages) can be an alpha or beta type. An alpha bond is formed when the OH group on the carbon-1 of the first glucose is below the ring plane, and a beta bond is formed when the OH group on the carbon-1 of the first glucose is above the ring plane.



**Figure 4:** Sucrose forms when a glucose monomer and a fructose monomer join in a dehydration reaction to form a glycosidic bond. In the process, a water molecule is lost. By convention, the carbon atoms in a monosaccharide are numbered from the terminal carbon closest to the carbonyl group. In sucrose, a glycosidic linkage forms between carbon 1 in glucose and carbon 2 in fructose.

Common disaccharides include lactose, maltose, and sucrose (FIGURE 4). Lactose is a disaccharide consisting of the monomers glucose and galactose. It is naturally in milk. Maltose, or malt sugar, is a disaccharide formed by a dehydration reaction between two glucose molecules. The most common disaccharide is sucrose, or table sugar, which is comprised of glucose and fructose monomers.



**chitin**

type of carbohydrate that forms the outer skeleton of all arthropods that include crustaceans and insects; it also forms fungi cell walls

**disaccharide**

two sugar monomers that a glycosidic bond links

**glycogen**

storage carbohydrate in animals

**glycosidic bond**

bond formed by a dehydration reaction between two monosaccharides with eliminating a water molecule

**monosaccharide**

single unit or monomer of carbohydrates

**polysaccharide**

long chain of monosaccharides; may be branched or unbranched

**starch**

storage carbohydrate in plants

# Textbook

## Glossary practice flashcards

## Quizlet

### Practice

Use these flashcards to review the glossary terms above.




 Cards

PROGRESS 2/9





 Play

 Shuffle

 Options

polysaccharide that makes up the cell wall of plants; provides structural support to the cell





## Text Quiz

An example of a monosaccharide is \_\_\_\_\_.

- fructose
- glucose
- galactose
- all of the above



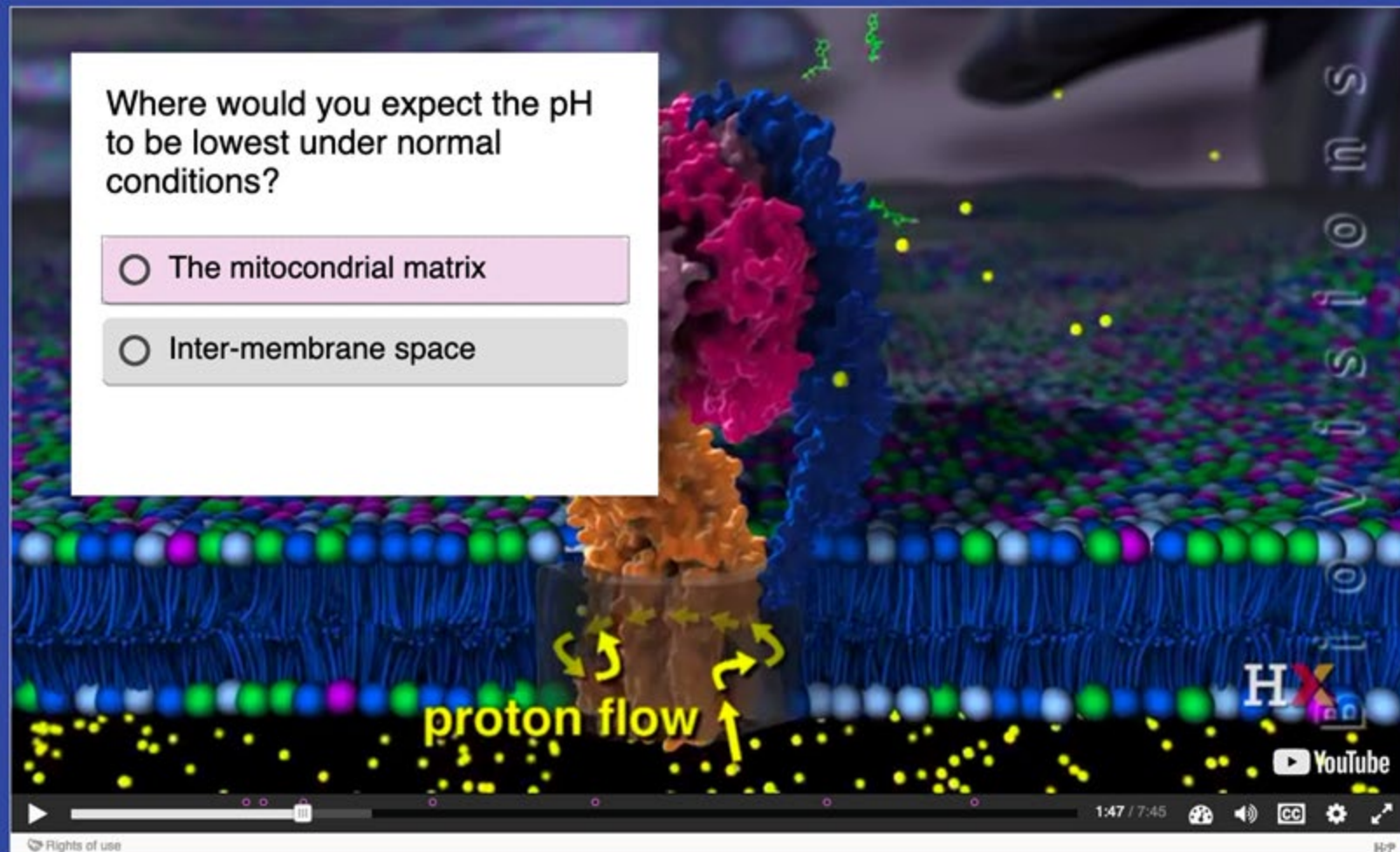
Text quizzes - H5P



## Video Quiz

Where would you expect the pH to be lowest under normal conditions?

- The mitochondrial matrix
- Inter-membrane space



Video quizzes - H5P

## Chapter Feedback

### GIVE FEEDBACK

Average Rating (1): 

Your Rating: 

Tag Your Feedback

COMPLIMENT

RECOMMENDATION

FIX

Leave your feedback on the page

Share any feedback you have!

Submit Feedback

Your feedback is appreciated.

Give Feedback



Complete before class on Thursday, February 7, 2019

8.1

8.2

8.3

8.4

8.5

**Oxidative Phosphorylation**



8.1

# Energy in Living Systems

New navigation elements,  
based on due dates

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TUE  
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4.1

Synthesis of  
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Lipids



THU

4.4

Proteins

4.5

Nucleic Acids

## Status Icons

Students monitor  
their quiz  
progress

# Learning analytics + dashboard



# Instructor Dashboards



## Class

Broad temperature of class progress



## Content

Identify content interaction and potential learning issues



## Student

Quickly identify students by key metrics for targeted interventions

## Class Progress

Due: 02/05/2019

[7.1 Energy and Metabolism](#)



[7.4 ATP: Adenosine Triphosphate](#)



Due: 02/07/2019

[8.1 Energy in Living Systems](#)



[8.2 Glycolysis](#)



[8.3 Oxidation of Pyruvate and the Citric Acid Cycle](#)



[8.4 Oxidative Phosphorylation](#)



[8.5 Metabolism without Oxygen](#)



Late: 19

How many have completed each quiz?

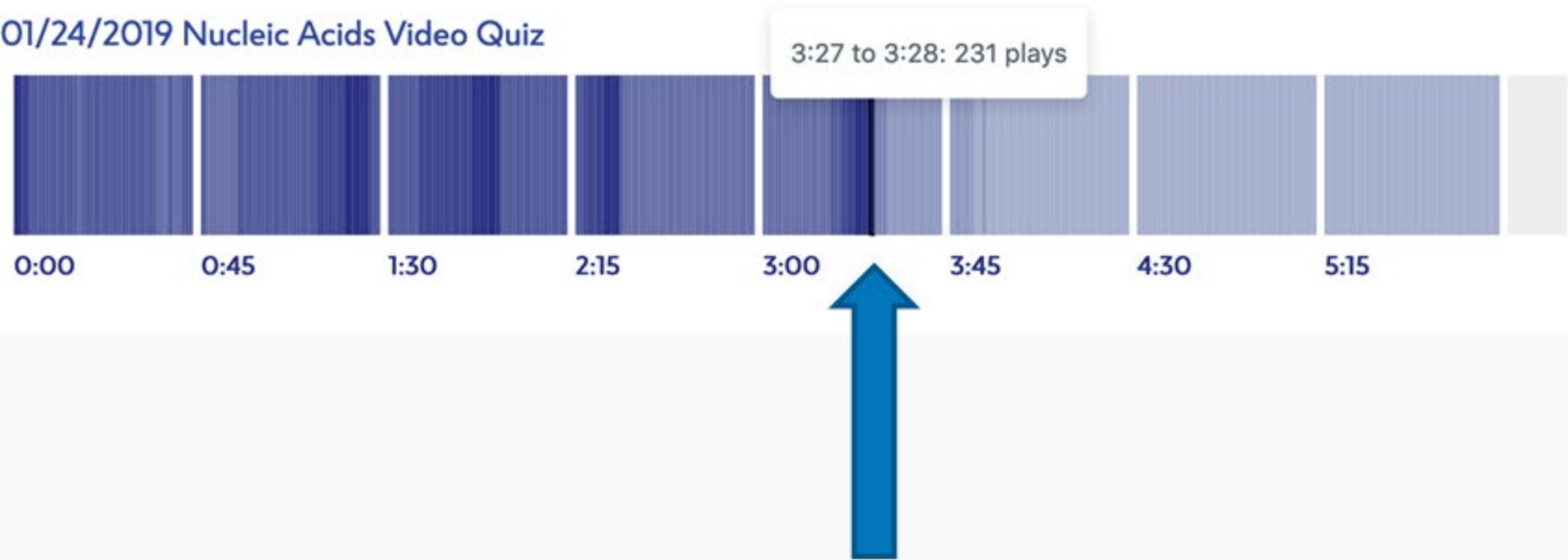


Due: 01/15/2019 - 2.1 Themes and Concepts of Biology



How did they do on each quiz question?

Due: 01/24/2019 Nucleic Acids Video Quiz

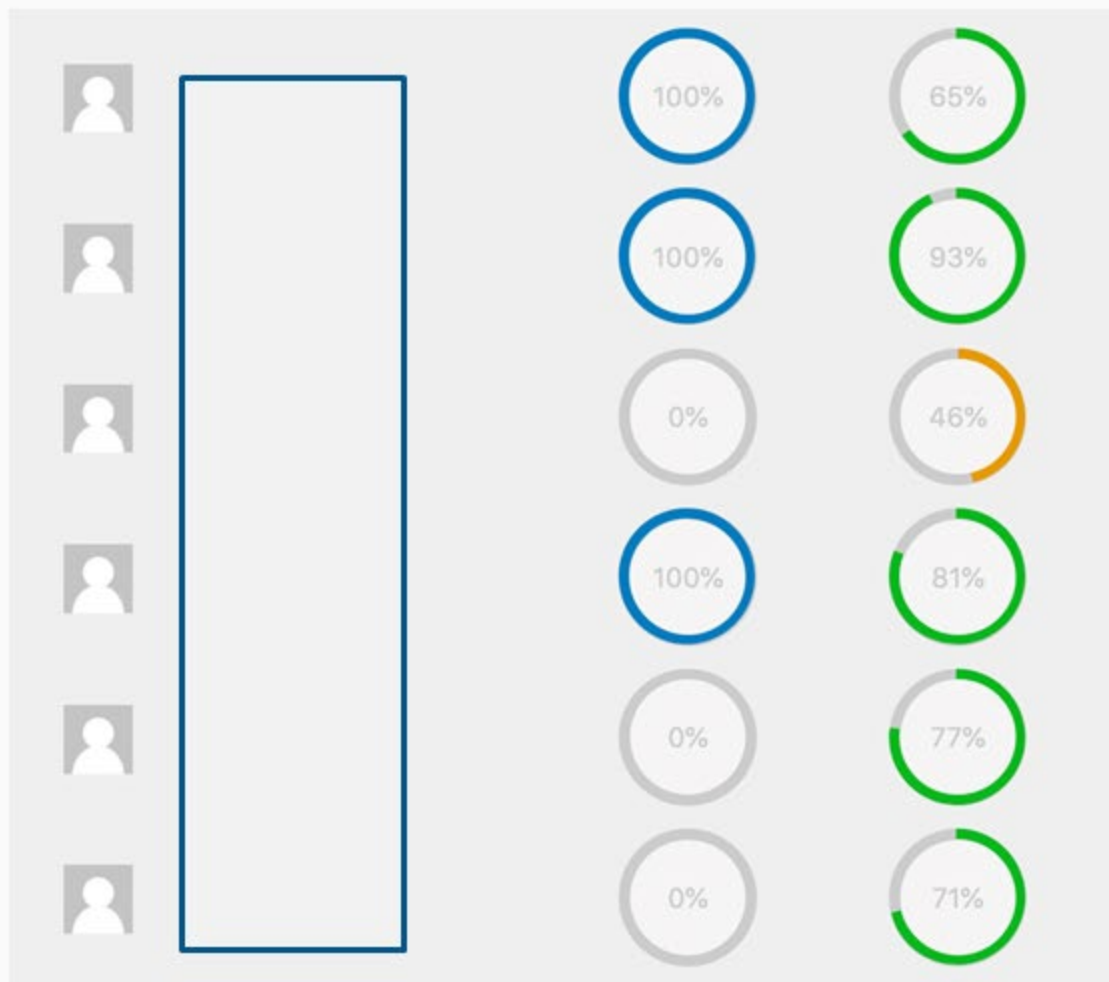


How many watched the video and what sections were viewed most?

How are individual students doing?

Upcoming

Overall



## Conclusion

Over 600 students have used

Some technical and implementation issues, esp in pilot semester

Made some mods based on student experience and faculty request

Been well received by students

Overall a success

# MAHALO

Questions?



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