

An interactive web native textbook for Material and Energy Balances: Student Feedback and Performance

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membership

Acknowledgments: Charles Vestal, Marc Donnelly,
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zyBooks

Disclaimer: I may financially
benefit from sales of the book
discussed in this talk

What fraction of your
students read the
textbook?

Does reading a textbook
translate into higher
course grades?

Interactive technology beneficial



Internet >> Textbook

Interactive web-native > static web

Students want interactive books

A short list of references:

T. Stelzer, et al., Am. J. Phys. 2009.

C. S. Lee, et al., J. Eng. Ed. 2013.

Edgcomb & Vahid, ASEE Conf. Proc. 2014 and 2015 and 2016.

Falconer & Nicodemus, CEE 2014 and ASEE Conf. Proc. 2015.

Branch & Butterfield, ASEE Conf. Proc. 2015 and 2016.

Seeling, FIE 2015.

Vestal, C.R. CEE Teaching Tip 2016.

A common theme for talks in this session

Setting goals



MEB course goal:

Develop problem solving skills
and conceptual understanding

‘Textbook’ authoring goal:

Bring active learning to a textbook

Features of a zyBook



Definitions

Learning questions

T/F, Multiple choice, Matching, Short answer

Animations

Links to additional, external resources

Challenge activities

Less text, more action™

Material and Energy Balances

Quantities, Units, and Calculations
Material Balances
Reacting Systems
Solids, Liquids, and Gases
Multiphase Systems
Energy Balances
Transient Systems

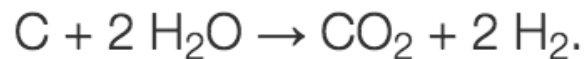
zyBooks.com

Less text, more action™

Learning with every response



Entering a reactor are water at 44 mol/hr and carbon at 36 mol/hr to complete the following reaction:



If 28 mol/hr of hydrogen are formed in the reactor, the fraction conversion of carbon should be:

0.78

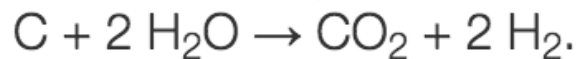
0.64

0.39

Learning with every response



Entering a reactor are water at 44 mol/hr and carbon at 36 mol/hr to complete the following reaction:



If 28 mol/hr of hydrogen are formed in the reactor, the fraction conversion of carbon should be:

- ✘ 0.78 comes from taking the ratio of 28 mol/hr of hydrogen in the reactor product to the 36 mol/hr of carbon fed to the reactor. While the 36 mol/hr of carbon fed is correct, the numerator of the fractional conversion should be a flow rate of carbon.

0.78

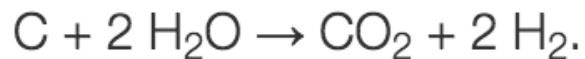
0.64

0.39

Learning with every response



Entering a reactor are water at 44 mol/hr and carbon at 36 mol/hr to complete the following reaction:



If 28 mol/hr of hydrogen are formed in the reactor, the fraction conversion of carbon should be:

- ✘ 0.64 is the correct conversion of water, which would come from a ratio of 28 mol/hr of water reacted to 44 mol/hr of water fed. However, the question asks for the conversion of carbon, not water.

0.78

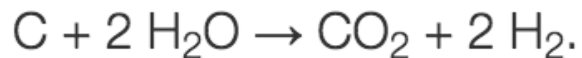
0.64

0.39

Learning with every response



Entering a reactor are water at 44 mol/hr and carbon at 36 mol/hr to complete the following reaction:



If 28 mol/hr of hydrogen are formed in the reactor, the fraction conversion of carbon should be:

- ✓ Using a stoichiometric ratio, 1 mol of C reacts to form 2 mol of H_2 . Therefore, 14 mol/hr of carbon reacted. Then the fraction conversion would be 14 mol/hr / 36 mol/hr = 0.39.

0.78

0.64

0.39

Over 75 animations _____



Turn static derivations into live exercises

Simplifying energy balance

Build up static figures

Constructing a phase diagram

Perform physical processes in equipment

Operating a distillation column

95% of students report watching multiple times

How much textbook reading occurs?



25-30% of students self reporting

2016 National Survey of Student Engagement. > 280,000 students

~20% from self report/quiz grade study

Burchfield and Sappington, *Teaching of Psychology*, 2000. > 900 students

Very few studies/data exist

How much textbook reading occurs?

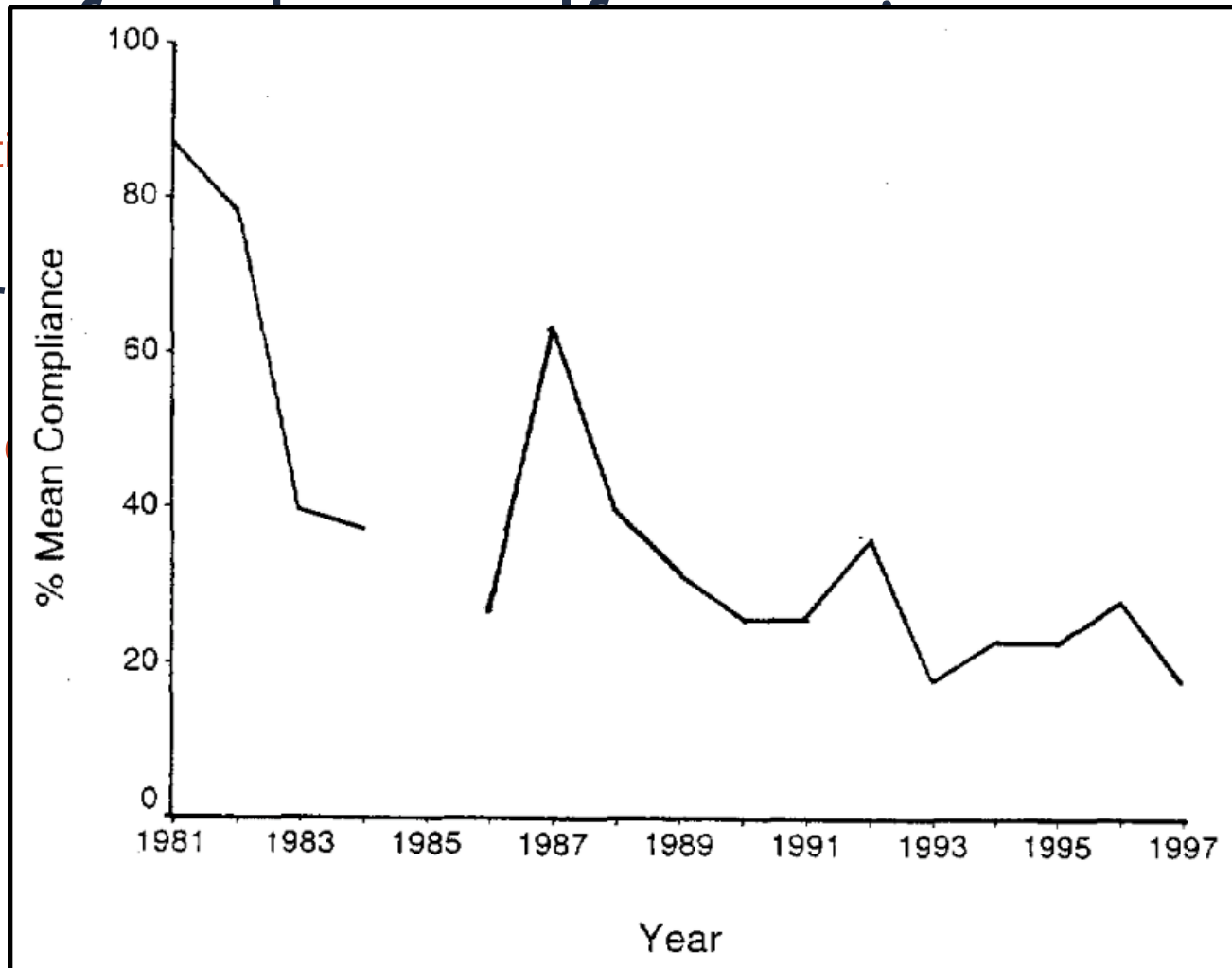


25-30%

2016 Nat

~20% fr

Burchfiel



dents

Very few studies/data exist

Providing an incentive

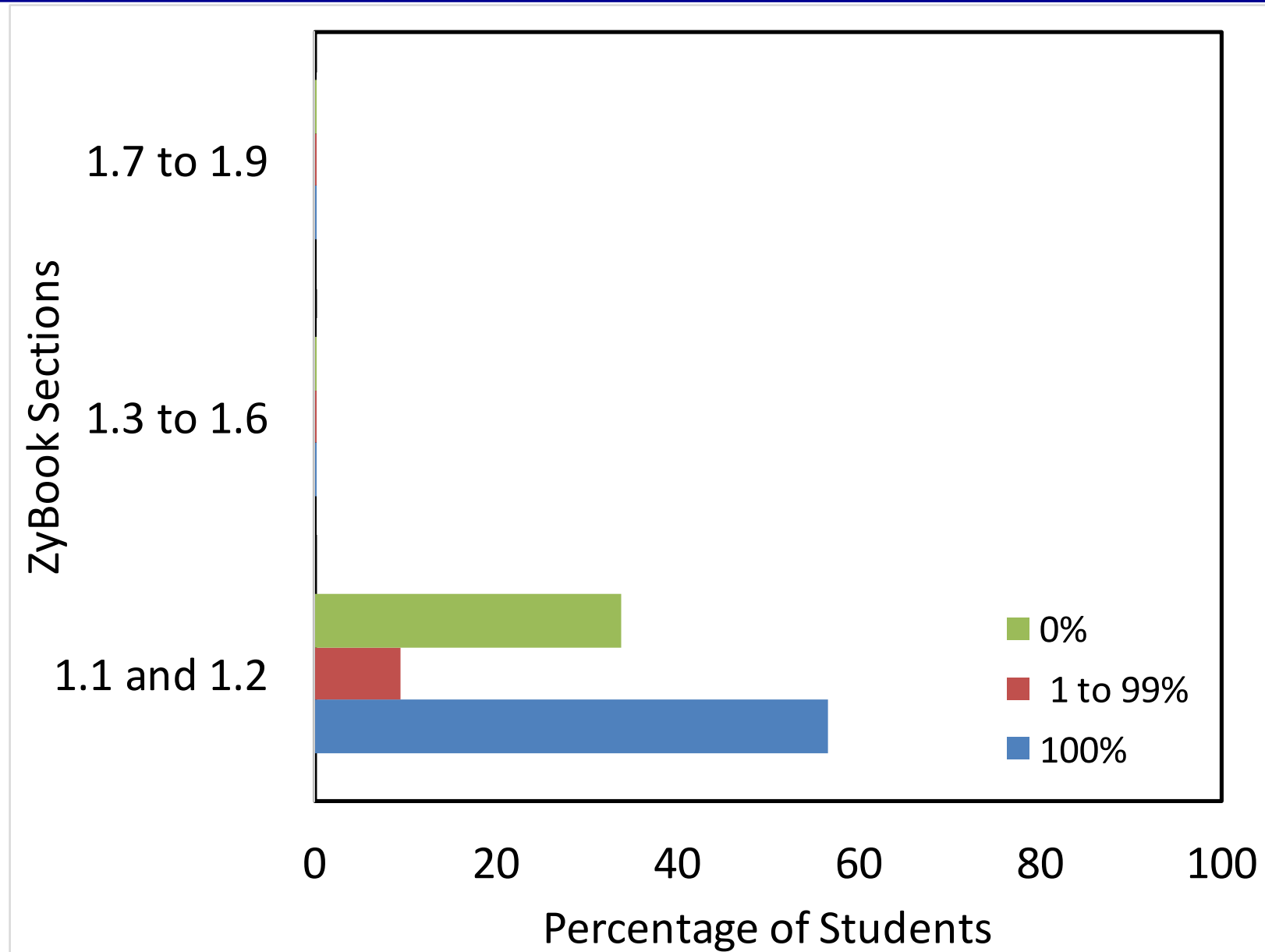


Offering 2 to 10% of final course grade leads to high reading rates

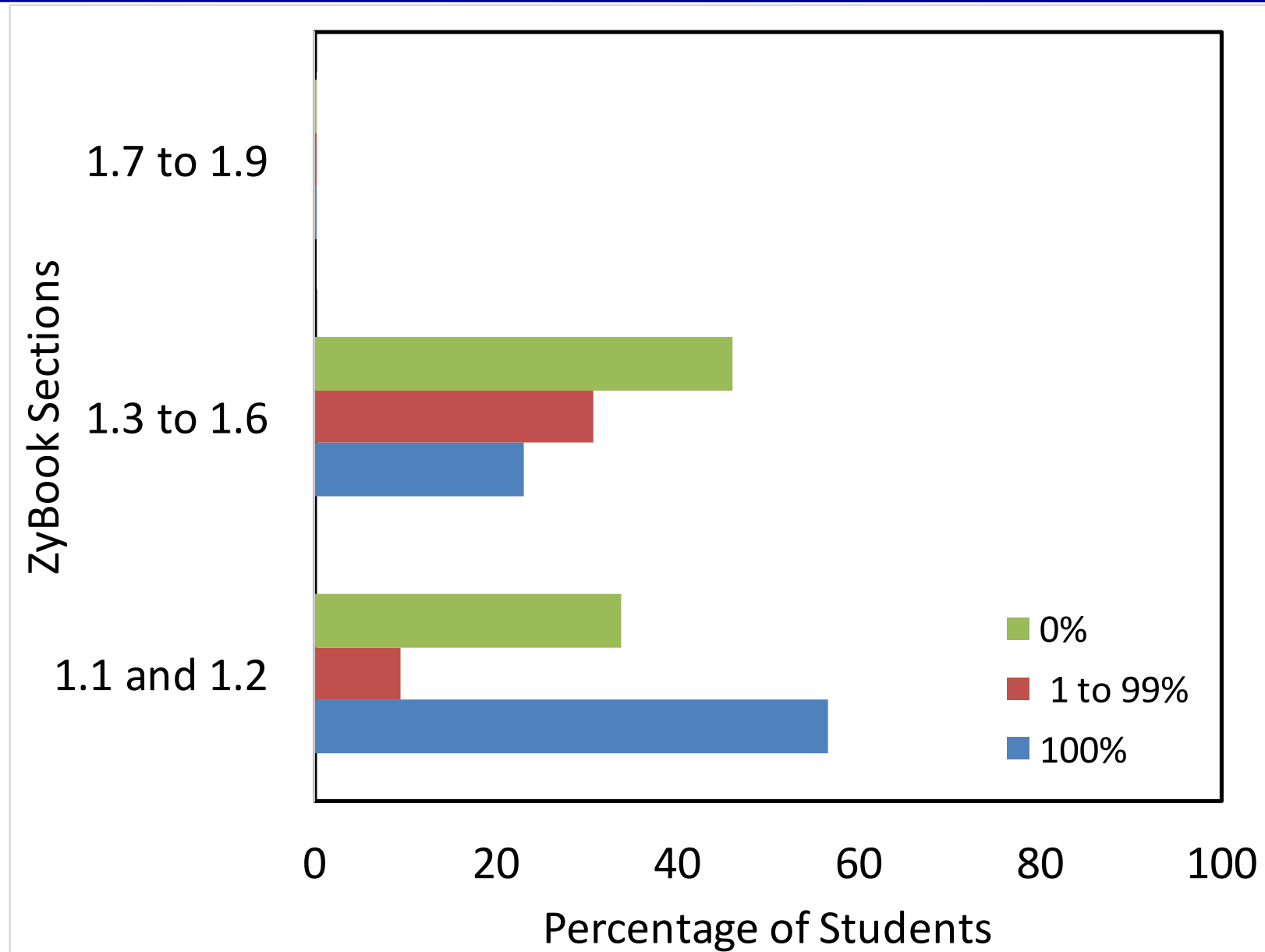
Edgcomb and Vahid. FIE. 2015. > 1100 students

6% of final course grade offered for MEB

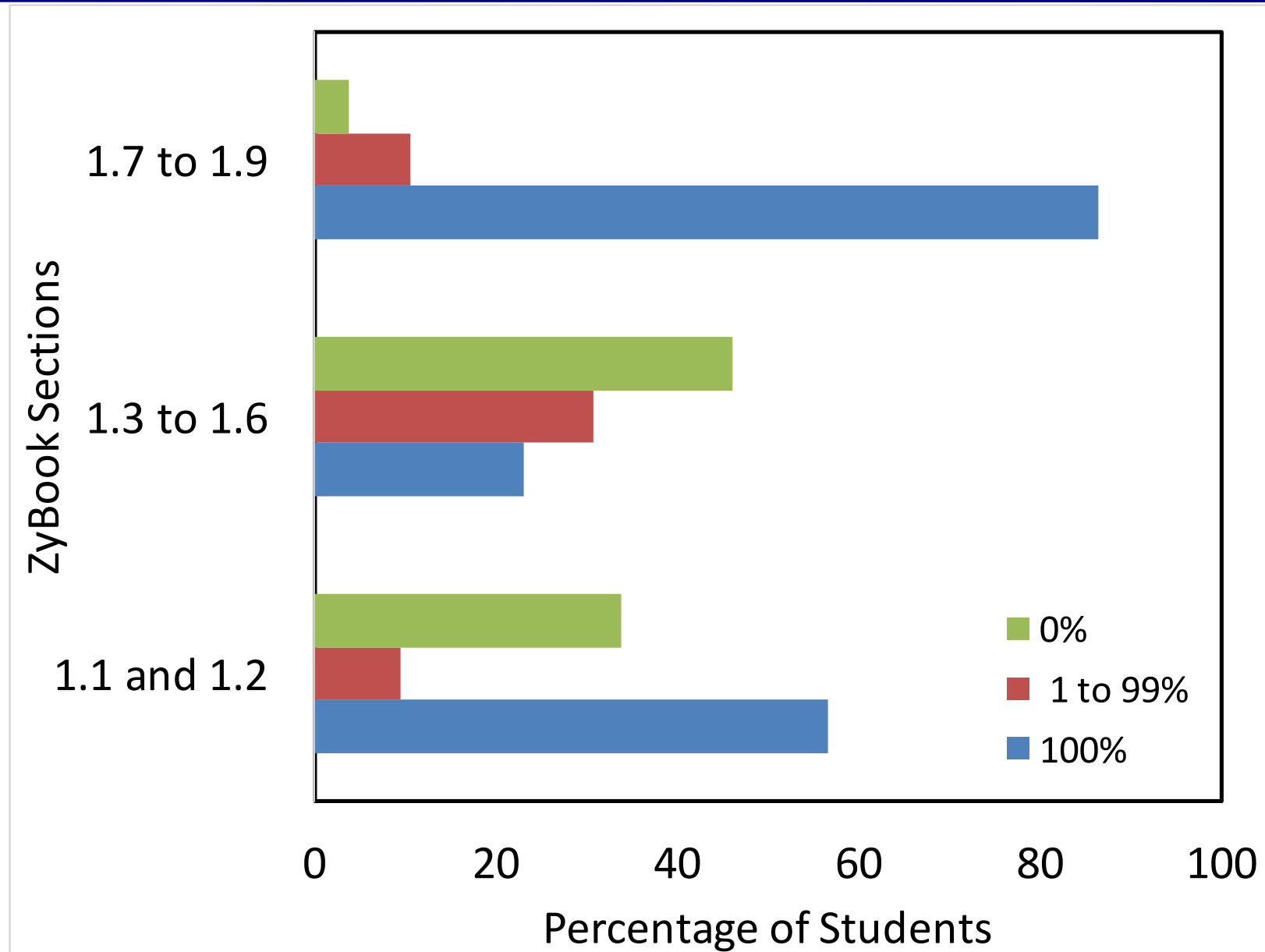
Learning to read/participate



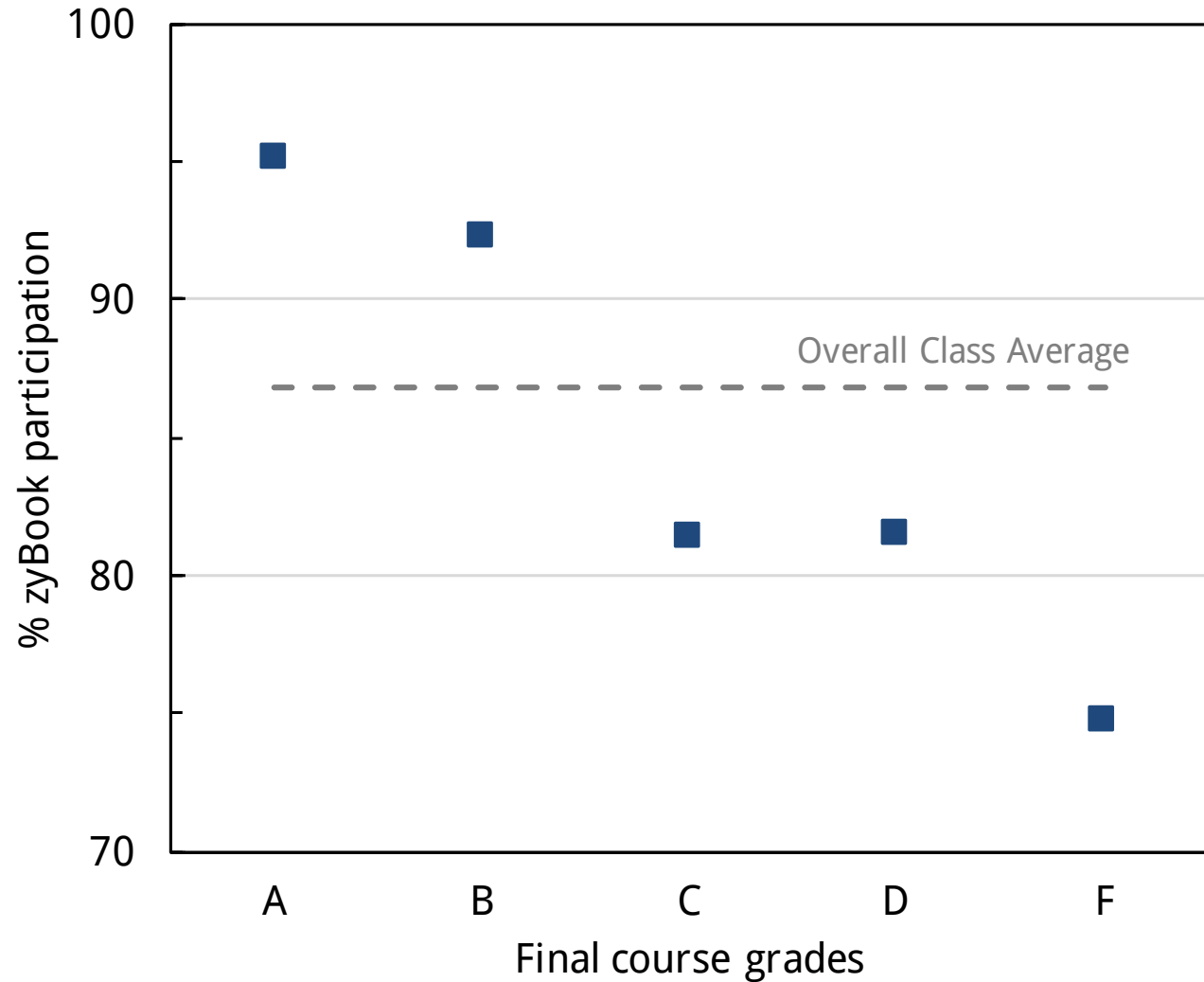
Learning to read/participate



Learning to read/participate

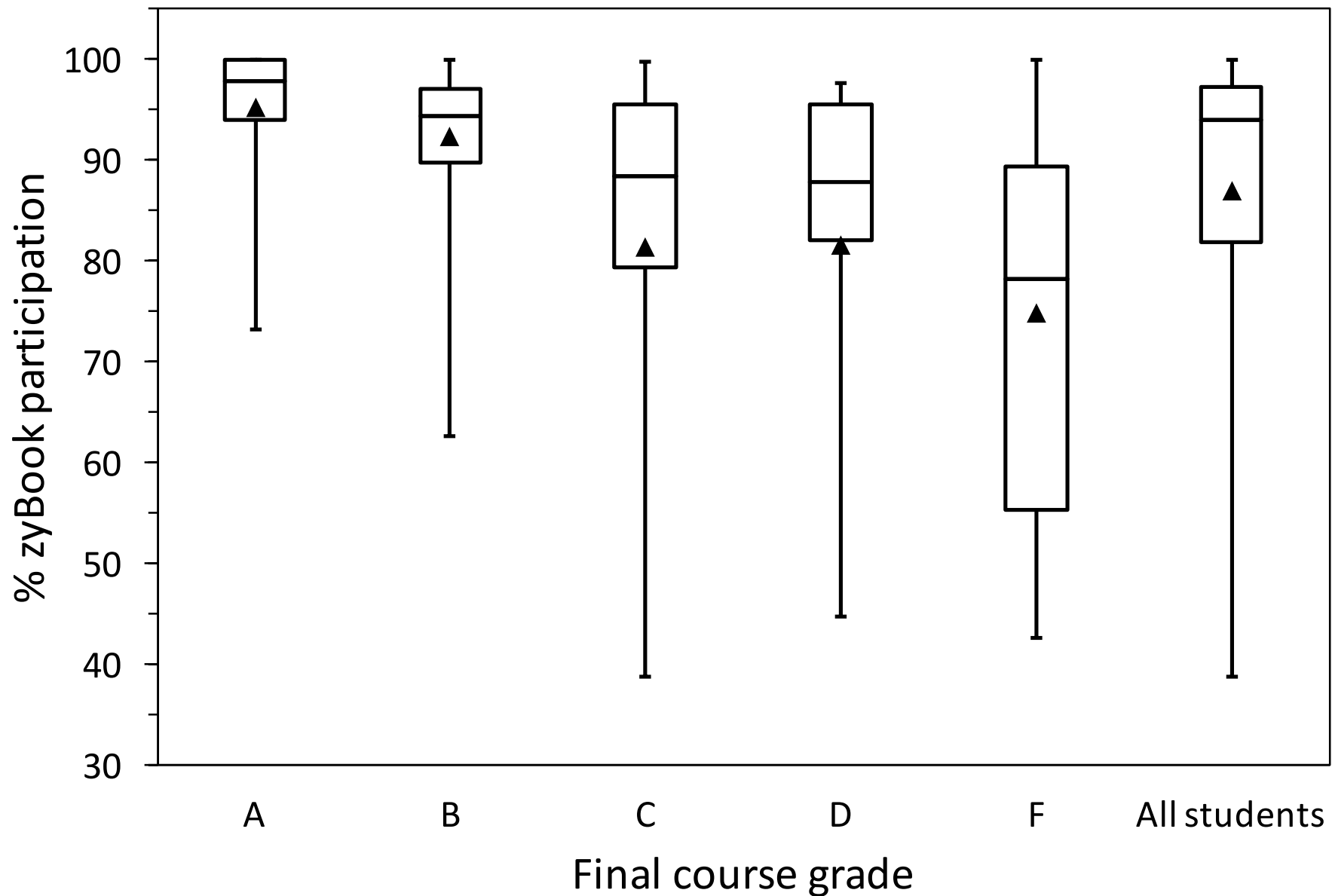


87% average reading rate

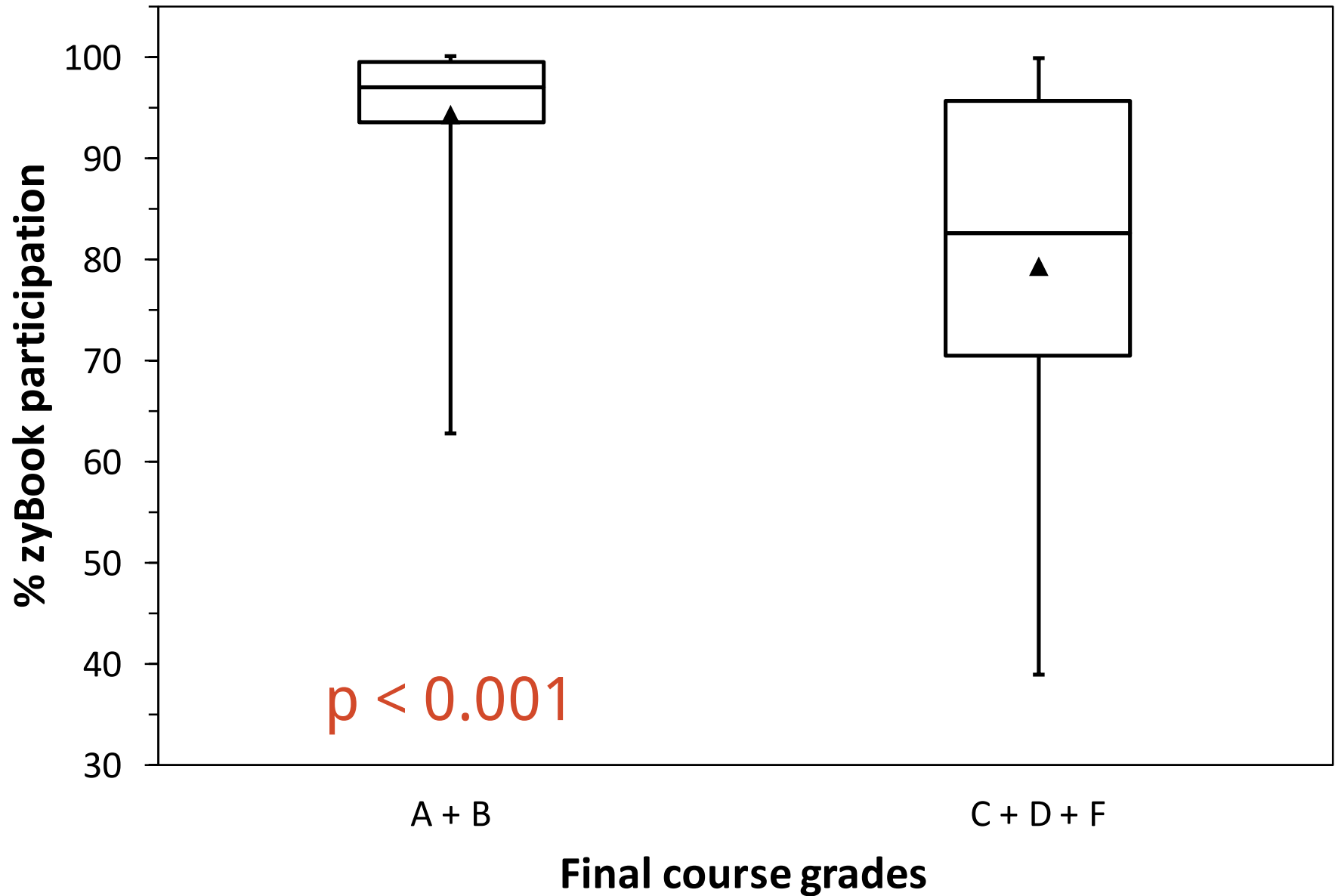


Read by due date + 67 sections + 100 students

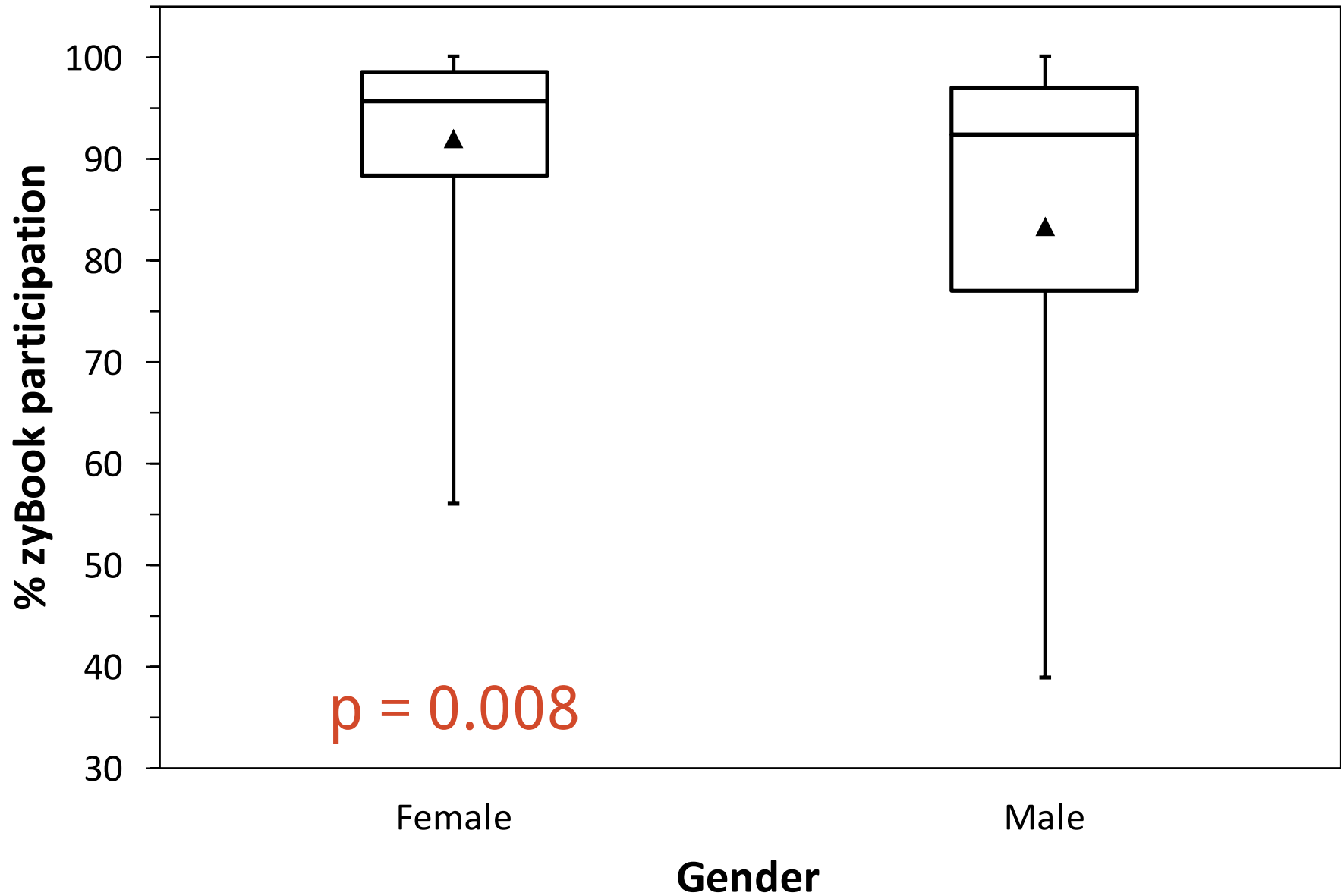
Reading correlates with final grades



A,B students read a lot more



Females read more



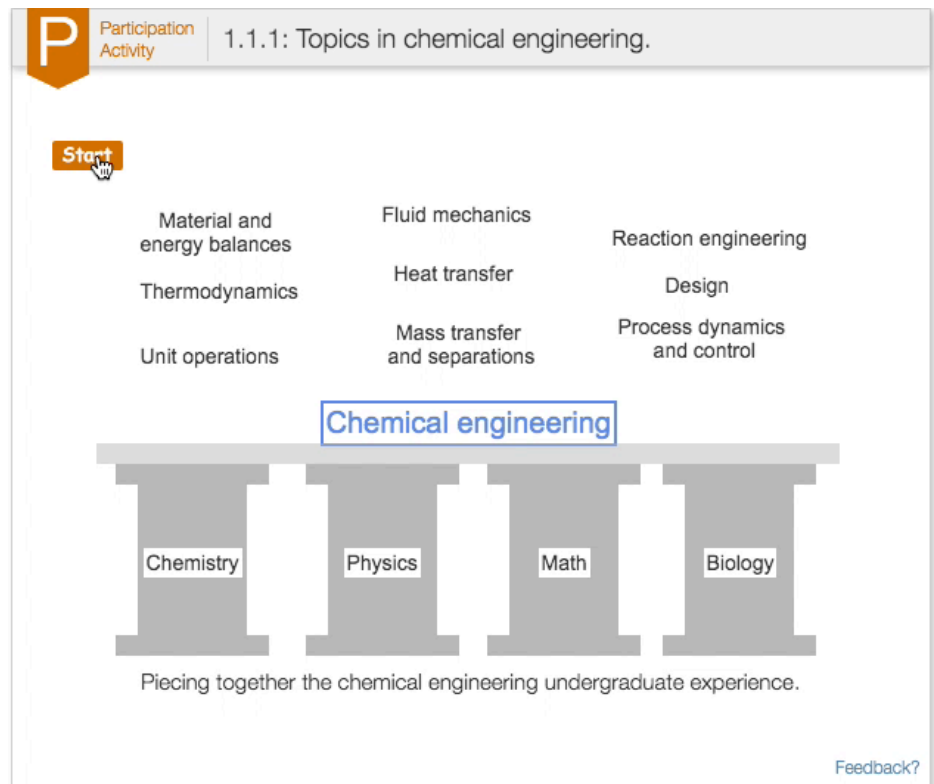
Zybook has high reading rate



87% of zyBook read
of students found useful

Reading correlated
with final grades

Zybook preferred
to static book



Better things will keep coming – [zyBooks.com](https://www.zybooks.com)

Table 39