WHY FLIPPED CLASSROOM?

2016 XJTLU Annual Learning and Teaching Colloquium
"Imagining the Next 10 Years in Learning and Teaching"

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PASSIVE LEARNING

Student See, Student Do

Student Do, Student Learn

ACTIVE LEARNING

The Traditional Approach

Expository lecture

- In lecture theatre
- Up to 300 students
- 4–5 hours per week

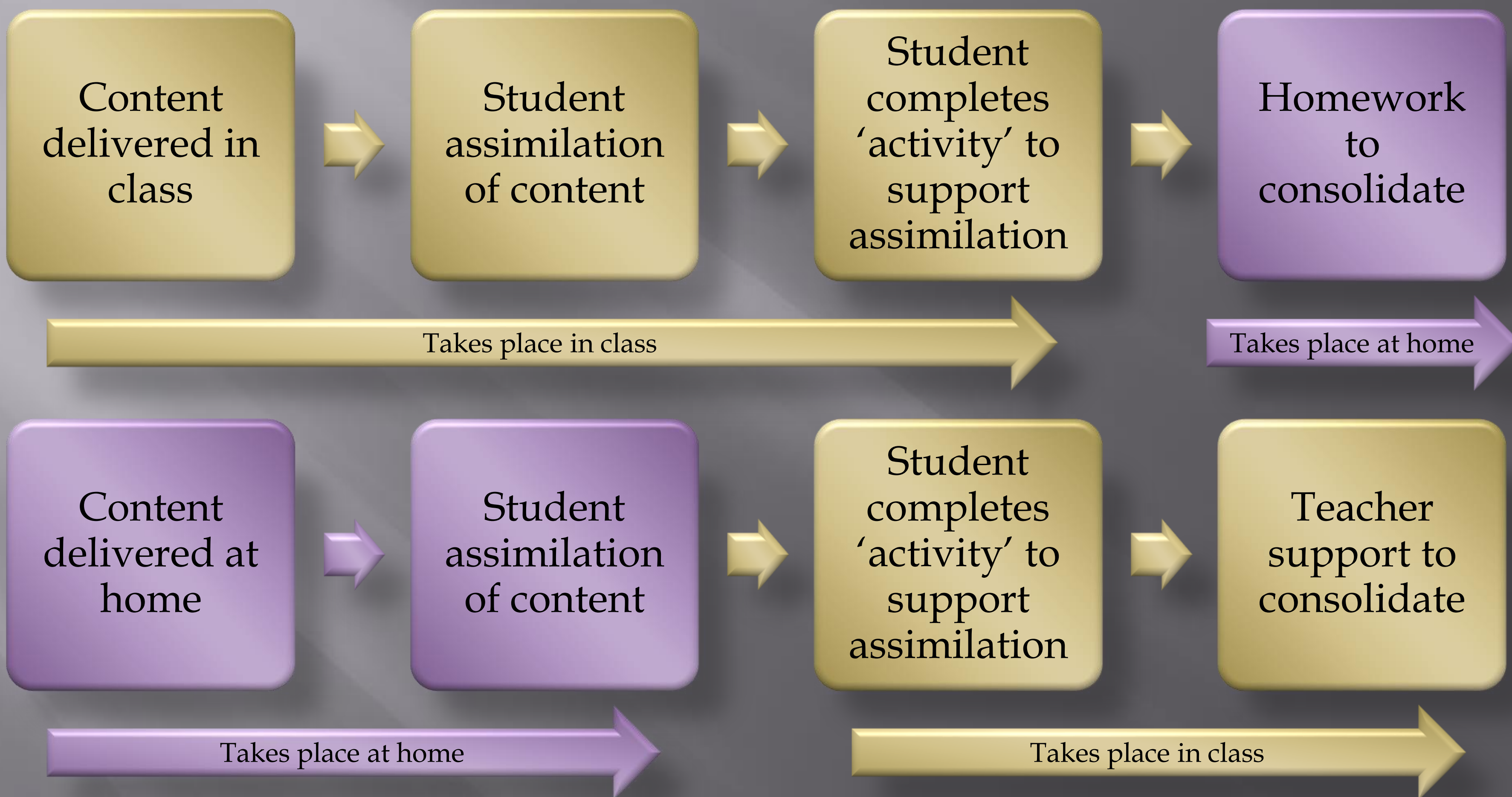
Tutorial class

- In small classroom
- Up to 25 students
- 1 hour per week

Assessment

- Final examination
- Mid-term test

Traditional *vs* Flipped



Based on a graphic taken from Steed, A. (2012) The Flipped Classroom, *Teaching Business & Economics*, **16**, 9–11.

Traditional *vs* Flipped

Traditional:
Lessons in class, homework at home

Flipped:
Lessons at home, homework in class

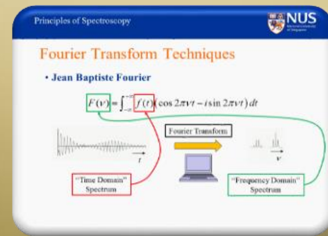
The Flipped Classroom

Week before class

One day before class

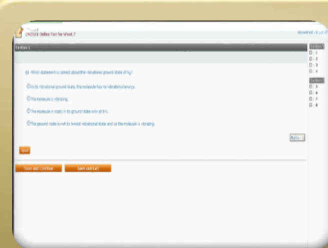
In class

Following week



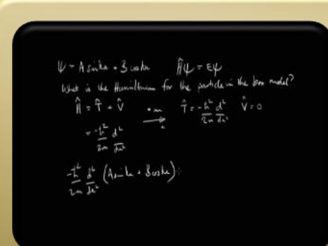
Online Lectures

- Playlists of short (10–15 minute), narrated presentations



Weekly Online Quizzes

- Identification of student misconceptions



Large Class Review Session

- Review of online material
- Learner response system

Small Group Active Learning

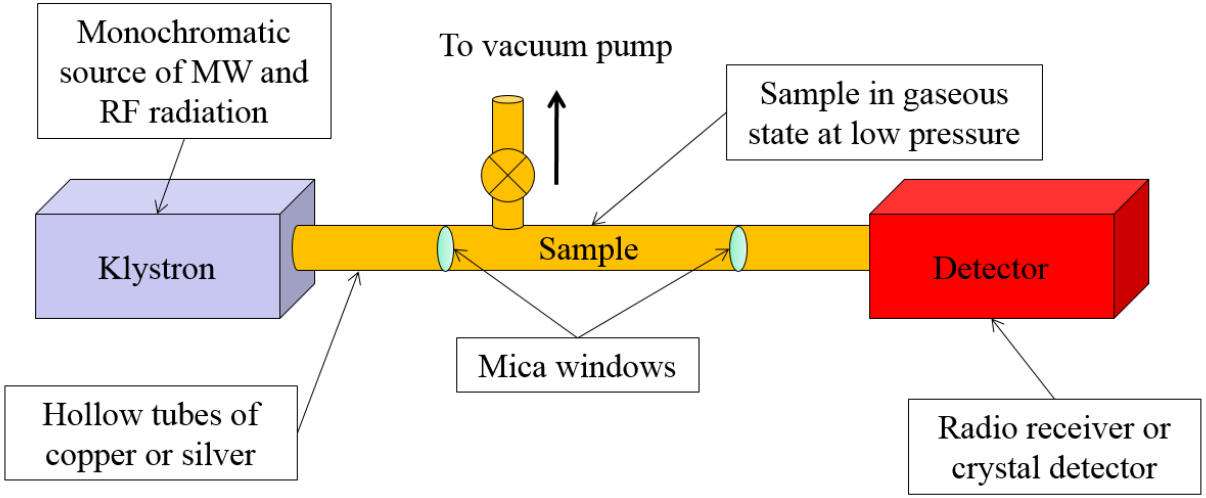
- Work in groups of 3–5 students
- Active problem solving
- Peer learning

Content Online

Physical Chemistry 2

NUS National University of Singapore

Microwave Absorption Instrumentation



- Spectral range: 0.1–100 cm^{-1}

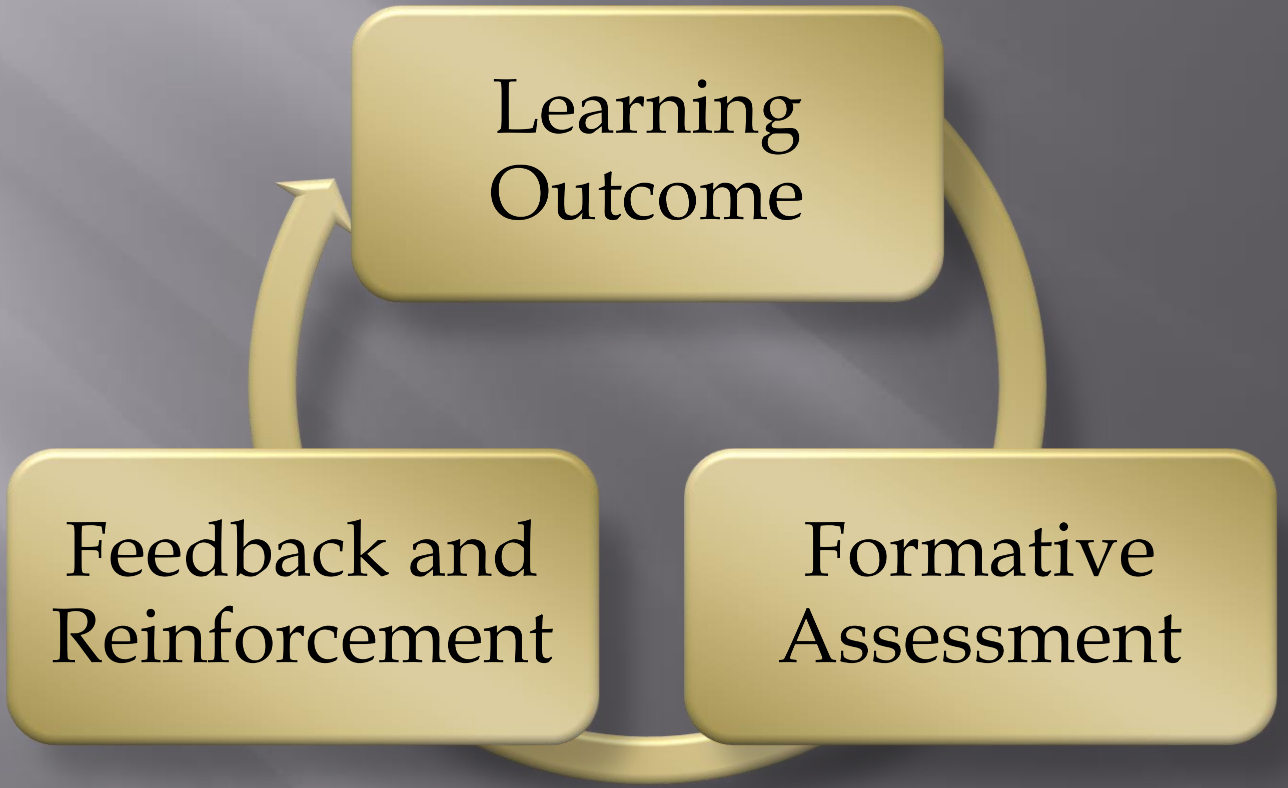
Just-in-Time Teaching

"The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly."

Ausubel, 1968.

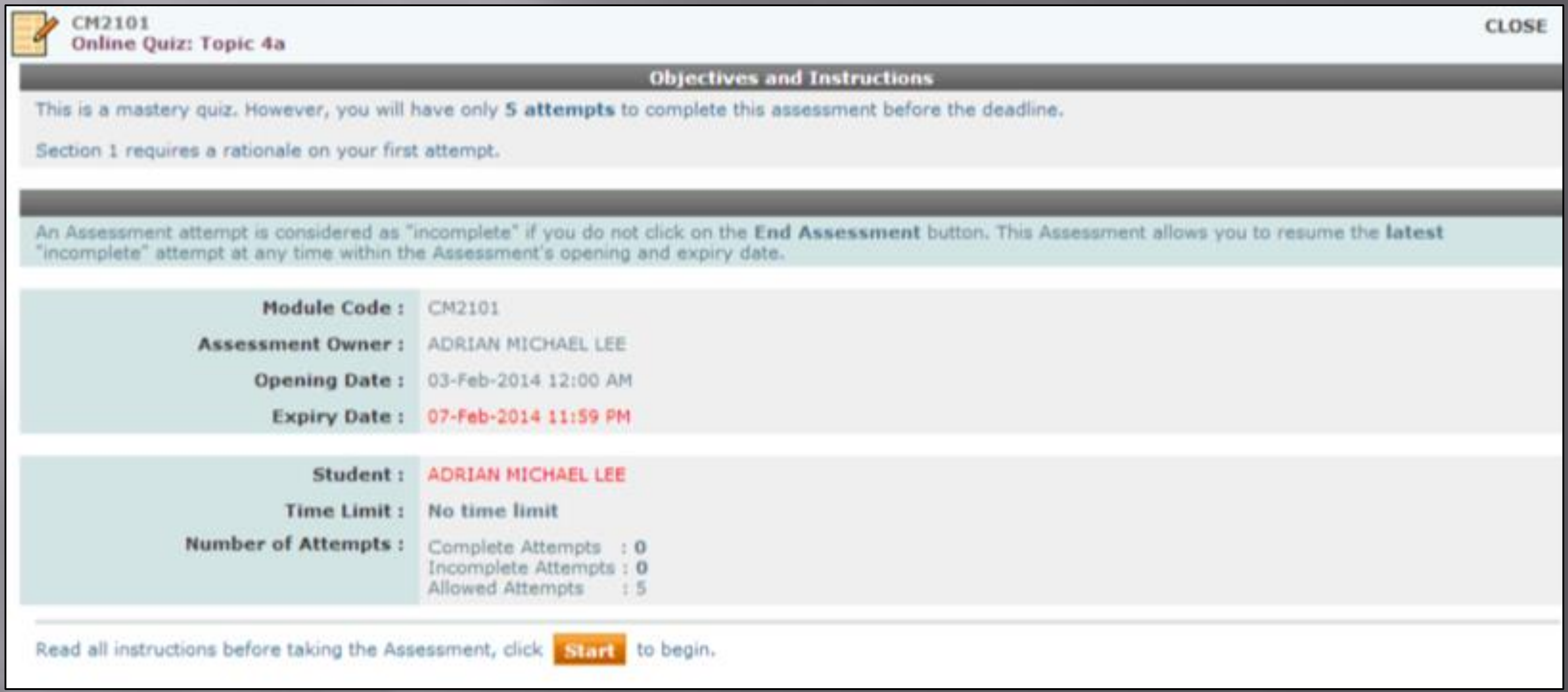
G. N. Novak, E. T. Patterson, A. Gavrin, and W. Christian. (1999) Just-in-Time Teaching: Blending Active Learning and Web Technology, Saddle River: Prentice Hall.
D. P. Ausubel. (1968) Educational Psychology: A Cognitive View, New York: Rinehart and Winston, Inc.

Mastery Learning



Bloom, B. S., and J. B. Carroll. (1971) *Mastery learning: Theory and practice,* New York: Holt, Rinehart and Winston.

Weekly Online Quiz



CM2101
Online Quiz: Topic 4a

CLOSE

Objectives and Instructions

This is a mastery quiz. However, you will have only **5 attempts** to complete this assessment before the deadline.

Section 1 requires a rationale on your first attempt.

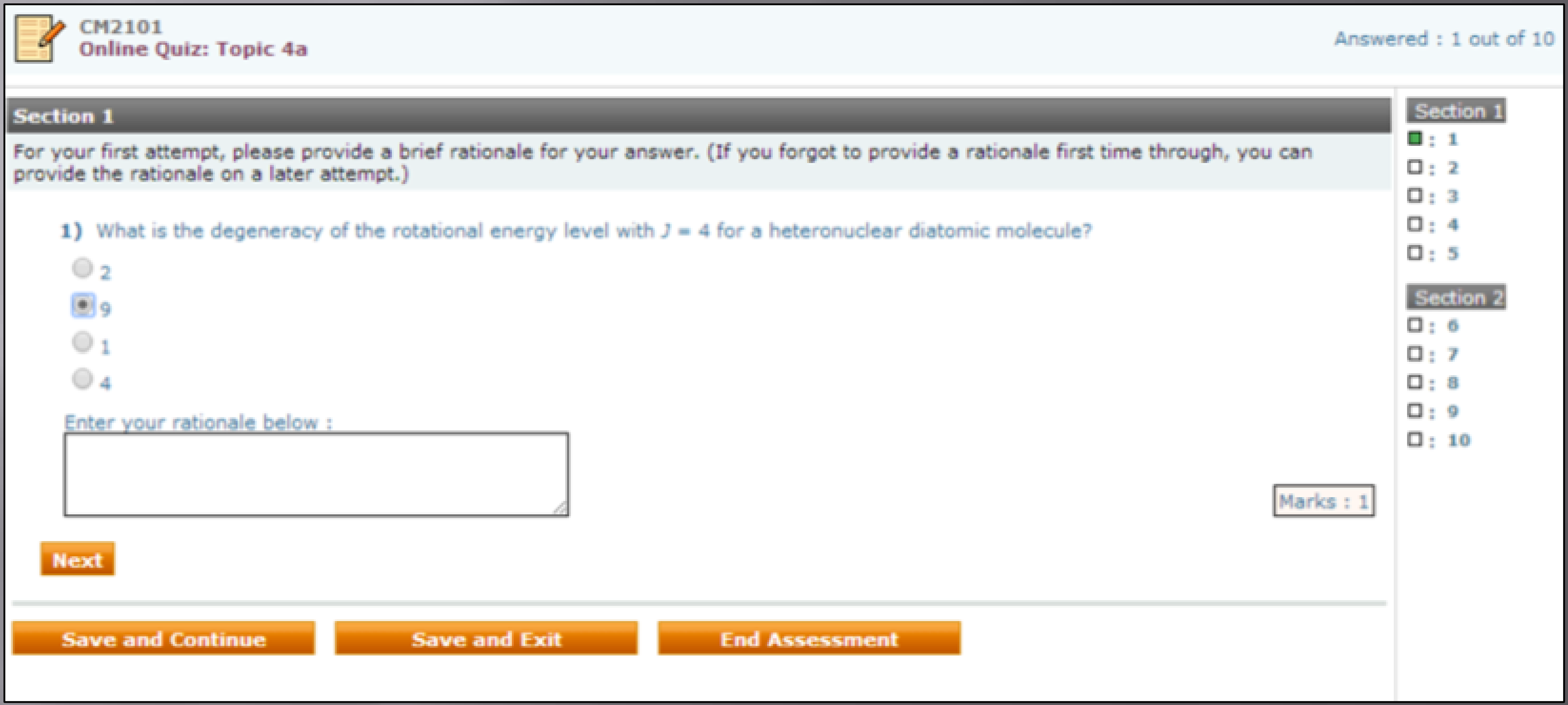
An Assessment attempt is considered as "incomplete" if you do not click on the **End Assessment** button. This Assessment allows you to resume the **latest** "incomplete" attempt at any time within the Assessment's opening and expiry date.

Module Code :	CM2101
Assessment Owner :	ADRIAN MICHAEL LEE
Opening Date :	03-Feb-2014 12:00 AM
Expiry Date :	07-Feb-2014 11:59 PM

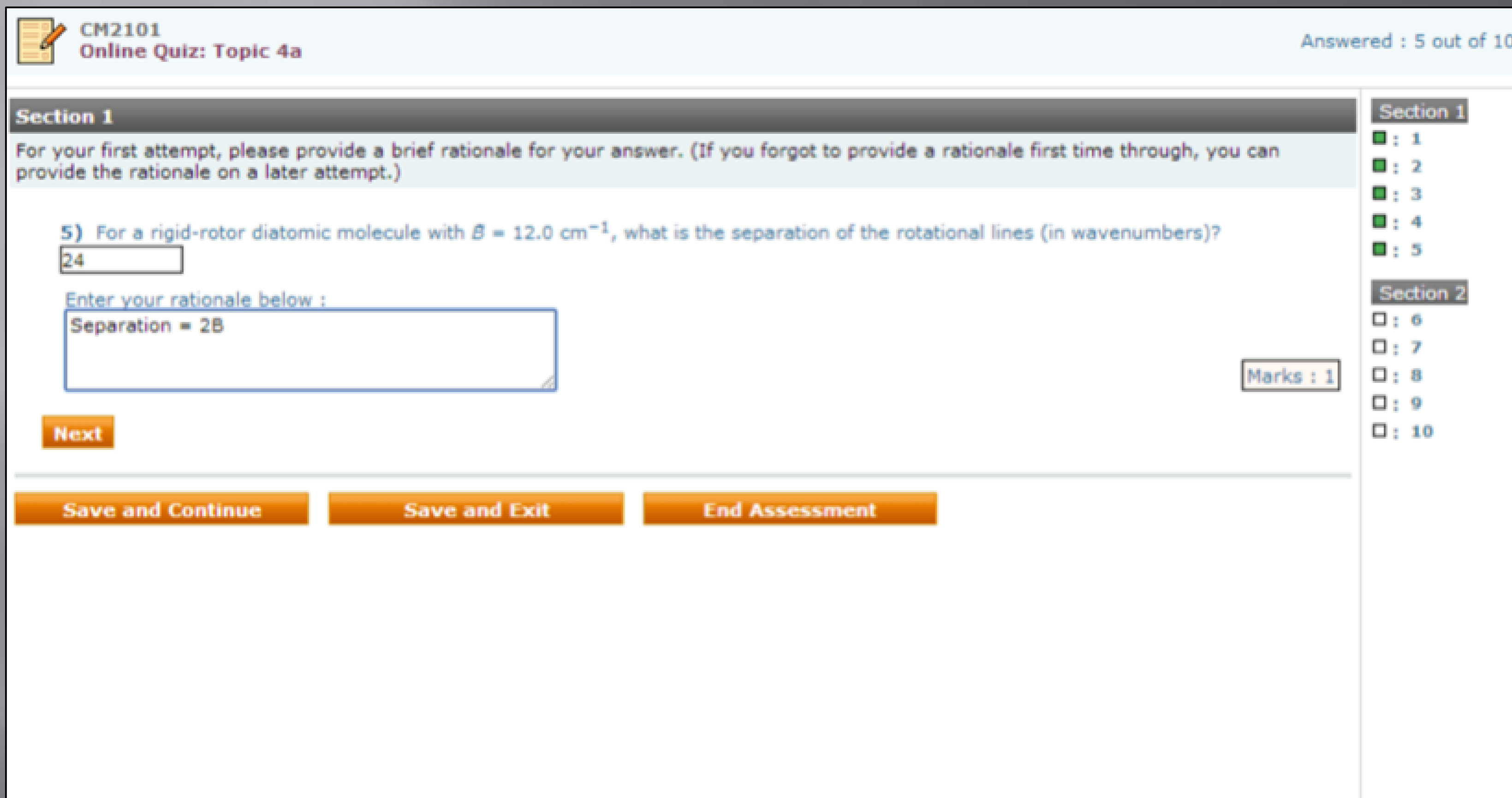
Student :	ADRIAN MICHAEL LEE
Time Limit :	**No time limit**
Number of Attempts :	Complete Attempts : **0** Incomplete Attempts : **0** Allowed Attempts : 5

Read all instructions before taking the Assessment, click **Start** to begin.

Weekly Online Quiz



Weekly Online Quiz



Weekly Online Quiz

CM2101
Online Quiz: Topic 4a

CLOSE

Print

Assessment Title :	Online Quiz: Topic 4a	**Number of Attempts :**	1 out of 5
Student Name :	ADRIAN MICHAEL LEE	**Duration :**	6m 50s
Start Date and Time :	09-Apr-2014 09:57 AM	**Total Marks :**	5 out of 10
	You can always view your assessment feedback by clicking on Usage/My Usage in the horizontal menu from the IVLE Workspace.		

Section 1

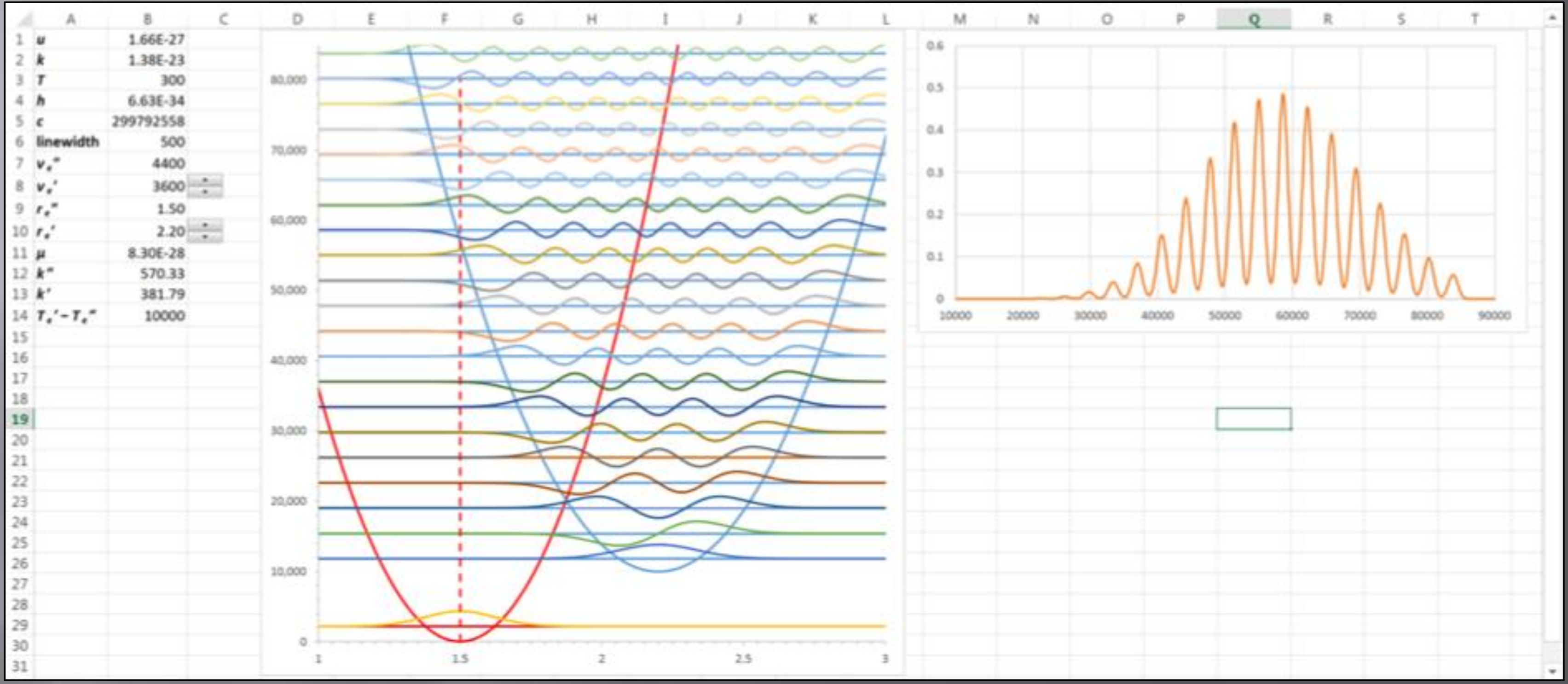
For your first attempt, please provide a brief rationale for your answer. (If you forgot to provide a rationale first time through, you can provide the rationale on a later attempt.)

1) What is the degeneracy of the rotational energy level with J = 4 for a heteronuclear diatomic molecule?

- 2
- 9
- 1
- 4

Your Answer :	9
Solution :	Degeneracy arises from the fact that the different spatial orientations have the sam energy. For a given value of J, there are a number of possible M_J values.
Your Marks :	1 out of 1

Interactive Visualisations



Large Class Session

Peer Instruction

EDUCATION

Farewell, Lecture?

A physics professor describes his evolution from lecturing to dynamically engaging students during class and improving how they learn.

Eric Mazur

Discussions of education are generally predicated on the assumption that we know what education is. I hope to convince you otherwise by recounting some of my own experiences. When I started teaching introductory physics to undergraduates at Harvard University, I never asked myself how I would educate my students. I did what my teachers had done—I lectured. I thought that was how one learns. Look around anywhere in the world and you'll find lecture halls filled with students and, at the front, an instructor. This approach to education has not changed since before the Renaissance and the birth of scientific inquiry. Early in my career I received the first hints that something was wrong with teaching in this manner, but I had ignored it. Sometimes it's hard to face reality.

When I started teaching, I prepared lecture notes and then taught from them. Because my lectures deviated from the textbook, I provided students with copies of these lecture notes. The infuriating result was that on my end-of-semester evaluations—which were quite good otherwise—a number of students complained that I was "lecturing straight from (his) lecture notes." What was I supposed to do? Develop a set of lecture notes different from the ones I handed out? I decided to ignore the students' complaints.

A few years later, I discovered that the students were right. My lecturing was ineffective, despite the high evaluations. Early on in the physics curriculum—in week 2 of a typical introductory physics course—the Laws of Newton are presented. Every student in such a course can recite Newton's third law of motion, which states that the force of object A on object B in an interaction between two objects is equal in magnitude to the force of B on A—it sometimes is known as "action is reaction." One day, when the course had progressed to more complicated material, I decided to test my students' understanding of this concept not by doing traditional problems, but by asking them a set of basic conceptual questions (*1*, *2*). One of the questions, for example, requires students to compare the forces that a heavy truck and a light car exert on one another when they collide. I expected that the students would have no trouble tackling such questions, but much to my surprise, hardly a minute after the test began, one student asked, "How should I answer these questions? According to what you taught me or according to the way I usually think about these things?" To my dismay, students had great difficulty with the conceptual questions. That was when it began to dawn on me that something was amiss.

In hindsight, the reason for my students' poor performance is simple. The traditional approach to teaching reduces education to a transfer of information. Before the industrial revolution, when books were not yet mass commodities, the lecture method was the only way to transfer information from one generation to the next. However, education is so

Click here. Students continually discuss concepts among themselves and with the instructor during class. Discussions are spurred by multiple-choice conceptual questions that students answer using a clicker device. See supporting online text for examples of such "clicker questions."

CREDIT: (BOTTOM) JON CHASE/HARVARD UNIVERSITY

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C. Crouch and E. Mazur. (2001) Peer Instruction: Ten Years of Experience and Results, *American Journal of Physics*, **69**, 970–977.

Peer Instruction

1. Instructor poses question based on students' responses to online quiz
2. Students reflect on the question
3. Students commit to an individual answer
4. Instructor reviews student responses
5. Students discuss their thinking and answers with their peers
6. Students then commit again to an individual answer
7. The instructor again reviews responses and decides whether more explanation is needed before moving on to the next concept

E. Mazur. (1998) *Peer Instruction: A User's Manual,* Englewood Cliffs: Prentice Hall.

Three Social Science Generalizations

1. Social connections motivate
2. Teaching teaches the teacher
3. Instant feedback improves learning

King, G., and M. Sen (2013) How social science research can improve teaching, *PS: Political Science and Politics*, **46**, 621–629.

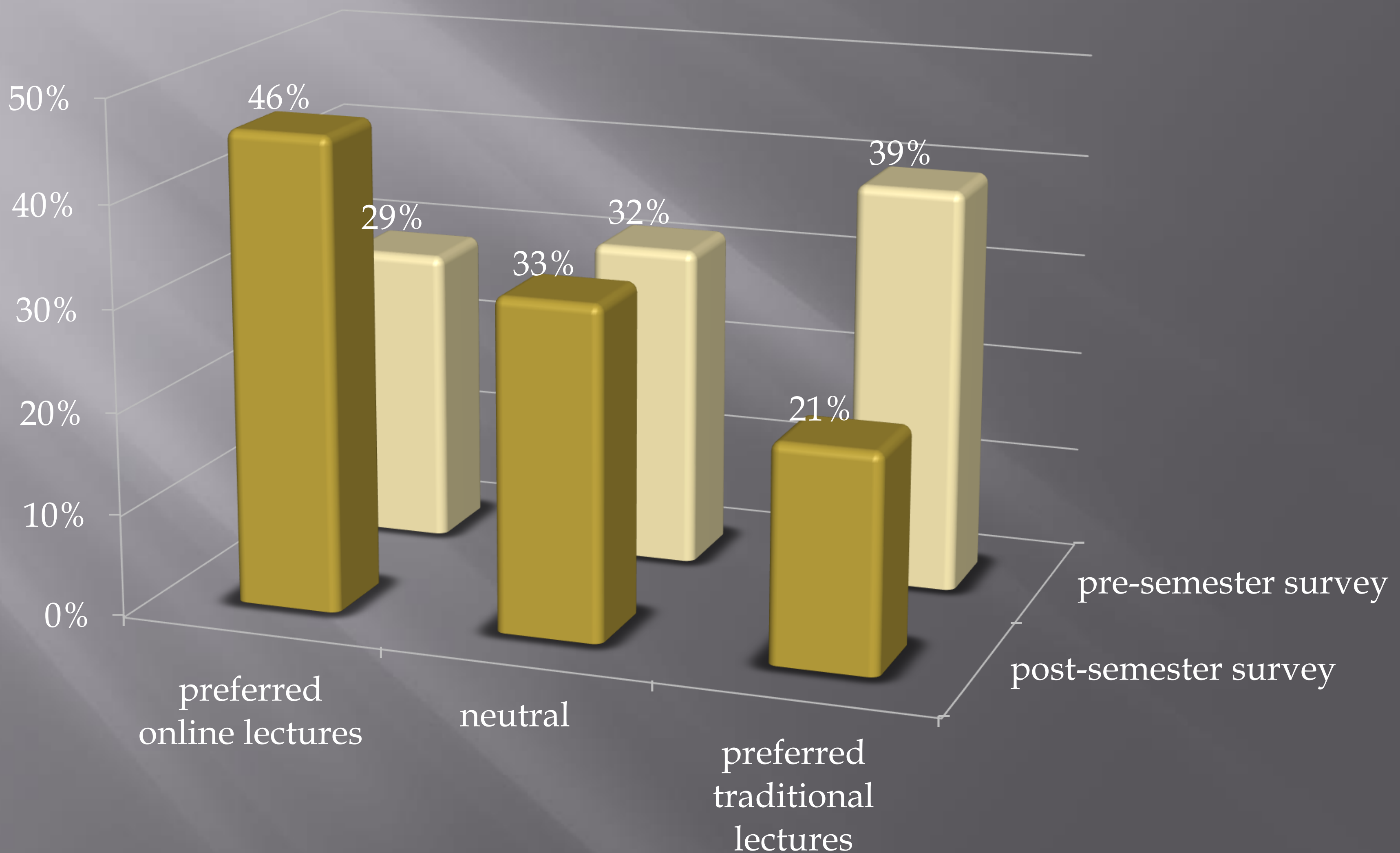
Active Learning Tutorial: Setting up the problem

Active Learning Tutorial: Facilitating discussion

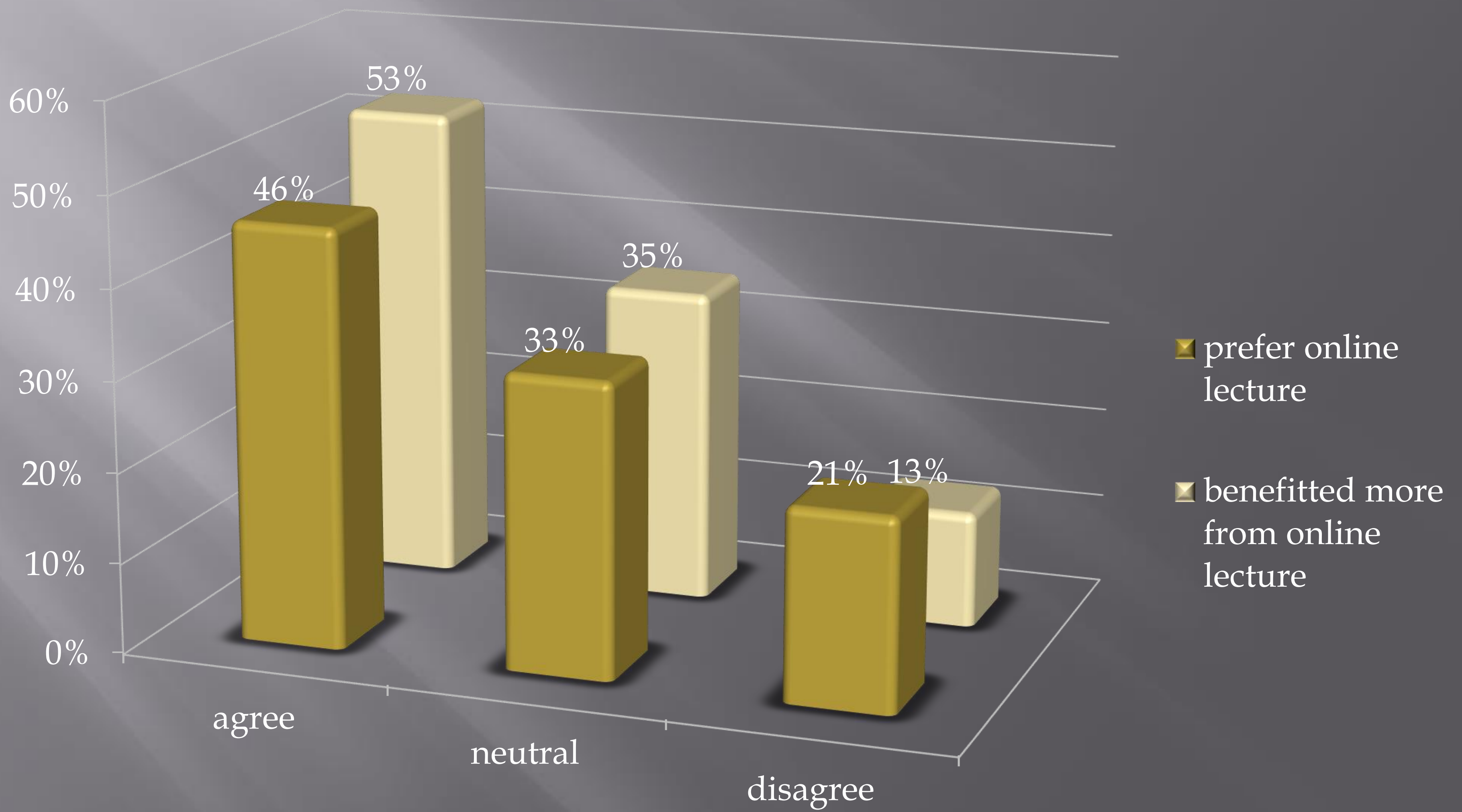
Active Learning Tutorial: Reinforcing understanding

"Guide on the side"

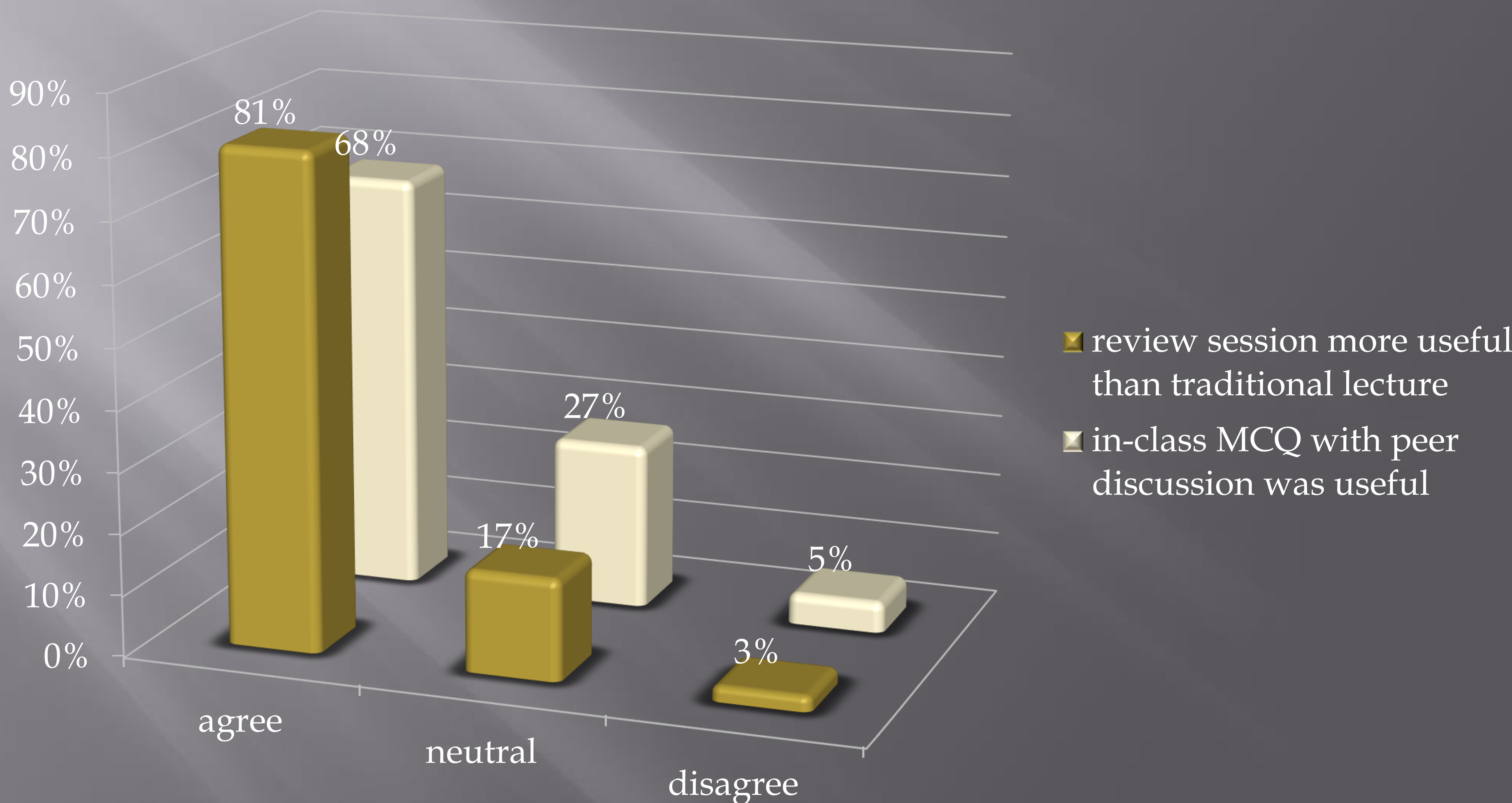
Student Feedback: Online Lectures



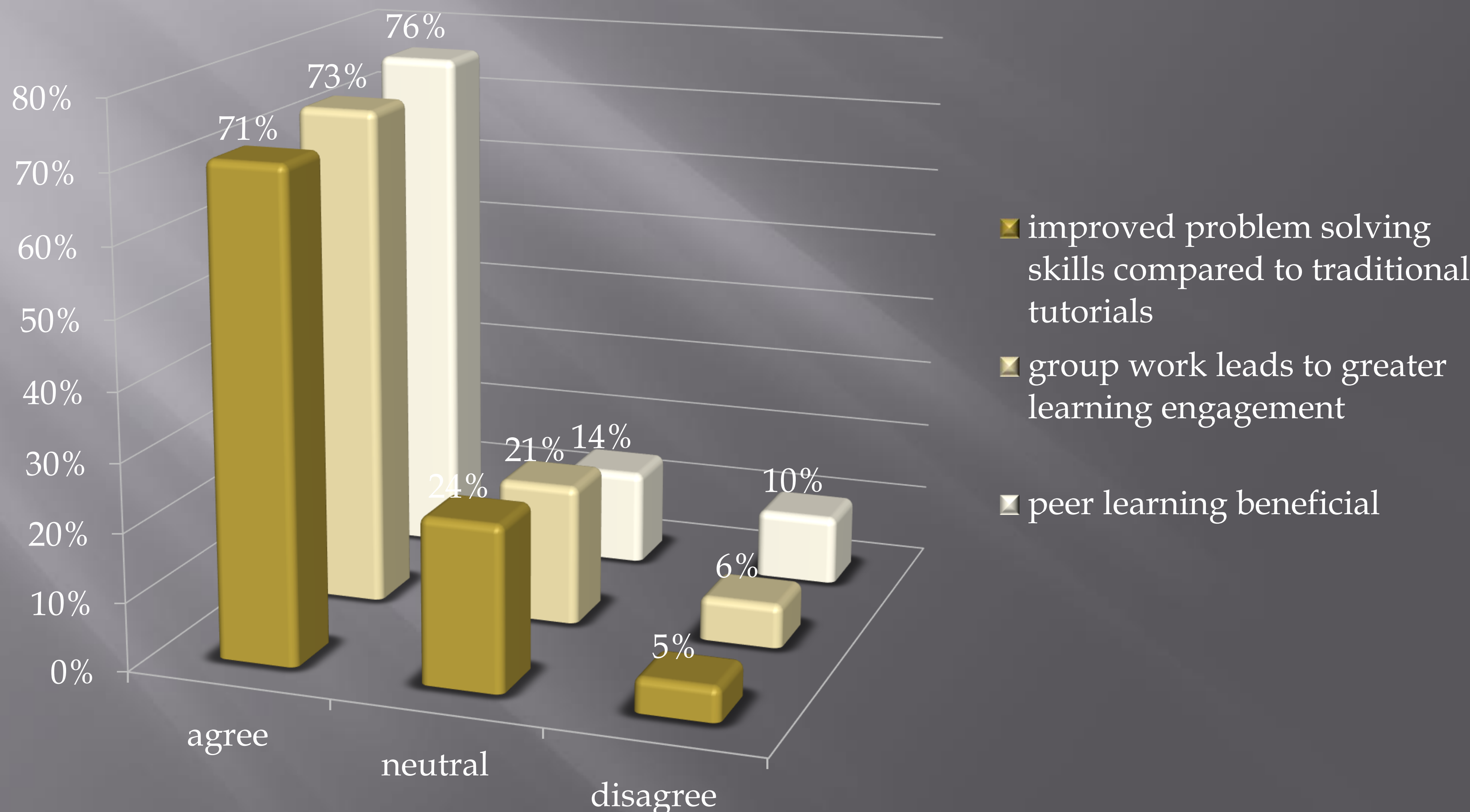
Student Feedback: Online Lectures



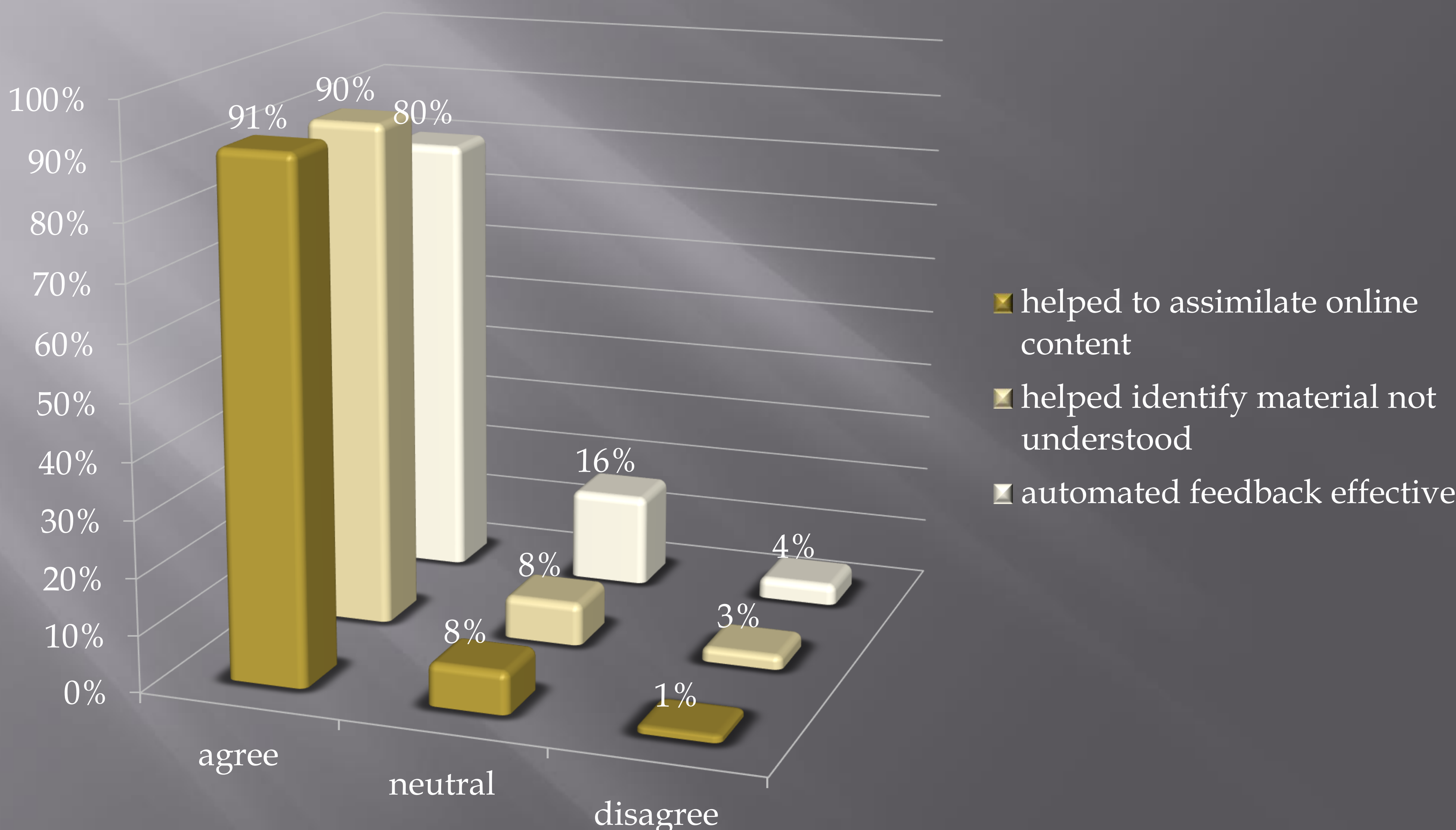
Student Feedback: Large Class Review Sessions



Student Feedback: Active Learning Classes



Student Feedback: Weekly Online Quizzes



Qualitative Feedback: Active learning tutorials

"They are much more effective than normal tutorials. Actually, normal tutorials aren't necessary because most students go there just looking for the answers to problems, which can be uploaded to IVLE directly. Active learning tutorials are different, we go there not knowing what to expect and the lessons are much more engaging."

Qualitative Feedback: Active learning tutorials

"I wished they were longer because we tend to only solve one question. But I must say the depth of discussion and mode of discussion coupled with your attentive feedback and encouragement really boosts self confidence in the topic and reinforces concepts much better… First time I was exposed to this style and actually really felt I was learning."

Why did it work?

- The approach shifts the balance of learning away from content to context
- Regular quizzing provided formative assessment of student understanding
- Strong support from students for both online approach and the active learning classroom
- In-class interaction is seen as important and productive
- Active learning promoted peer learning and student engagement
- The learning environment was appropriate