

Flipping your classroom using CRAs: Real strategies for your classroom

Julie Schell

*Senior Postdoctoral Fellow
Harvard University
Instructional Designer
UT-Austin*

CRAFT

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Professional Development Institute



THE UNIVERSITY OF TEXAS AT AUSTIN
WHAT STARTS HERE CHANGES THE WORLD



WORKSHOP GOALS

after this workshop you will be able to:

- identify motivations for moving from coverage- to an *uncoverage*-based teaching philosophy
- select real, research-based strategies for motivating students to prepare before, and engage deeply during, your class
- locate resources for learning more about Peer Instruction

Think of something you are good at, something that you know you do very well.

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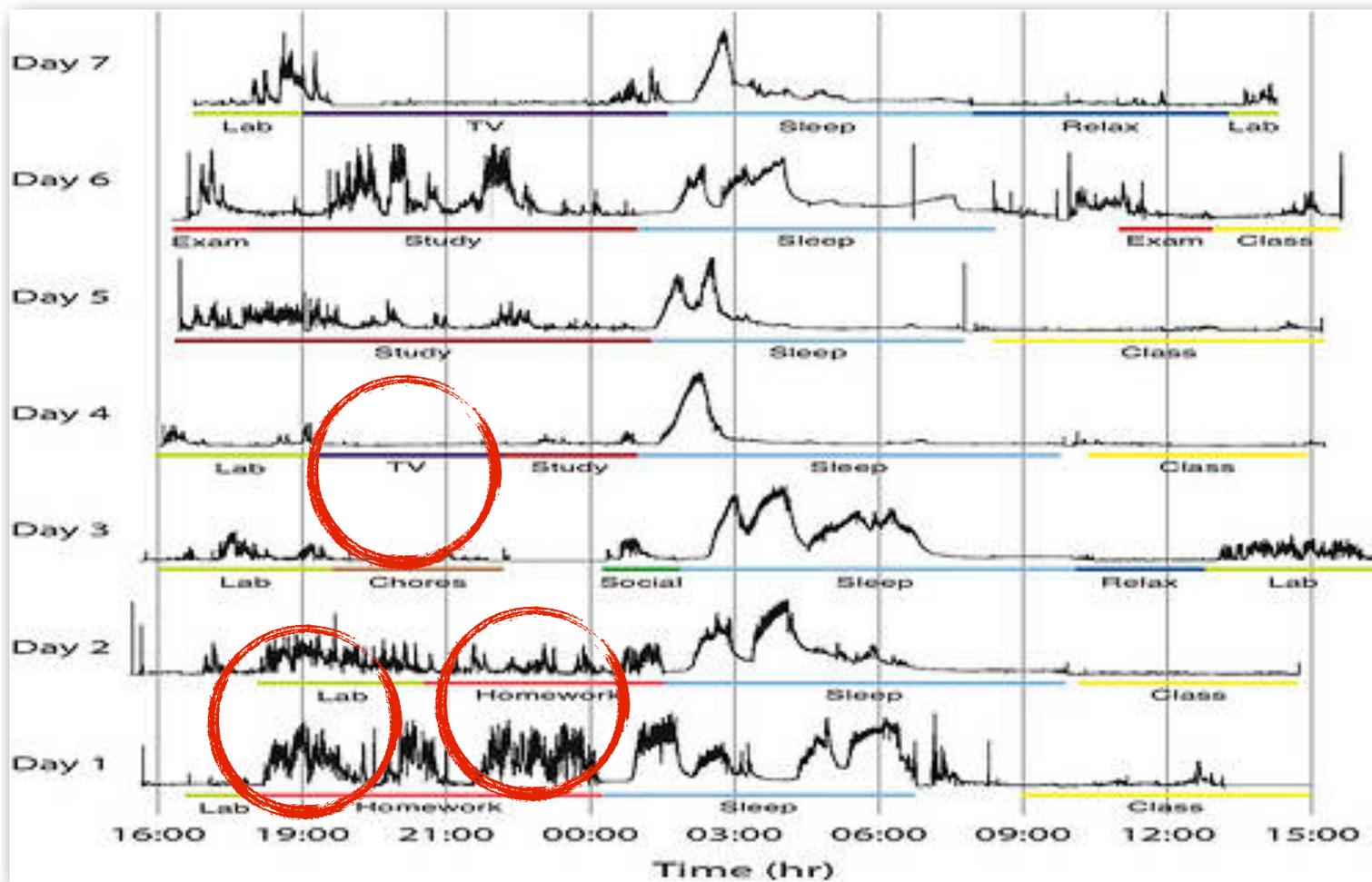
How did you learn this deeply?

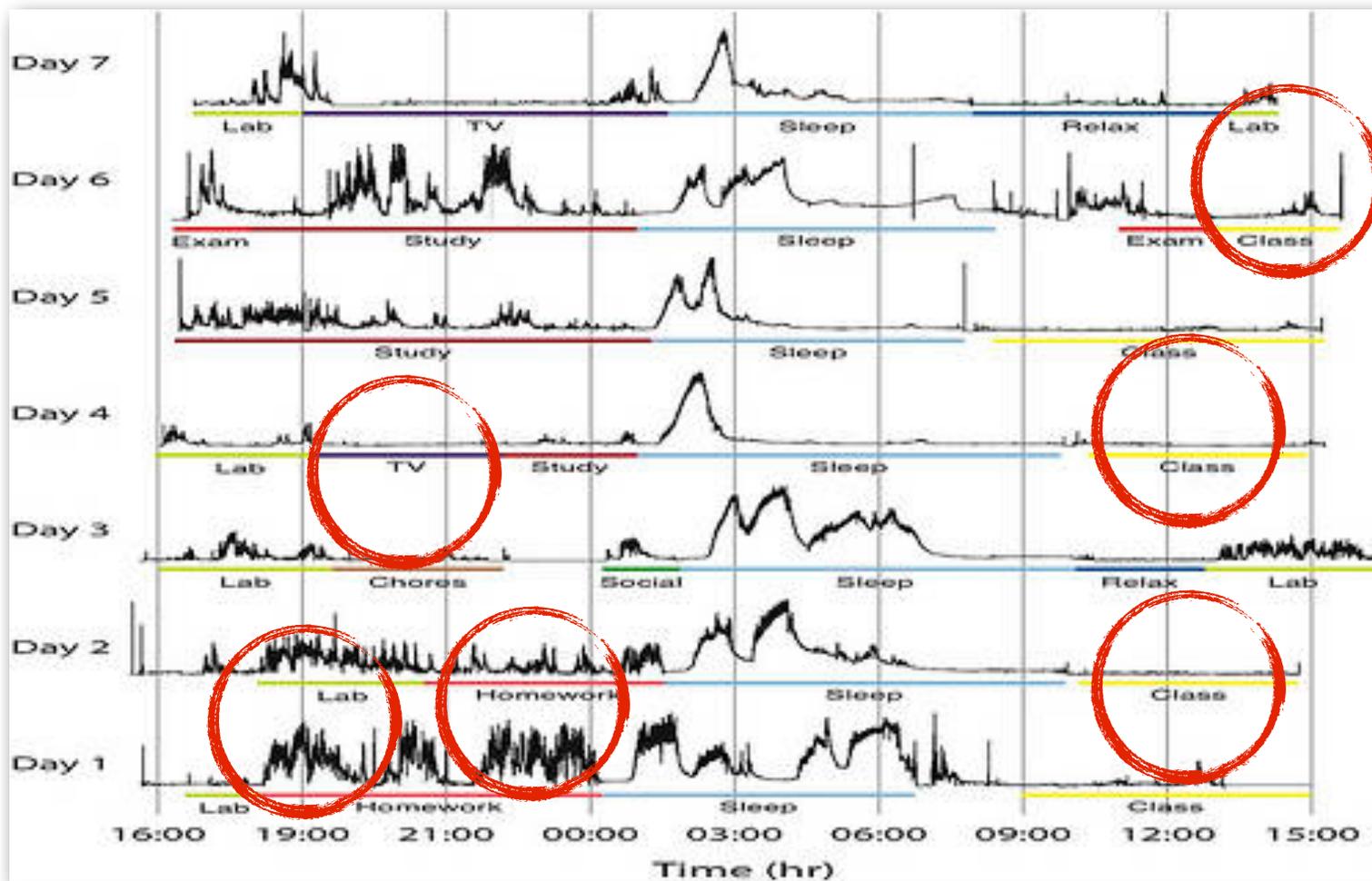
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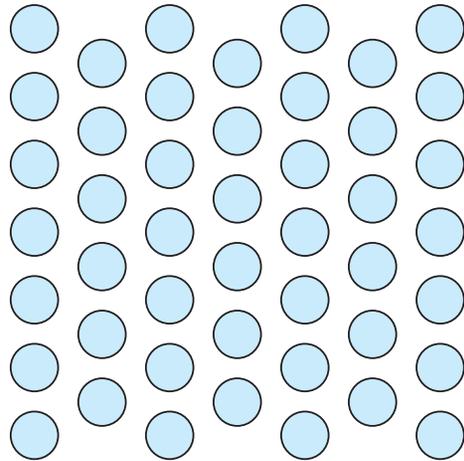
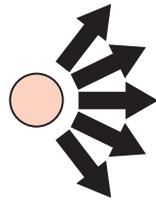
I learned it by:

- A. Lectures
- B. Practicing or experimenting (trial and error)
- C. Observing someone else (apprenticeship)
- D. Other

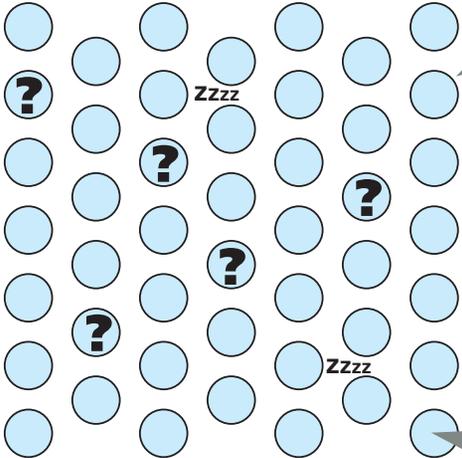




lectures focus on knowledge coverage



I think they understand



I think I understand

I did awesome on my exam

lecture's lullaby

To get from his high school to his home, Martin travels 5.0 miles east and then 4.0 miles north. When Veronica goes to her home from that same high school, she travels 8.0 miles east and 2.0 miles south.

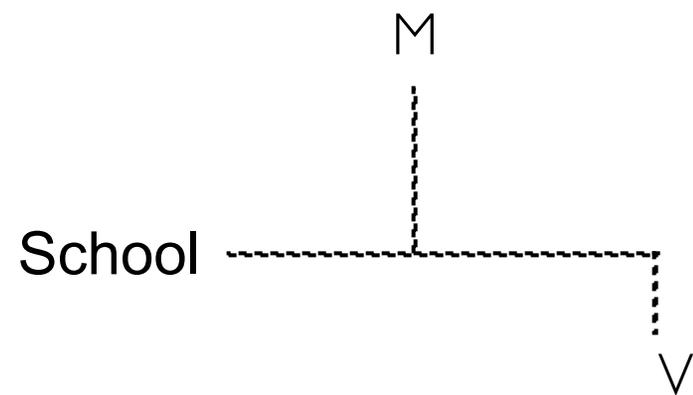
What is the approximate measure of the shortest distances, between Martin's home and Veronica's home?

1. ~3 miles
2. ~7 miles
3. ~9 miles
4. ~17 miles

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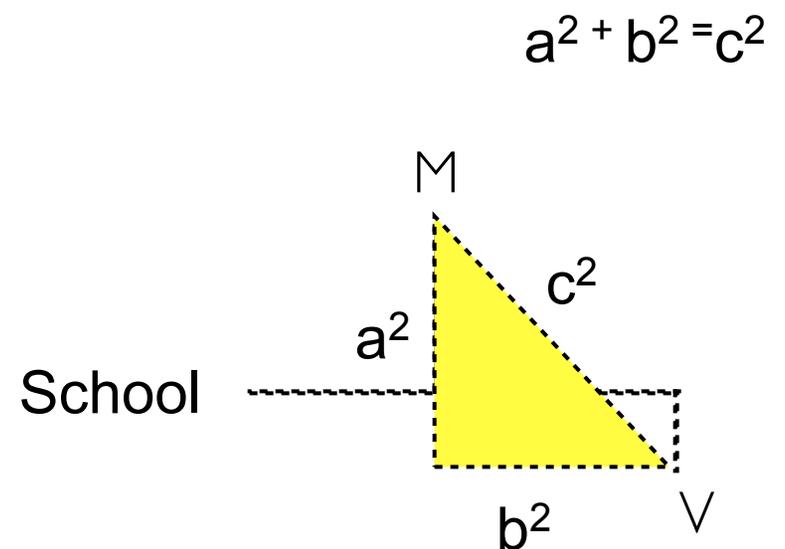
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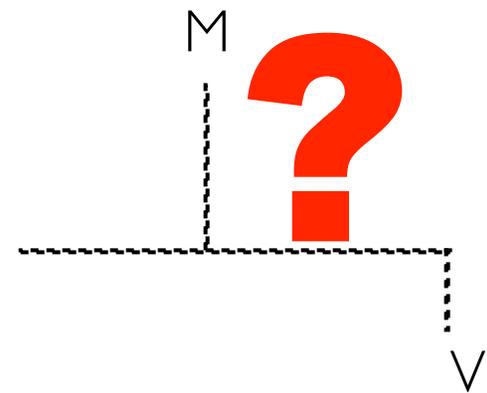
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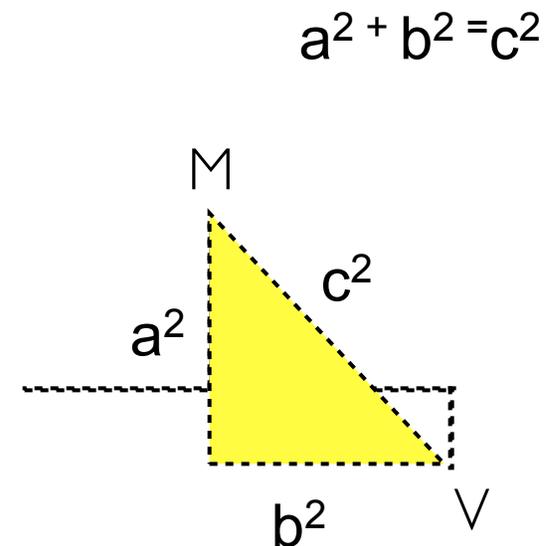
What they see= *Foreign context*



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What is the approximate measure of the shortest distances, between Martin's home and Veronica's home?

What they see = *Foreign context*
What we see = *Pythagorean theorem*



knowledge transfer

the signpost of understanding

it is the most important skill for 21st century students

1. Information transfer (easier)(**faculty**)

2. Information assimilation (harder)(**students**)

knowledge transfer

the signpost of understanding

it is the most important skill for 21st century students

1. Information transfer (easier) **(students)**
2. Information assimilation (harder) **(faculty)**

ENGLISH/LANGUAGE ARTS STANDARDS

9. Identify and analyze the audience, purpose, and message of an informational or persuasive text.
10. Identify and analyze how an author's use of language appeals to the senses, creates imagery, and suggests mood.
11. Identify, analyze, and evaluate similarities and differences in how multiple texts present information, argue a position, or relate a theme.

B. Understand new vocabulary and concepts and use them accurately in reading, speaking, and writing.

1. Identify new words and concepts acquired through study of their relationships to other words and concepts.
2. Apply knowledge of roots and affixes to infer the meanings of new words.
3. Use reference guides to confirm the meanings of new words or concepts.

C. Describe, analyze, and evaluate information within and across literary and other texts from a variety of cultures and historical periods.

1. Read a wide variety of texts from American, European, and world literatures.
2. Analyze themes, structures, and elements of myths, traditional narratives, and classical and contemporary literature.
3. Analyze works of literature for what they suggest about the historical period and cultural contexts in which they were written.
4. Analyze and compare the use of language in literary works from a variety of world cultures.

D. Explain how literary and other texts evoke personal experience and reveal character in particular historical circumstances.

1. Describe insights gained about oneself, others, or the world from reading specific texts.
2. Analyze the influence of myths, folktales, fables, and classical literature from a variety of world

III. Speaking

A. Understand the elements of communication both in informal group discussions and formal presentations (e.g., accuracy, relevance, rhetorical features, organization of information).

1. Understand how style and content of spoken language varies in different contexts and influences the listener's understanding.
2. Adjust presentation (delivery, vocabulary, length) to particular audiences and purposes.

B. Develop effective speaking styles for both group and one-on-one situations.

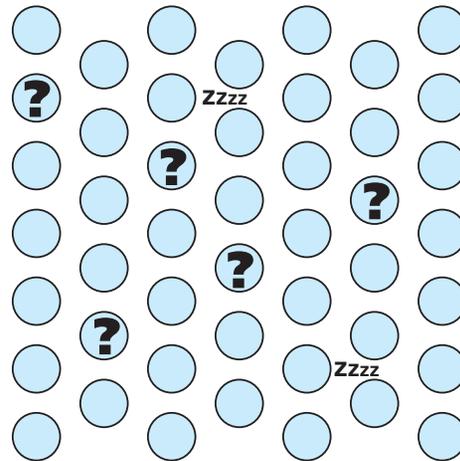
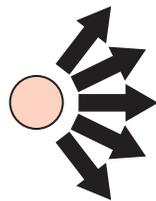
1. Participate actively and effectively in one-on-one oral communication situations.
2. Participate actively and effectively in group discussions.
3. Plan and deliver focused and coherent presentations that convey clear and distinct perspectives and demonstrate solid reasoning.

IV. Listening

A. Apply listening skills as an individual and as a member of a group in a variety of settings (e.g., lectures, discussions, conversations, team projects, presentations, interviews).

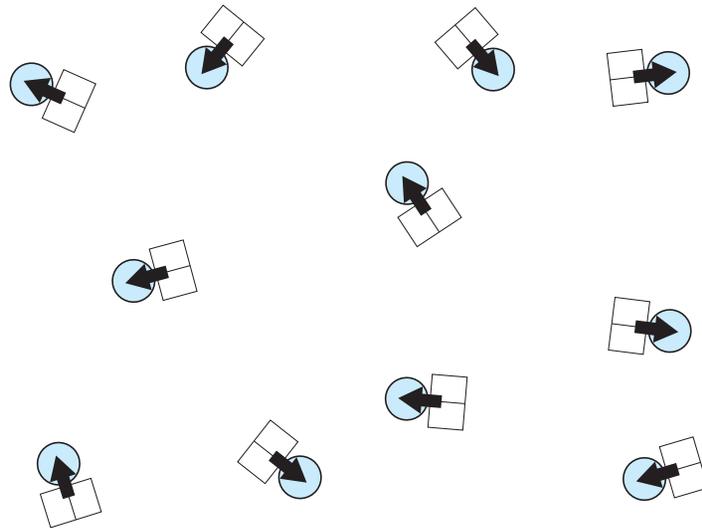
1. Analyze and evaluate the effectiveness of a public presentation.
2. Interpret a speaker's message; identify the position taken and the evidence in support of that position.
3. Use a variety of strategies to enhance listening comprehension (e.g., focus attention on message, monitor message for clarity and understanding, provide verbal and nonverbal feedback, note cues such as change of pace or particular words that indicate a new point

move coverage out



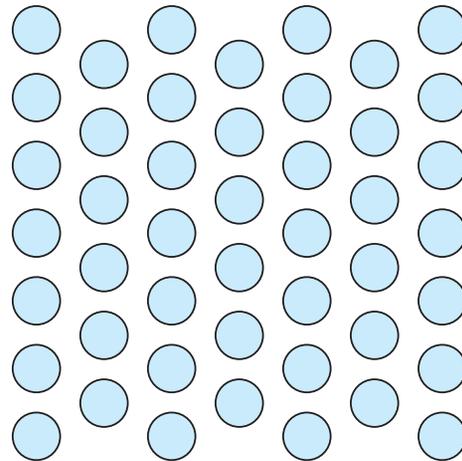
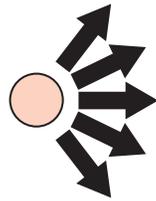
flip your class

students do coverage before class

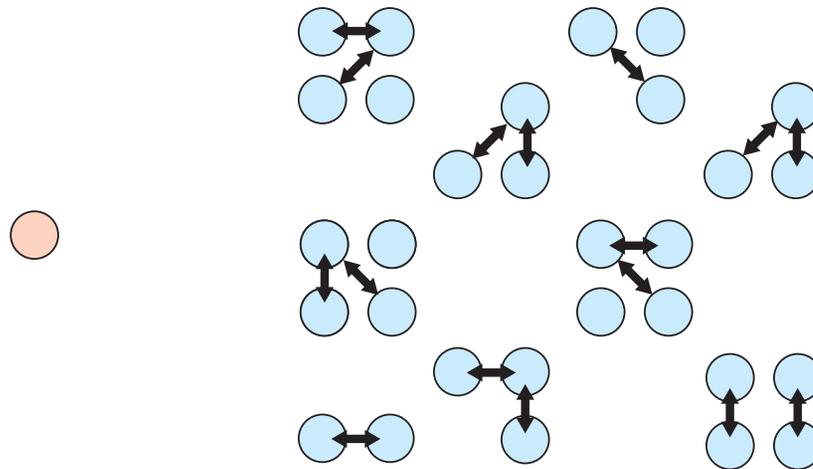


students do UNcoverage in class

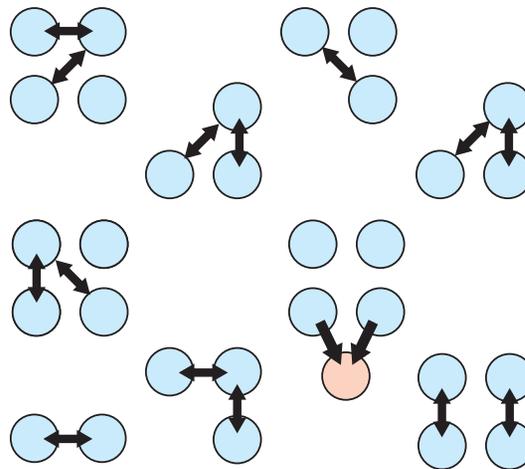
you, lecture a little



you, help students uncover
meaning in class a lot



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meaning in class a lot

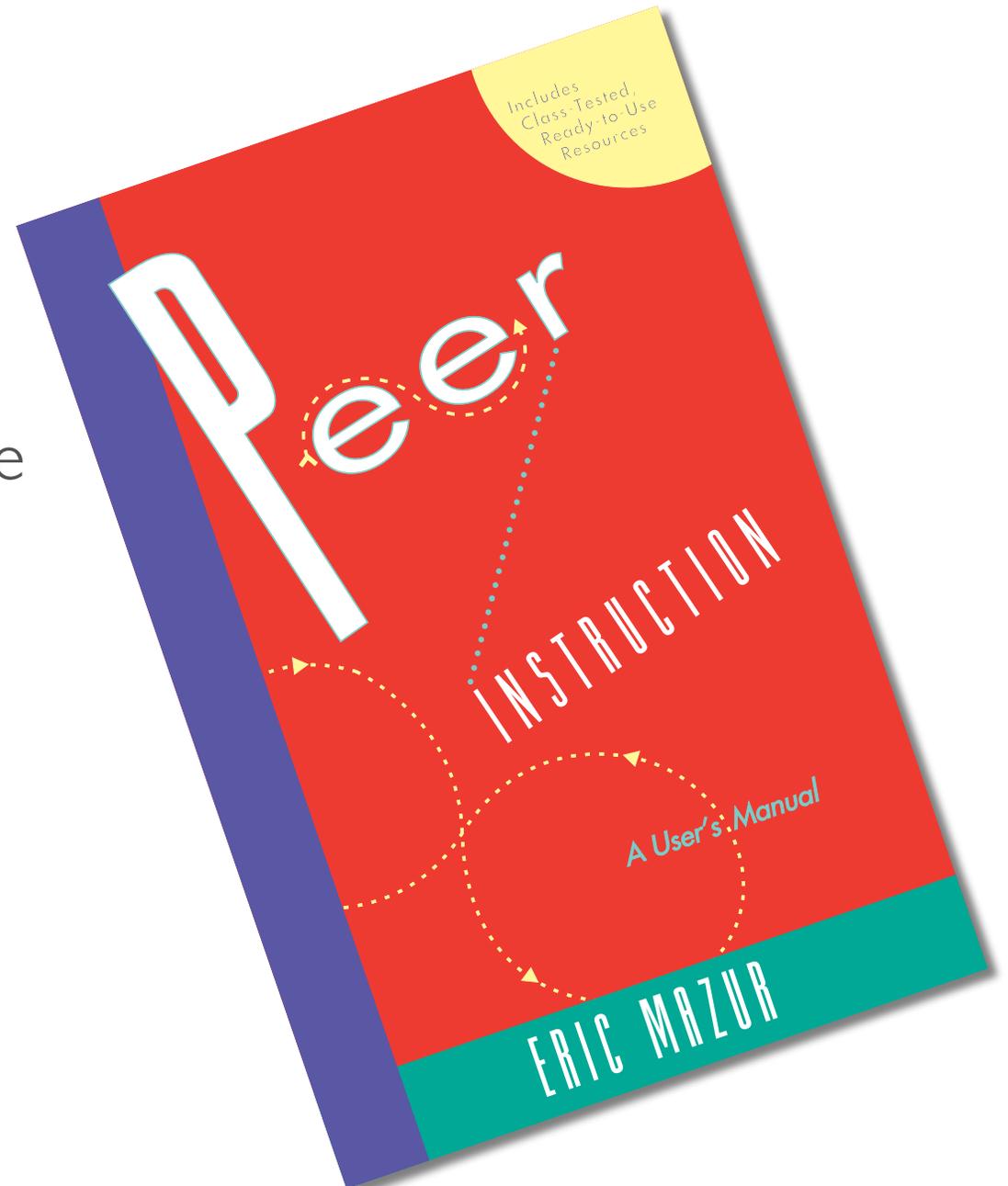


Outline

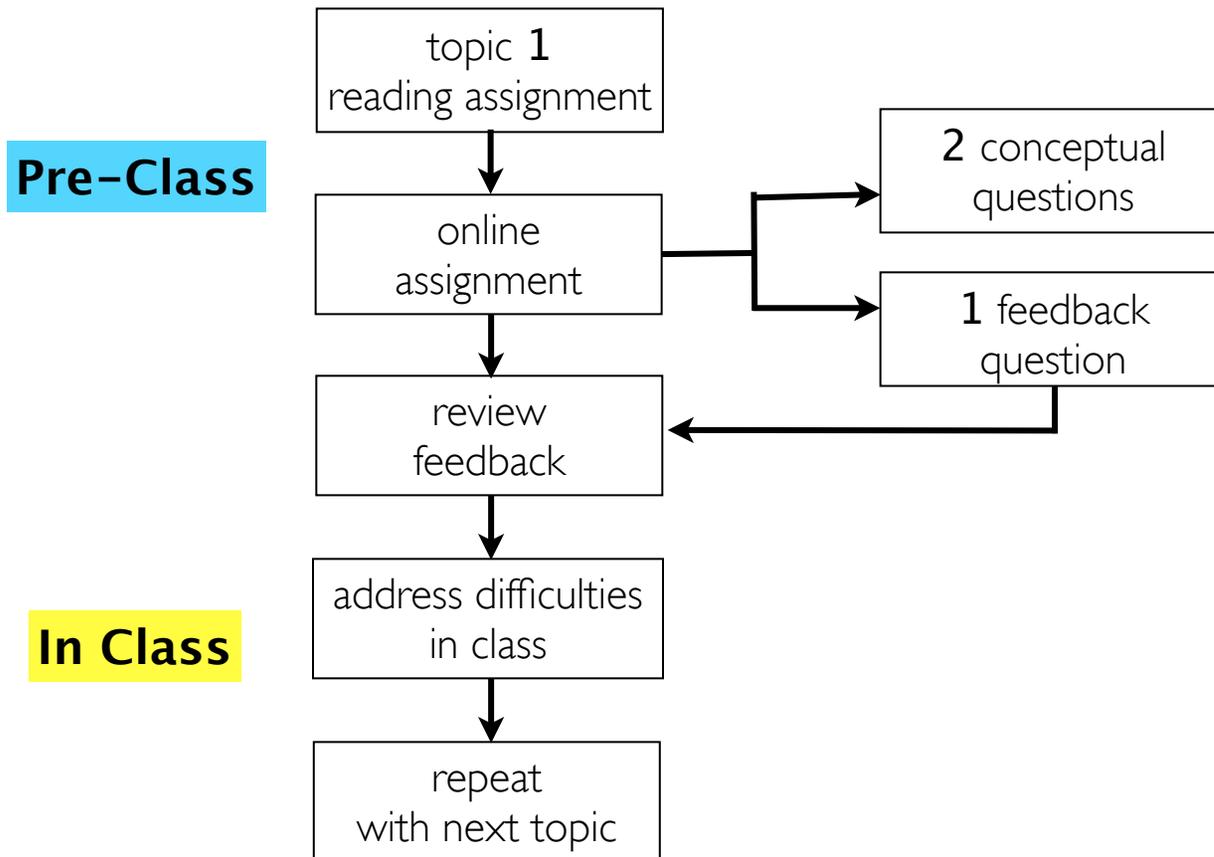
- JiTT and Peer Instruction Overview
- Peer Instruction Demonstration

PEER INSTRUCTION

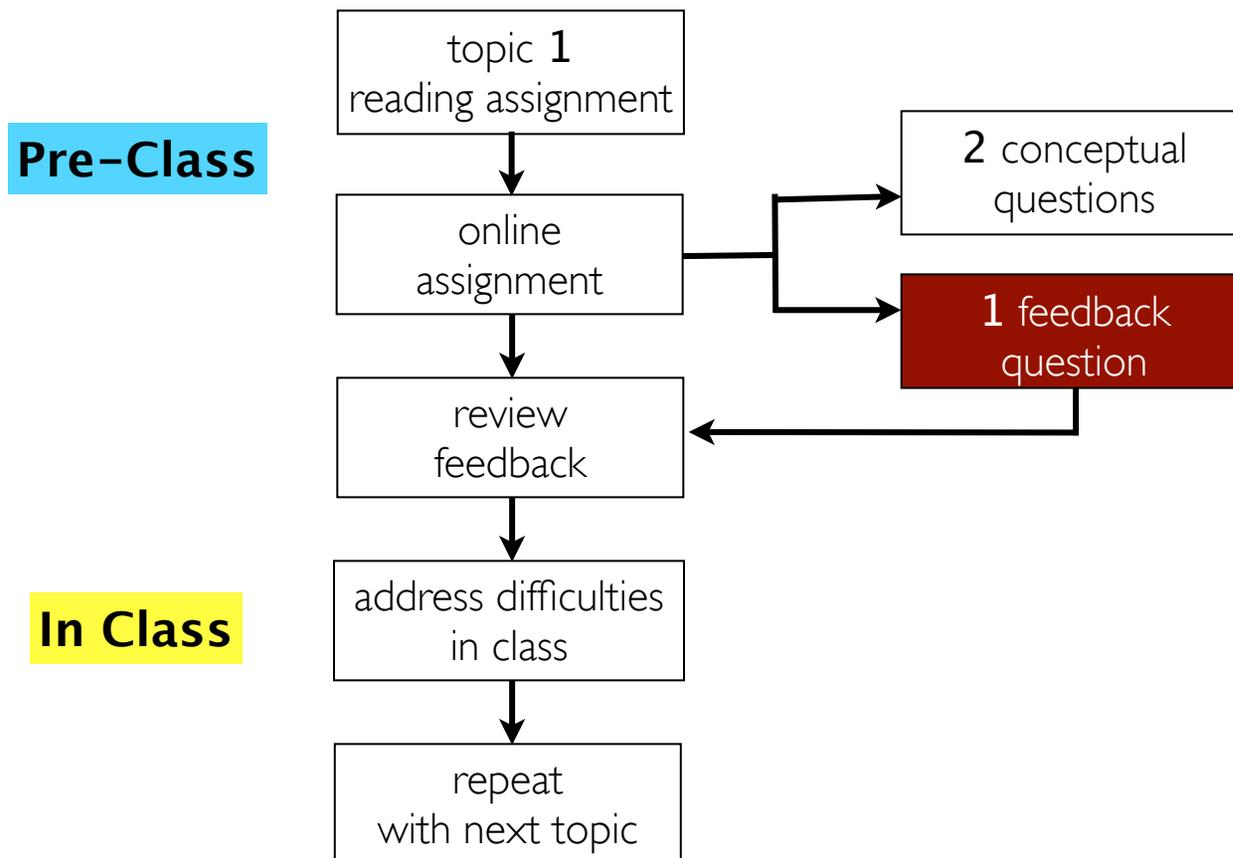
- pre-class activity
- in-class: depth, not coverage
- use Socratic method



PEER INSTRUCTION

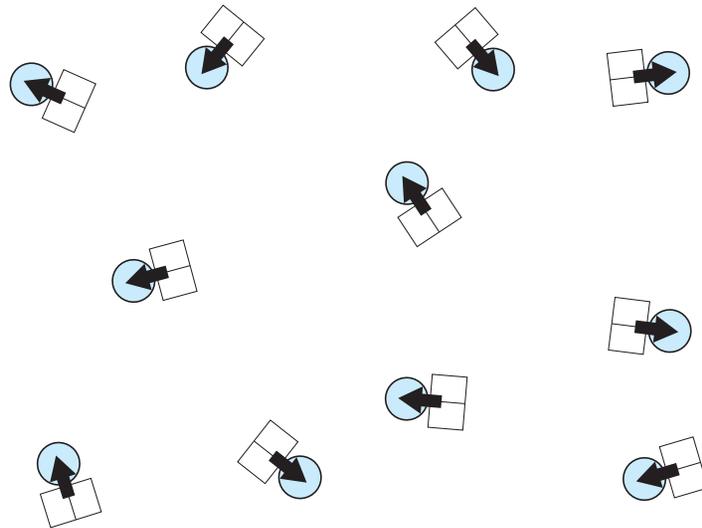


PEER INSTRUCTION



PEER INSTRUCTION

EXAMPLE



PEER INSTRUCTION

EXAMPLE

What did you find most confusing about the First Amendment reading?

I am confused about different kinds of speech protected by the first Amendment.

PEER INSTRUCTION

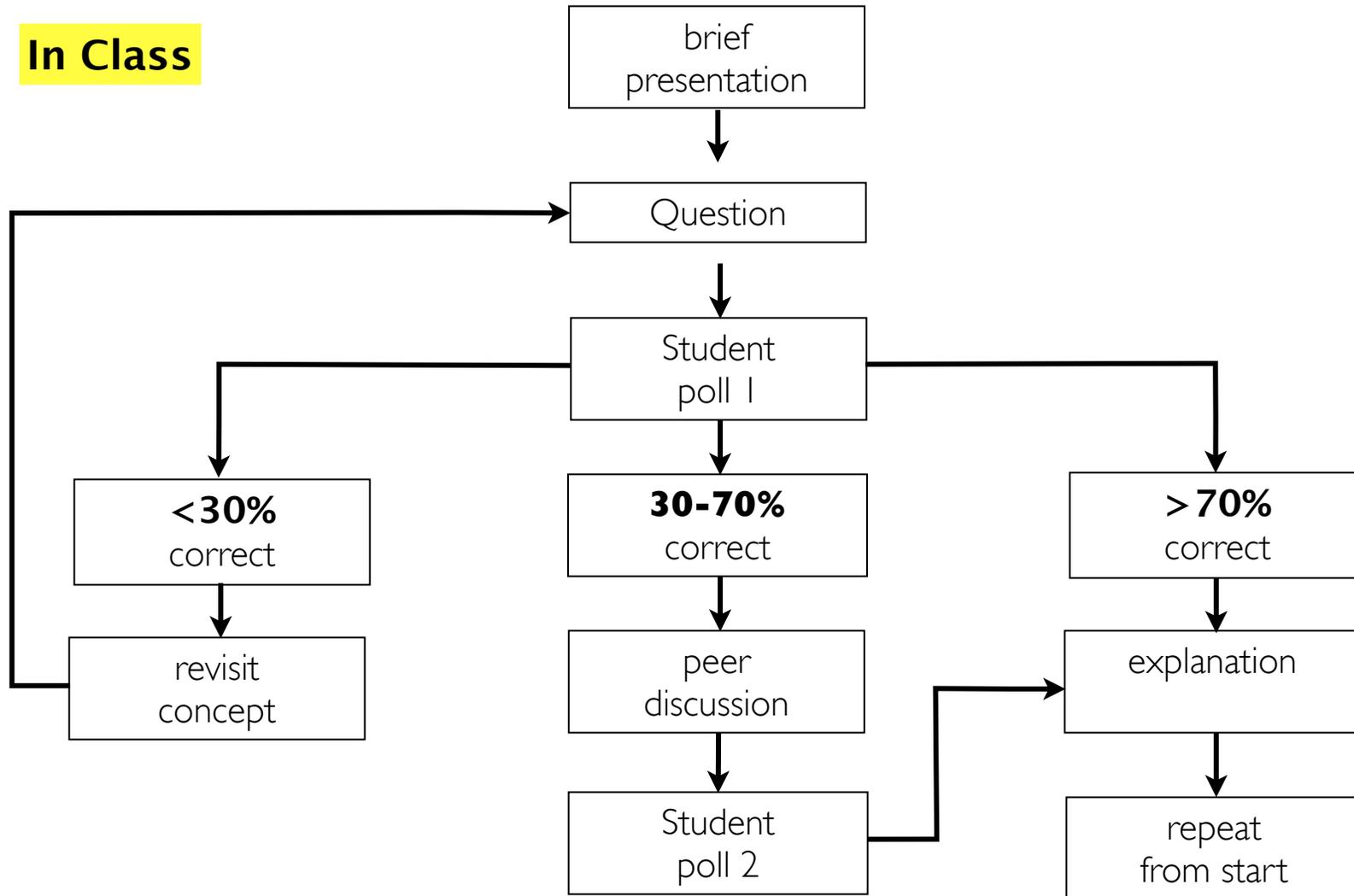
EXAMPLE

What type of speech is the most highly guarded?

- A. Core political speech
- B. Commercial speech
- C. Expressive conduct
- D. I don't know

PEER INSTRUCTION

In Class



PEER INSTRUCTION

EXAMPLE

Who is most responsible for protecting students from bullying?

- A. Teachers
- B. Parents
- C. Friends
- D. Law Enforcement

Outline

- JiTT and Peer Instruction Overview
- Peer Instruction Demonstration

Let's Try It

PEER INSTRUCTION: DEMO



PEER INSTRUCTION: DEMO

SCIENCE STANDARDS

4. Understand the properties and behavior of sound waves.

H. Thermodynamics

1. Understand the gain and loss of heat energy in matter.
2. Understand the basic laws of thermodynamics.

I. Electricity

1. Discuss electric charge and electric force.
2. Gain qualitative and quantitative understandings of voltage, current, and resistance.
3. Understand Ohm's Law.
4. Apply the concept of power to electricity.
5. Discuss basic DC circuits that include voltage sources and combinations of resistors.
6. Discuss basic DC circuits that include voltage sources and combinations of capacitors.
7. Understand magnetic fields and their relationship to electricity.
8. Relate electricity and magnetism to everyday life.

J. Optics

1. Know the electromagnetic spectrum.
2. Understand the wave/particle duality of light.
3. Understand concepts of geometric optics.

IX. Earth and Space Sciences

A. Earth systems

1. Know the major features and characteristics of atmosphere, geosphere, hydrosphere, and biosphere.
2. Understand relationships and interactions among atmosphere, geosphere, hydrosphere, and biosphere.

2. Possess a scientific understanding of the formation of the Earth and moon.

C. Solar system

1. Describe the structure and motions of the solar system and its components.
2. Possess a scientific understanding of the formation of the solar system.

D. Origin and structure of the universe

1. Understand scientific theories for the formation of the universe.
2. Know the current scientific descriptions of the components of the universe.

E. Plate tectonics

1. Describe the evidence that supports the current theory of plate tectonics.
2. Identify the major tectonic plates.
3. Describe the motions and interactions of tectonic plates.
4. Describe the rock cycle and its products.

F. Energy transfer within and among systems

1. Describe matter and energy transfer in the Earth's systems.
2. Give examples of effects of energy transfer within and among systems.

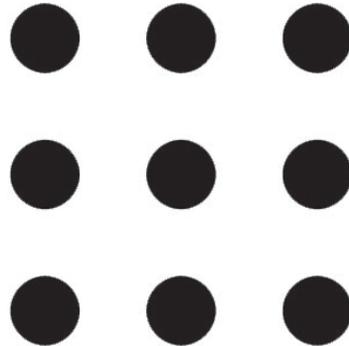
X. Environmental Science

A. Earth systems

1. Recognize the Earth's systems.
2. Know the major features of the geosphere and the factors that modify them.
3. Know the major features of the atmosphere.

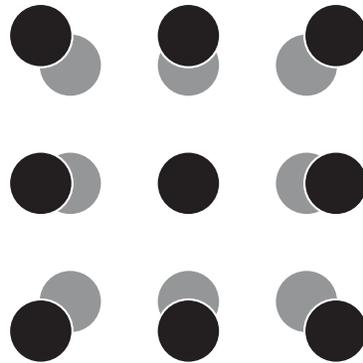
PEER INSTRUCTION: DEMO

When metals heat up, they expand



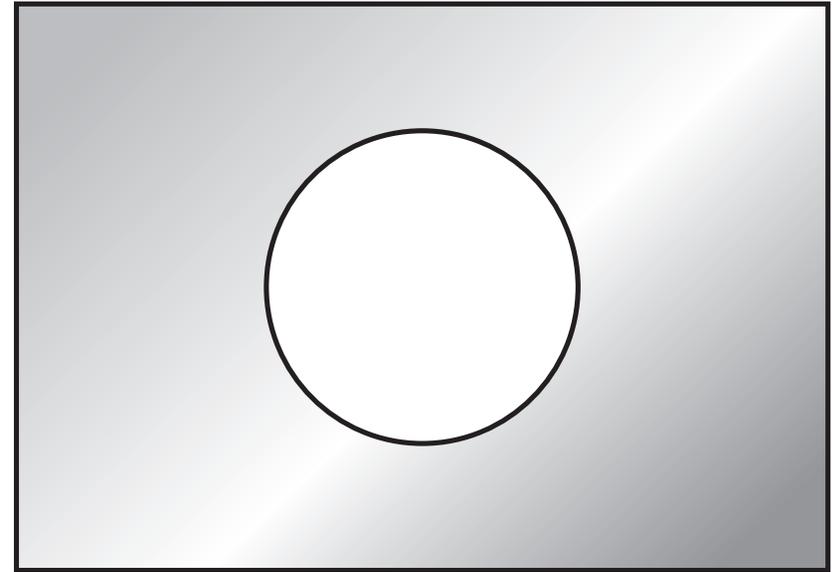
PEER INSTRUCTION: DEMO

When metals heat up, they expand



PEER INSTRUCTION: DEMO

Consider a metal plate with a circular hole in it.

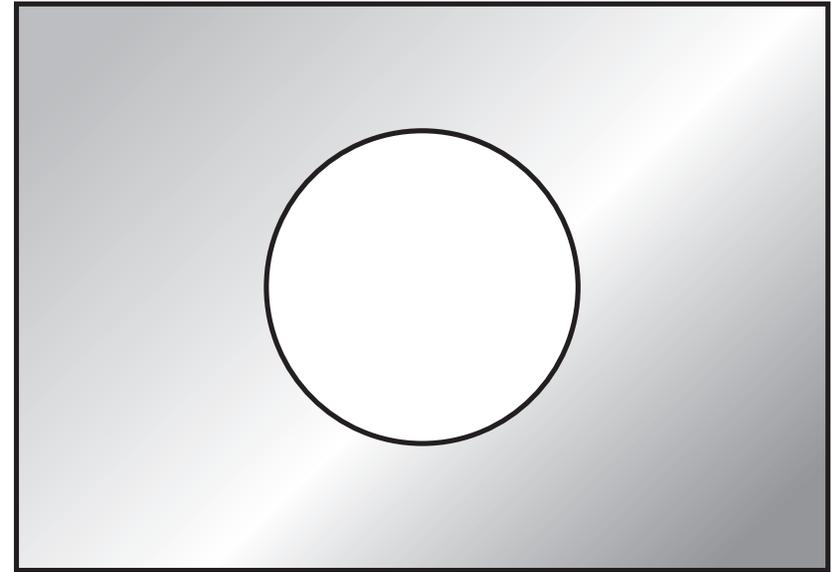


PEER INSTRUCTION: DEMO

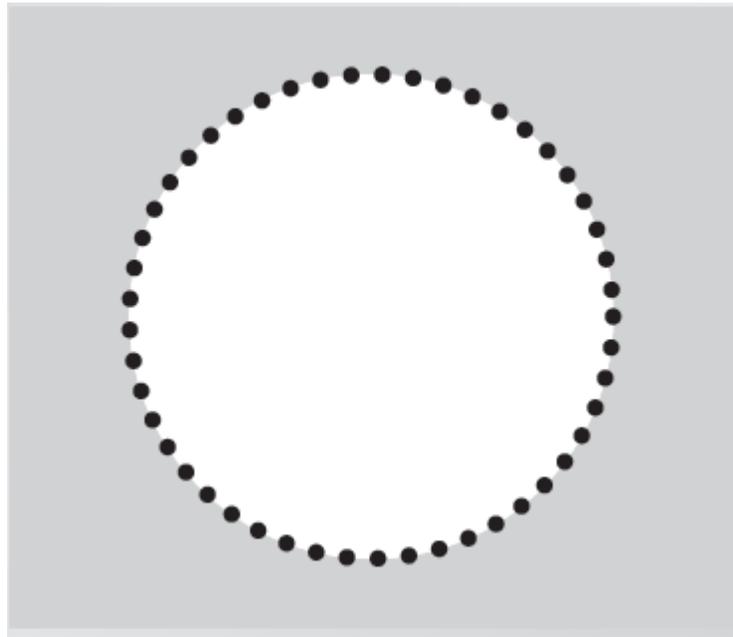
Consider a metal plate with a circular hole in it.

When the plate is uniformly heated, the diameter of the hole

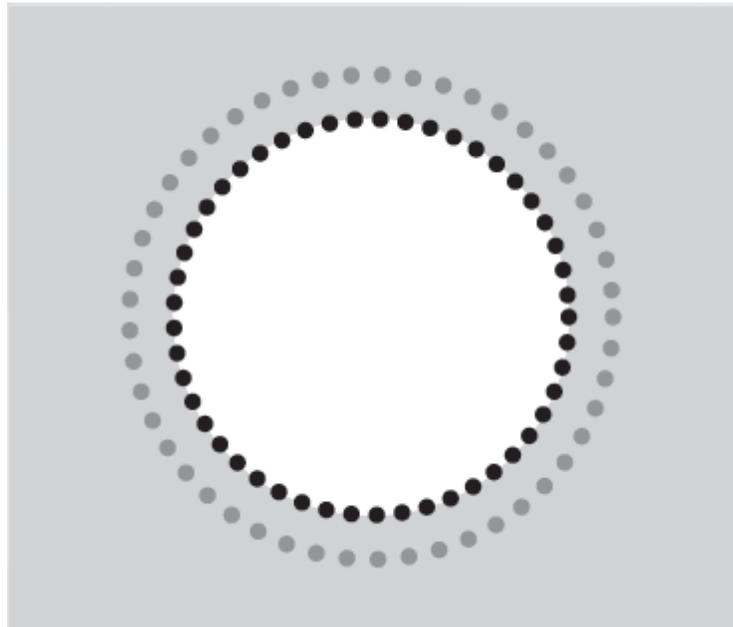
1. increases.
2. stays the same.
3. decreases.



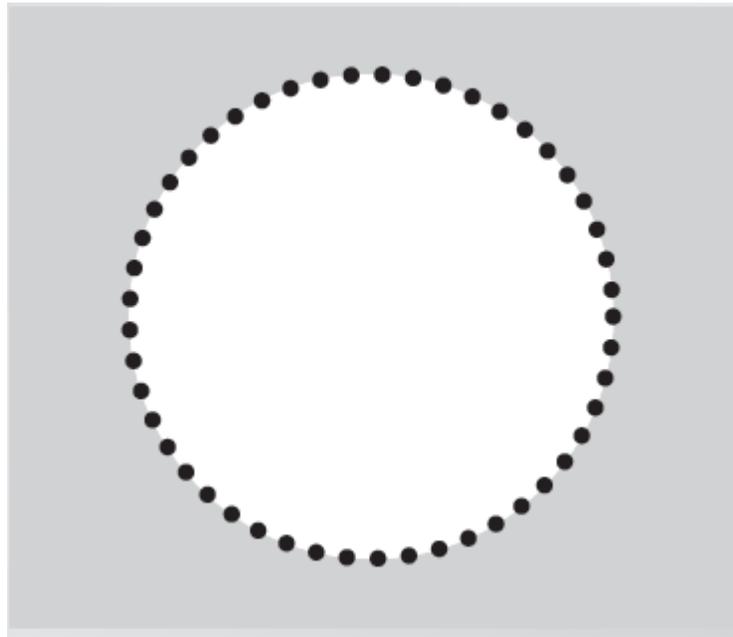
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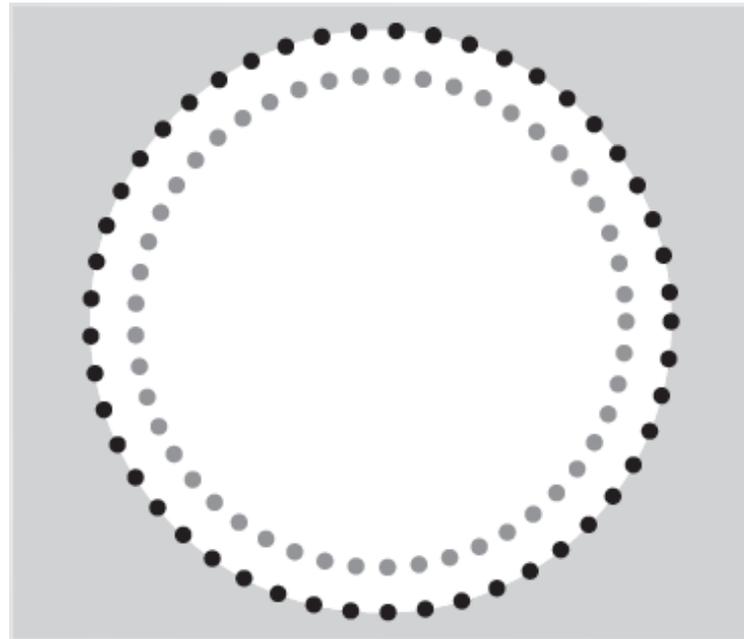
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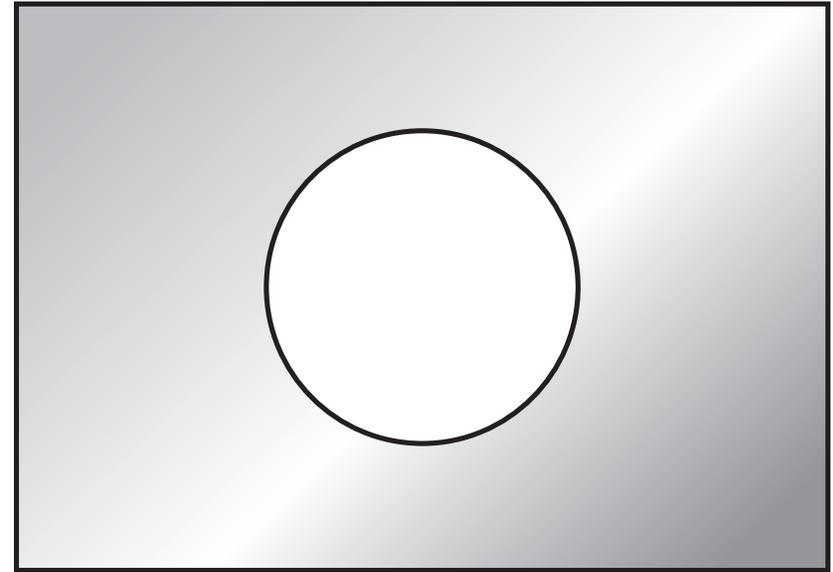


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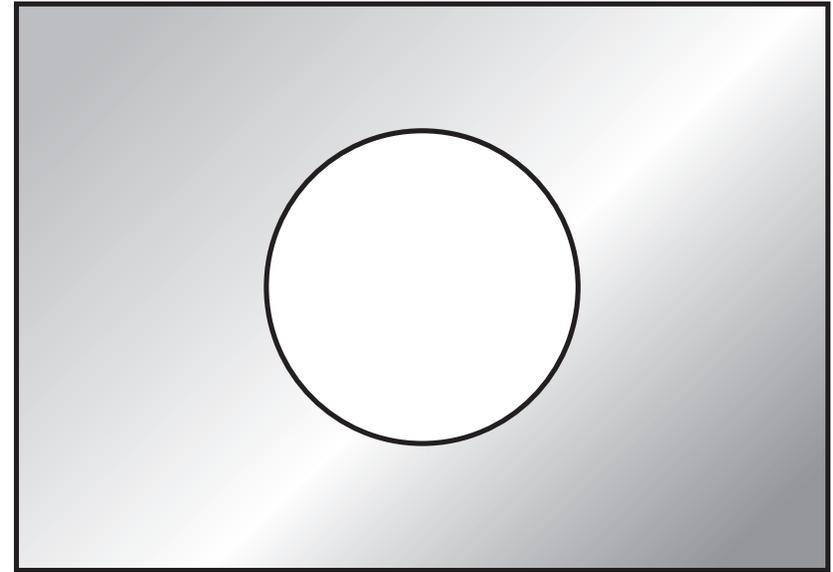
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PEER INSTRUCTION: DEMO

Benefits

- turns classroom into higher-order thinking sandbox
 - retrieval practice, feedback and metacognition
- spaces learning (home and in class)
- engages all students, not just the most courageous
- brings greater awareness to students and teachers
- encourages deep versus surface learning

PEER INSTRUCTION: DEMO

CROSS-DISCIPLINARY STANDARDS

Foundations of Learning and Knowing

Although the College and Career Readiness Standards (CCRS) are organized into four distinct disciplinary areas, English/language arts, mathematics, science, and social studies, there are elements that cut across one or more disciplines. In fact, some skill areas span all four subject areas. It is important to identify the cross-cutting knowledge and skills that underlie and connect the four disciplinary areas. This important need has been addressed through the addition of a section of cross-disciplinary standards.

Think of cross-disciplinary standards as tools that college instructors in all areas use to challenge, engage, and evaluate students in each specific subject area. They include key cognitive skills such as reasoning and problem solving, as well as foundational skills such as reading, writing, data analysis, and conducting research.

Many of these skills are also taught within the context of a single subject area. Reading and writing are excellent examples. While the primary responsibility for developing reading and writing skills in secondary school resides within English/language arts courses, first-year college students are expected to employ a range of subject-specific reading and writing strategies and techniques in all of their courses. For example, they will write a lab report in a biology class or read primary source documents in a history class.

Academic and business leaders emphasize the importance of being able to apply these skills across a variety of contexts and subject matter. They describe 21st century learning and work environments in which the cross-disciplinary skills are prerequisites to solving many of the most important problems students will encounter in college and the workplace. These problems increasingly require applying knowledge across disciplines and subject areas and the mastery of a base set of communication and analysis skills that span subject areas. Students, then, not only need to possess content knowledge, but also need to be able to apply key cognitive skills to the academic tasks presented to them, most of which require much more than simple recall of factual knowledge. These cross-disciplinary standards

enable students to engage in deeper levels of thinking across a wide range of subjects. They help high school students prepare for the transition from high school's primary focus on acquiring content knowledge to a postsecondary environment in which complex cognitive skills are necessary to achieve deeper understanding.

Understanding and Using The Cross-Disciplinary Standards

The cross-disciplinary standards are organized into two major areas: Key Cognitive Skills and Foundational Skills. The Key Cognitive Skills specify intellectual behaviors that are prevalent in entry-level college courses. The list includes intellectual curiosity, reasoning, problem solving, academic behaviors, work habits, and academic integrity. Foundational Skills consist of proficiencies students need to be able to transfer knowledge and apply it across the curriculum. These include reading, writing, conducting research, understanding and using data, and using technology.

The first three levels of the cross-disciplinary standards are written to apply across subject areas. The performance indicators found in the appendix illustrate how the cross-disciplinary standards are manifested within the subject areas. The Vertical Teams created an example in each subject area of at least one performance indicator that could be applied in that subject area. These indicators are meant to exemplify how the cross-disciplinary standards could be demonstrated in all subject areas.

I. Key Cognitive Skills

A. Intellectual curiosity

1. Engage in scholarly inquiry and dialogue.
2. Accept constructive criticism and revise personal views when valid evidence warrants.

B. Reasoning

1. Consider arguments and conclusions of self and others.
2. Construct well-reasoned arguments to explain phenomena, validate conjectures, or support positions.

3. Gather evidence to support arguments, findings, or lines of reasoning.
4. Support or modify claims based on the results of an inquiry.

C. Problem solving

1. Analyze a situation to identify a problem to be solved.
2. Develop and apply multiple strategies to solve a problem.
3. Collect evidence and data systematically and directly relate to solving a problem.

D. Academic behaviors

1. Self-monitor learning needs and seek assistance when needed.
2. Use study habits necessary to manage academic pursuits and requirements.
3. Strive for accuracy and precision.
4. Persevere to complete and master tasks.

E. Work habits

1. Work independently.
2. Work collaboratively.

F. Academic integrity

1. Attribute ideas and information to source materials and people.
2. Evaluate sources for quality of content, validity, credibility, and relevance.
3. Include the ideas of others and the complexities of the debate, issue, or problem.
4. Understand and adhere to ethical codes of conduct.

II. Foundational Skills

A. Reading across the curriculum

1. Use effective prereading strategies.
2. Use a variety of strategies to understand the meanings of new words.
3. Identify the intended purpose and audience of the text.
4. Identify the key information and supporting

CROSS-DISCIPLINARY STANDARDS

5. Analyze textual information critically.
6. Annotate, summarize, paraphrase, and quote texts when appropriate.
7. Adapt reading strategies according to structure of texts.
8. Connect reading to historical and current events and personal interest.

B. Writing across the curriculum

1. Write clearly and coherently using standard writing conventions.
2. Write in a variety of forms for various audiences and purposes.
3. Compose and revise drafts.

C. Research across the curriculum

1. Understand which topics or questions are investigated.
2. Explore a research topic.
3. Refine a research topic based on preliminary research and devise a timeline for completed work.
4. Evaluate the validity and reliability of sources.
5. Synthesize and organize information effectively.
6. Design and present an effective product.
7. Integrate source material.
8. Present final product.

D. Use of data

1. Identify patterns or departures from patterns among data.
2. Use statistical and probabilistic skills necessary for planning an investigation and collecting, analyzing, and interpreting data.
3. Present analyzed data and communicate findings in a variety of formats.

E. Technology

1. Use technology to gather information.
2. Use technology to organize, manage, and analyze information.
3. Use technology to communicate and display findings in a clear and coherent manner.

Let's Try It

Let's Try It

CROSS-DISCIPLINARY STANDARDS

3. Gather evidence to support arguments, findings, or lines of reasoning.
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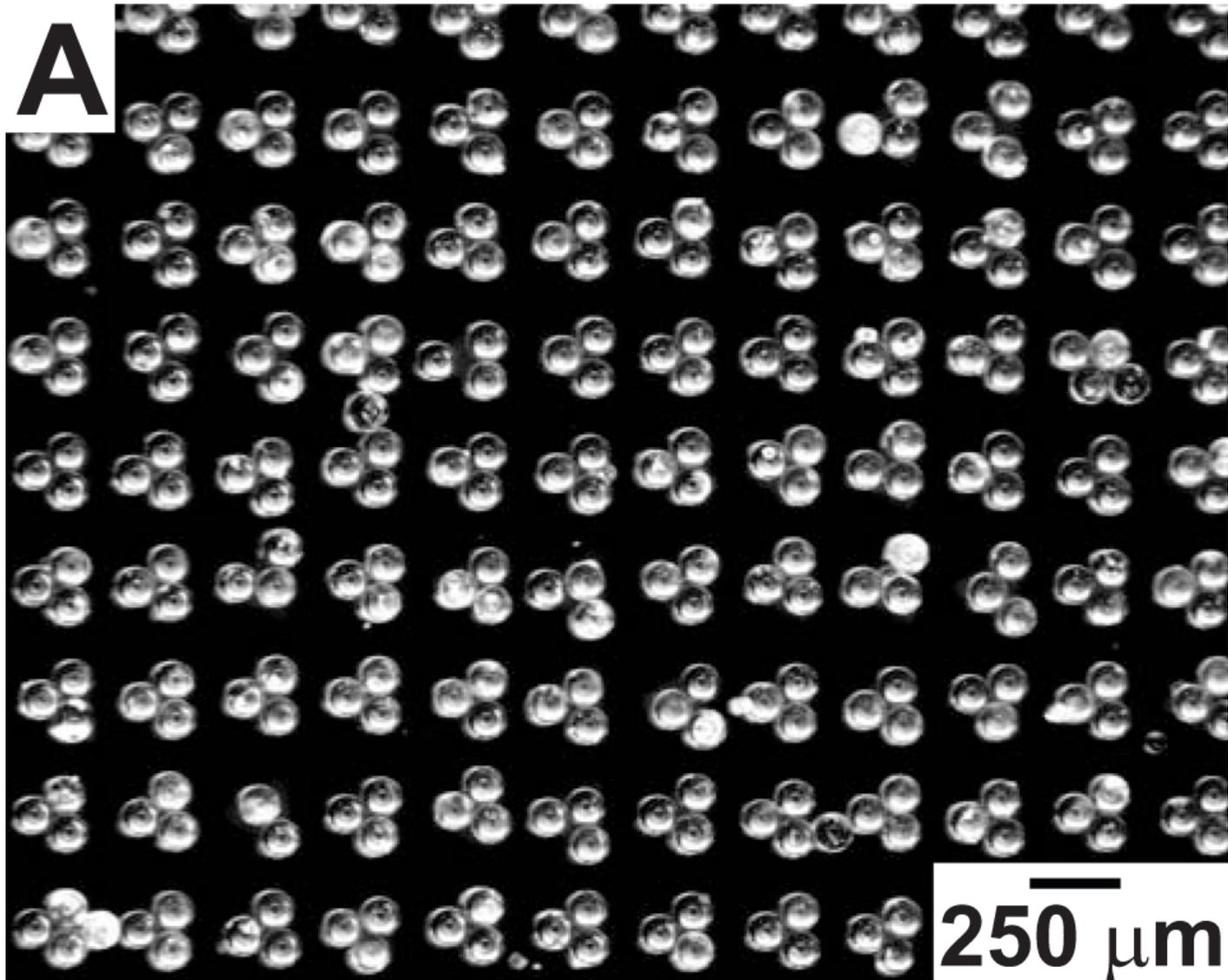
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D. Use of data

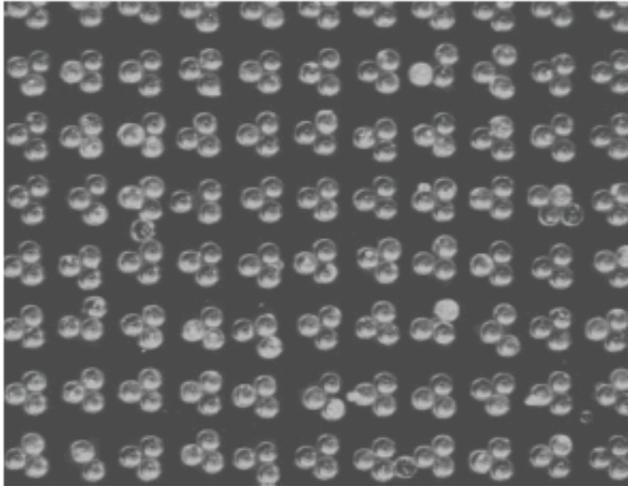
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PEER INSTRUCTION: DEMO

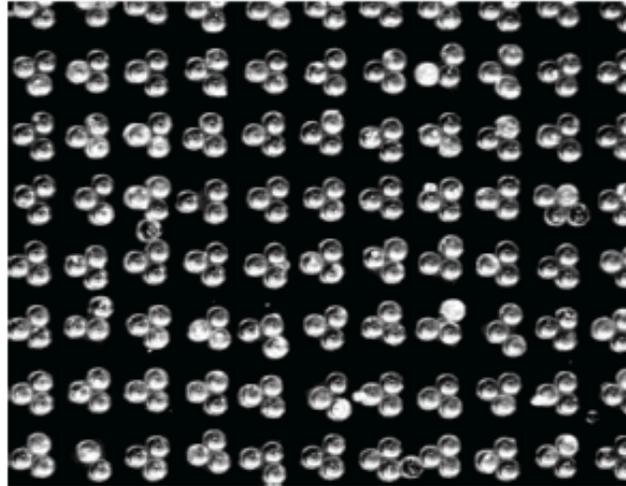


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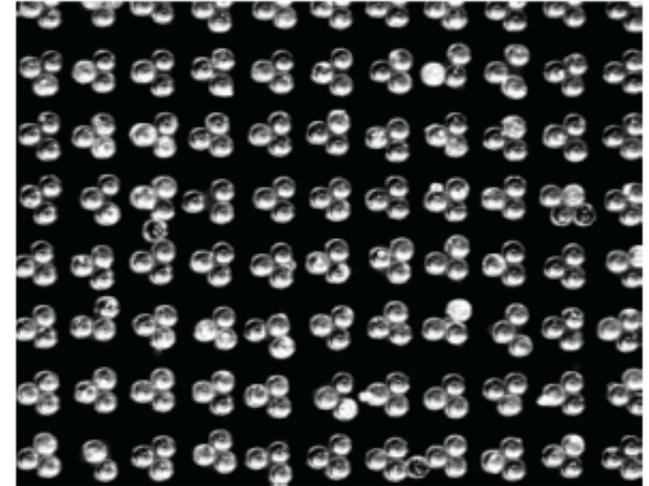
original



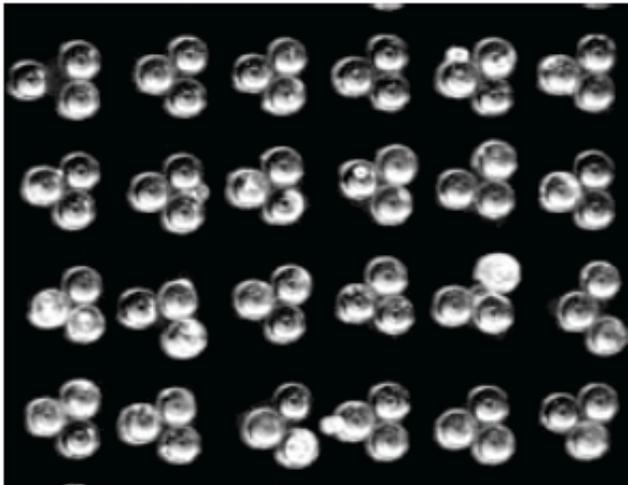
1. adjust contrast



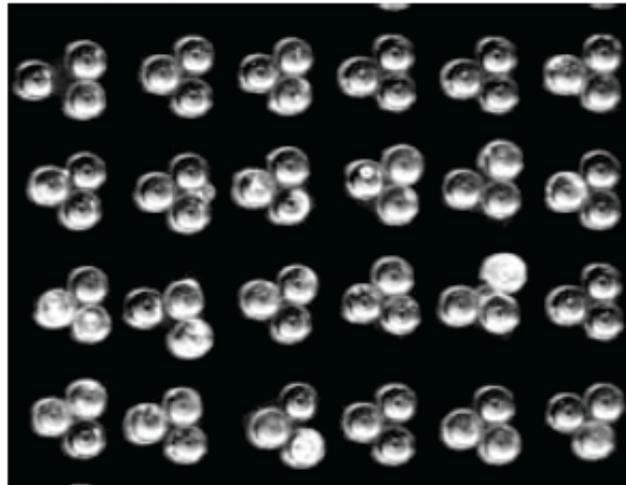
2. remove blemishes



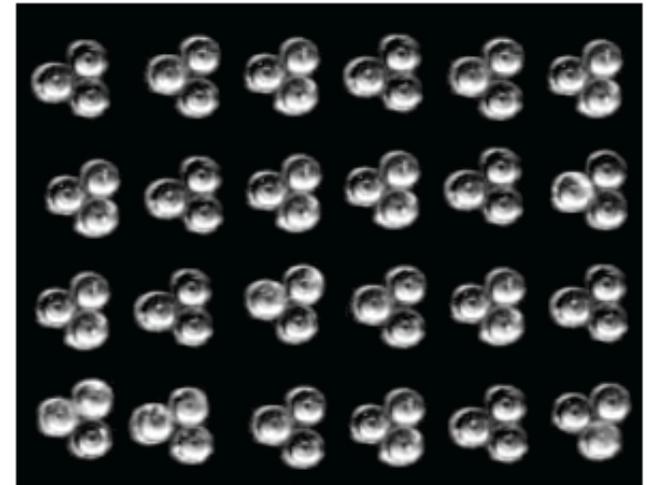
3. crop



4. remove outliers



5. reconstruct



At which step were acceptable standards of ethics violated?

1. optimize brightness/contrast
2. Remove blemishes
3. Crop optimal area
4. Remove outliers
5. Reconstruct image

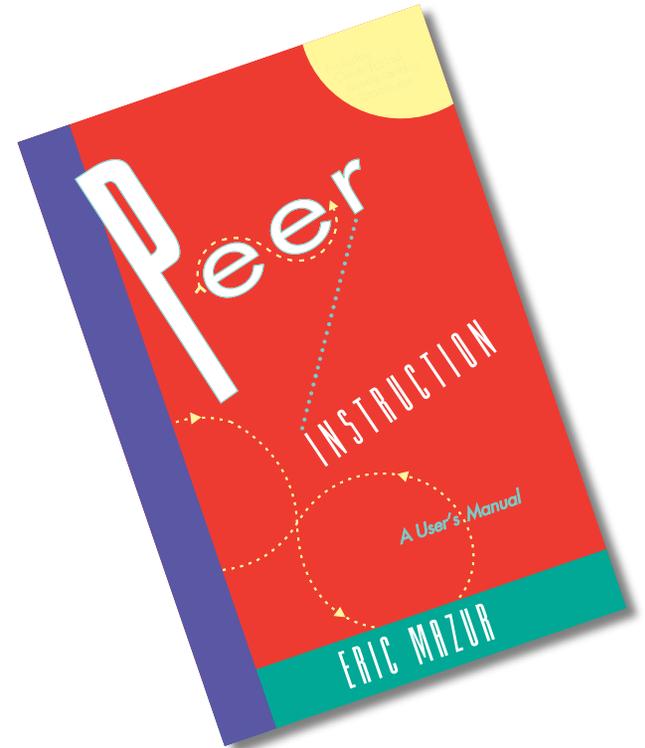
PEER INSTRUCTION: DEMO

Benefits

- don't need a right answer
- everyone was engaged

PEER INSTRUCTION: DEMO

Great for dealing with student misconceptions or scaffolding...



PEER INSTRUCTION: CRA Examples

EXAMPLE

MATHEMATICS STANDARDS *with performance indicators*

2. Determine the surface area and volume of three-dimensional figures.

- EXAMPLES
- a. Describe the difference between surface area and volume of three-dimensional figures and the relationship in the units of measurement used in their calculation.
 - b. Solve problems involving surface area and volume of three-dimensional simple and composite figures with some unknown dimensions, including prisms, pyramids, cylinders, cones, and spheres.

3. Determine indirect measurements of figures using scale drawings, similar figures, the Pythagorean Theorem, and basic trigonometry.

- EXAMPLES
- a. Determine how changes in dimension affect the perimeter, area, and volume of common geometric figures and solids.
 - b. Solve problems using proportional relationships in similar two-dimensional and three-dimensional figures to determine unknown measurements.
 - c. Determine unknown sides and angles in a right triangle using the Pythagorean Theorem and basic trigonometry.

D. Measurement involving statistics and probability

1. Compute and use measures of center and spread to describe data.

- EXAMPLES
- a. Select, compute, and justify measurements of center (e.g., mean, median, mode) based on the data set and other influential information.
 - b. Select, compute, and justify measurements of variation (e.g., range, IQR, percentiles, variance, standard deviation) based on the

- EXAMPLES
- a. Justify decisions made from probability measures from a set of data.
 - b. Interpret given probability measures in a problem.
 - c. Use and interpret a normal distribution as a mathematical model of measurement for summarizing some sets of data.

V. Probabilistic Reasoning

A. Counting principles

1. Determine the nature and the number of elements in a finite sample space.

- EXAMPLES
- a. Use lists, tables, and tree diagrams to represent all possible outcomes in determining specifics of the sample space.
 - b. Determine the number of ways an event may occur using combination and permutation formulas and the Fundamental Counting Principle.

B. Computation and interpretation of probabilities

1. Compute and interpret the probability of an event and its complement.

- EXAMPLES
- a. Conduct an experiment or simulation to compute the empirical probability of an event and its complement.
 - b. Compute and interpret the theoretical probability of a simple event and its complement.
 - c. Compare the empirical and theoretical probabilities of an event (e.g., experimental probabilities converge to theoretical probability as the number of trials increases).

2. Compute and interpret the probability of

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Does Peer Instruction Work in High Schools?

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Authors

ttynadmin

Many [Peer Instruction Network](#) members wonder if PI works in high schools and how. For example, Andrew from Tomball, Texas wants to know – What does PI look like in high schools and member Janet from Falls Church, Virginia asks, how can PI be well-integrated in high school?

We have a number of experienced PI users in PI-Network – such as Steve who teaches high school math and statistics in Phoenix and Larry who uses PI in high school economics in Dallas. So, the short answer is yes – PI does work in high schools – but the how part Andrew and Janet are inquiring about require a more expert level response.

This week, we have Part 1 in a 2-Part series guest post from high school PI expert – Ryan Campbell, an active PI-Network member who uses PI in his history courses (you can contact

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