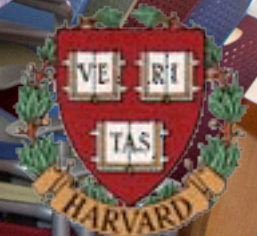


Interactive Learning, online and in-person



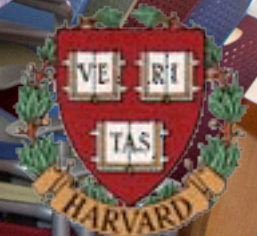
IAP Research Symposium on Innovative Leadership
Transforming Higher Education in the Digital Age
Cambridge, MA, 19 June 2023



Interactive Learning, online and in-person



IAP Research Symposium on Innovative Leadership
Transforming Higher Education in the Digital Age
Cambridge, MA, 19 June 2023



quick reflection



The background of the slide is a faded, artistic illustration of a person's face, focusing on the eyes. The face is rendered in a sketchy, painterly style with muted colors. The eyes are large and expressive, looking directly forward. The background of the illustration consists of vertical stripes in shades of yellow and red. The text is overlaid on this background.

quick reflection

think of something you are good at

The background is a faded image of a book cover. It features a portrait of a man with dark hair and a beard, looking slightly to the left. The text 'quick reflection' is printed in a bold, black, sans-serif font at the top of the cover. The book is bound in a light-colored, textured material, possibly cloth or paper, with visible vertical lines suggesting the spine and cover edges.

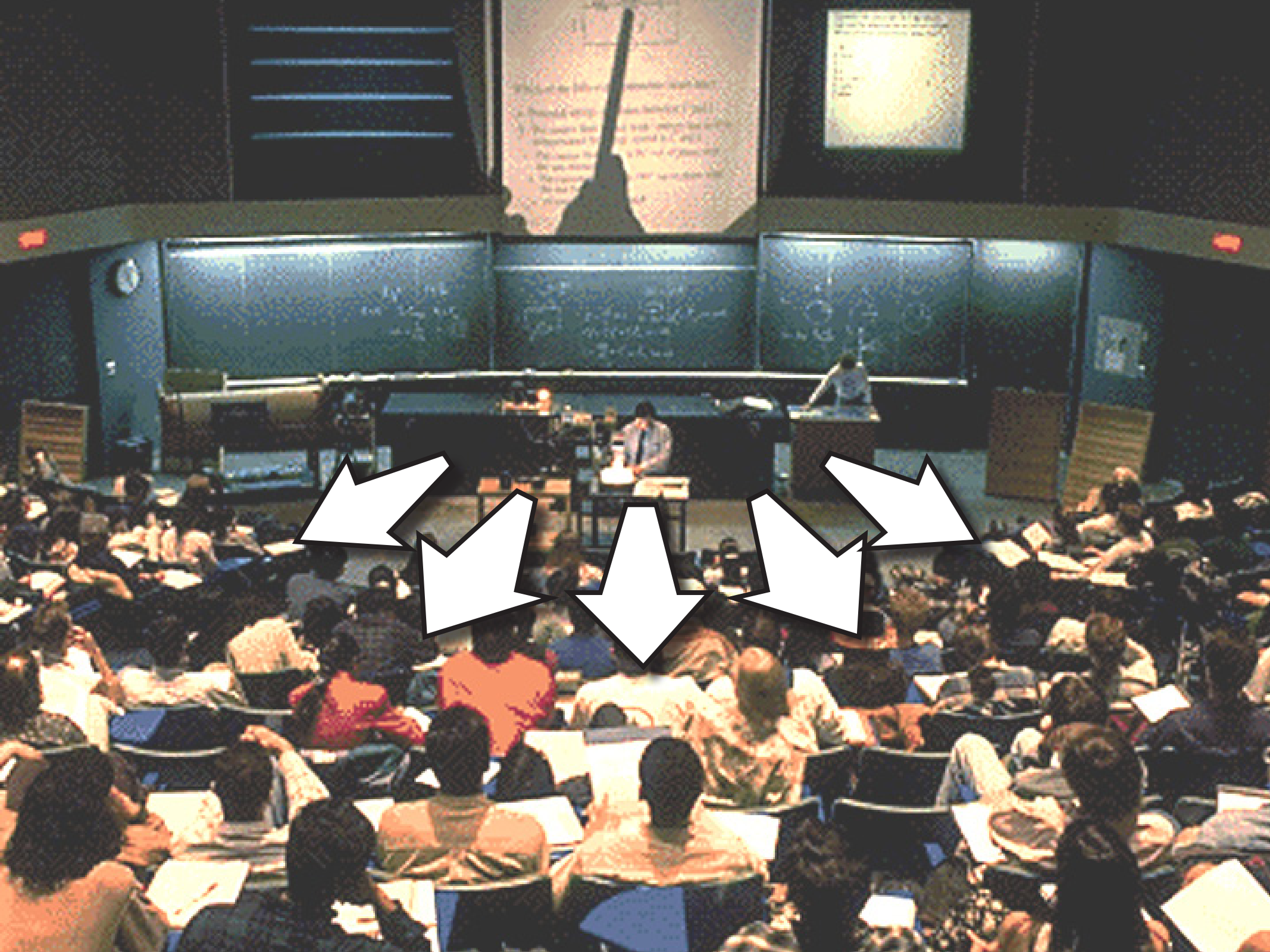
quick reflection

how did you become good at that?









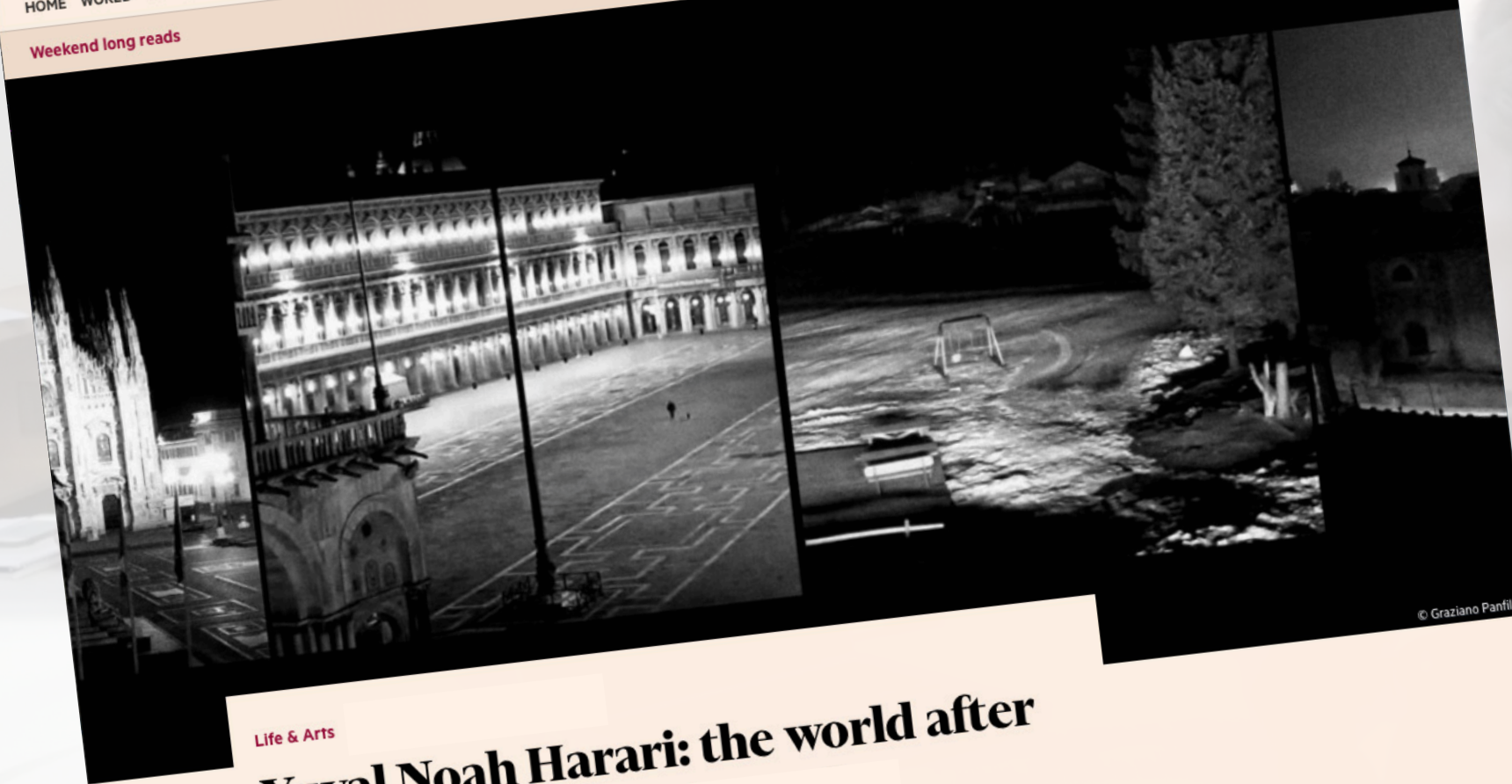








Weekend long reads



© Graziano Pantili

Life & Arts

Yuval Noah Harari: the world after coronavirus

This storm will pass. But the choices we make now could change our lives for years to come

Yuval Noah Harari MARCH 20 2020



Save

Humankind is now facing a global crisis. Perhaps the biggest crisis of our generation. The decisions people and governments take in the next few weeks will shape the world for years to come. They will shape not just our lives but the lives of future generations. We must act



Many short-term emergency measures will become a fixture of life. That is the nature of emergencies. They fast-forward historical processes. Decisions that in normal times could take years of deliberation are passed in a matter of hours. Immature and even dangerous technologies are pressed into service, because the risks of doing nothing are bigger. Entire countries serve as guinea-pigs in large-scale social experiments. What happens when everybody works from home and communicates only at a distance? What happens when entire schools and universities go online? In normal times, governments, businesses and educational boards would never agree to conduct such experiments. But these aren't normal times.





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Yuval Noah Harari MARCH 20 2020

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Many short-term emergency measures will become a fixture of life. That is the nature of emergencies. They fast-forward historical processes. Decisions that in normal times could take years of deliberation are passed in a matter of hours. Immature and even dangerous technologies are pressed into service, because the risks of doing nothing are bigger. Entire countries serve as guinea-pigs in large-scale social experiments. What happens when everybody works from home and communicates only at a distance? What happens when entire schools and universities go online? In normal times, governments, businesses and educational boards would never agree to conduct such experiments. But these aren't normal times.

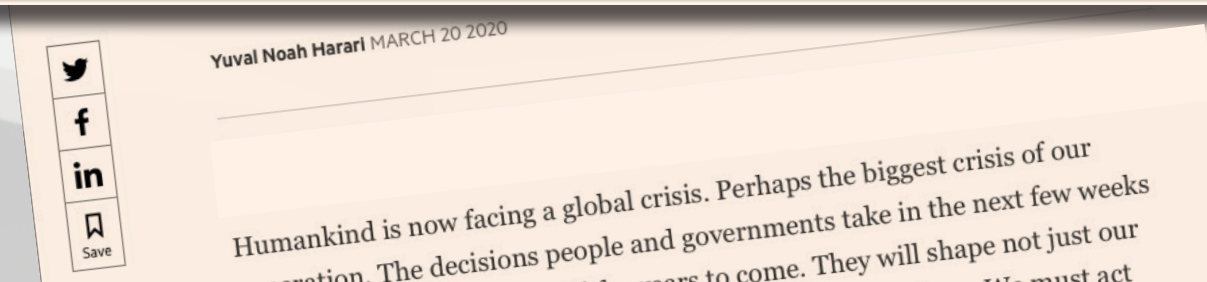


Yuval Noah Harari MARCH 20 2020

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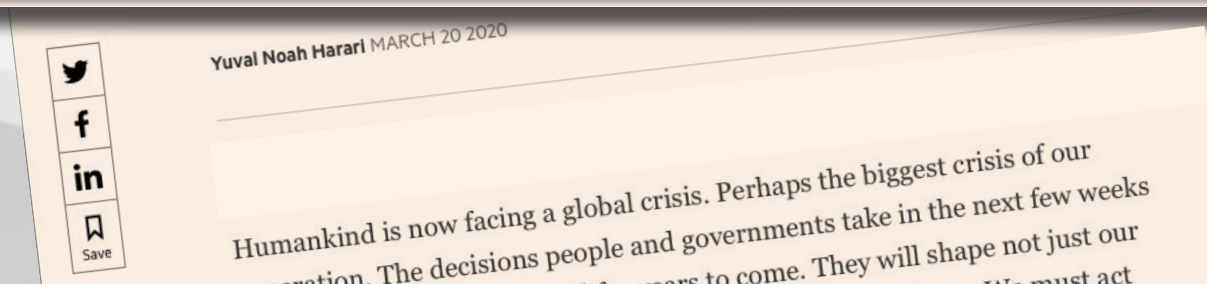


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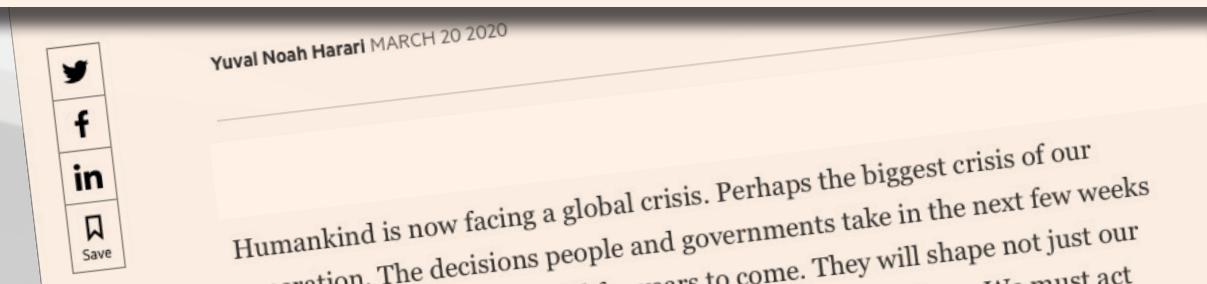




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Will online teaching become a fixture of life?

What happens when everybody works from home and communicates only at a distance? What happens when entire schools and universities go online? In normal times, governments, businesses and educational boards would never agree to conduct such experiments. But these aren't normal times.



lkbeat

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THE WALL STREET JOURNAL.

A photograph of a woman with long brown hair, wearing a green shirt and jeans, sitting on a tan sofa in a living room. She is looking at a laptop. Four children are also on the sofa: a boy on the left in a blue shirt and red shorts is reading a book; a boy in the middle in a red and blue plaid shirt is looking at a tablet; a girl on the right in a white dress is looking down; and a boy in the foreground in a red shirt is looking towards the camera. The room has two floor lamps with warm light, a coffee table with a blue tablet and books, and a patterned rug.

The Results Are In for Remote Learning: It Didn't Work

The pandemic forced schools into a crash course in online education. Problems piled up quickly. 'I find it hectic and stressful'

Lucia Curatolo-Boylan supervises the online schooling of her four children, ages 4 to 10, in Staten Island, N.Y. KEVIN HAGEN FOR THE WALL STREET JOURNAL

by Howard and Lee Hawkins

lkbeat

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THE WALL STREET JOURNAL.



Popular

Latest

The Atlantic

IDEAS

Remote Learning Is a Bad Joke

My kid can't handle a virtual education, and neither can I.

AUGUST 18, 2020

Emily Gould

Author and essayist



RECOMMEN
READING

Put Anthony Fauci in
Dunk Tank

CONOR FRIEDERSDORF

Why Millennials Can
Up



The reason? Bad pedagogy!



**information
transfer**

sense-making

Traditional model

class

**information
transfer**

home

sense-making

Traditional model

class

**information
transfer**

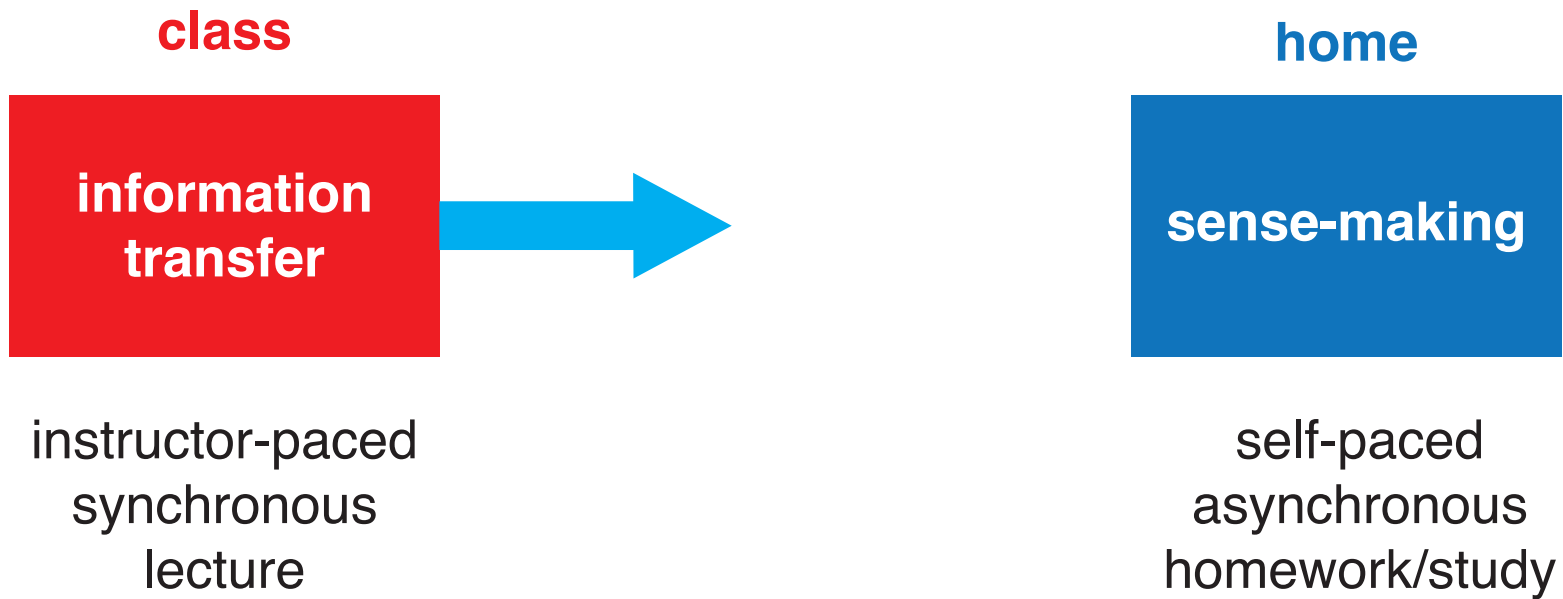
instructor-paced
synchronous
lecture

home

sense-making

self-paced
asynchronous
homework/study

Traditional model online



Traditional model online

class

information
transfer

instructor-paced
synchronous
lecture

home

information
transfer

instructor-paced
synchronous
online lecture

home

sense-making

self-paced
asynchronous
homework/study

Traditional model online

class

information
transfer

instructor-paced
synchronous
lecture

home

information
transfer

instructor-paced
asynchronous
recorded lecture

home

sense-making

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asynchronous
home work/study

Traditional model online

class

information
transfer

instructor-paced
synchronous
lecture

home

information
transfer

instructor-paced
asynchronous
recorded lecture

home

sense-making

self-paced
asynchronous
home work/study

all alone!

A group of people are working in a modern office environment. In the foreground, a woman with blonde hair is looking at a laptop screen. Next to her, a woman with dark hair is looking down at a notebook. In the background, several other people are working at their desks, some with laptops. The office has large windows and a bright, airy feel. The text "Small wonder!" is overlaid in the center of the image.

Small wonder!

Traditional model

class

**information
transfer**

home

sense-making

Flipped model

home

**information
transfer**

class

sense-making

Flipped model

home

**information
transfer**

self-paced
asynchronous

class

sense-making

instructor-led
synchronous
& **interactive**

Flipped model

home

**information
transfer**

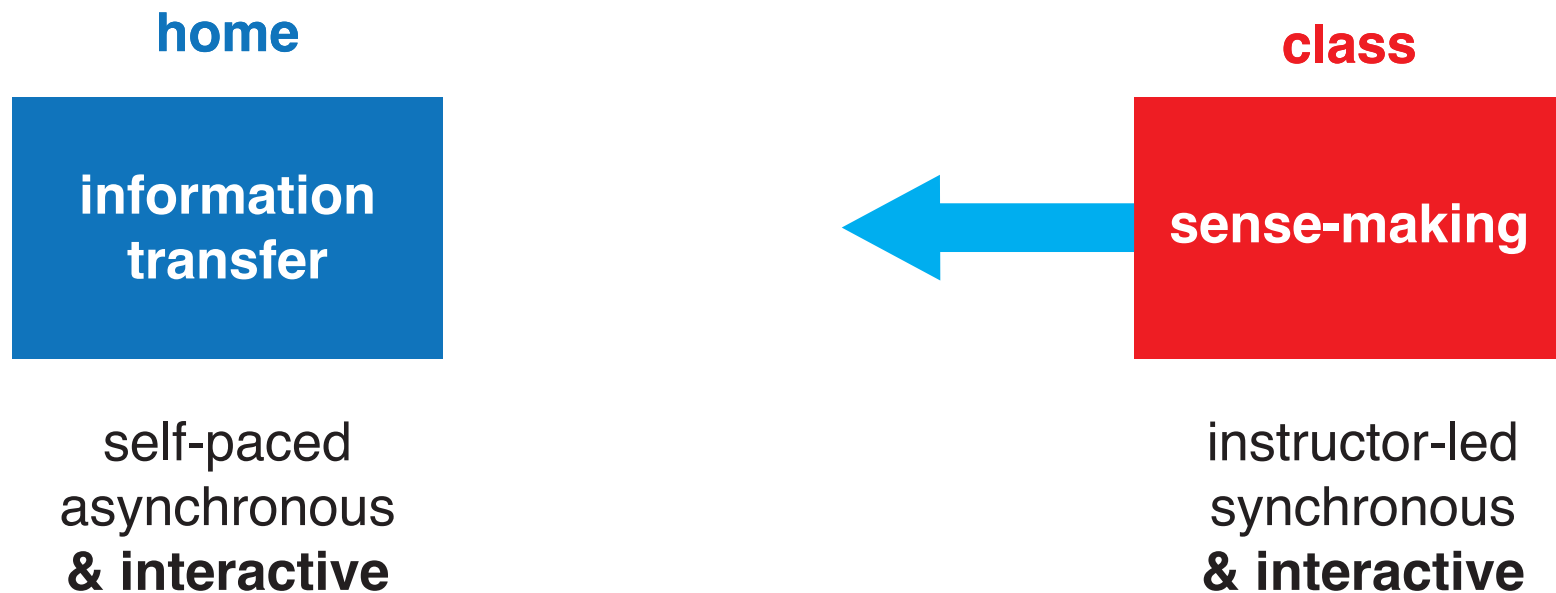
self-paced
asynchronous
& **interactive**

class

sense-making

instructor-led
synchronous
& **interactive**

Flipped model online



Flipped model online

home

**information
transfer**

self-paced
asynchronous
& **interactive**

home

sense-making

instructor-led
synchronous
& **interactive**

class

sense-making

instructor-led
synchronous
& **interactive**

Flipped model online





1 pandemic lessons



1 pandemic lessons

2 new normal



1 pandemic lessons

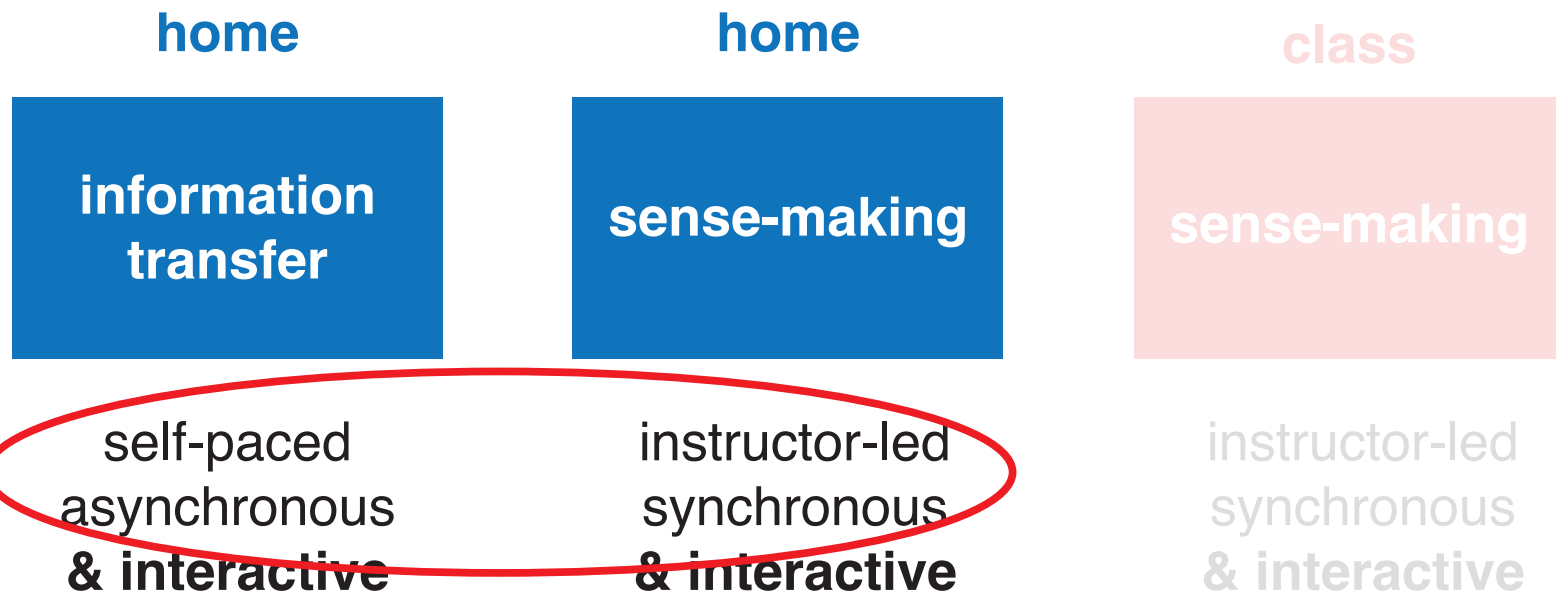
2 new normal

3 self-paced PI

Optimize instructional face-to-face time

A group of students in a classroom setting, focused on their laptops and interacting with each other. The students are seated at a large, light-colored table. In the foreground, a student is looking at a laptop screen displaying a website with the title "learning catalysis". Other students are visible in the background, some working on laptops and others engaged in discussion. The overall atmosphere is one of collaborative learning.

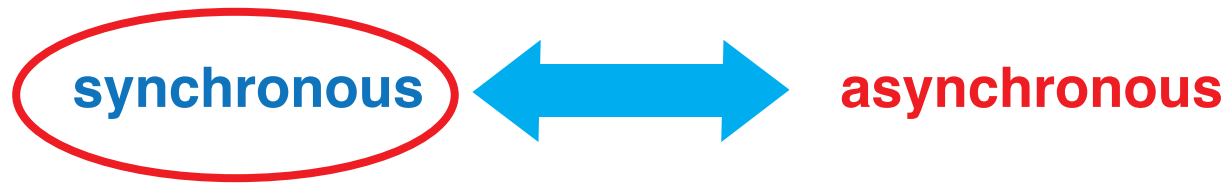
Optimize instructional face-to-face time



Optimize instructional face-to-face time

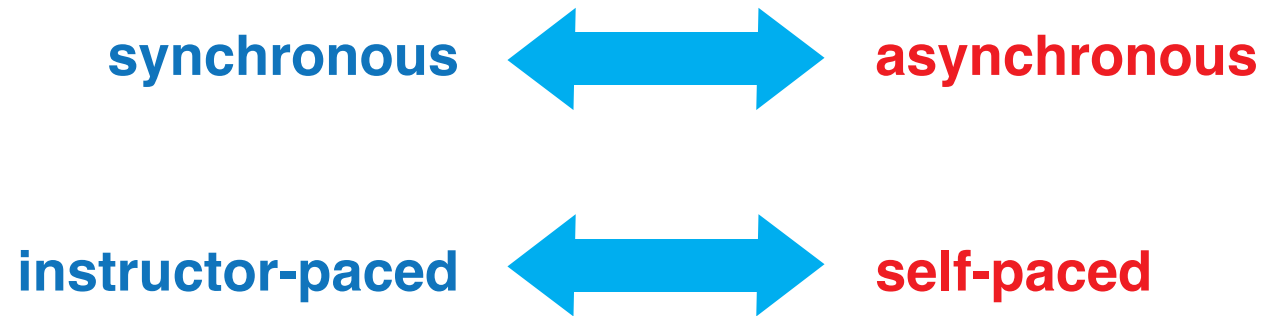
synchronous  asynchronous

Optimize instructional face-to-face time

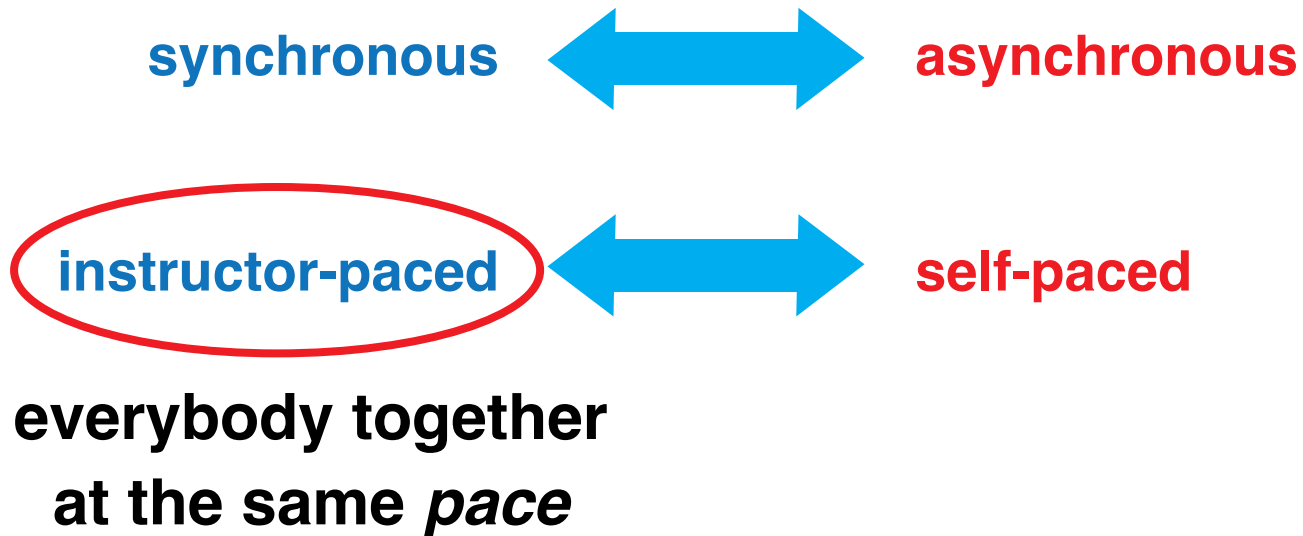


**everybody together
at the same *time***

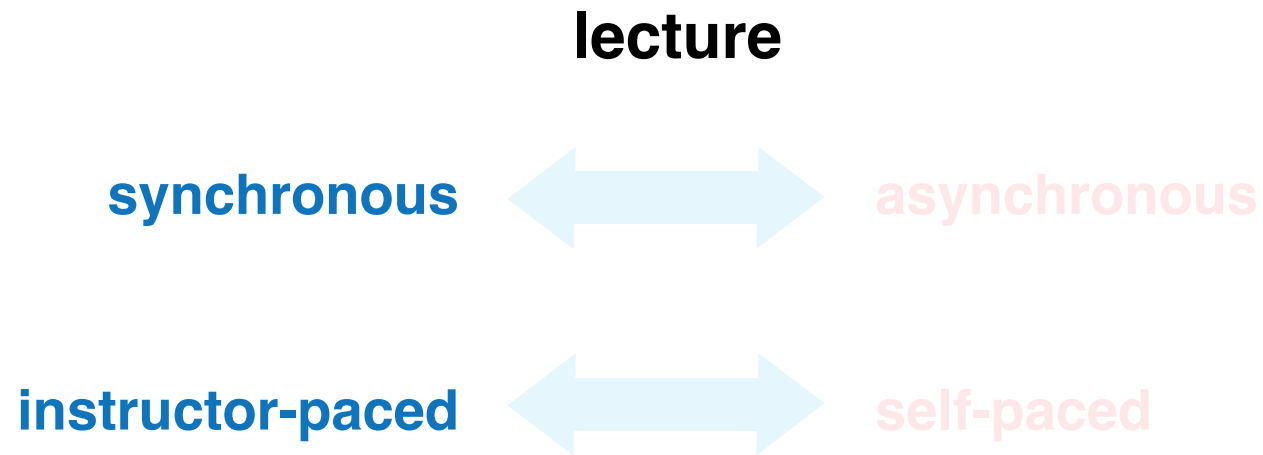
Optimize instructional face-to-face time



Optimize instructional face-to-face time



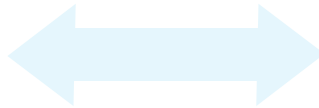
Optimize instructional face-to-face time



Optimize instructional face-to-face time

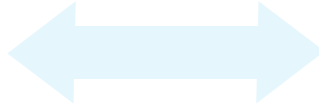
recorded lecture

synchronous



asynchronous

instructor-paced

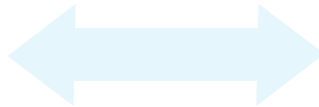


self-paced

Optimize instructional face-to-face time

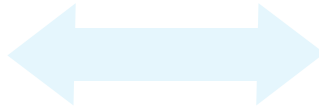
recorded lecture

synchronous



asynchronous

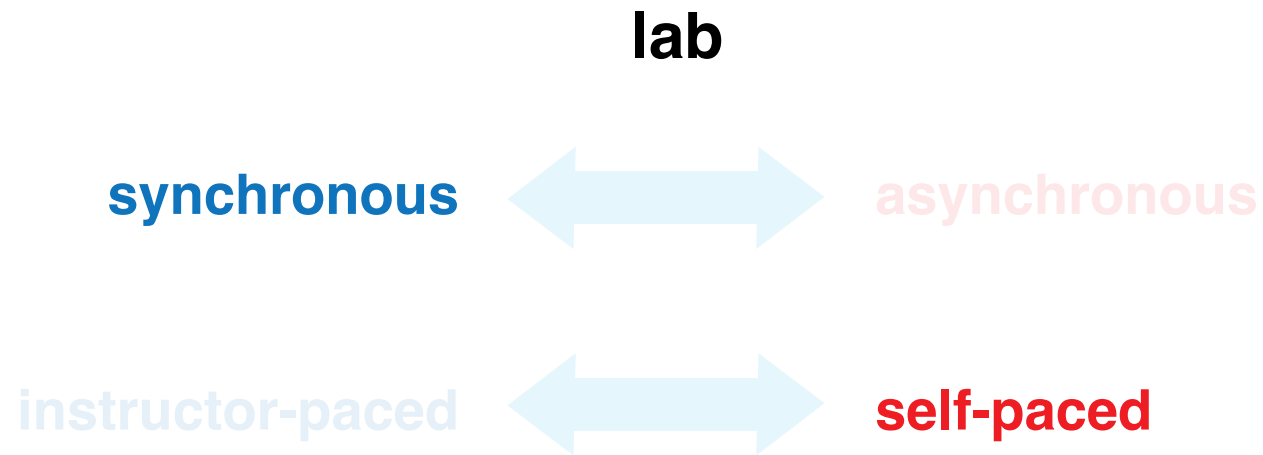
instructor-paced



self-paced

1.5x!

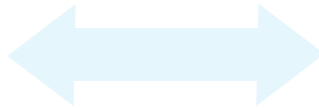
Optimize instructional face-to-face time



Optimize instructional face-to-face time

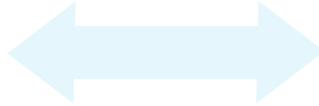
homework/study

synchronous



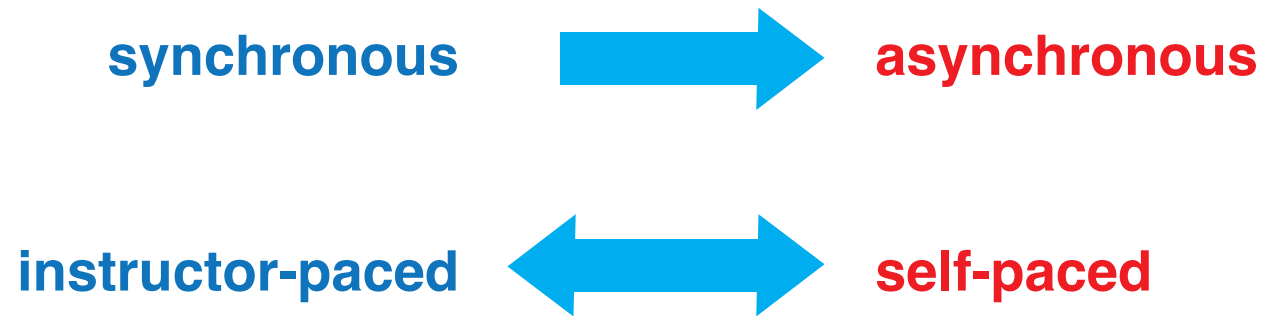
asynchronous

instructor-paced

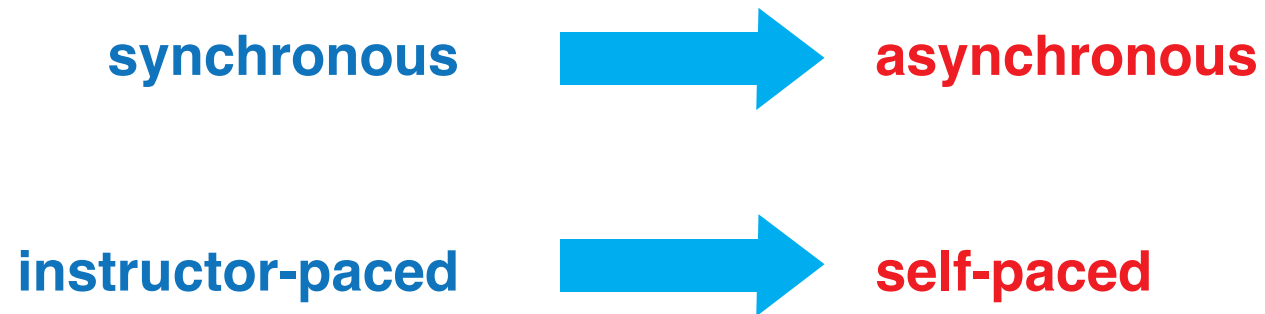


self-paced

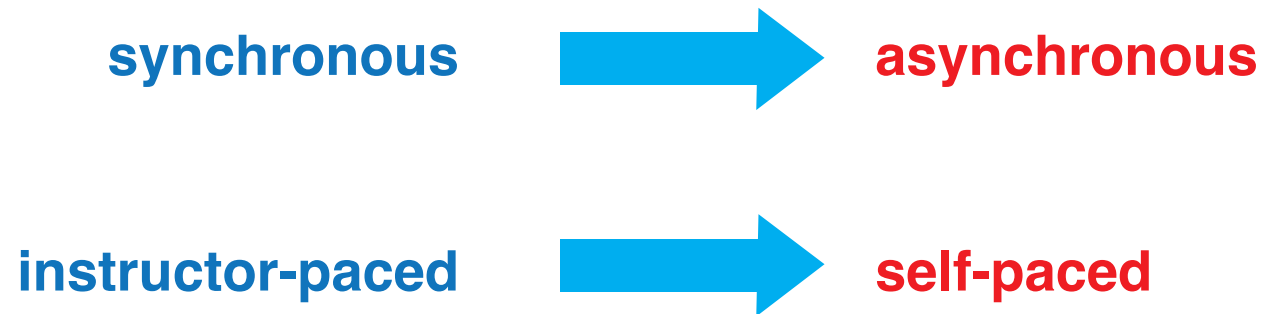
Optimize instructional face-to-face time



Optimize instructional face-to-face time



Optimize instructional face-to-face time



**more time to help students
where it really matters!**



Try this exercise!

Optimize team face-to-face time

synchronous

collaborative work

Optimize team face-to-face time

synchronous

collaborative work

- not all students engaged
- inefficient team work
- poor use of staff time
- no quality control

Optimize team face-to-face time

synchronous

collaborative work

- not all students engaged
- inefficient team work
- poor use of staff time
- no quality control

asynchronous

**individual
work**

Optimize team face-to-face time

synchronous

collaborative work

- not all students engaged
- inefficient team work
- poor use of staff time
- no quality control

asynchronous

**individual
work**



synchronous

**team
work**

Optimize team face-to-face time

synchronous

collaborative work

- not all students engaged
- inefficient team work
- poor use of staff time
- no quality control

asynchronous

**individual
work**



synchronous

**team
work**



**team
check**

Optimize team face-to-face time

synchronous

collaborative work

- not all students engaged
- inefficient team work
- poor use of staff time
- no quality control

asynchronous

individual
work

all engaged



synchronous

team
work

efficient team



team
check

quality control

Establish continuous accountability

Inside Higher Ed, Yes, Virginia, there is a better way to grade

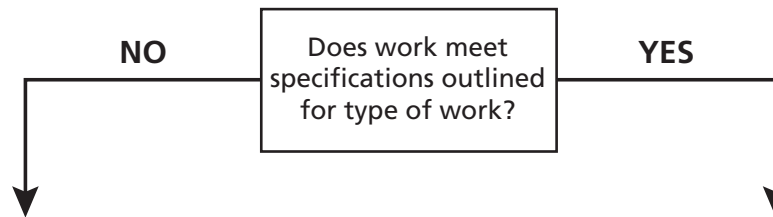
A group of people in a modern office setting, working on laptops and discussing documents. The image is faded and serves as a background for the text.

Establish continuous accountability

Specifications grading

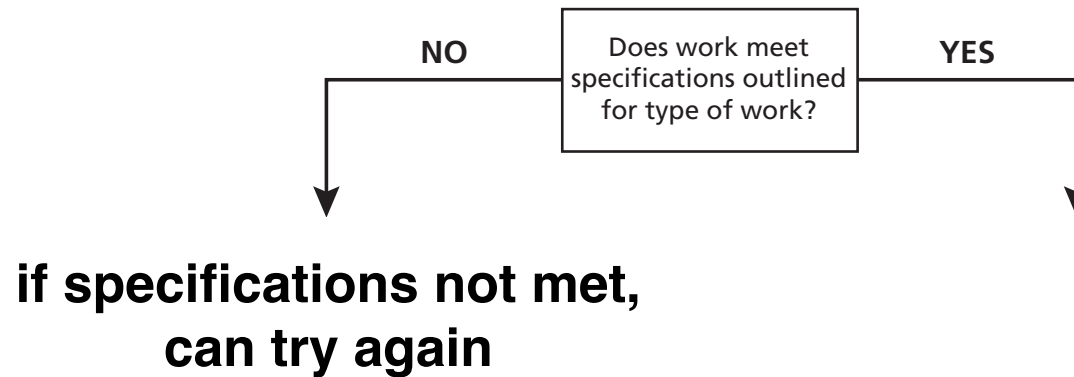
Inside Higher Ed, Yes, Virginia, there is a better way to grade

Establish continuous accountability



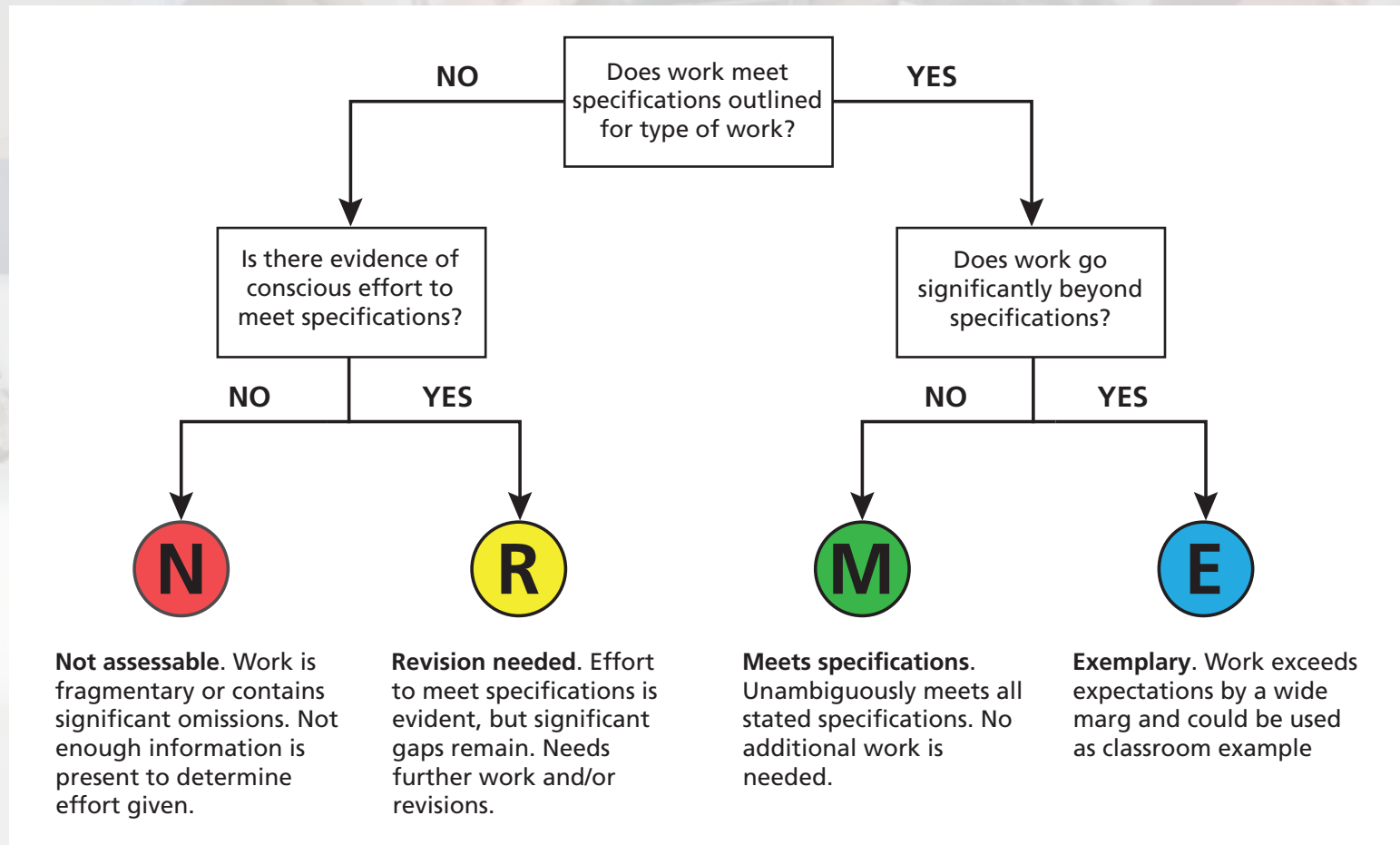
Inside Higher Ed, *Yes, Virginia, there is a better way to grade*

Establish continuous accountability



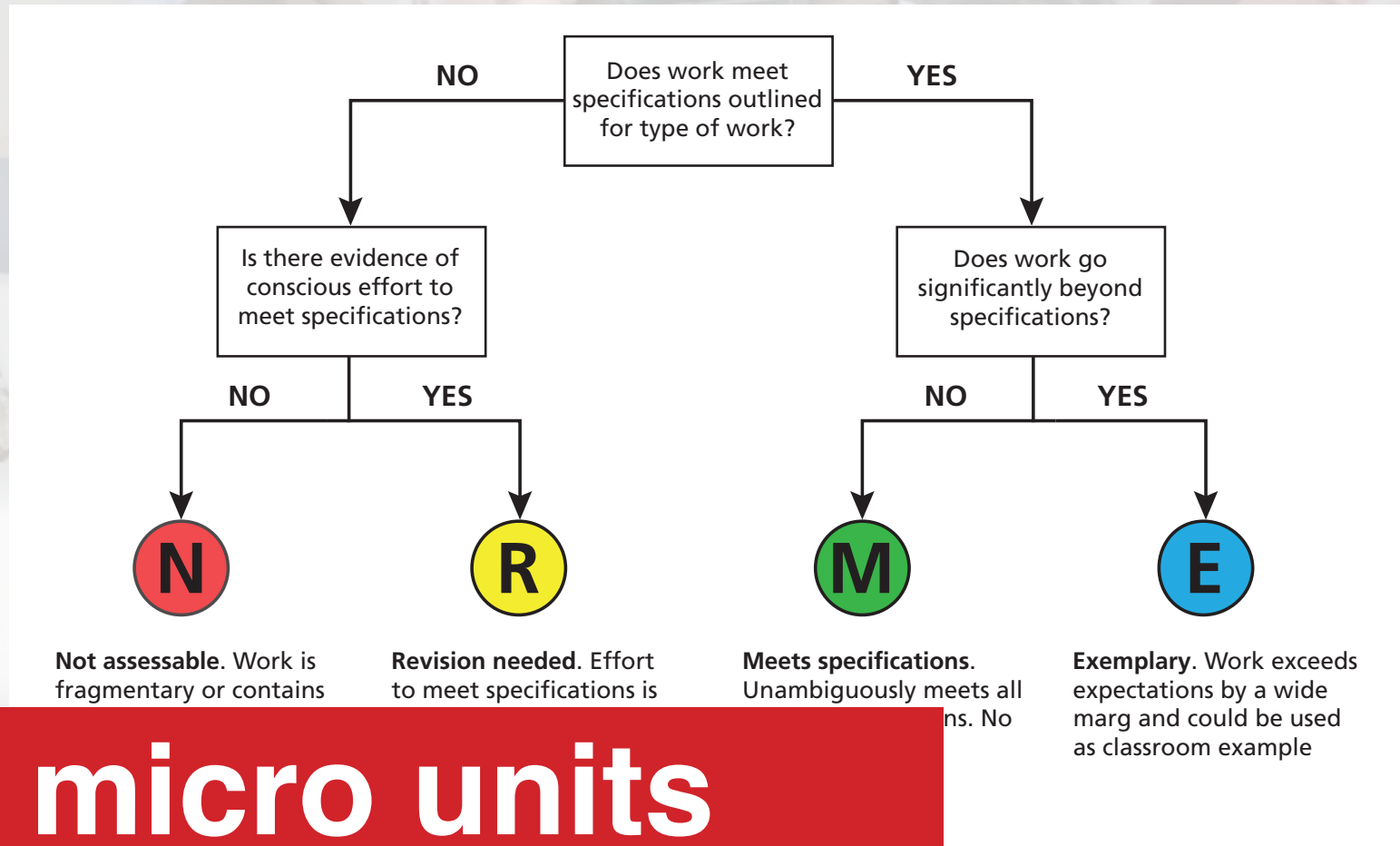
Inside Higher Ed, *Yes, Virginia, there is a better way to grade*

Establish continuous accountability



Inside Higher Ed, *Yes, Virginia, there is a better way to grade*

Establish continuous accountability

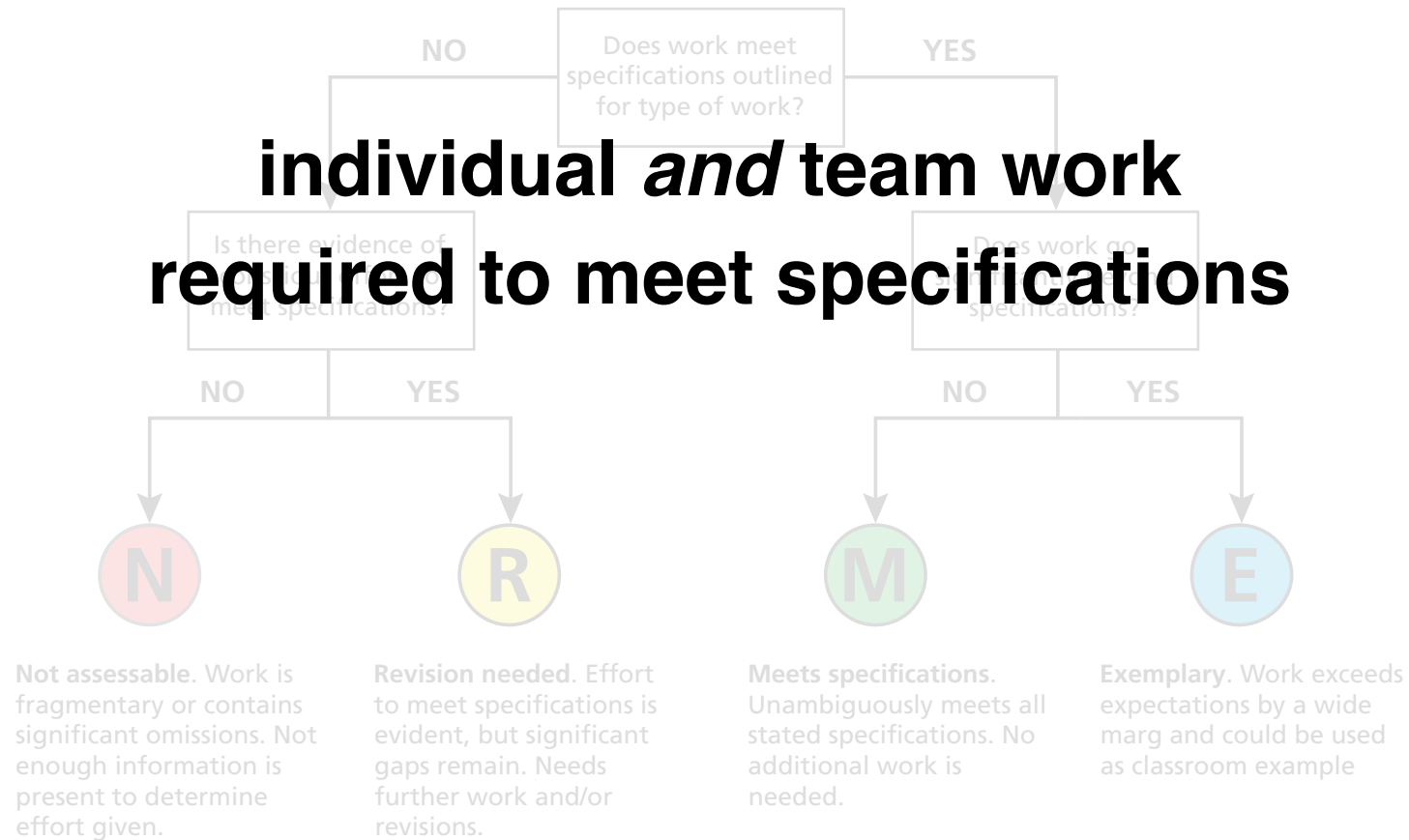


70 micro units

Inside Higher Ed, *Yes, Virginia, there is a better way to grade*

Establish continuous accountability

individual *and* team work required to meet specifications



Inside Higher Ed, *Yes, Virginia, there is a better way to grade*

Establish continuous accountability

**individual *and* team work
required to meet specifications**

**course grade determined by number of units
for which specifications were met**

N
Not assessable. Work is fragmented, incomplete, or contains significant omissions. Not enough information is present to determine effort given.

R
Revision needed. Effort evident, but significant gaps remain. Needs further work and/or revisions.

M
Meets specifications. Work meets stated specifications. No additional work is needed.

E
Exemplary. Work exceeds specifications. Work is exemplary and could be used as classroom example.

Inside Higher Ed, *Yes, Virginia, there is a better way to grade*

Shift ownership of learning space

instead of all students coming to instructor's room...

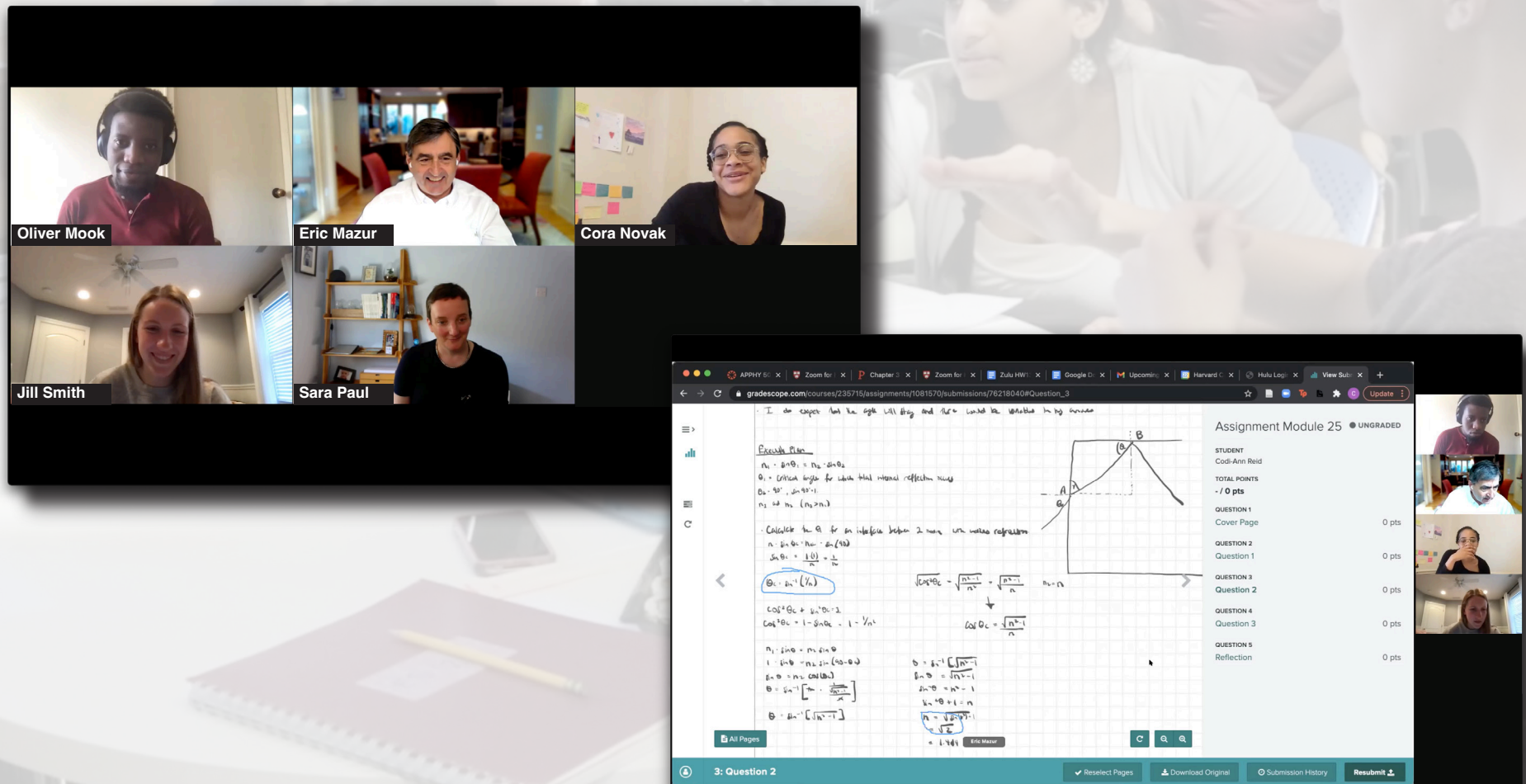
Shift ownership of learning space

instead of all students coming to instructor's room...

...instructional staff visits each team's own room

Shift ownership of learning space

80 students in one room → 20 rooms with 4 students



Oliver Mook

Eric Mazur

Cora Novak

Jill Smith

Sara Paul

Assignment Module 25 • UNGRADED

STUDENT: Codi-Ann Reid

TOTAL POINTS: - / 0 pts

QUESTION 1: Cover Page 0 pts

QUESTION 2: Question 1 0 pts

QUESTION 3: Question 2 0 pts

QUESTION 4: Question 3 0 pts

QUESTION 5: Reflection 0 pts

3: Question 2

Reselect Pages Download Original Submission History Resubmit

Shift ownership of learning space

every student on front row

The collage illustrates the shift in ownership of the learning space. It features a Zoom meeting grid with five participants: Oliver Mook, Eric Mazur, Cora Novak, Jill Smith, and Sara Paul. Below the grid is a screenshot of a physics assignment on a grid background, showing handwritten notes and a diagram. The assignment is titled "Assignment Module 25" and includes a list of questions. The notes include the following text:

Example 1
 $n_1 \sin \theta_1 = n_2 \sin \theta_2$
 $\theta_1 = \theta_2$ (critical angle for which total internal reflection occurs)
 $\theta_1 = 90^\circ$, $\theta_2 = 90^\circ$
 $n_1 \sin \theta_1 = n_2 \sin \theta_2$
 $n_1 \sin 90^\circ = n_2 \sin 90^\circ$
 $n_1 = n_2$ (if $n_1 > n_2$)

Calculate the θ_c for an interface between 2 media with indices of refraction n_1 and n_2 ($n_1 > n_2$)
 $n_1 \sin \theta_c = n_2 \sin 90^\circ$
 $\sin \theta_c = \frac{n_2}{n_1}$
 $\theta_c = \sin^{-1}(\frac{n_2}{n_1})$

$\cos^2 \theta_c = 1 - \sin^2 \theta_c = 1 - \frac{n_2^2}{n_1^2}$
 $\cos \theta_c = \sqrt{1 - \frac{n_2^2}{n_1^2}} = \frac{\sqrt{n_1^2 - n_2^2}}{n_1}$

$n_1 \sin \theta = n_2 \sin \theta$
 $1 \sin \theta = n_2 \sin \theta$
 $\sin \theta = n_2 \sin \theta$
 $\theta = \sin^{-1}(\frac{n_2}{n_1})$
 $\theta = \sin^{-1}(\frac{\sqrt{n_1^2 - n_2^2}}{n_1})$

$\theta = \sin^{-1}(\frac{\sqrt{n_1^2 - n_2^2}}{n_1})$
 $\theta = \sin^{-1}(\frac{\sqrt{1^2 - 0.75^2}}{1})$
 $\theta = \sin^{-1}(\frac{\sqrt{1 - 0.5625}}{1})$
 $\theta = \sin^{-1}(\frac{\sqrt{0.4375}}{1})$
 $\theta = \sin^{-1}(0.6614)$
 $\theta = 41.5^\circ$

The assignment also includes a diagram of a light ray incident on a boundary between two media, with angles θ_1 and θ_2 labeled. The right side of the screenshot shows a list of questions and a table of scores:

QUESTION	Score
QUESTION 1	0 pts
QUESTION 2	0 pts
QUESTION 3	0 pts
QUESTION 4	0 pts
QUESTION 5	0 pts

Shift ownership of learning space

every student on front row & address each by their name

The collage illustrates pandemic lessons in education. It features a Zoom meeting grid with five participants: Oliver Mook, Eric Mazur, Cora Novak, Jill Smith, and Sara Paul, each with their name circled in yellow. Below the grid is a screenshot of a Gradescope assignment page for 'Assignment Module 25' showing handwritten physics notes and a diagram of a light ray reflecting off a surface. To the right of the Gradescope page is a vertical strip of five small video thumbnails showing individual students.



Does it work?

1 pandemic lessons

Doubling of...

- content learning gains
- physics self-efficacy gains

Research Shows Students Falling Months Behind During Virus Disruptions

The abrupt switch to remote learning wiped out academic gains for many students in America, and widened racial and economic



What do students say?

Research Shows Students Falling Months Behind During Virus Disruptions

The abrupt switch to remote learning wiped out academic gains for many students in America, and widened racial and economic gaps. It won't be easy.

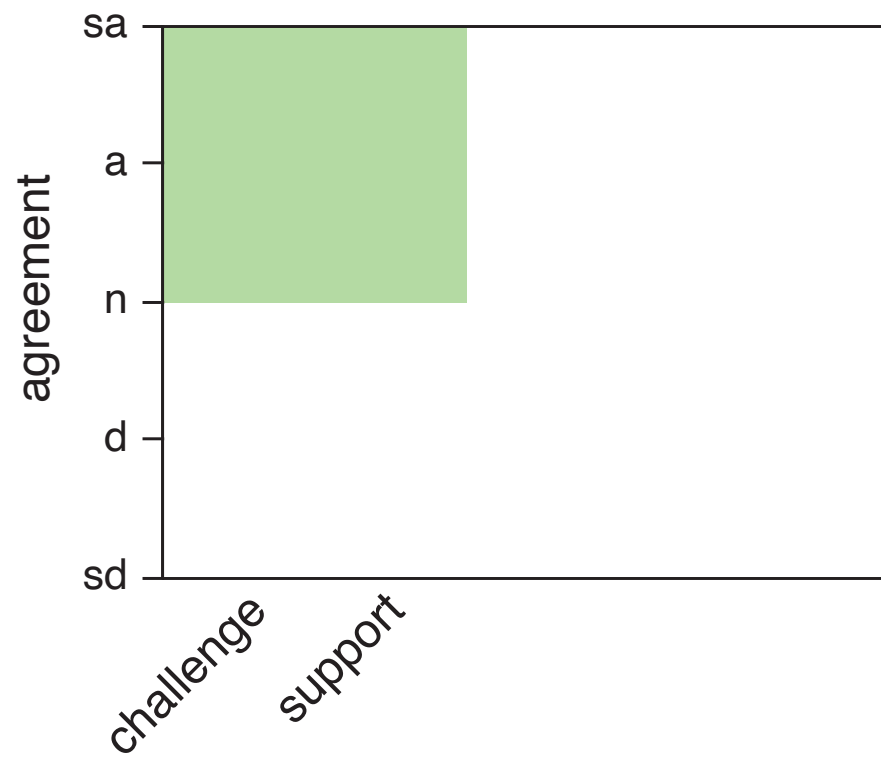
Agile Feedback Survey (Talbert)

- 1. I was challenged intellectually**
- 2. I had plenty of support**
- 3. I am closer to mastering the ideas of the course now**
- 4. I made progress because of my own efforts and choices**
- 5. I felt I was part of a community of learners**

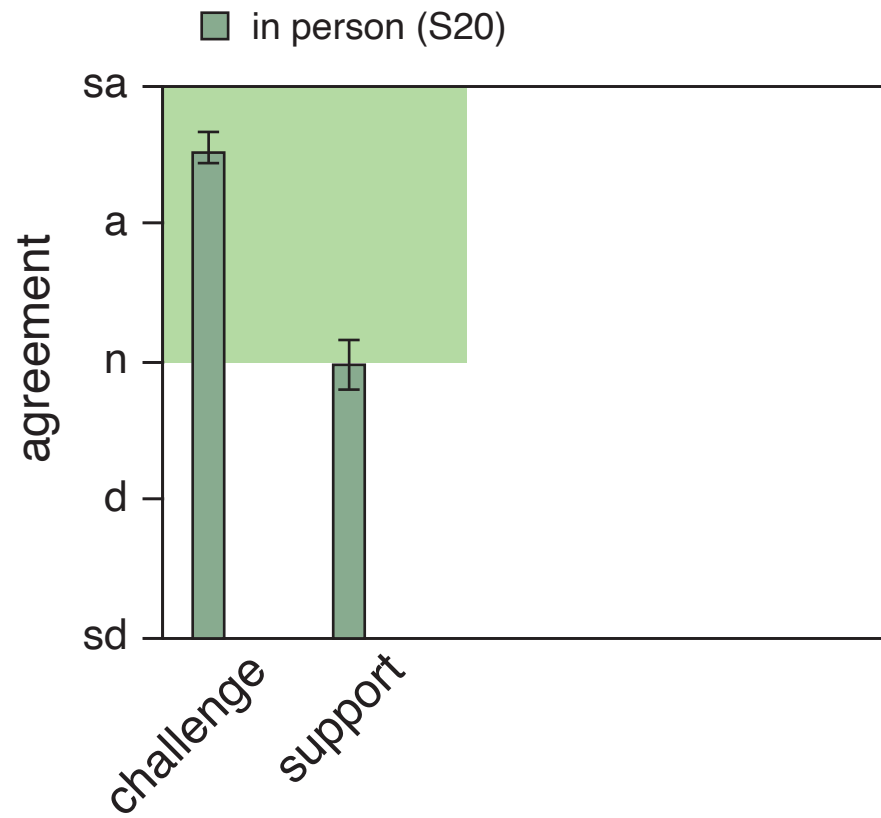
challenge vs. support

- 1. I was challenged intellectually**
- 2. I had plenty of support**
3. I am closer to mastering the ideas of the course now
4. I made progress because of my own efforts and choices
5. I felt I was part of a community of learners

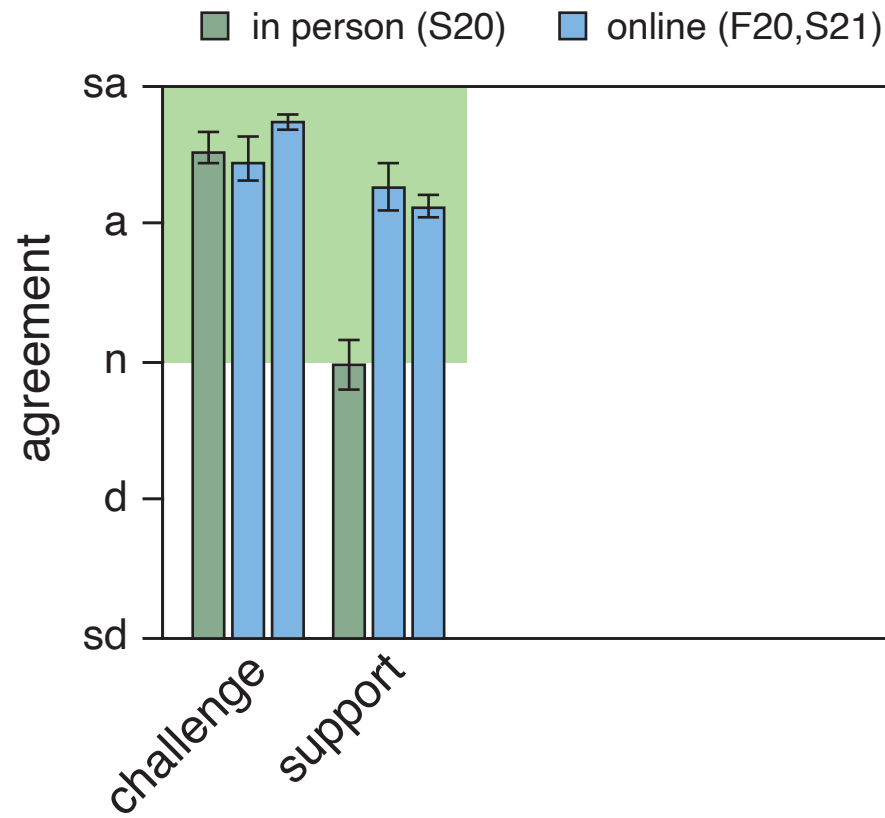
challenge vs. support



challenge vs. support



challenge vs. support





self-determination

1. I was challenged intellectually (challenge)

2. I had plenty of support (support)

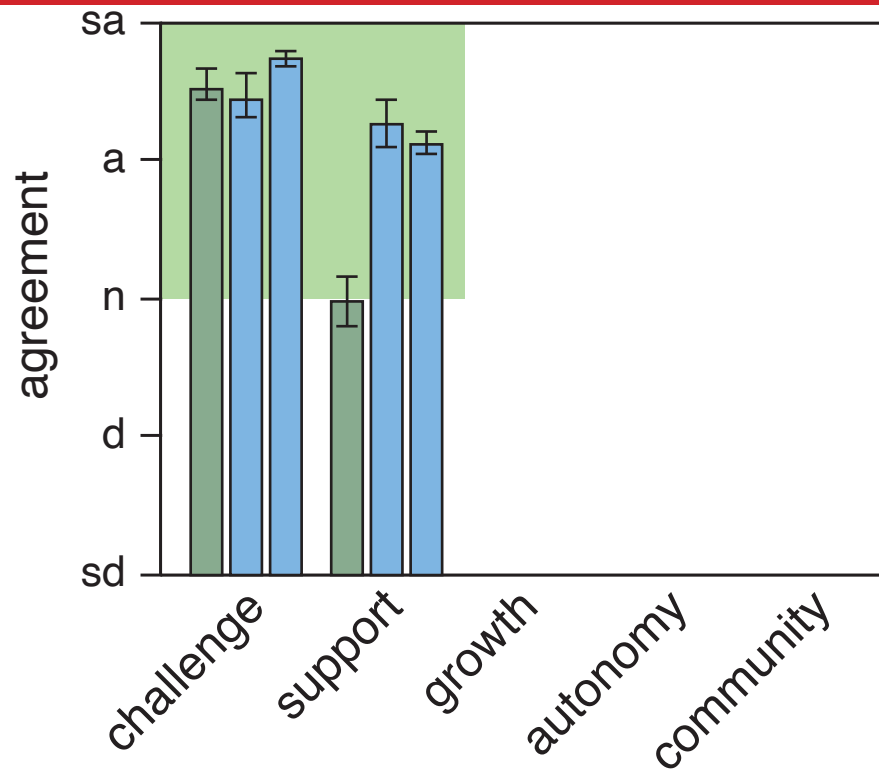
3. I am closer to mastering the ideas of the course now (growth)

4. I made progress because of my own efforts and choices (auton.)

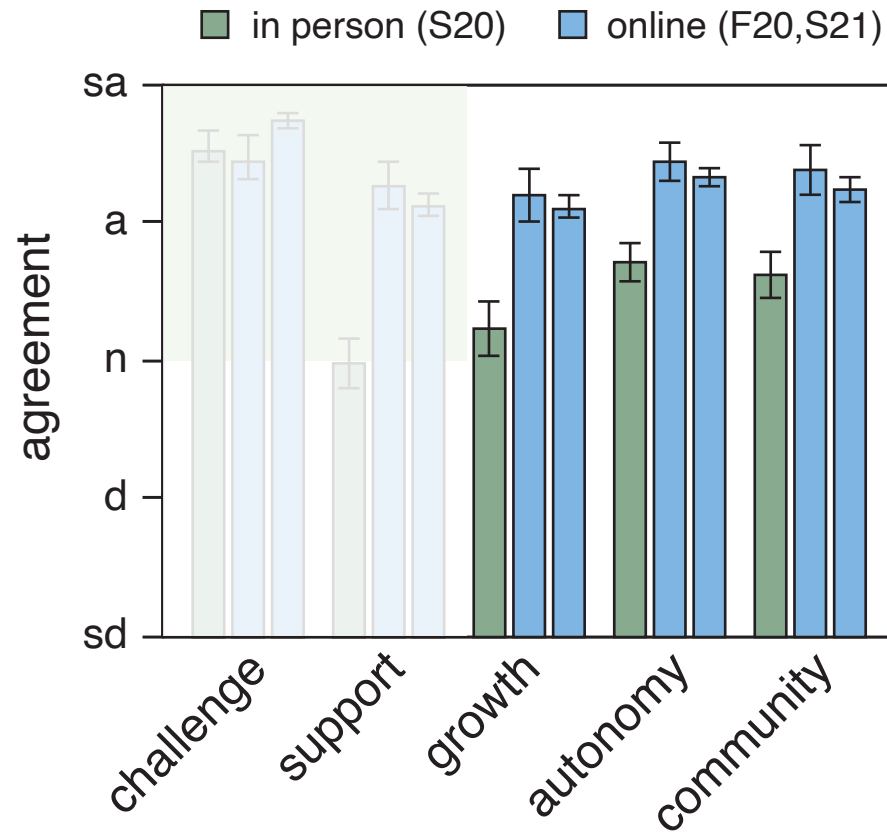
5. I felt I was part of a community of learners (relatedness)

self-determination

What do you predict?



self-determination





I did my best teaching *ever* online!



1 pandemic lessons **2** new normal

A group of people in a modern office setting, working on laptops and discussing projects. The image is semi-transparent, serving as a background for the text.

weekly workflow

1 pandemic lessons

2 new normal

weekly workflow

content module

practical work

1 pandemic lessons

2 new normal

weekly workflow

content module

practical work

reading

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

practical work

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

tutorial

practical work

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

tutorial

challenge

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76 CHAPTER 4 MOMENTUM

In the preceding two chapters, we developed a mathematical framework for describing motion along a straight line. In this chapter, we continue our study of motion by investigating inertia, a property of objects that affects their motion. The experiments we carry out in studying inertia lead us to discover one of the most fundamental laws in physics—conservation of momentum.

4.1 Friction

Picture a block of wood sitting motionless on a smooth wooden surface. If you give the block a shove, it slides some distance but eventually comes to rest. Depending on the smoothness of the block and the smoothness of the wooden surface, this stopping may happen sooner or it may happen later. If the two surfaces in contact are very smooth and slippery, the block slides for a longer time interval than if the surfaces are rough or sticky. This you know from everyday experience: A hockey puck slides easily on ice but not on a rough road.

Figure 4.1 shows how the velocity of a wooden block decreases on three different surfaces. The slowing down is due to *friction*—the resistance to motion that one surface or object encounters when moving over another. Notice that, during the interval covered by the velocity-versus-time graph, the velocity decrease as the block slides over ice is hardly observable. The block slides easily over ice because there is very little friction between the two surfaces. The effect of friction is to bring two objects to rest with respect to each other—in this case the wooden block and the surface it is sliding on. The less friction there is, the longer it takes for the block to come to rest.

Figure 4.1 Velocity-versus-time graph for a wooden block sliding on three different surfaces. The rougher the surface, the more quickly the velocity decreases.



Figure 4.2 Low-friction track and carts used in the experiments described in this chapter.



You may wonder whether it is possible to make surfaces that have no friction at all, such that an object, once given a shove, continues to glide forever. There is no totally frictionless surface over which objects slide forever, but there are ways to minimize friction. You can, for instance, float an object on a cushion of air. This is most easily accomplished with a low-friction track—a track whose surface is dotted with little holes through which pressurized air blows. The air serves as a cushion on which a conveniently shaped object can float, with friction between the object and the track all but eliminated. Alternatively, one can use wheeled carts with low-friction bearings on an ordinary track. Figure 4.2 shows low-friction carts you may have encountered in your lab or class. Although there is still some friction both for low-friction tracks and for the track shown in Figure 4.2, this friction is so small that it can be ignored during an experiment. For example, if the track in Figure 4.2 is horizontal, carts move along its length without slowing down appreciably. In other words:

In the absence of friction, objects moving along a horizontal track keep moving without slowing down.

Another advantage of using such carts is that the track constrains the motion to being along a straight line. We can then use a high-speed camera to record the cart's position at various instants, and from that information determine its speed and acceleration.

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Figure 4.1 shows how the velocity of a wooden block decreases on three different surfaces. The slowing down is due to *friction*—the resistance to motion that one surface or object encounters when moving over another. Notice that, during the interval covered by the velocity-versus-time graph, the velocity decreases as the block slides over ice; it hardly decreases as the block slides over a smooth surface; and it decreases rapidly as the block slides over a rough surface. The effect of friction is to bring two objects to rest with respect to each other—in this case the wooden block and the surface it is sliding on. The less friction there is, the longer it takes for the block to come to rest.

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highlighting text...

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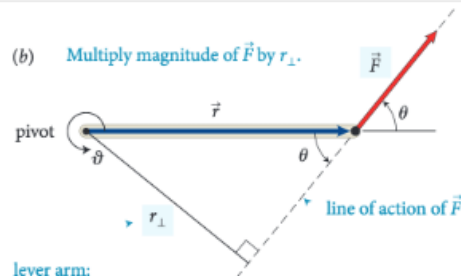
Another advantage of using such carts is that the track constrains the motion to being along a straight line. We can then use a high-speed camera to record the cart's position at various instants, and from that information determine its speed and acceleration.

? No friction at all seems impossible. Isn't there always some friction in any real case.

Nov 1 4:41 pm

Enter your comment or question and press Enter

(b) Multiply magnitude of \vec{F} by r_{\perp} .



lever arm:
perpendicular distance
from line of action of force to rotation axis (pivot)

action of the force and the axis of rotation. So, the torque caused by a force exerted on an object is the product of the magnitude of the force and its lever arm distance. It can be written equivalently as rF_{\perp} and as $r_{\perp}F$.

Like other rotational quantities, torque carries a sign that depends on the choice of direction for increasing ϑ . In Figure 12.4, for example, the torque caused by \vec{F}_1 about the pivot tends to rotate the rod in the direction of increasing ϑ and so is positive; the torque caused by \vec{F}_2 is negative. The sum of the two torques about the pivot is then $r_1F_1 + (-r_2F_2)$. As we've seen, the two torques are equal in magnitude when the rod is balanced, and so the sum of the torques is zero. When the sum of the torques is not zero, the rod's rotational acceleration is nonzero, and so its rotational velocity and angular momentum change.

In the situations depicted in Figures 12.4 and 12.5 we used the pivot to calculate the lever arm distances. This is a natural choice because that is the point about which the object under consideration is free to rotate. However, torques also play a role for stationary objects that are suspended or supported at several different points and that are not free to rotate—for example, a plank or bridge supported at either end. To determine what reference point to use in such cases, complete the following exercise.

Exercise 12.1 Reference point

Consider again the rod in Figure 12.4. Calculate the sum of the torques about the left end of the rod.

SOLUTION: I begin by making a sketch of the rod and the three

reference point



The lever arm distances must now be determined relative to the left end of the rod. The lever arm distance of force \vec{F}_1 to this point is zero, and so the torque caused by that force about the left end of the rod is zero. If I choose counterclockwise as the positive direction of rotation, \vec{F}_2 causes a negative torque about the left end of the rod; the force \vec{F}_{pr} exerted by the pivot causes a positive torque about the left end of the rod. The lever arm distance of \vec{F}_2 about the left end of the rod is $r_1 + r_2$; that of \vec{F}_{pr} is r_1 . Because the rod is at rest, the magnitude of the force exerted by the pivot is equal to the sum of the forces \vec{F}_1 and \vec{F}_2 . Taking into account the signs of the torques, we find that the sum of the torques about the left end of the rod is $r_1(F_1 + F_2) - (r_1 + r_2)F_2 = r_1F_1 - r_2F_2$. This is the same result we obtained for the torques about the pivot, and so the sum of the torques about the left end is zero. ✓

Exercise 12.1 shows that the sum of the torques about the left end of the rod is zero, just like the sum of the torques about the pivot. You can repeat the calculation for the torques about the right end of the rod or any other point, and each time you will find that the sum of the torques is zero. The reason is that the rod is not rotating about any point, and so the sum of the torques must be zero about any point. In general we can say:

For a stationary object, the sum of the torques is zero.

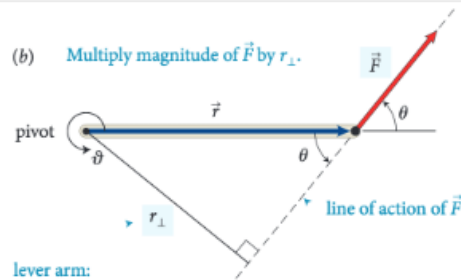
For a stationary object we can choose any reference point we like to calculate torques. It pays to choose a reference point that simplifies the calculation. As you have seen, we do not need to consider any force that is exerted at the reference point. So, by putting the reference point at the point of application of a force, we can eliminate that force from the calculation.



12.2 In the situation depicted in Figure 12.2a, you must continue to exert a force on the seesaw to keep the child off the ground. The force you exert causes a torque on the seesaw, and yet the seesaw's rotational acceleration is zero. How can this be if torques cause objects to accelerate rotationally?

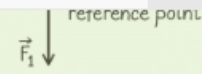
Example 12.2 Torques on lever

Three forces are exerted on the lever of Figure 12.7. Forces \vec{F}_1 and \vec{F}_3 are equal in magnitude, and the magnitude of \vec{F}_2 is half as great. Force \vec{F}_1 is horizontal, \vec{F}_2 and \vec{F}_3 are vertical, and the lever

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Perusall AP50 Fall 2015 » Chapter 12 Group 1's comments Page 284 Eric Mazur

reference point

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through self-paced Peer Instruction**

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each table: agree on a team name

Enter the name of your team. Make sure that everyone

Team name:

23

✓ [OK](#)

name of your team goes here!

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23
Lukoff, Brian
Miller, Kelly

Please wait for your instructor to start the individual round.

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This is the individual round; work on these questions on your own.



Jump to ▼

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many choice question

Teaching by questioning, as described in the Science article you read has the following advantage(s) over the traditional lecture method (check all that apply)

A.

Students engage in meaningful thinking during class time

B.

Students become emotionally invested in the learning process

C.

It provides an opportunity for the instructor to integrate technology (such as clickers) into the classroom

D.

Students help each other resolve misunderstandings more effectively

E.

Promotes memorization of factual questions

You may select zero, one, or many answers.

Submit response

Current team: 23  [Change team](#)

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Jump to ▼

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+ [Show my team's responses](#)

multiple choice question

For an assessment like this to work in an online setting which of the following must be true? (check all that apply)

A.

The questions must have a correct answer.

B.

The questions must not be so difficult that the best students can't score 100% individually

C.

Each of the questions must permit at least 3 choices

D.

The instructor must make sure that the answers to the questions are not available on the internet.

E.

The questions must involve thinking skills on Bloom's taxonomy higher than memorization (understanding or higher).

F.

The assessment must be low-stakes and frequent

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+ [Show my team's responses](#)

C, D, E, and F
Brian Lukoff

A, C, D, E, and F
Kelly Miller

many choice question

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Readiness Assurance

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Jump to ▼

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+ [Show my team's responses](#)

C, D, E, and F
Brian Lukoff

A, C, D, E, and F
Kelly Miller

many choice question

1st attempt: 4 pts

2nd attempt: 2 pts

3rd attempt: 1 pt

4th attempt: solution revealed

For an assessment like this to work in an online setting which of the following must be true? (check all that apply)

A.

The questions must have a correct answer.

B.

The questions must not be cumulative. If you can't score on a question, you can't score on the next one.

C.

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Readiness Assurance

You have completed all of the questions.

5/5 questions attempted, 13.0/20 possible points in team round [Q Score details](#)

Question	Individual Result	Points	Team Result	Points	Total Points
1	Correct	4.0	Correct (on attempt 1)	4.0	4.0
2	Correct	4.0	Correct (on attempt 2)	2.0	3.0
3	Incorrect	0.0	Correct (on attempt 1)	4.0	2.0
4	Correct	4.0	Correct (on attempt 2)	2.0	3.0
5	Incorrect	0.0	Correct (on attempt 3)	1.0	0.5
Total		12.0		13.0	12.5

<http://bit.ly/remoterAA>

Readiness Assurance

- teambasedlearning.org
- need to make questions difficult
- need to “de-Google” questions

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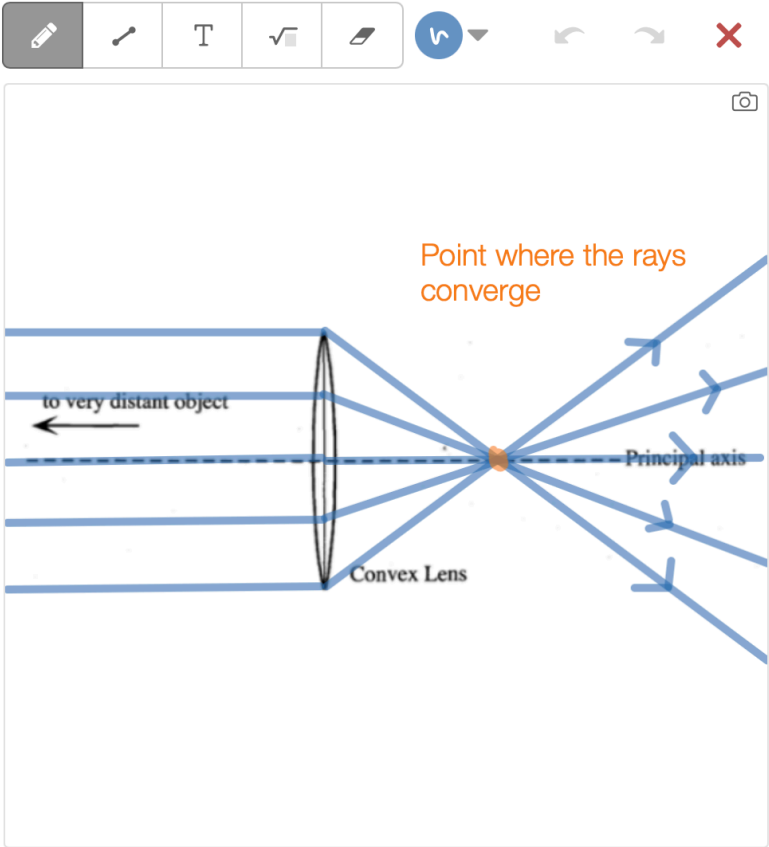
project work

resolve common misconceptions

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Part 2. Ray tracing and convex lenses



B. Consider a point on the distant object that is also on the principal axis of the lens. On the diagram, sketch several rays from this distant point that reach the lens.

How are these rays oriented with respect to one another and to the principal axis? Explain.

they are parallel



Submit

On the basis of your observations from part A, show the continuation of each of these rays through the lens and out the other side. On the diagram, indicate where the rays converge.

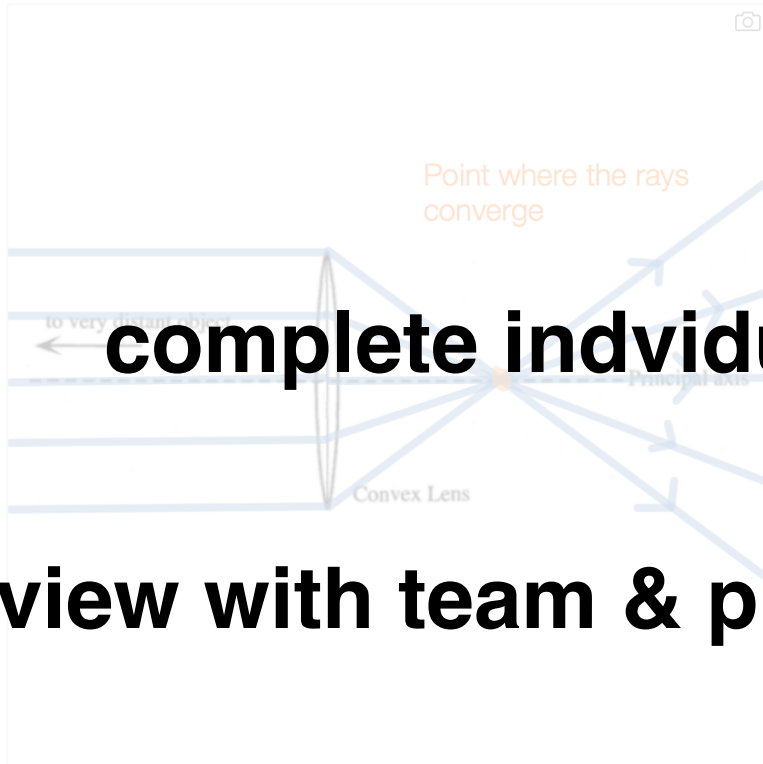
Note: Refraction takes place at the two surface of the lens. However, in drawing a diagram for a thin lens, it is customary to draw rays as if all refraction takes place at the center of the lens.

In the diagram below x represents the x location of the orange point below. The dashed lines represent a few of the rays that emanate from the orange point and hit the red vertical plane.

Try entering a large negative number below to test your answer

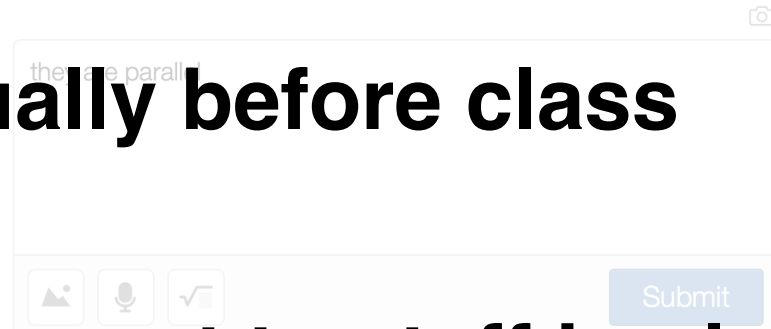
desmos.com

Part 2. Ray tracing and convex lenses



B. Consider a point on the distant object that is also on the principal axis of the lens. On the diagram, sketch several rays from this distant point that reach the lens.

How are these rays oriented with respect to one another and to the principal axis? Explain.



Note: Refraction takes place at the two surface of the lens. However, in drawing a diagram for a thin lens, it is customary to draw rays as if all refraction takes place at the center of the lens.

In the diagram below x represents the x location of the orange point below. The dashed lines represent a few of the rays that emanate from the orange point and hit the red vertical plane.

Try entering a large negative number below to test your answer



1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

tutorial

challenge

practical work

skills session

project work

1 pandemic lessons

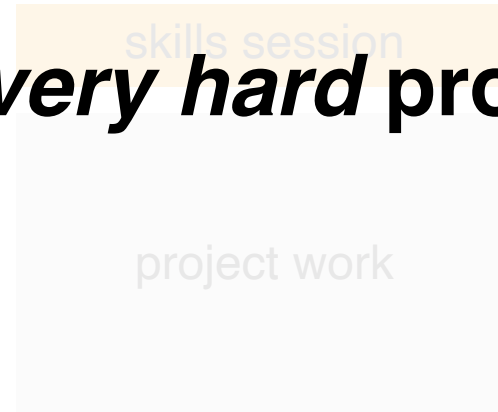
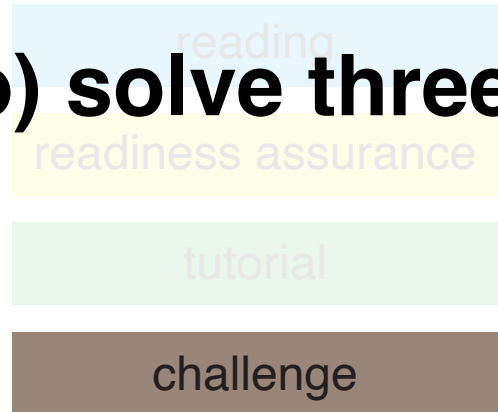
2 new normal

weekly workflow

(try to) solve three *very hard* problems

content module

practical work



1 pandemic lessons

2 new normal

weekly workflow

content module

practical work

(try to) solve three *very hard* problems
(and reflect on your work)

reading
readiness assurance
tutorial

skills session
project work

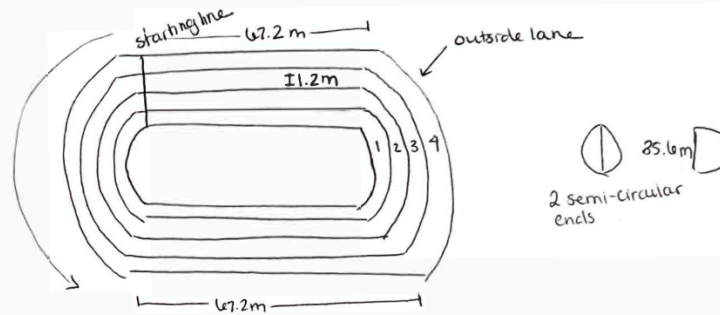
challenge

1 pandemic lessons

2 new normal

Question 2

1. Getting Started: The goal here is to look at a 4-lane track with given measurements for straightaways and curves and to calculate how much more distance the runner on the outside lane would run given a specified starting point.



upload individual work before class

2. Devise a Plan

- ① Calculate how much the runner in lane 1 runs
 - ② calculate how much runner in lane 2 runs
 - ③ calculate how much runner in lane 3 runs
 - ④ calculate how much runner in lane 4 runs
 - ⑤ double check by subtracting lane 1 from lane 4 distance
- each time, add the lane thickness allotted,
2 straightaways + appropriate diameter

3. Execute the Plan

- ① straightaways for runner 4: $67.2 \text{ m} + 67.2 \text{ m} = 134.4 \text{ m}$
 curves: $35.6 \text{ diameter} - 0 \text{ m}$ (no lane adjustment)
 $35.6 \pi = 111.84$
 distance around curve is circumference, $2\pi r$ (whole circle, since 2 curves)
 Curves for runner in lane 4: 246.2 m
 + straightaways

- ② Runner 3: $67.2 \text{ m} + 67.2 \text{ m} = 134.4 \text{ m}$ straightaways
 curves: $35.6 - 1.2 - 1.2 = 33.2$
 distance around both curves is $2\pi r = 33.2 \pi = 104.3$
 altogether runner in lane 3: 238.7

- ③ Runner in lane 2: $67.2 \text{ m} + 67.2 \text{ m} = 134.4 \text{ m}$ straightaways
 curves: $35.6 - 1.2 - 1.2 - 1.2 - 1.2 = \text{diameter of } 30.8$
 distance around both curves = $2\pi r = 30.8 \pi = 96.8$
 altogether runner in lane 2: 231.2 m

- ④ Runner in lane 1: $67.2 \text{ m} + 67.2 \text{ m} = 134.4 \text{ m}$ straightaways
 curves: $35.6 - 1.2 - 1.2 - 1.2 - 1.2 - 1.2 - 1.2 = 28.4$
 distance around both curves is $2\pi r = 28.4 \pi = 89.2$
 altogether runner in lane 1: 223.6 m
 AP50 F2021

- ⑤ lane 4 distance - lane 1 distance $\rightarrow 246.2 \text{ m} - 223.6 \text{ m} = 22.6 \text{ m extra}$

4. Evaluate the Plan

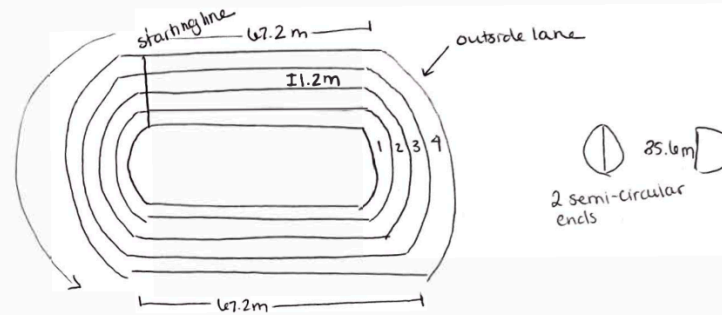
This seems reasonable, both in expectation as well as considering why a track stagger starts to offset the difference (runner in lane 4 would start 20 m ahead or so here so as to not run extra).

Another way to check is to do
 $35.6 \pi - (35.6 - 6(1.2)) \pi$,
 which is the difference of diameters. This checks out!

gradescope.com

Question 2

1. Getting Started: The goal here is to look at a 4-lane track with given measurements for straightaways and curves and to calculate how much more distance the runner on the outside lane would run given a specified starting point.



upload individual work before class

2. Devise a Plan

- ① Calculate how much the runner in lane 4 runs
 - ② calculate how much the runner in lane 1 runs
 - ③ calculate how much runner in lane 4 runs
 - ④ calculate how much runner in lane 1 runs
 - ⑤ double check by subtracting lane 1 from lane 4 distance
- (evaluated on effort)

4. Evaluate the Plan

This seems reasonable, both in expectation as well as considering why a track stagger starts to offset the difference (runner in lane 4 would start 20 m ahead or so here so as to not run extra).

Another way to check is to do $35.6\pi - (35.6 - 6(1-2))\pi$, which is the difference of diameters. This checks out!

3. Execute the Plan

- ① straightaways for runner 4: $67.2\text{ m} + 67.2\text{ m} = 134.4\text{ m}$
 curves: $35.6\text{ diameter} - 0\text{ m}$ (no lane adjustment)
 $35.6\pi = 111.84$
 distance around curve is circumference, $2\pi r$ (whole circle, since 2 curves)
 curves for runner in lane 4: 246.2 m
 + straightaways

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 curves: $35.6 - 1.2 - 1.2 - 1.2 - 1.2 = \text{diameter of } 30.8$
 distance around both curves = $2\pi r = 30.8\pi = 96.8$
 altogether runner in lane 2: 231.2 m

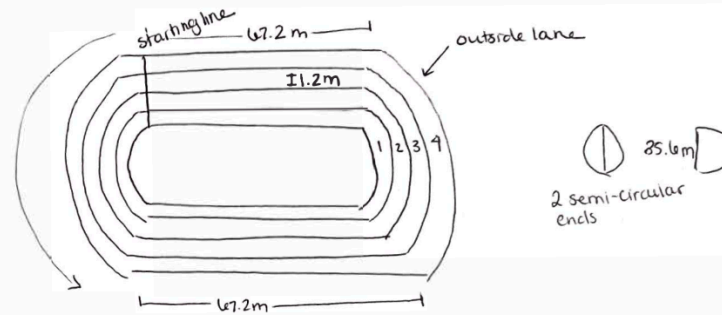
- ④ Runner in lane 1: $67.2\text{ m} + 67.2\text{ m} = 134.4\text{ m}$ straightaways
 curves: $35.6 - 1.2 - 1.2 - 1.2 - 1.2 - 1.2 = 28.4$
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 AP50 F2021

- ⑤ lane 4 distance - lane 1 distance $\rightarrow 246.2\text{ m} - 223.6\text{ m} = 22.6\text{ m extra}$

gradescope.com

Question 2

1. Getting started: The goal here is to look at a 4-lane track with given measurements for straightaways and curves and to calculate how much more distance the runner on the outside lane would run given a specified starting point.



2. Devise a Plan

- ① Calculate how much the runner in lane 1 runs
 - ② calculate how much runner in lane 2 runs
 - ③ calculate how much runner in lane 3 runs
 - ④ calculate how much runner in lane 4 runs
 - ⑤ double check by subtracting lane 1 from lane 4 distance
- each time, add the lane thickness allotted,
2 straightaways + appropriate diameter

3. Execute the Plan

- (inside)
- ① straightaways for runner 4: $67.2\text{ m} + 67.2\text{ m} = 134.4\text{ m}$
 curves: $35.6\text{ diameter} - 0\text{ m}$ (no lane adjustment)
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 curves: $35.6 - 1.2 - 1.2 - 1.2 - 1.2 = \text{diameter of } 30.8$
 distance around both curves = $2\pi r = 30.8\pi = 96.8$
 altogether runner in lane 2: 231.2 m

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 curves: $35.6 - 1.2 - 1.2 - 1.2 - 1.2 - 1.2 = 28.4$
 distance around both curves is $2\pi r = 28.4\pi = 89.2$
 altogether runner in lane 1: 223.6 m
 AP50 F2021

- ⑤ lane 4 distance - lane 1 distance $\rightarrow 246.2\text{ m} - 223.6\text{ m} = 22.6\text{ m extra}$

4. Evaluate the Plan

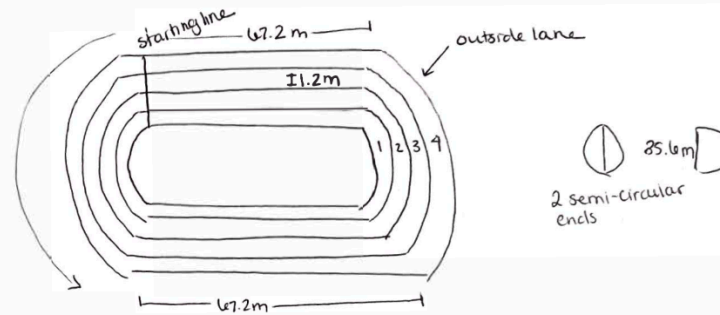
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Another way to check is to do
 $35.6\pi - (35.6 - 6(1.2))\pi$,
 which is the difference of diameters. This checks out!

gradescope.com

Question 2

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2. Devise a Plan

- ① Calculate how much the runner in lane 1 runs
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3. Execute the Plan

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 distance around both curves is $2\pi r = 33.2 \pi = 104.3$
 altogether runner in lane 3: 238.7

- ③ Runner in lane 2: $67.2 \text{ m} + 67.2 \text{ m} = 134.4 \text{ m}$ straightaways
 curves: $35.6 - 1.2 - 1.2 - 1.2 - 1.2 = \text{diameter of } 30.8$
 distance around both curves = $2\pi r = 30.8 \pi = 96.8$
 altogether runner in lane 2: 231.2 m

- ④ Runner in lane 1: $67.2 \text{ m} + 67.2 \text{ m} = 134.4 \text{ m}$ straightaways
 curves: $35.6 - 1.2 - 1.2 - 1.2 - 1.2 - 1.2 = 28.4$
 distance around both curves is $2\pi r = 28.4 \pi = 89.2$
 altogether runner in lane 1: 223.6 m
 AP50 F2021

- ⑤ lane 4 distance - lane 1 distance $\rightarrow 246.2 \text{ m} - 223.6 \text{ m} = 22.6 \text{ m extra}$

4. Evaluate the Plan

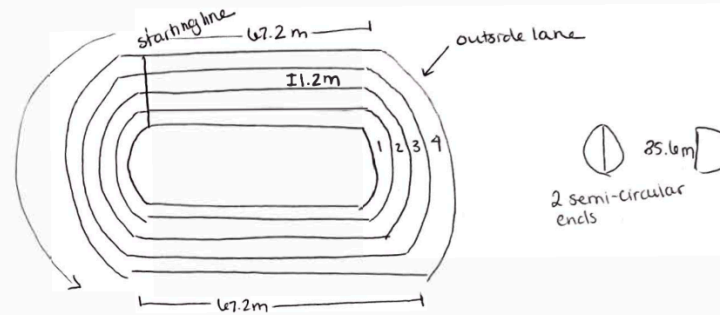
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gradescope.com

Question 2

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2. Devise a Plan

- ① Calculate how much the runner in lane 1 runs
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 curves: $35.6 - 1.2 - 1.2 - 1.2 - 1.2 - 1.2 = 28.4$
 distance around both curves is $2\pi r = 28.4\pi = 89.2$
 altogether runner in lane 1 = 223.6 m
 AP50 F2021

4. Evaluate the Plan

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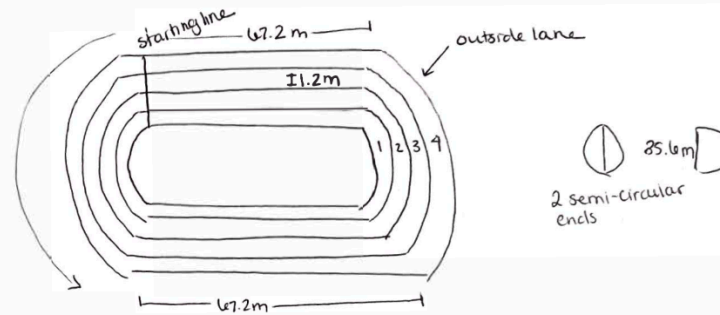
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⑤ lane 4 distance - lane 1 distance $\rightarrow 246.2\text{ m} - 223.6\text{ m} = 22.6\text{ m extra}$

gradescope.com

Question 2

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2. Devise a Plan

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3. Execute the Plan

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 distance around both curves = $2\pi r = 30.8\pi = 96.8$
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 altogether runner in lane 1: 223.6 m
 AP50 F2021

4. Evaluate the Plan

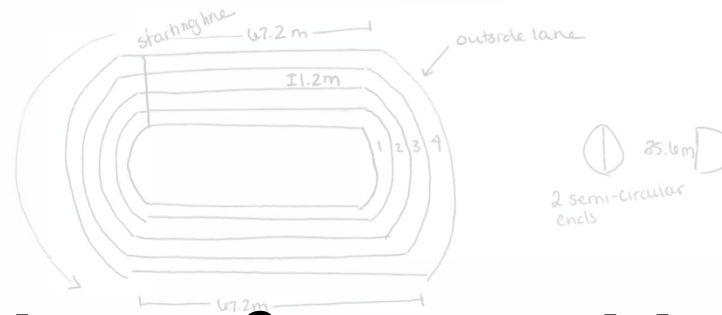
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gradescope.com

Question 2

1. Getting started: The goal here is to look at a 4-lane track with given measurements for straightaways and curves and to calculate how much more distance the runner in the outside lane would run given a specified starting point.



review with team & present to staff in class

2. Devise a Plan

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 altogether runner in lane 3: 238.7

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 curves: $35.6 - 1.2 - 1.2 - 1.2 - 1.2 = \text{diameter of } 30.8$
 distance around both curves = $2\pi r = 30.8\pi = 96.8$
 altogether runner in lane 2: 231.2 m

- ④ Runner in lane 1: $67.2\text{ m} + 67.2\text{ m} = 134.4\text{ m}$ straightaways
 curves: $35.6 - 1.2 - 1.2 - 1.2 - 1.2 - 1.2 - 1.2 = 28.4$
 distance around both curves is $2\pi r = 28.4\pi = 89.2$
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 AP50 F2021

- ⑤ lane 4 distance - lane 1 distance $\rightarrow 246.2\text{ m} - 223.6\text{ m} = 22.6\text{ m extra}$

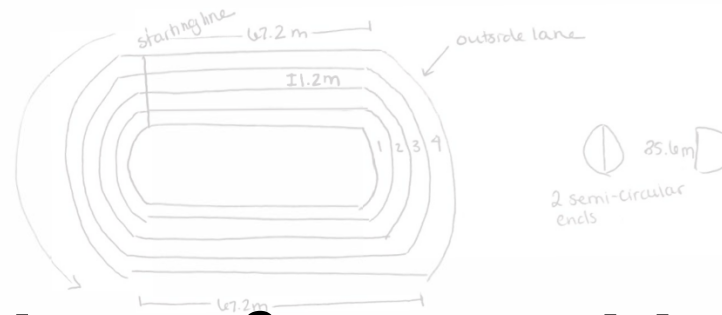
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gradescope.com

1. Getting started: The goal here is to look at a 4-lane track with given measurements for straightaways and curves and to calculate how much more distance the runner on the outside lane would run given a specified starting point.



review with team & present to staff in class

2. Devise a Plan

- ① Calculate how much the runner in lane 1 runs
 - ② Calculate how much runner in lane 2 runs
 - ③ Calculate how much runner in lane 3 runs
 - ④ Calculate how much runner in lane 4 runs
- each time, add the lane thickness allotted, 2 straightaways + appropriate diameter

⑤ Subtract by subtracting lane 1 from lane 4 distance

mark up, write reflection, & reupload after class

3. Execute the Plan

- ① straightaways for runner 4: $67.2\text{ m} + 67.2\text{ m} = 134.4\text{ m}$
 curves: $35.6\text{ diameter} - 0\text{ m}$ (no lane adjustment)
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 curves: $35.6 - 1.2 - 1.2 - 1.2 - 1.2 - 1.2 = 28.4$
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 altogether runner in lane 1: 223.6 m
 AP50 F2021
- ⑤ Lane 4 distance - Lane 1 distance $\rightarrow 246.2\text{ m} - 223.6\text{ m} = 22.6\text{ m extra}$

gradescope.com

weekly workflow

content module

reading

readiness assurance

tutorial

challenge

practical work

skills session

project work

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

develop relevant skills

challenge

practical work

skills session

project work

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

develop relevant skills

challenge

practical work

skills session

project work

(team work, taking data, building circuits, etc.)

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

tutorial

challenge

practical work

skills session

project work

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

tutorial

challenge

practical work

skills session

project work

3 month-long projects per semester (six total)

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

tutorial

challenge

practical work

skills session

project work

3 month-long projects per semester (six total)
new team for each project

1 pandemic lessons

2 new normal



classrooms are a constraint

1 pandemic lessons

2 new normal

InnoBreakCafe

learning space

content module

reading

readiness assurance

tutorial

challenge

practical work

skills session

project work

1 pandemic lessons

2 new normal

InnoBreakCafe

learning space

content module

reading

ONLINE

readiness assurance

tutorial

challenge

practical work

skills session

project work

1 pandemic lessons

2 new normal

InnoBreakCafe

learning space

content module

reading

ONLINE

readiness assurance

tutorial

challenge

FLEX SPACE

practical work

skills session

project work

1 pandemic lessons

2 new normal

InnoBreakCafe

learning space

content module

reading

ONLINE

readiness assurance

tutorial

challenge

FLEX SPACE

practical work

skills session

project work

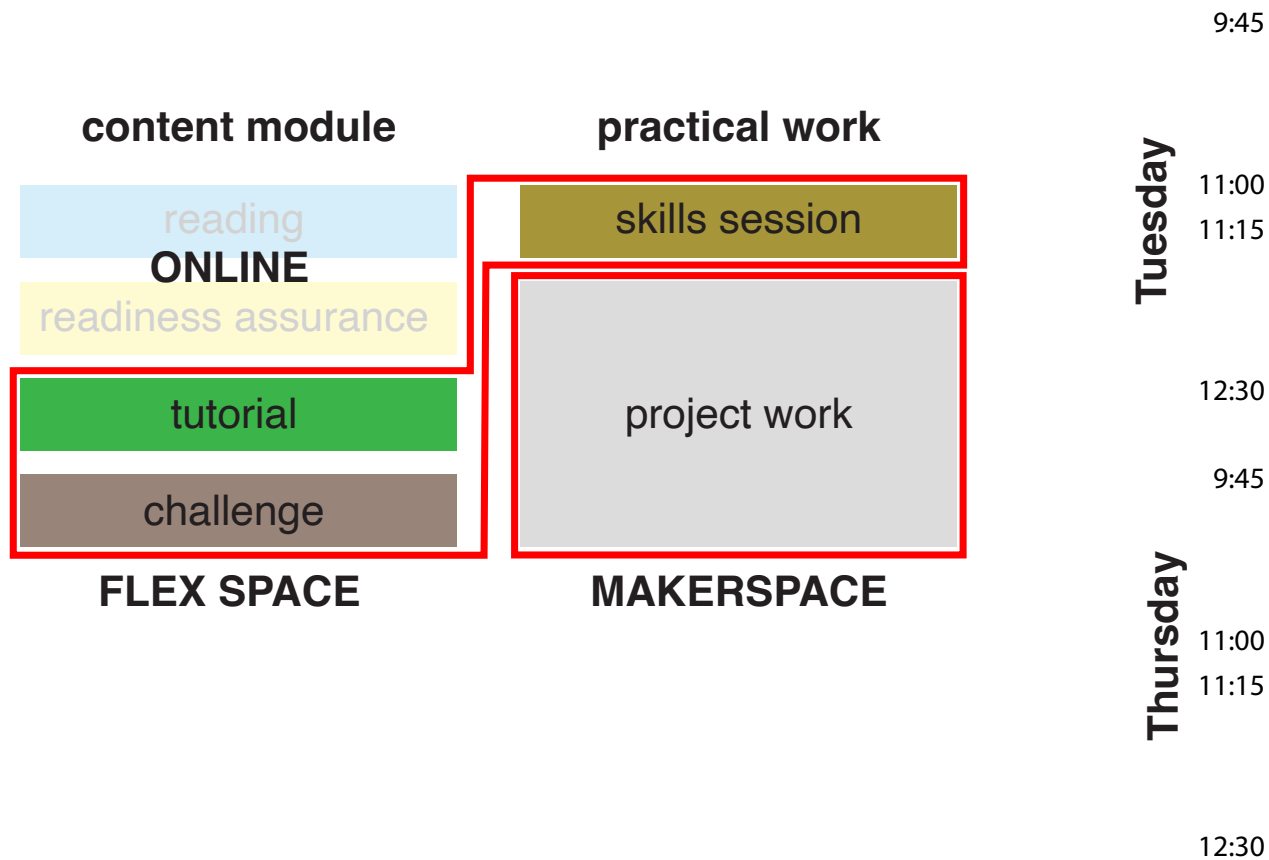
MAKERSPACE

1 pandemic lessons

2 new normal

InnoBreakCafe

learning space



1 pandemic lessons

2 new normal

InnoBreakCafe

learning space

COHORTS

A B C D

9:45

content module

practical work

reading

ONLINE

readiness assurance

skills session

tutorial

challenge

project work

FLEX SPACE

MAKERSPACE

Tuesday

11:00

11:15

12:30

9:45

Thursday

11:00

11:15

12:30

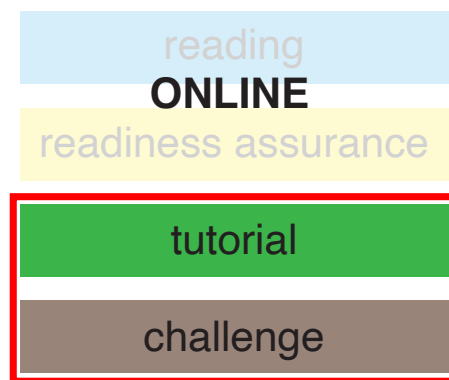
1 pandemic lessons

2 new normal

InnoBreakCafe

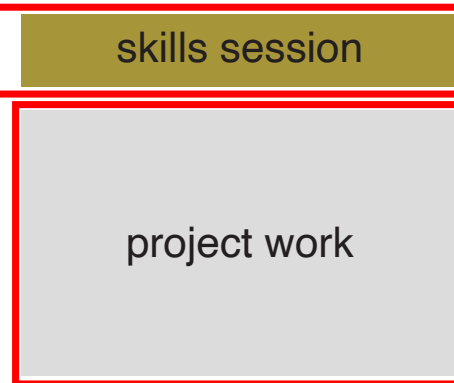
learning space

content module



FLEX SPACE

practical work



MAKERSPACE

COHORTS

	A	B	C	D
Tuesday	9:45			
Thursday	9:45			

	A	B	C	D
Tuesday	9:45			
Thursday	9:45			

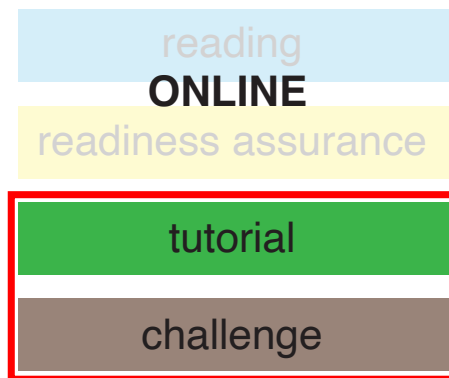
1 pandemic lessons

2 new normal

InnoBreakCafe

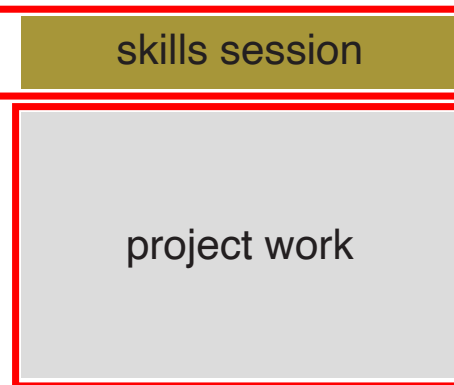
learning space

content module



FLEX SPACE

practical work



MAKERSPACE

COHORTS

	A	B	C	D
Tuesday	9:45	Team Review of Tutorial LL2.229	Project A.L.L	Skills LL2.223
	11:00			
	11:15	Project A.L.L	Skills LL2.223	Team Review of Tutorial LL2.229
	12:30			
Thursday	9:45	Team Review of Challenge LL2.229	Skills LL2.223	Project A.L.L
	11:00			
	11:15	Skills LL2.223	Project A.L.L	Team Review of Challenge LL2.229
	12:30			

1 pandemic lessons

2 new normal



1 pandemic lessons **2** new normal



“breaking down classroom walls”

1 pandemic lessons

2 new normal

the new (not so) normal



1 pandemic lessons

2 new normal

the new (not so) normal

- no lectures

1 pandemic lessons

2 new normal

the new (not so) normal

- no lectures
- no exams

1 pandemic lessons

2 new normal

the new (not so) normal

- no lectures
- no exams
- no (fixed) classroom

1 pandemic lessons

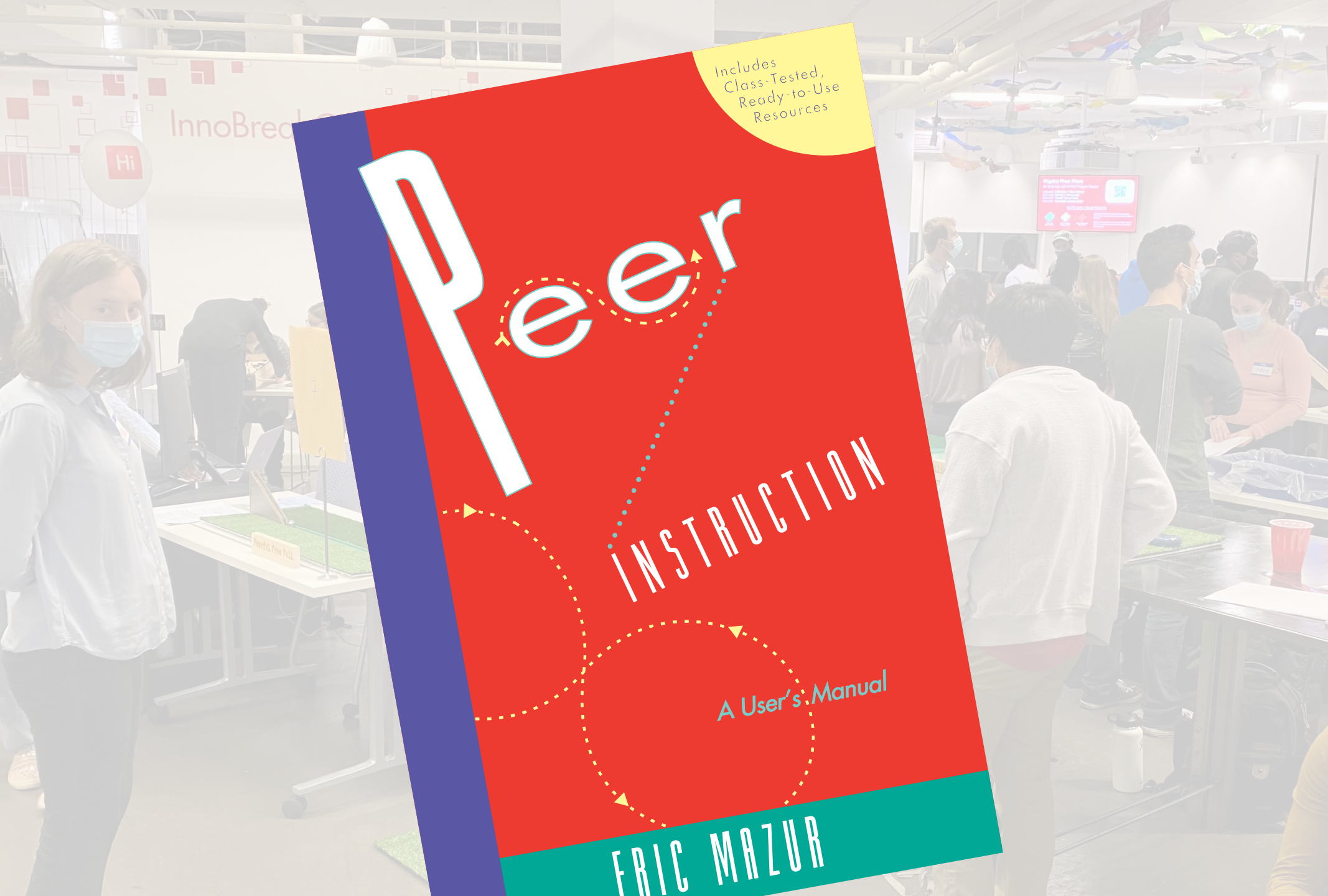
2 new normal

the new (not so) normal

- no lectures
- no exams
- no (fixed) classroom
- no (fixed) start or end time

1 pandemic lessons

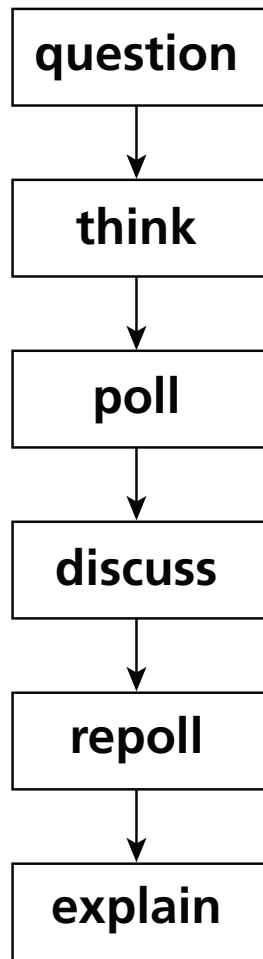
2 new normal



1 pandemic lessons

2 new normal

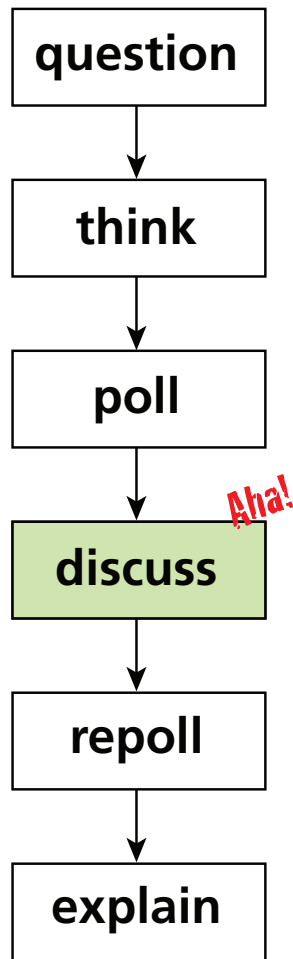
3 self-paced PI



1 pandemic lessons

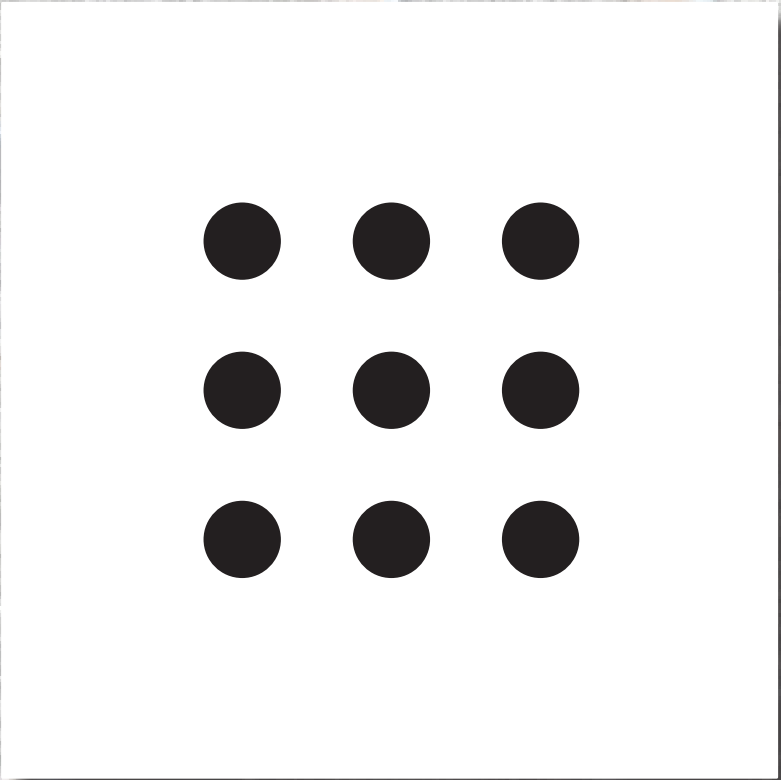
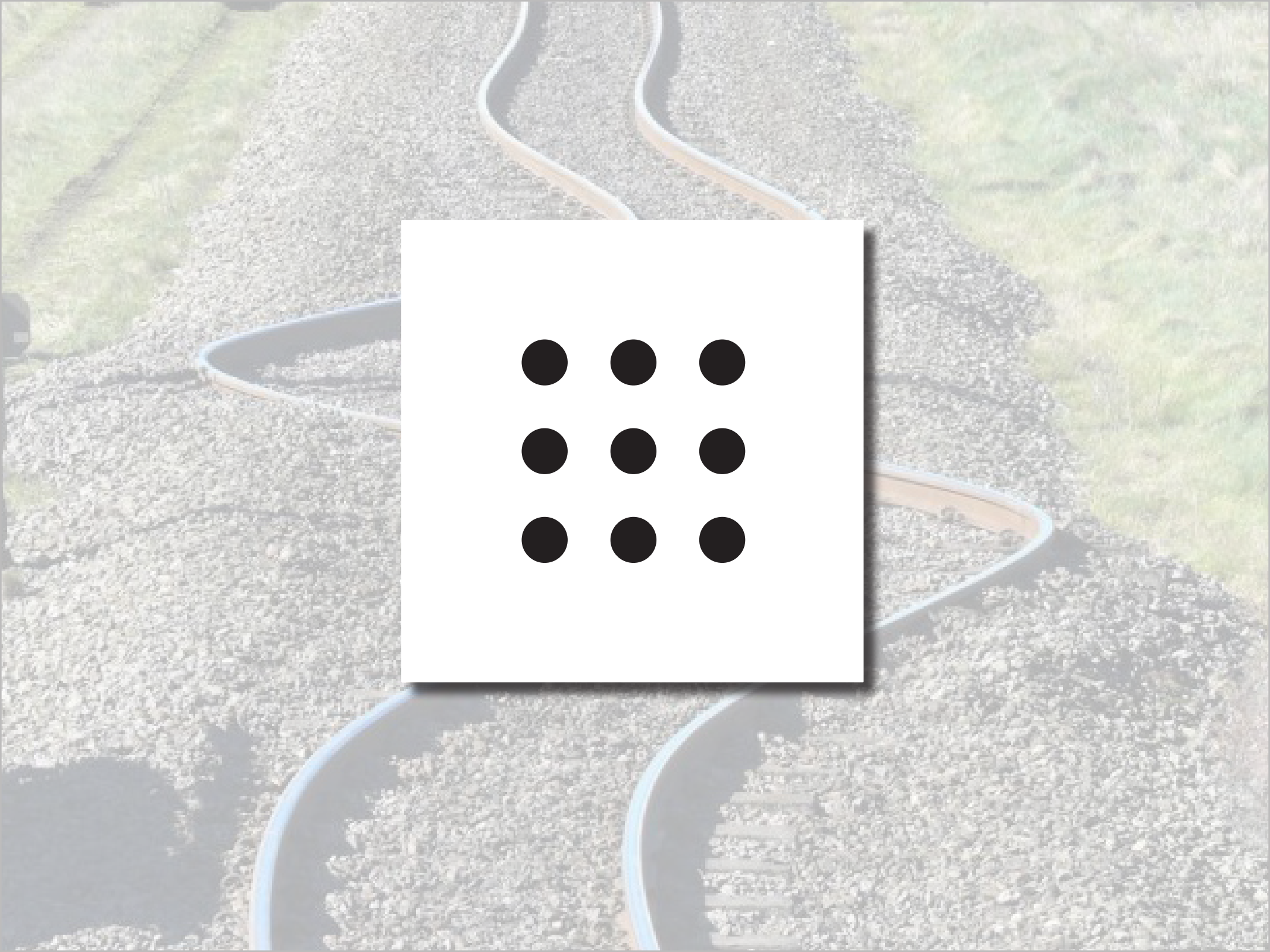
2 new normal

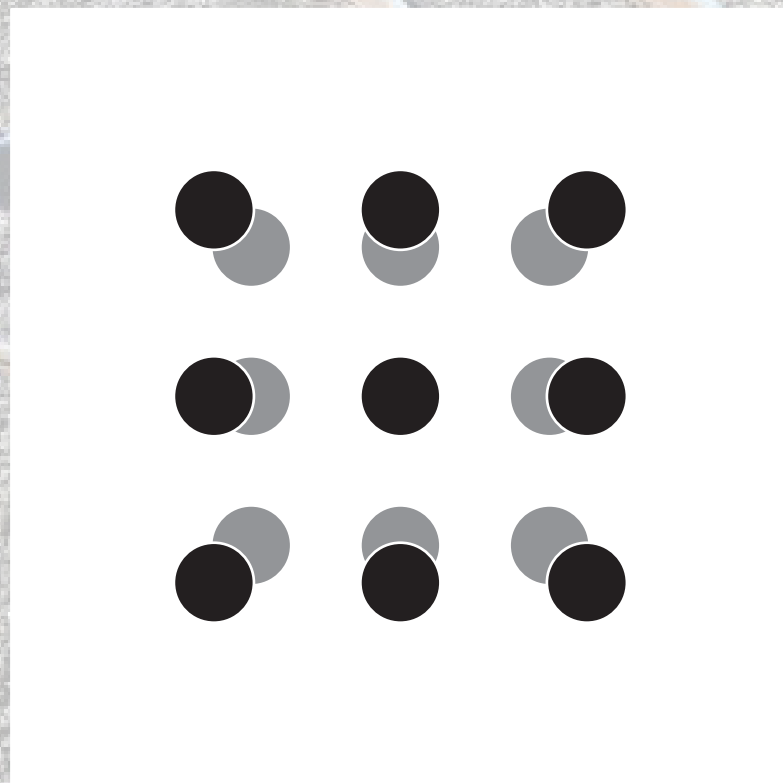
3 self-paced PI



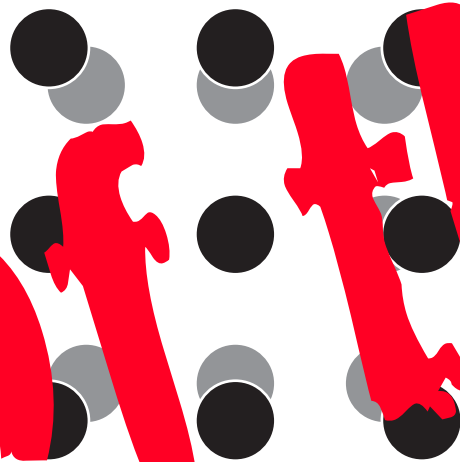
A photograph of a railway track with a wavy, undulating path, illustrating the concept of thermal expansion. The track is composed of gravel and wooden sleepers, and the rails are curved in a series of S-shapes. The text "thermal expansion" is overlaid on the image.

thermal expansion





all of them

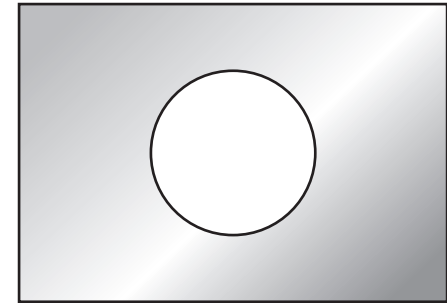


**Consider a rectangular metal plate
with a circular hole in it.**



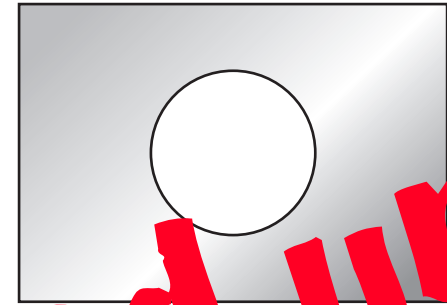
Consider a rectangular metal plate with a circular hole in it.

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



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

Consider a rectangular metal plate with a circular hole in it.



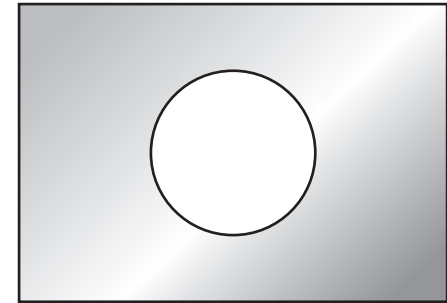
When the plate is uniformly heated, the diameter of the hole

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

you got all fired up!

Consider a rectangular metal plate with a circular hole in it.

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

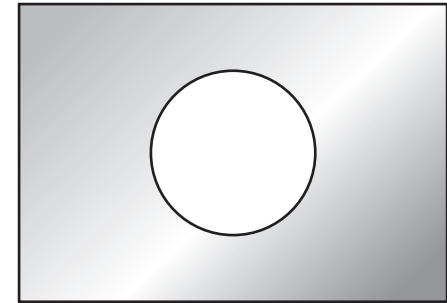


- 1. increases.**
- 2. stays the same.**
- 3. decreases.**

Consider a rectangular 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.**



www.menti.com
8682 6567

Before I tell you the answer, let's analyze what happened.

Before I tell you the answer, let's analyze what happened.

You...

Before I tell you the answer, let's analyze what happened.

You...

1. made a commitment

Before I tell you the answer, let's analyze what happened.

You...

- 1. made a commitment**
- 2. externalized your answer**

Before I tell you the answer, let's analyze what happened.

You...

- 1. made a commitment**
- 2. externalized your answer**
- 3. moved from the answer/fact to reasoning**

Before I tell you the answer, let's analyze what happened.

You...

- 1. made a commitment**
- 2. externalized your answer**
- 3. moved from the answer/fact to reasoning**
- 4. became emotionally invested in the learning process**

Consider a rectangular metal plate with a circular hole in it.



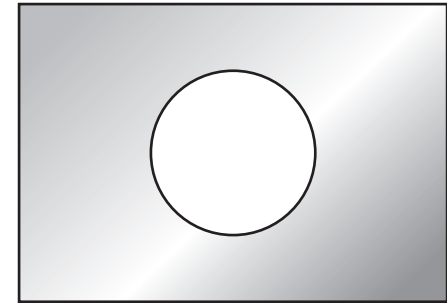
When the plate is uniformly heated, the diameter of the hole

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

Consider a rectangular metal plate with a circular hole in it.

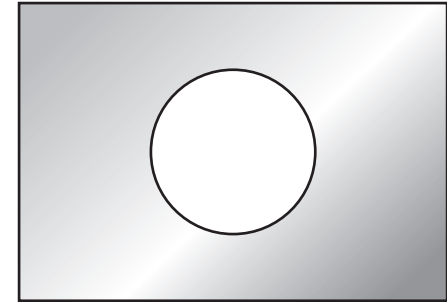
When the plate is uniformly heated, the diameter of the hole

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



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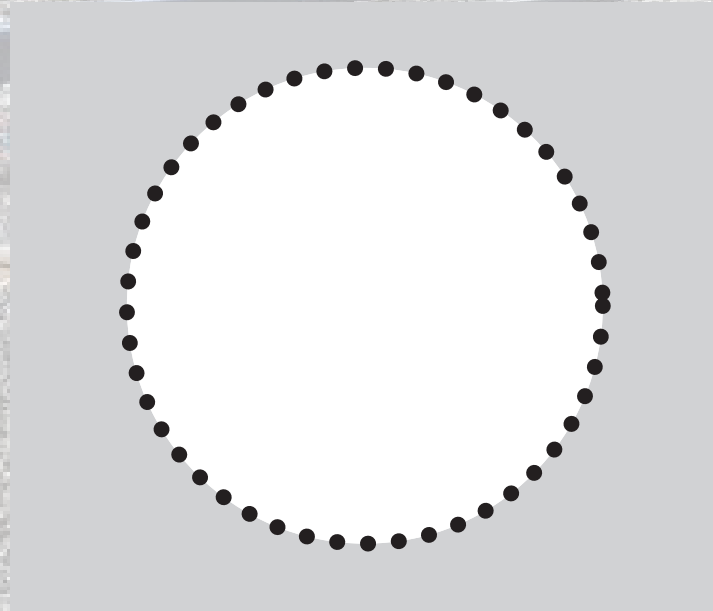
Consider a rectangular metal plate with a circular hole in it.



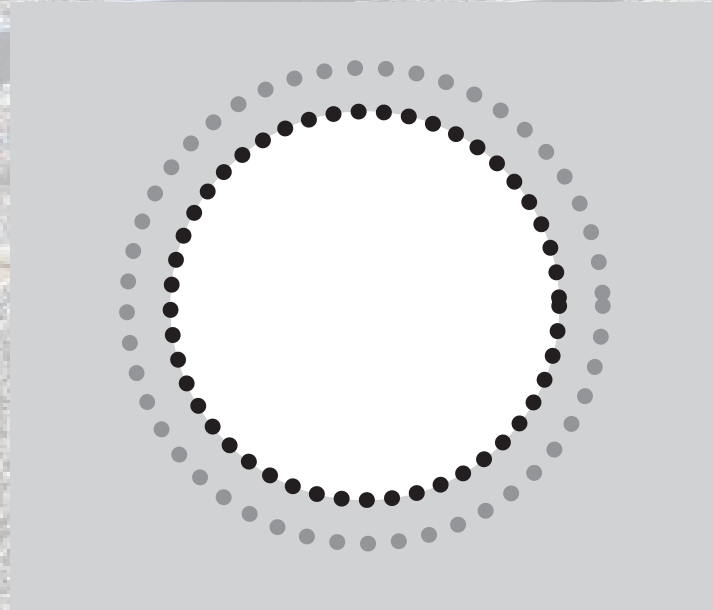
When the plate is uniformly heated, the diameter of the hole

- 1. increases. ✓**
- 2. stays the same.
- 3. decreases.

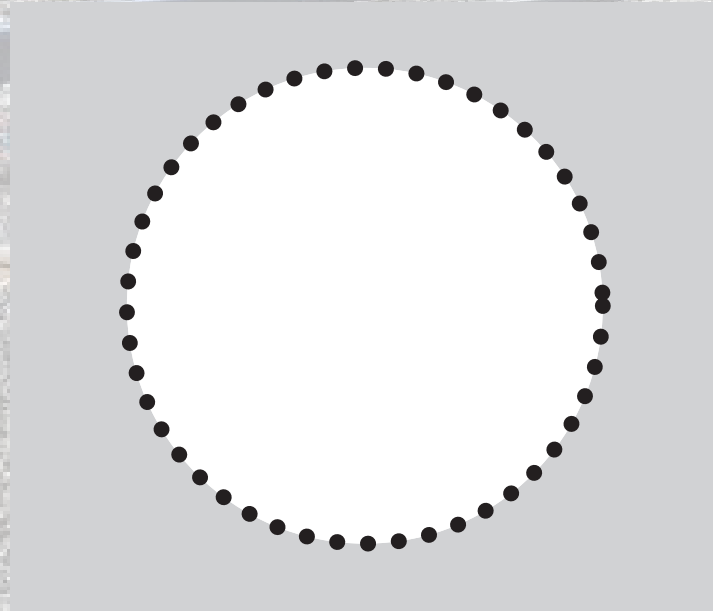
consider atoms at rim of hole



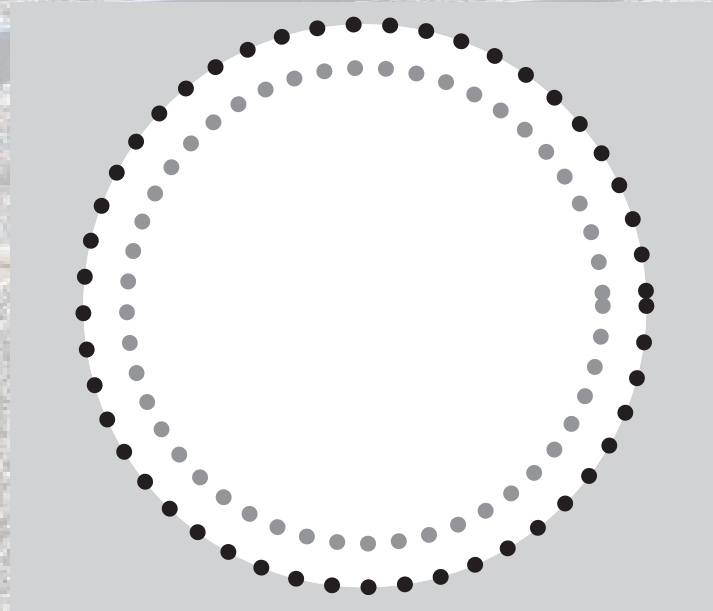
consider atoms at rim of hole



consider atoms at rim of hole



consider atoms at rim of hole



consider atoms at rim of hole

you won't forget this

An aerial photograph of a gravel path that winds in a series of S-curves. The path is bordered by a thin orange line on the left and a thin blue line on the right. The path leads from the top of the frame towards the bottom, where a wooden boardwalk or bridge is visible. The surrounding area is covered in green grass.

points worth noting

- **my “clear” lecture wasn’t very good**
- **discussion promoted “aha” moments**

Peer Instruction

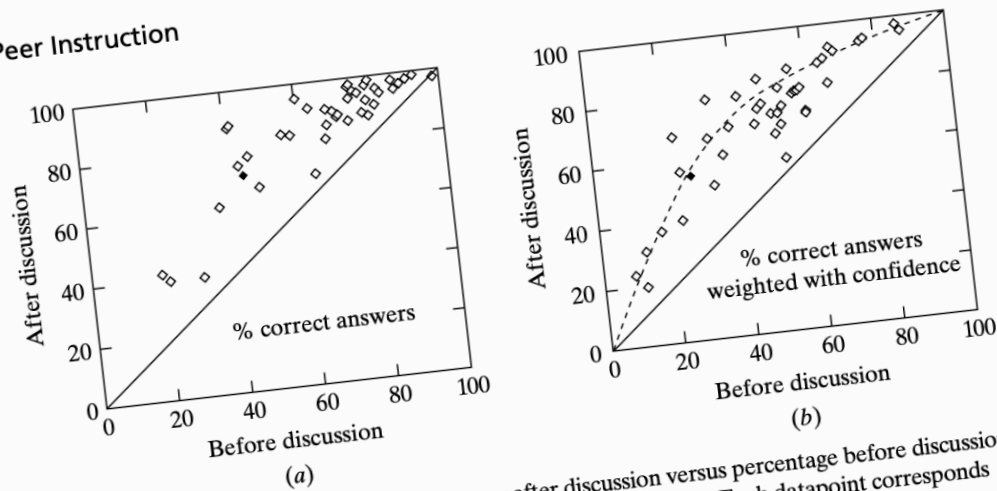


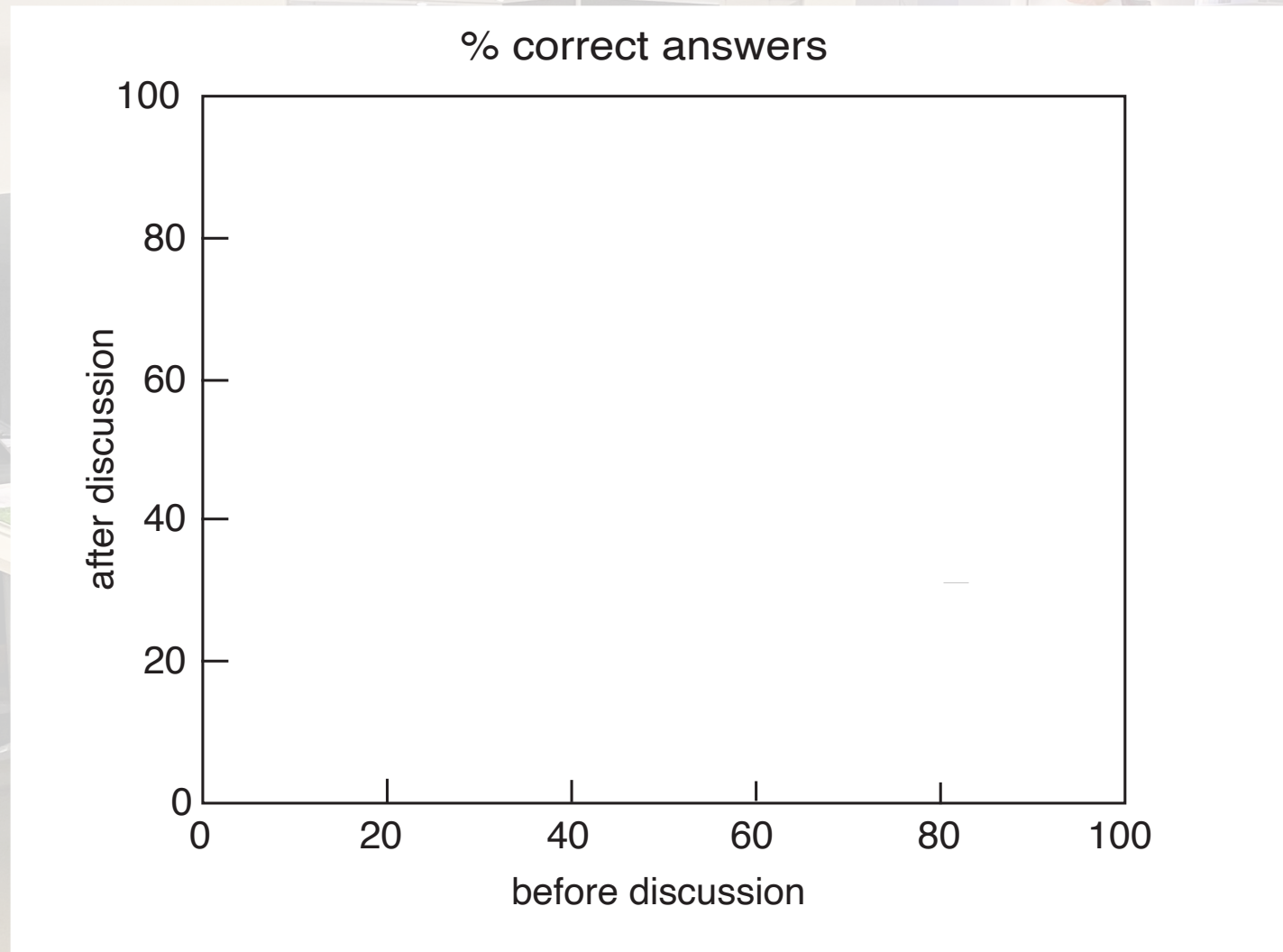
Figure 2.3 (a) Percentage of correct answers after discussion versus percentage before discussion and (b) the same information weighted with the students' confidence. Each datapoint corresponds to a single *ConceptTest* question. The filled datapoint is for the buoyancy question in Figure 2.1.

Figure 2.4 shows how students revised their answers in the discussion of the buoyancy question posed in Figure 2.1. In fact, 29% correctly revised their initially incorrect answer, while only 3% changed from correct to incorrect. Figure 2.3 demonstrates that there is always an increase and never a decrease in the percentage of correct answers. The reason is that it is much easier to change the mind of someone who is wrong than it is to change the mind of someone who has selected the right answer for the right reasons. The observed improvement in confidence is also no surprise. Students who are initially right but not very confident become more confident when it appears that neighbors have chosen the same answer or when their confidence is reinforced by reasoning that leads to the right answer.

At times, it seems that students are able to explain concepts to one another more effectively than are their teachers (see Figure 2.5). A likely explanation is that students who understand the concept when the question is posed have only recently mastered the idea and are still aware of the difficulties involved in grasping that concept. Consequently, they know precisely what to emphasize in

29% 3% 29% ■ Wrong to right

in-class PI

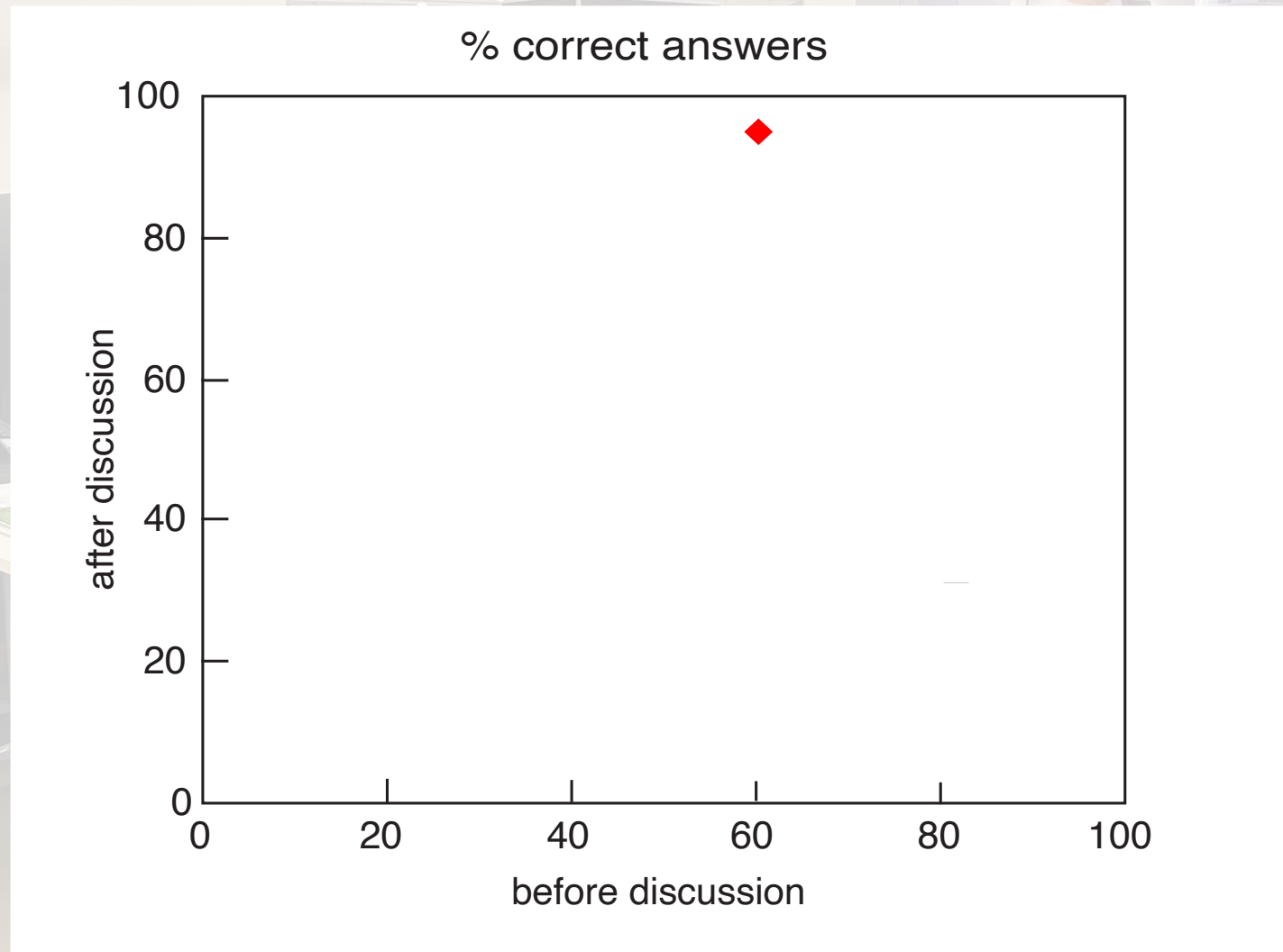


1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI

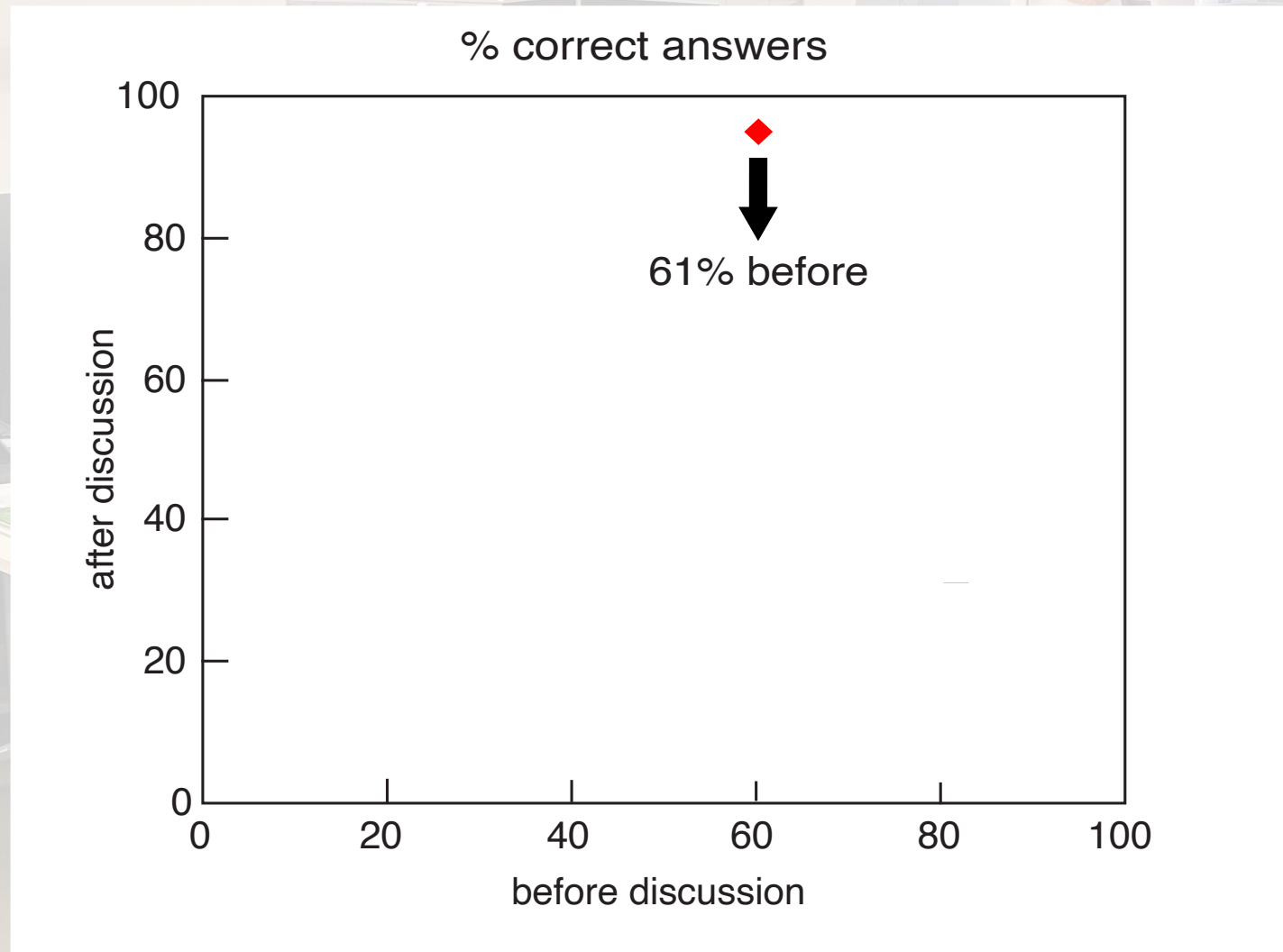


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2 new normal

3 self-paced PI

in-class PI

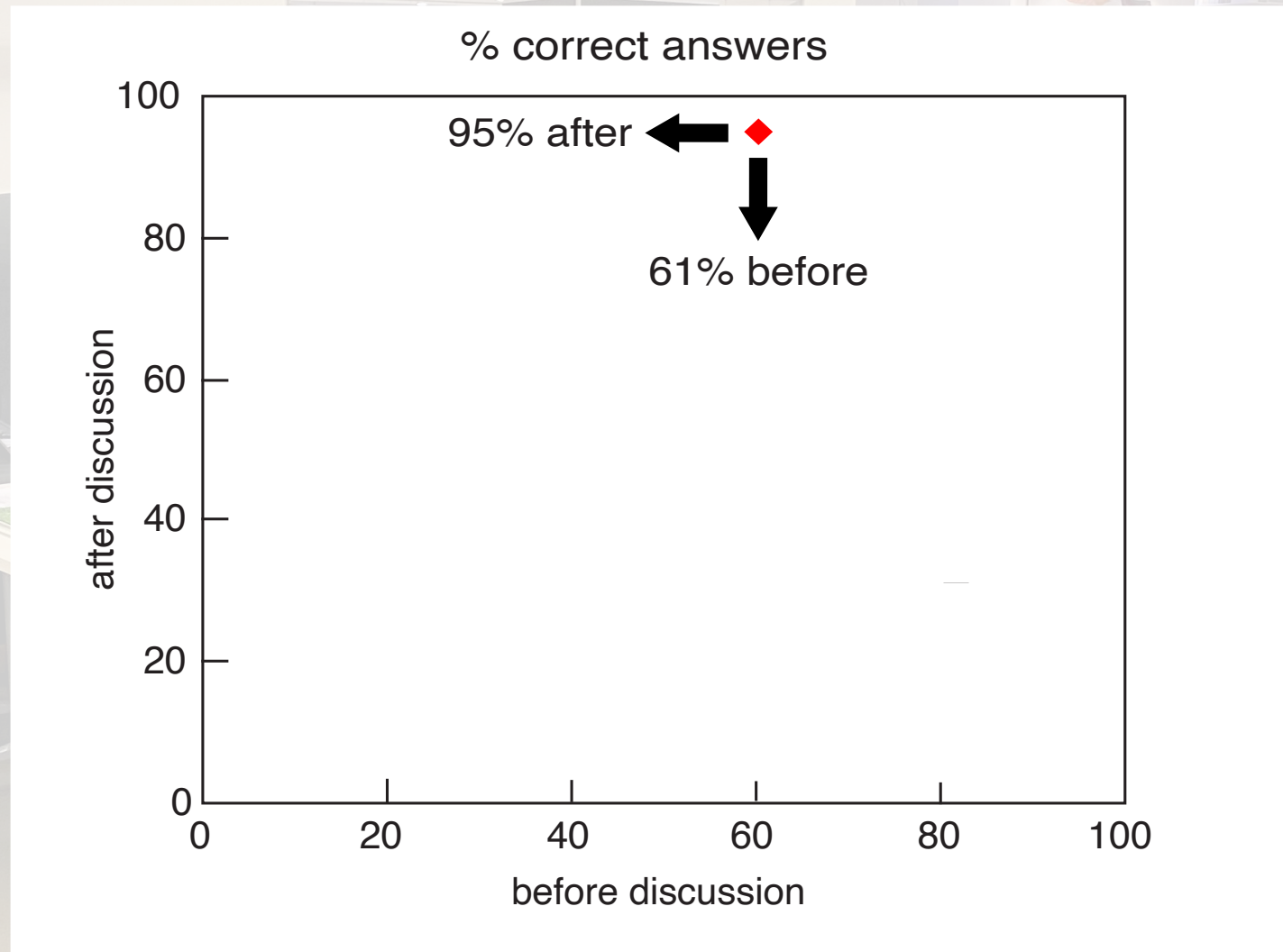


1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI

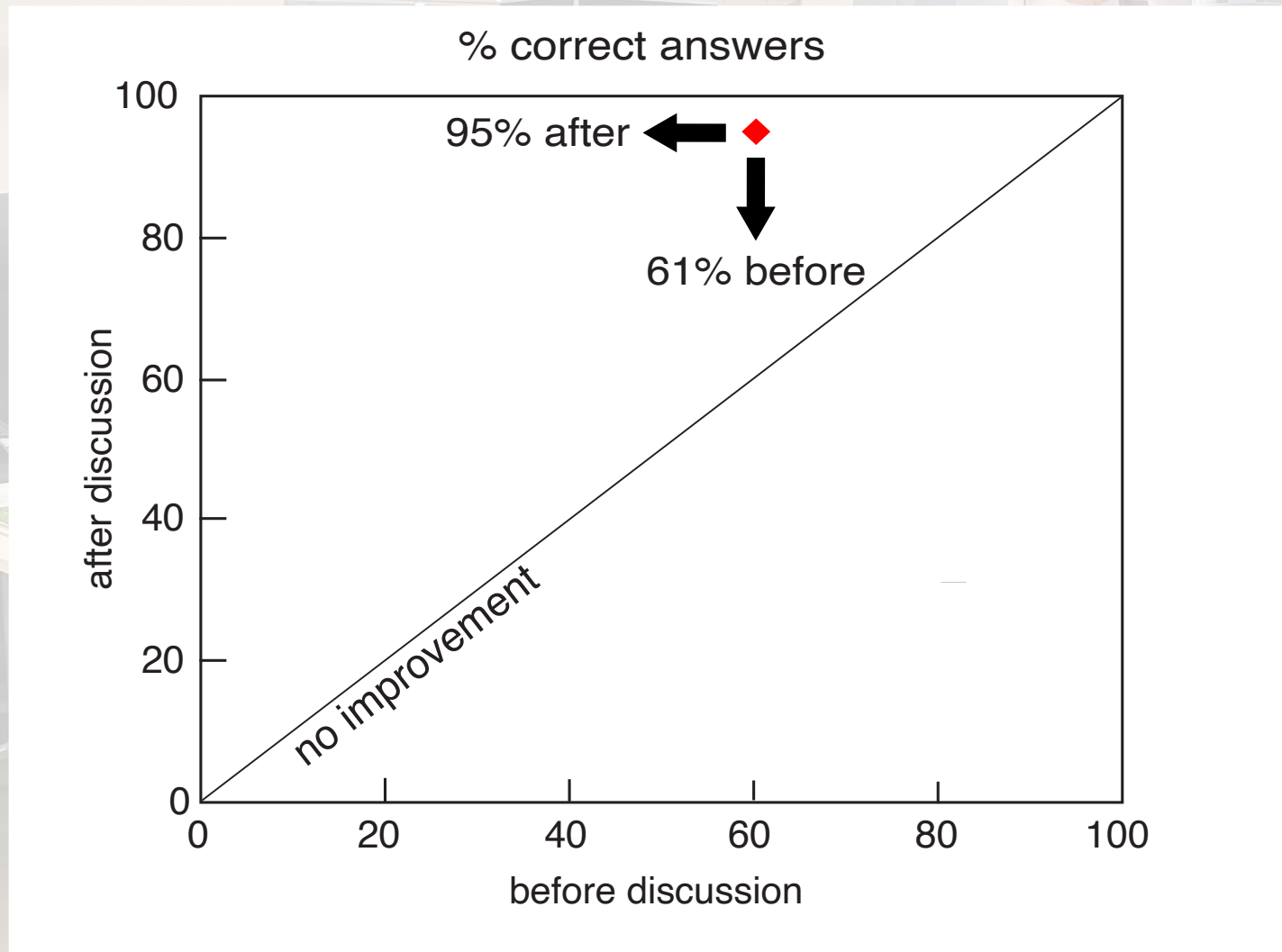


1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI

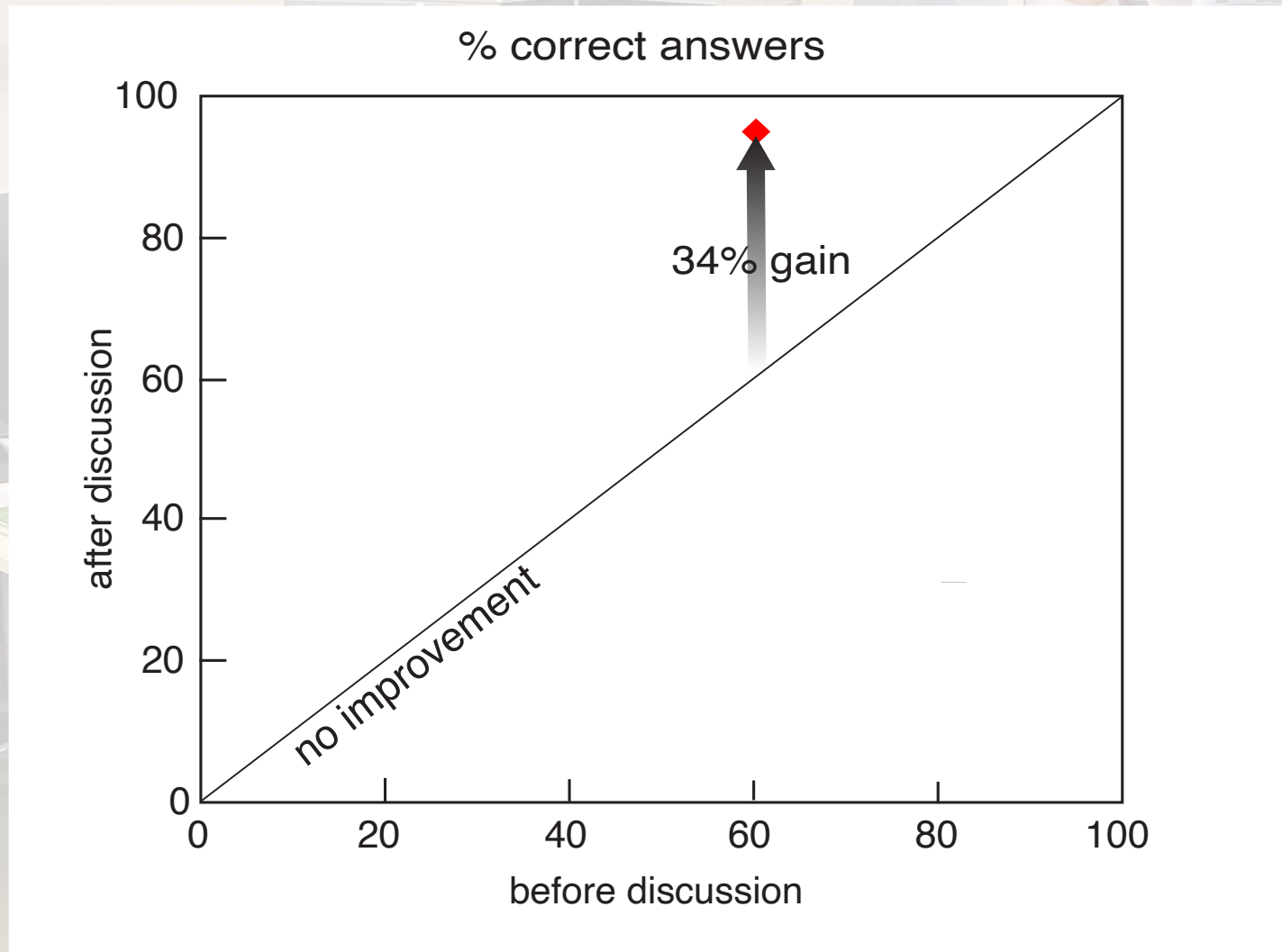


1 pandemic lessons

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in-class PI

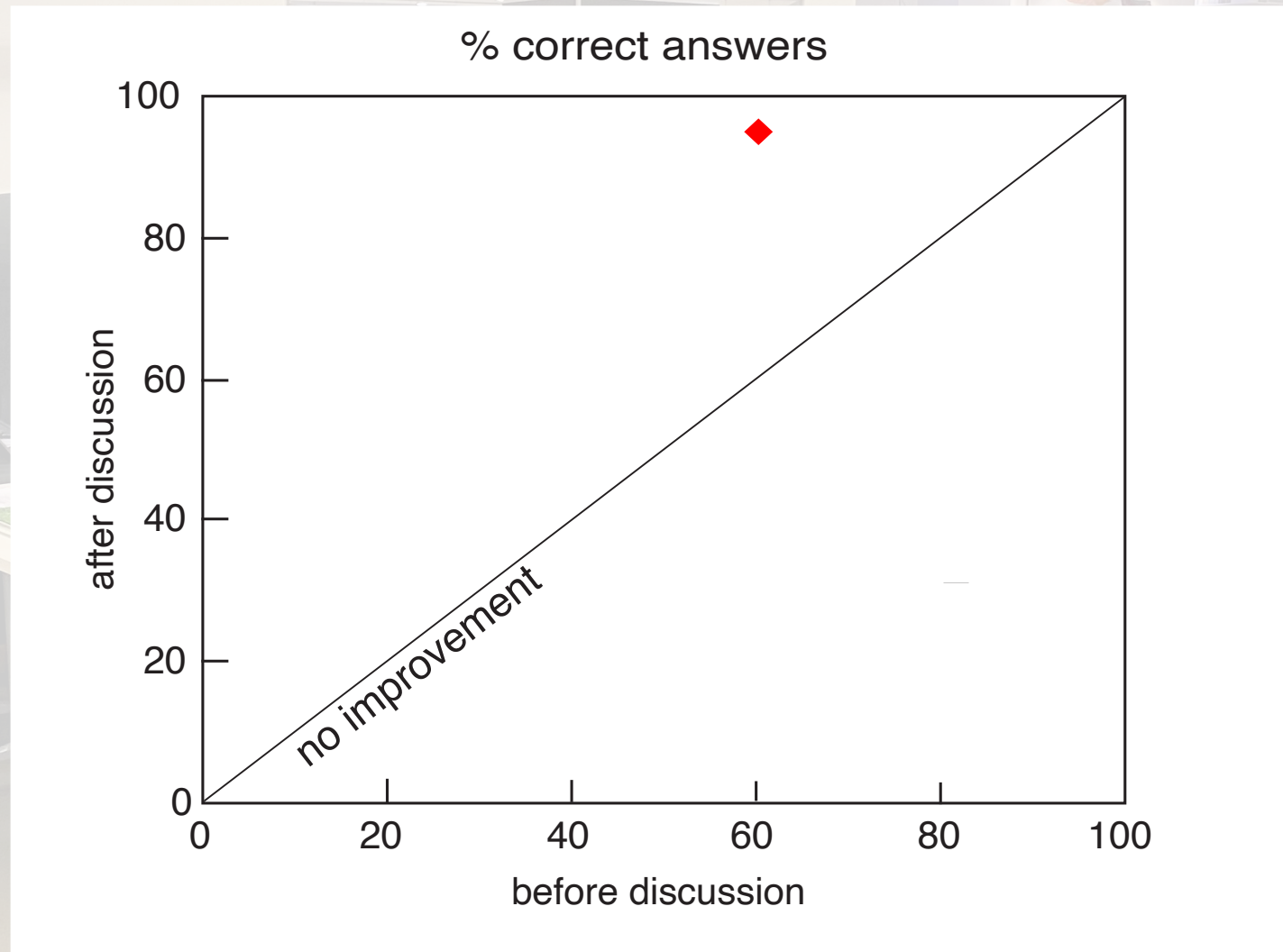


① pandemic lessons

② new normal

③ self-paced PI

in-class PI

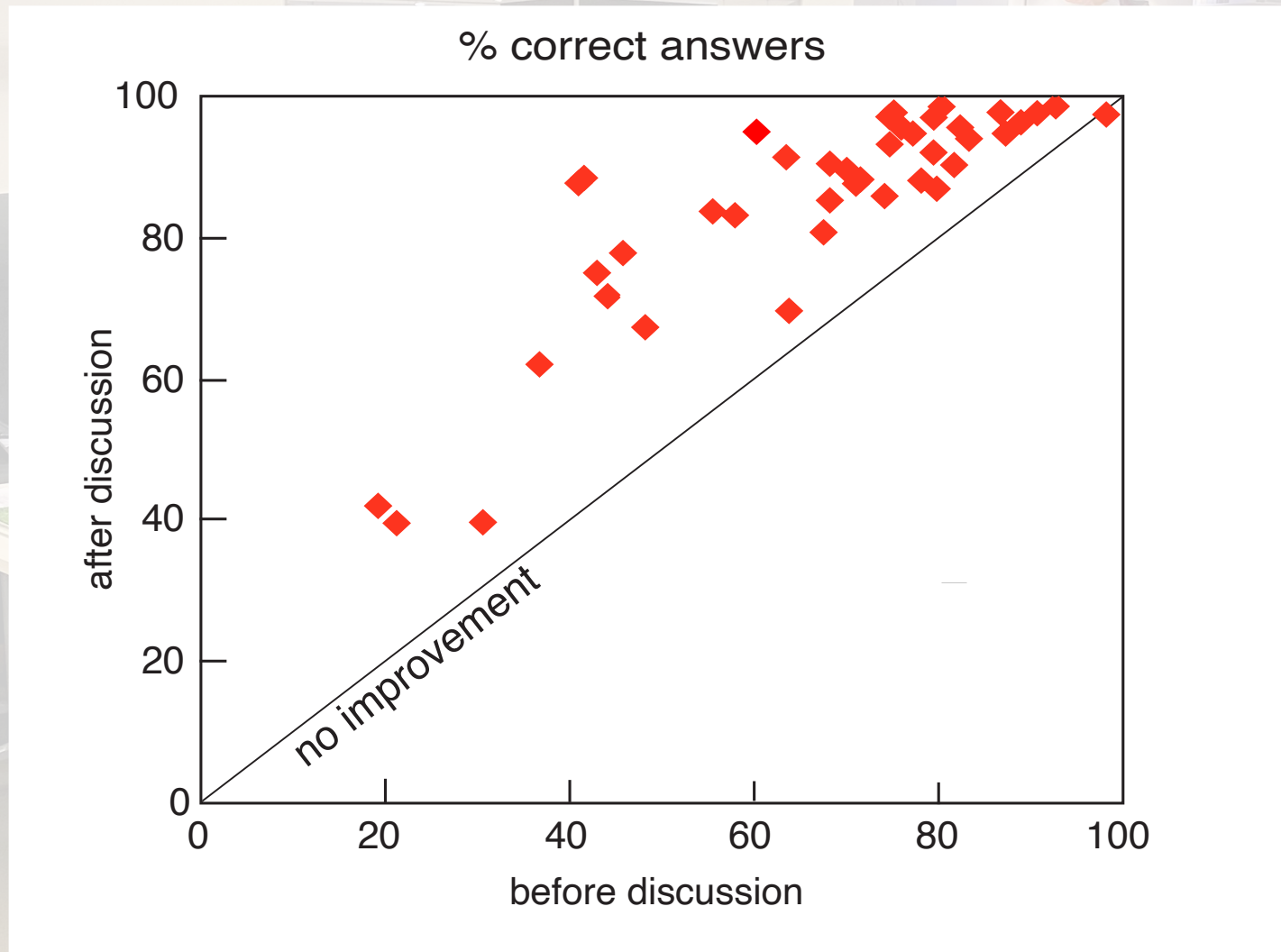


1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI

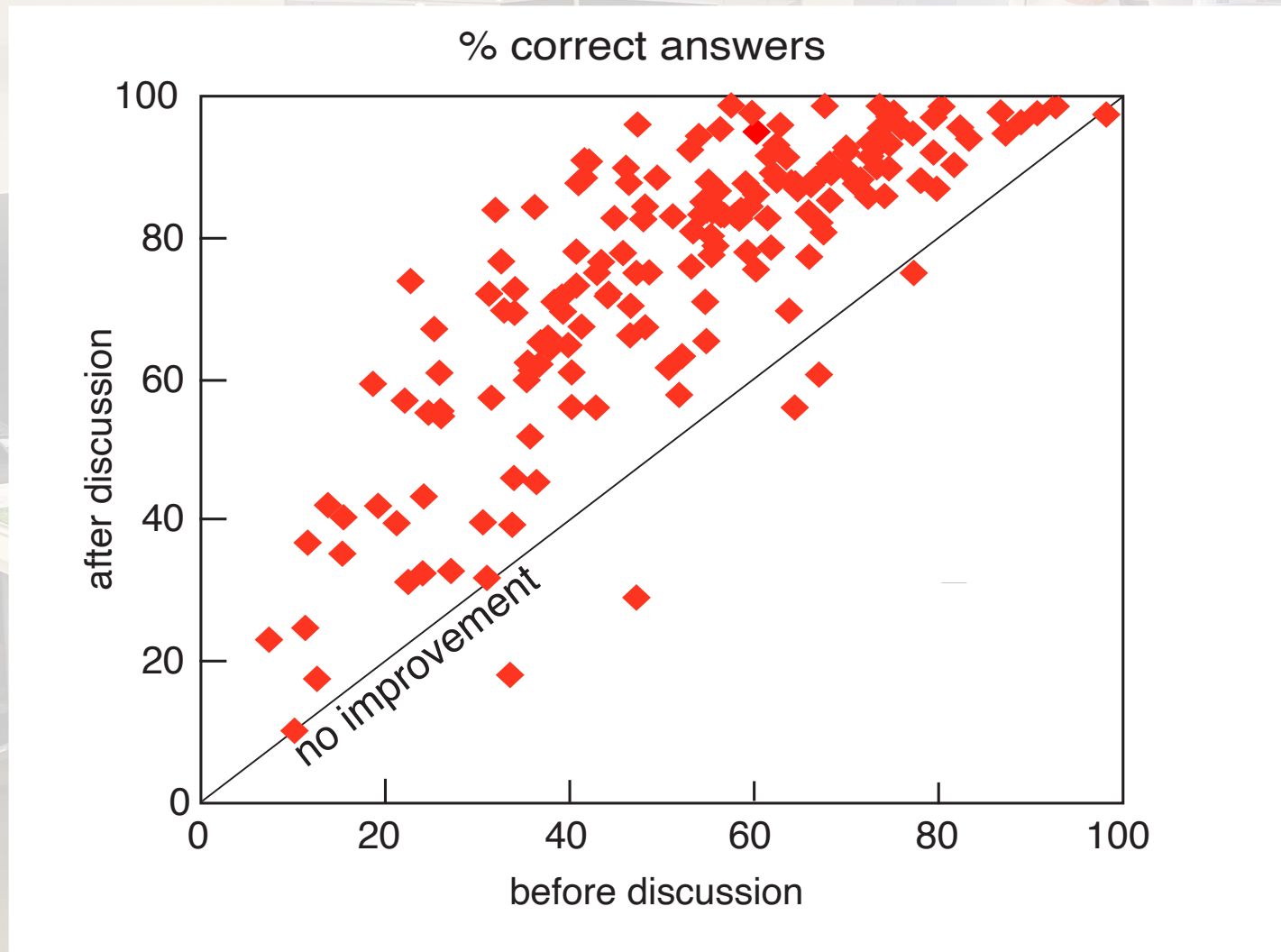


① pandemic lessons

② new normal

③ self-paced PI

in-class PI

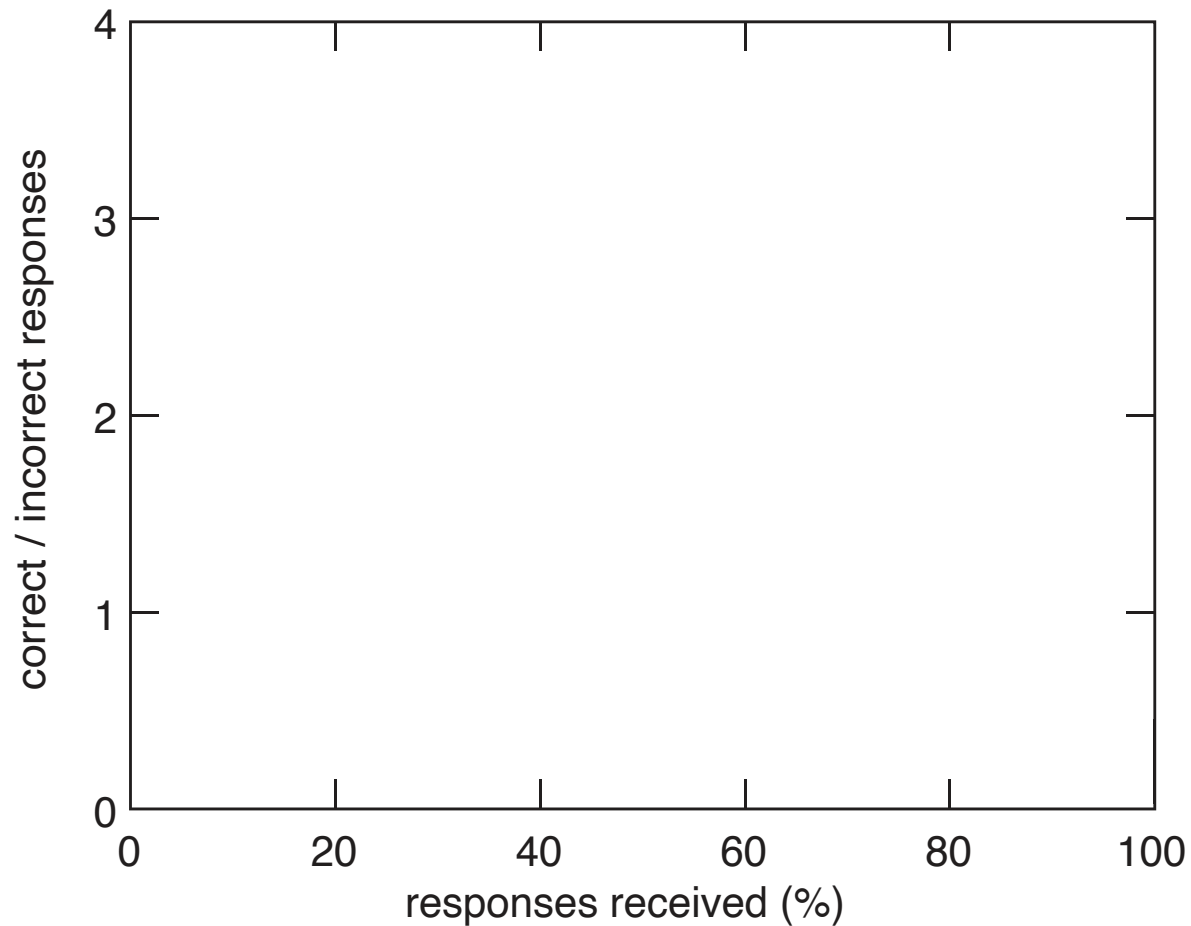


① pandemic lessons

② new normal

③ self-paced PI

in-class PI: response time analysis

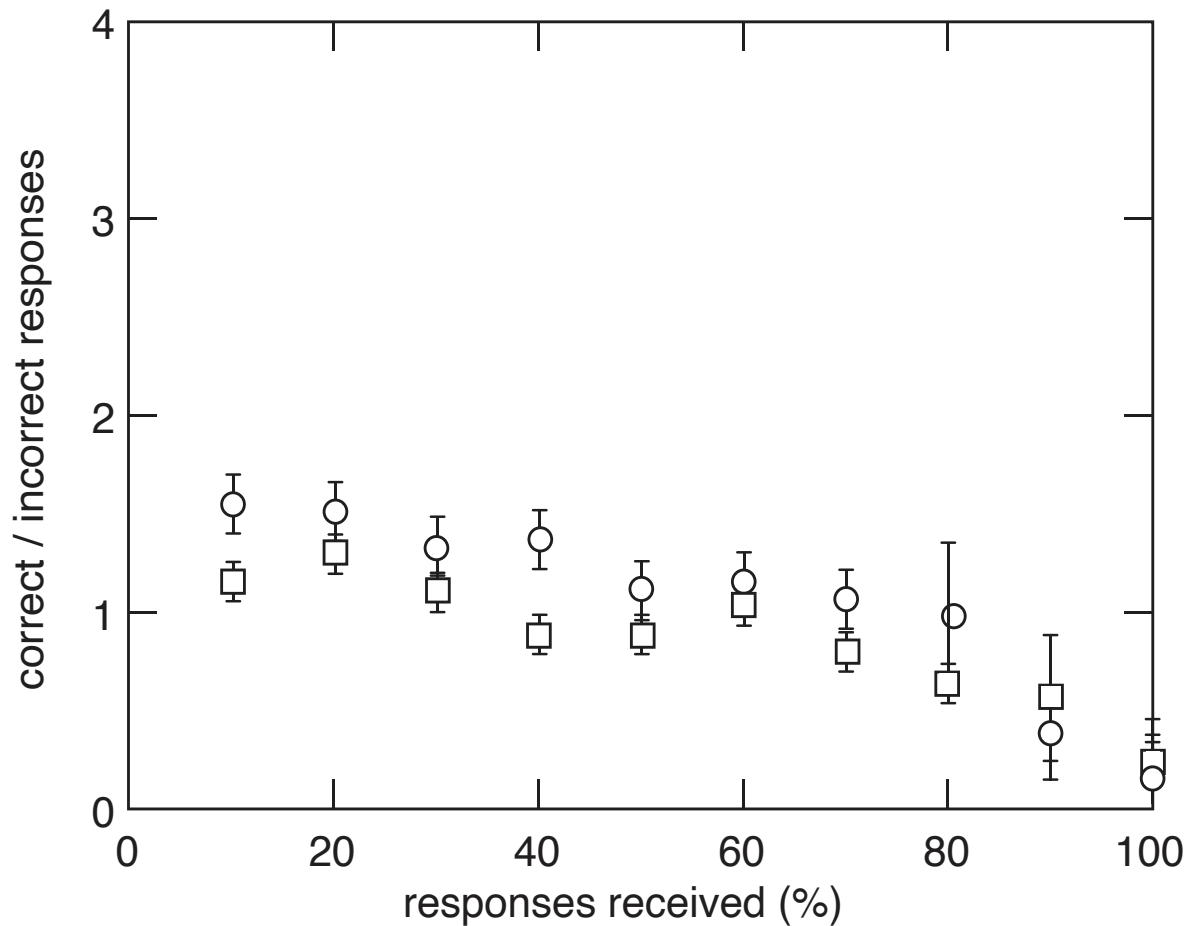


1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI: response time analysis

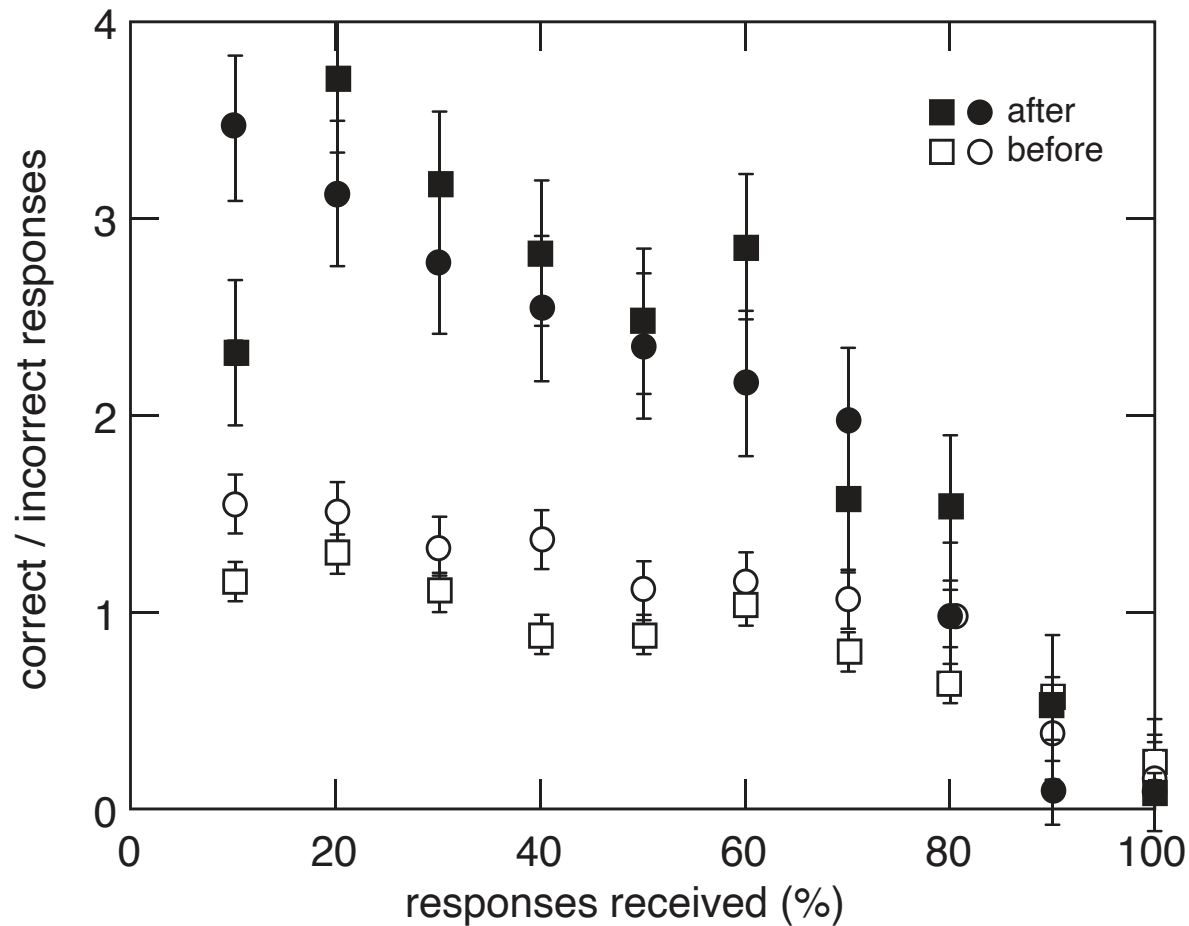


1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI: response time analysis

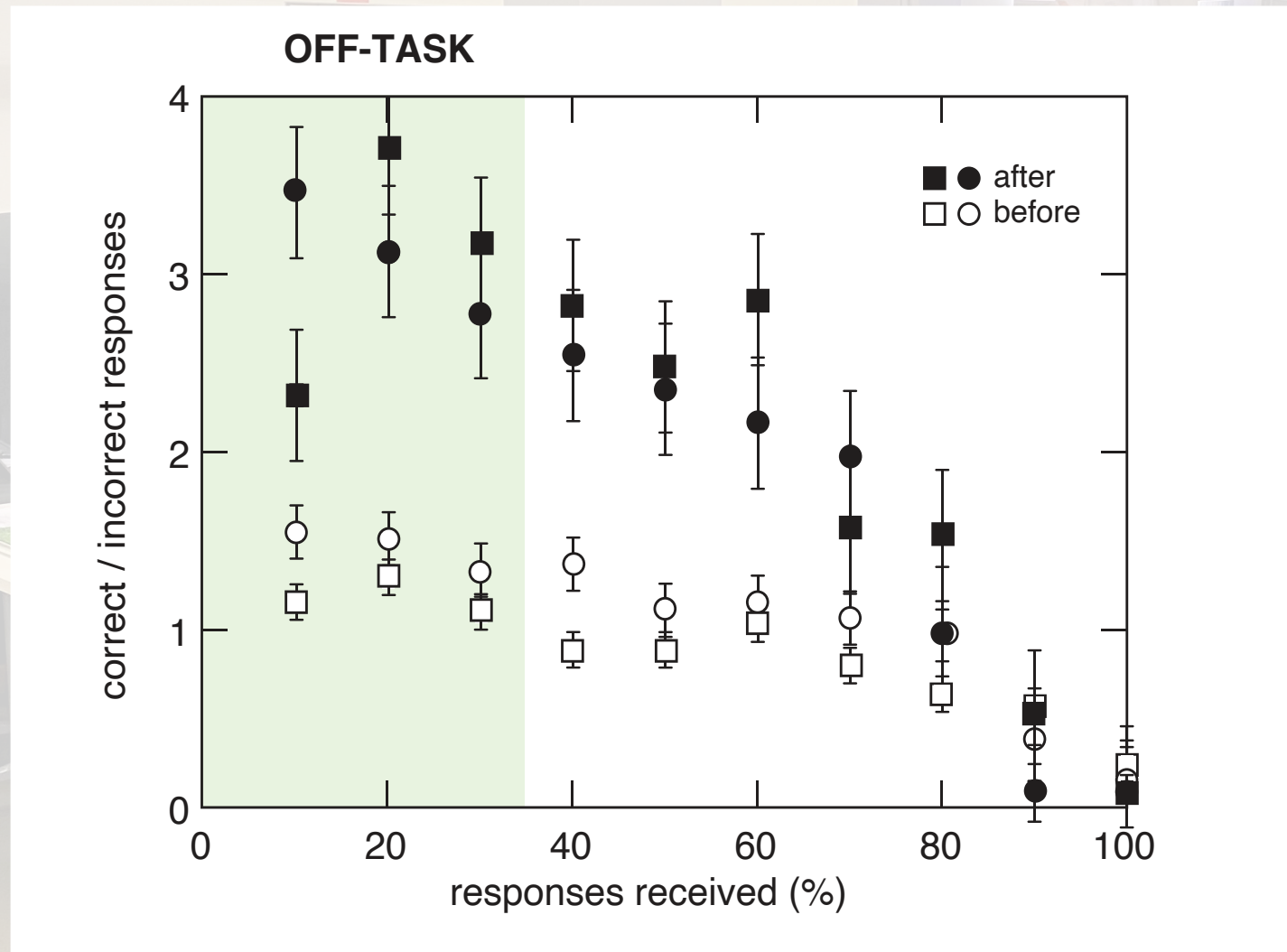


1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI: response time analysis

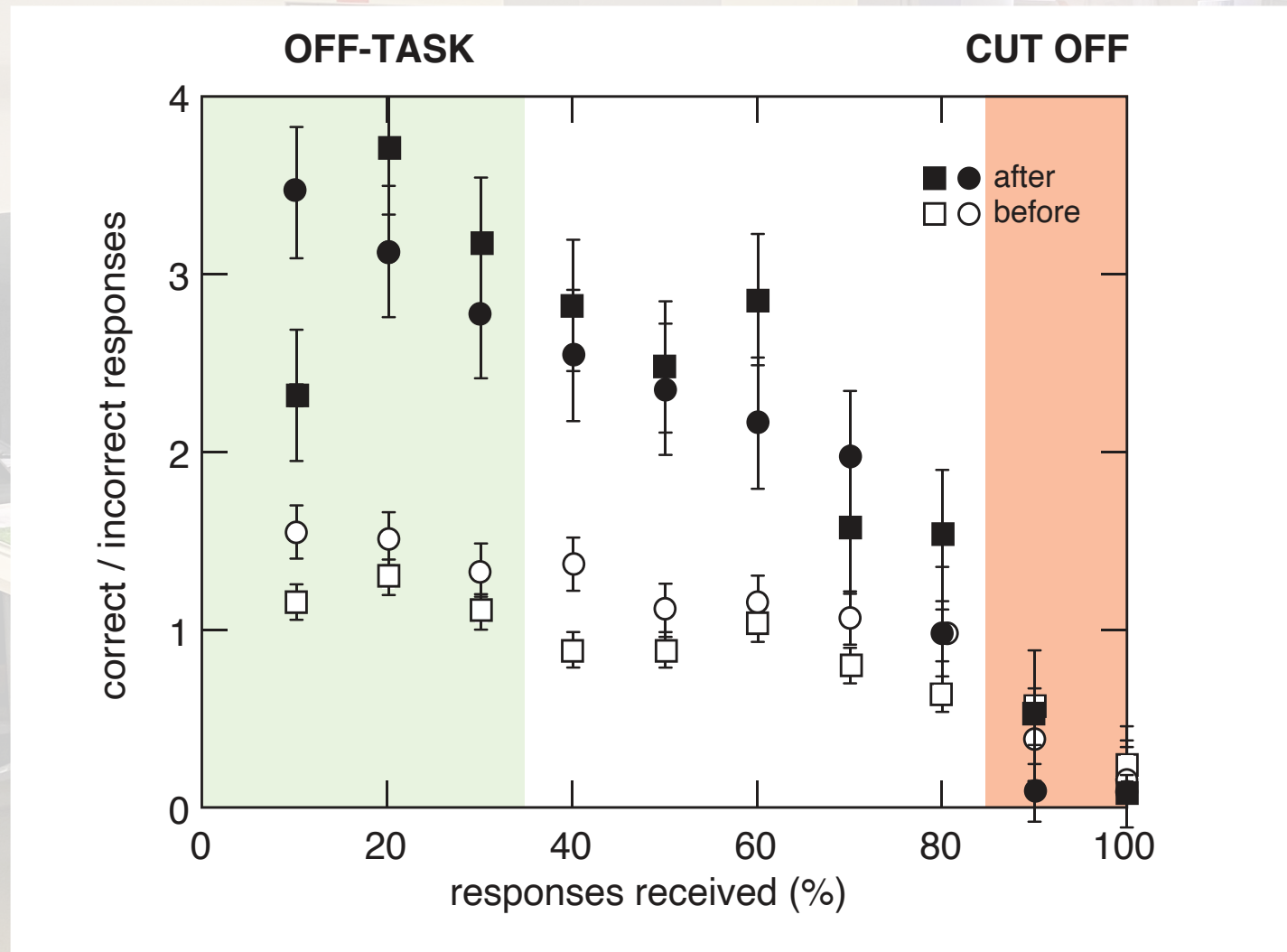


1 pandemic lessons

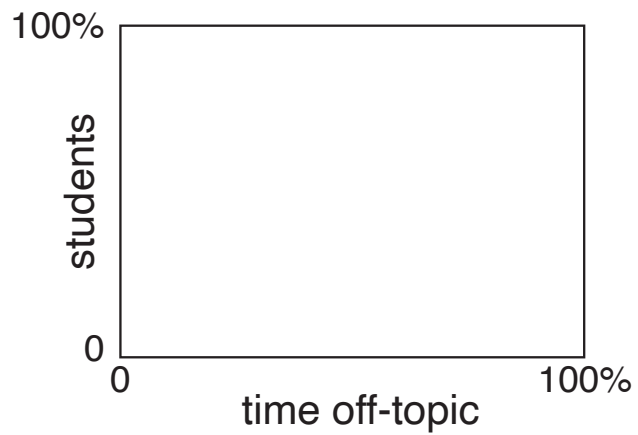
2 new normal

3 self-paced PI

in-class PI: response time analysis



in-class PI: time off-task

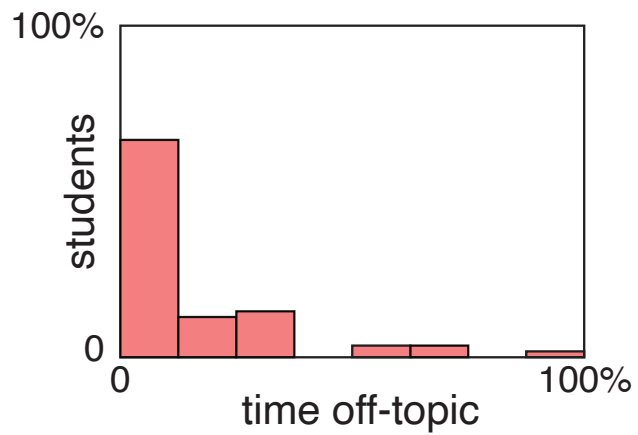


1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI: time off-task

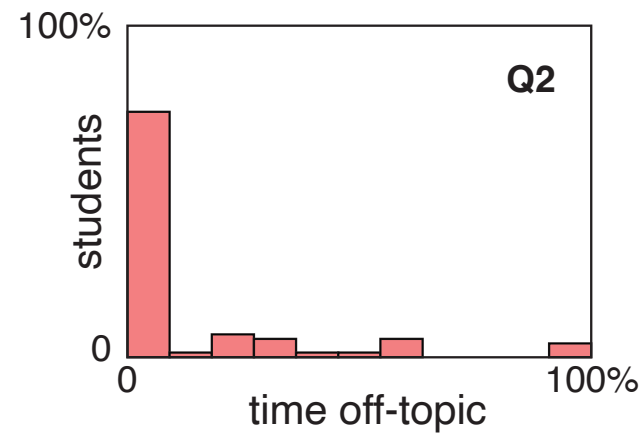
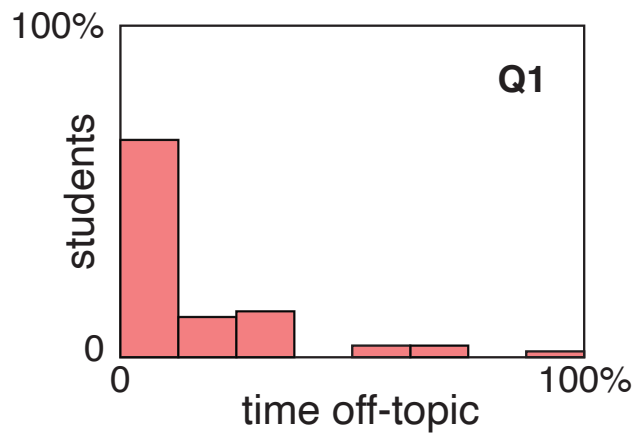


1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI: time off-task

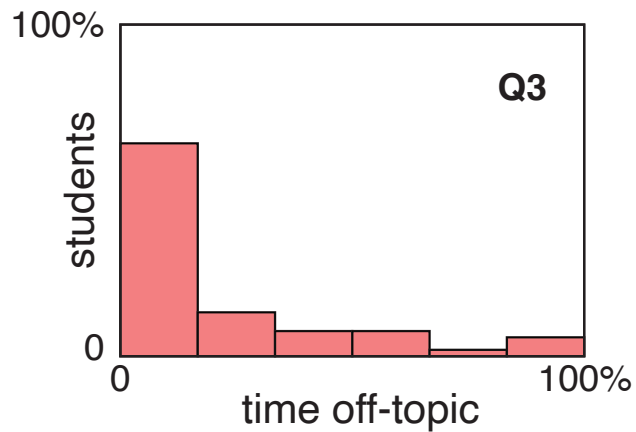
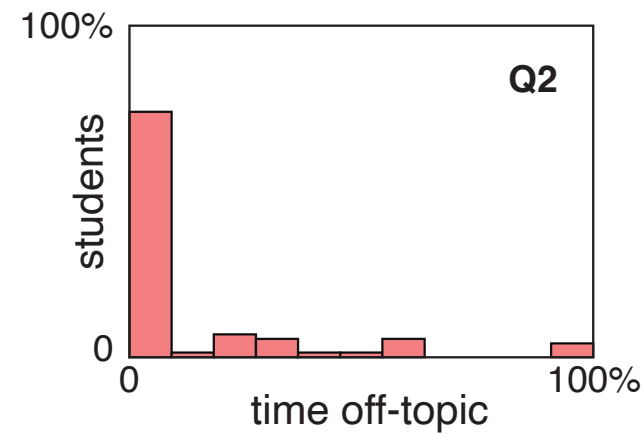
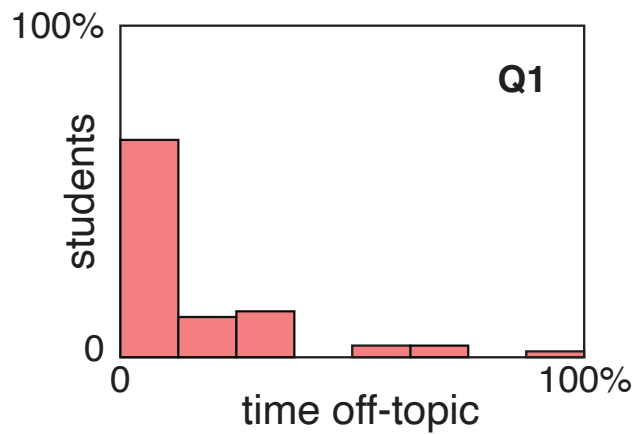


1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI: time off-task

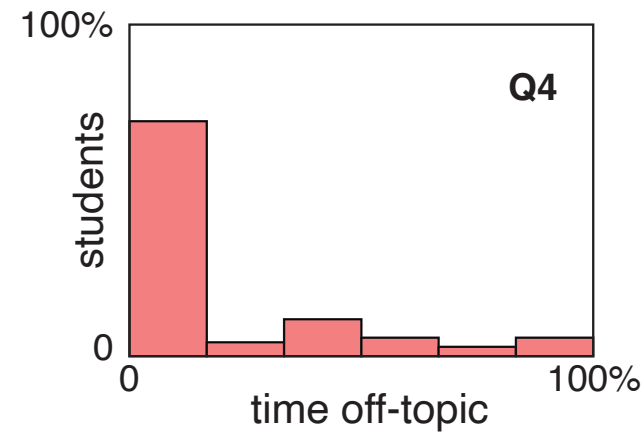
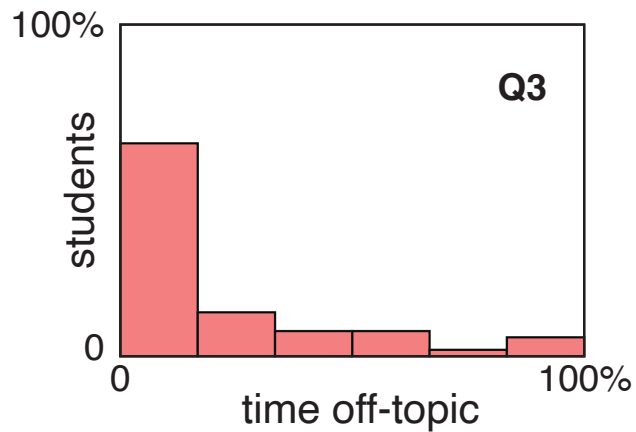
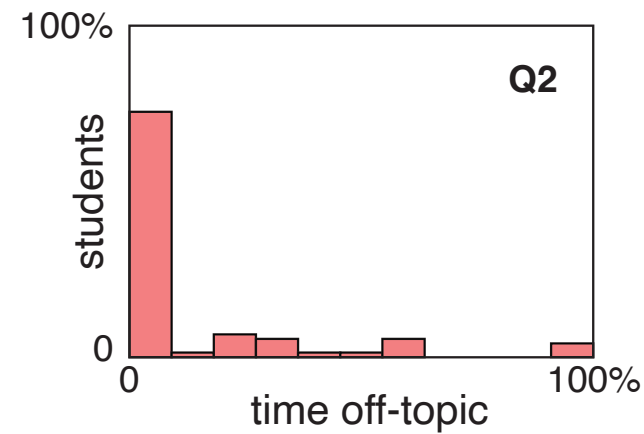
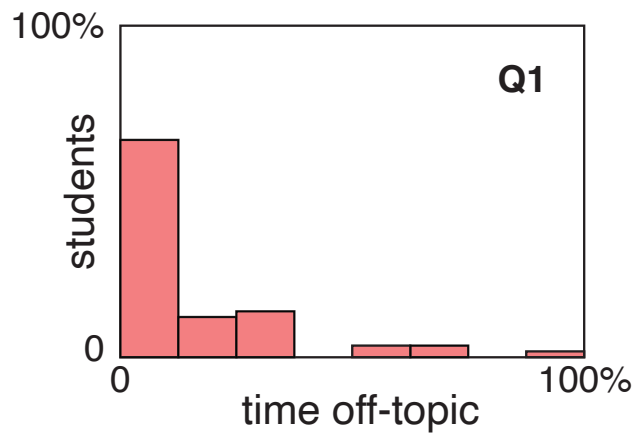


1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI: time off-task

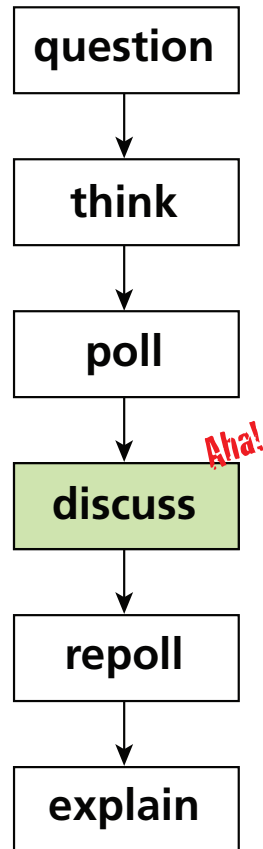


1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI: class sequence

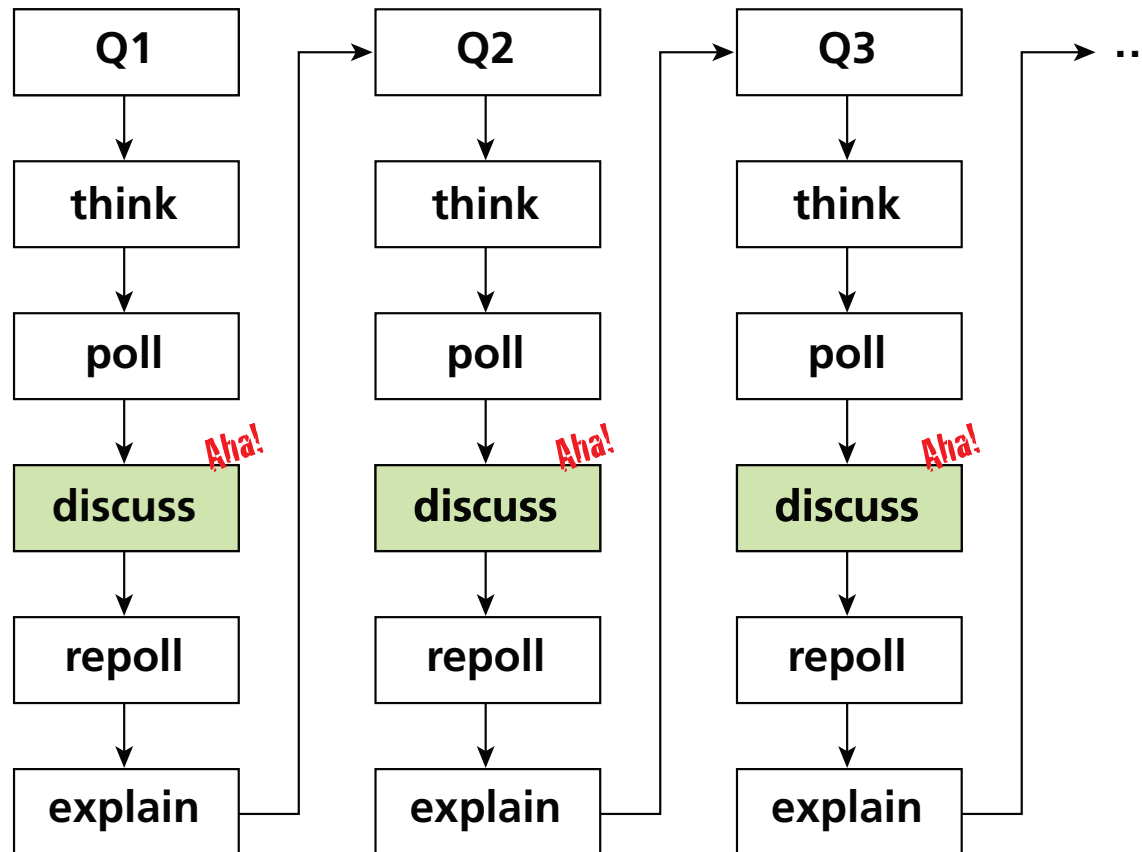


① pandemic lessons

② new normal

③ self-paced PI

in-class PI: class sequence

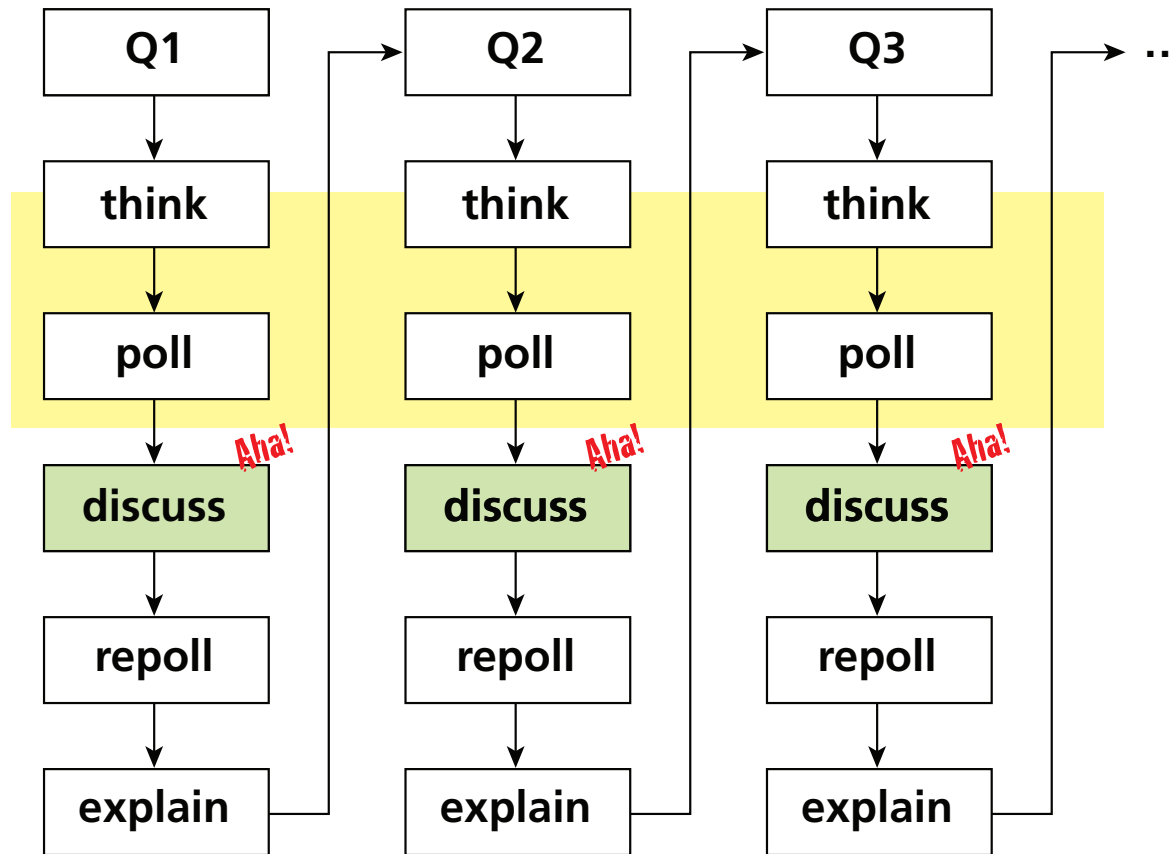


① pandemic lessons

② new normal

③ self-paced PI

in-class PI: class sequence

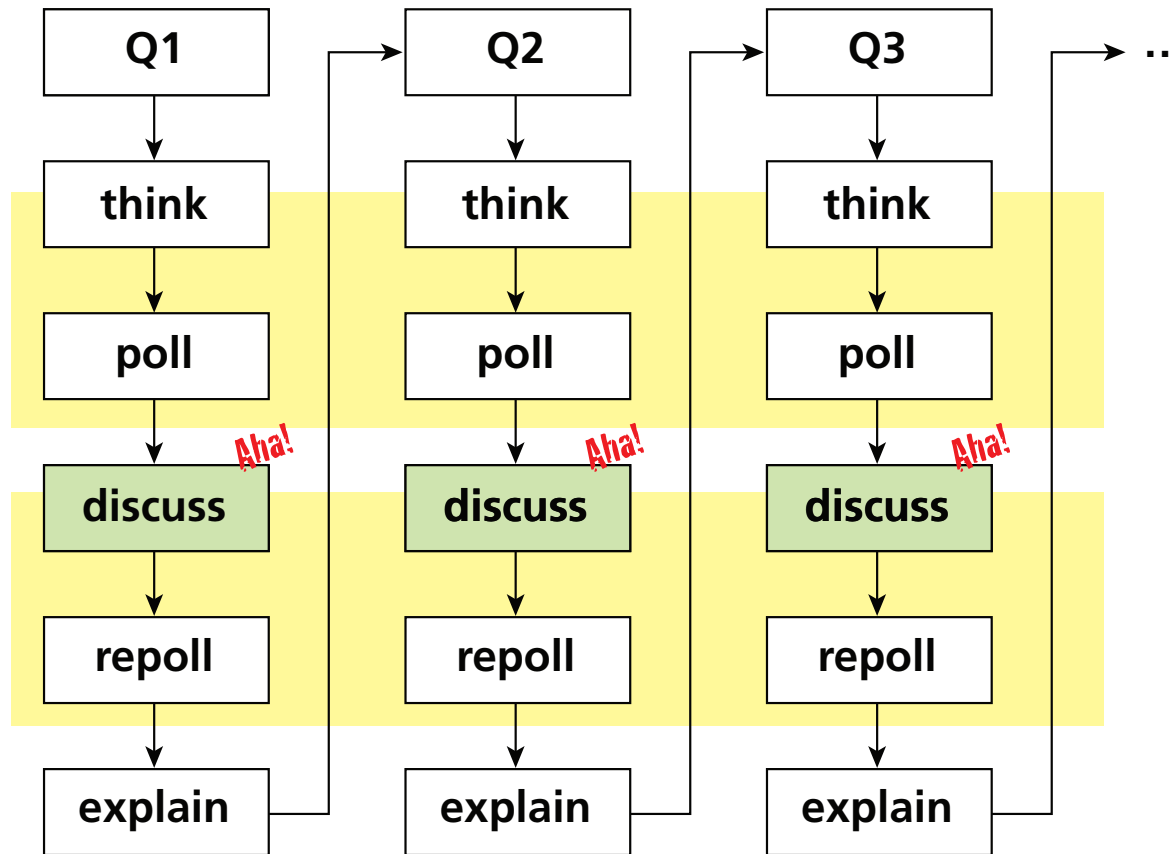


① pandemic lessons

② new normal

③ self-paced PI

in-class PI: class sequence

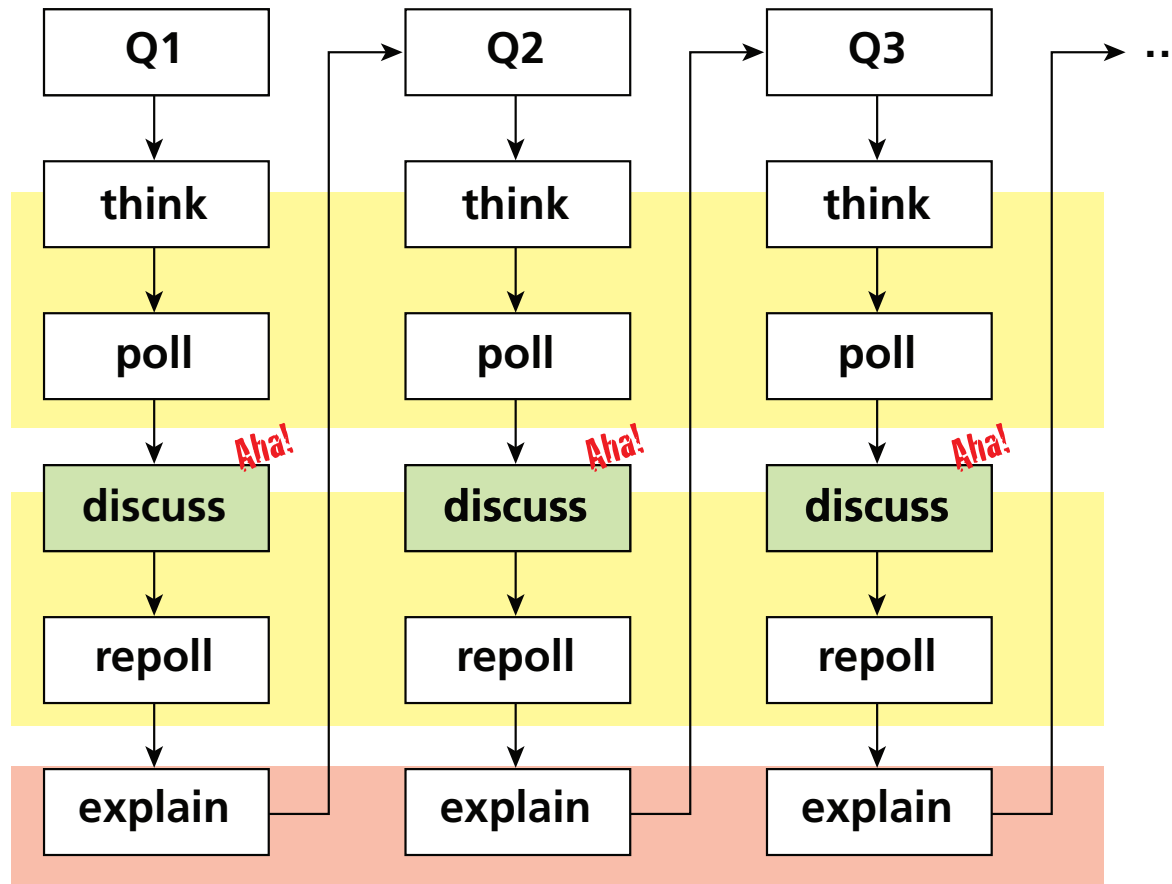


① pandemic lessons

② new normal

③ self-paced PI

in-class PI: class sequence

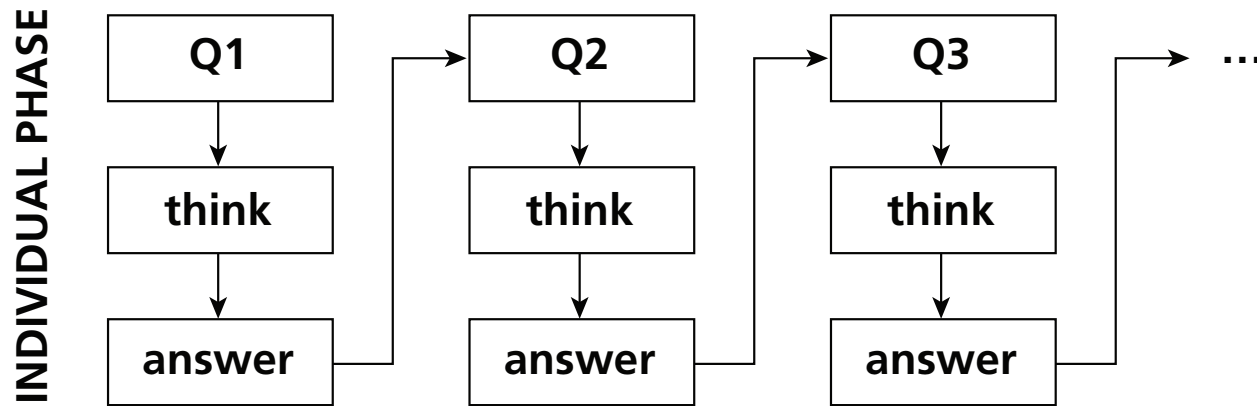


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI

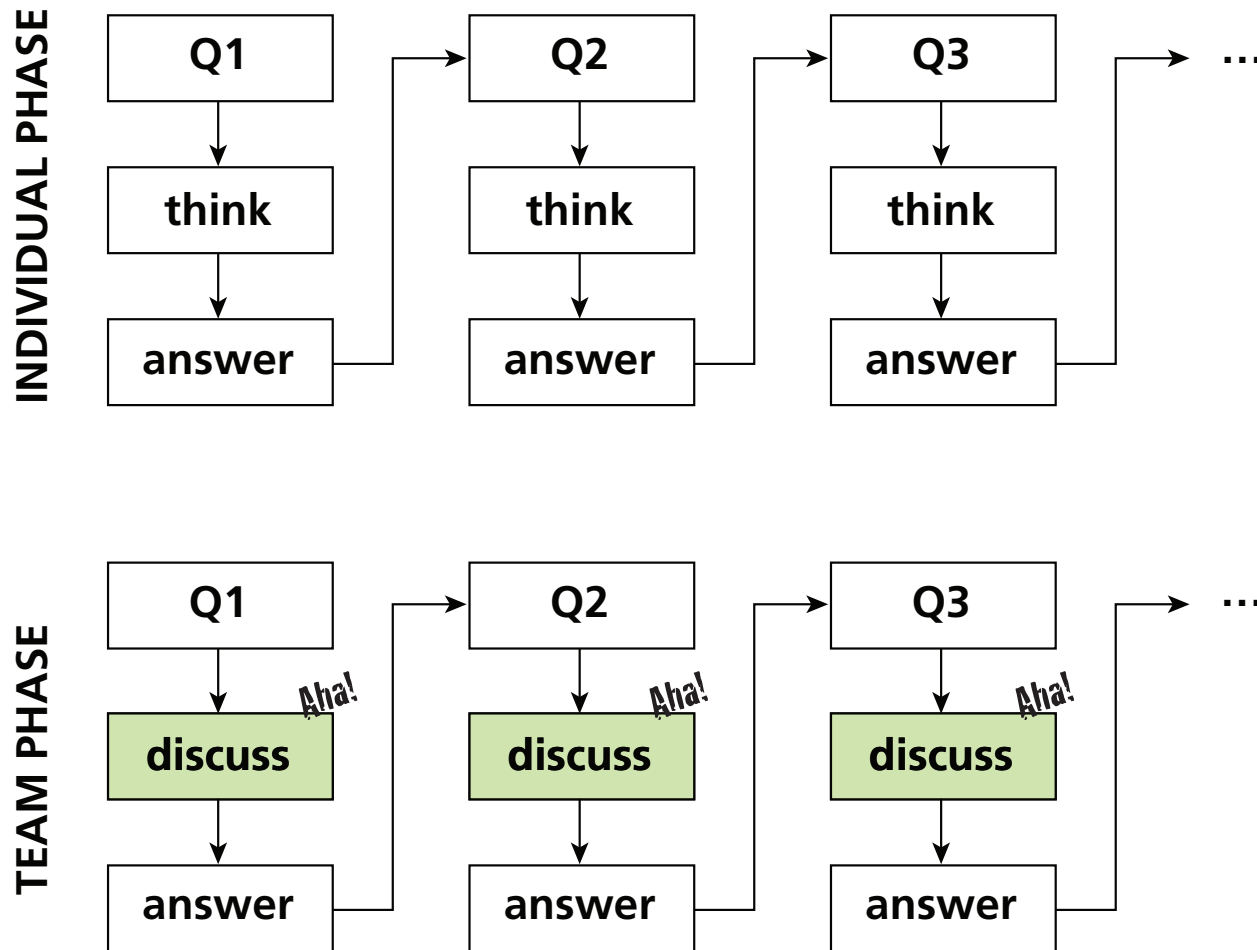


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI



1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: attempts & points

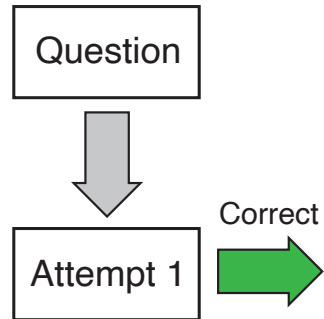
Question

1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: attempts & points

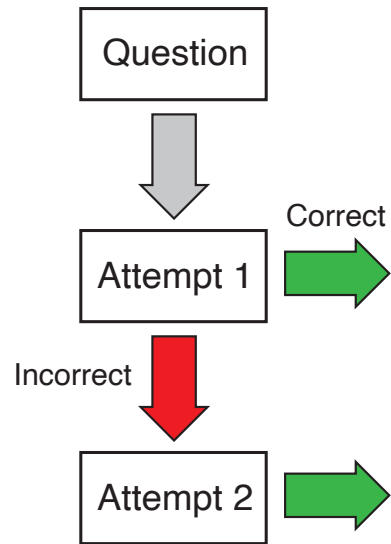


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: attempts & points

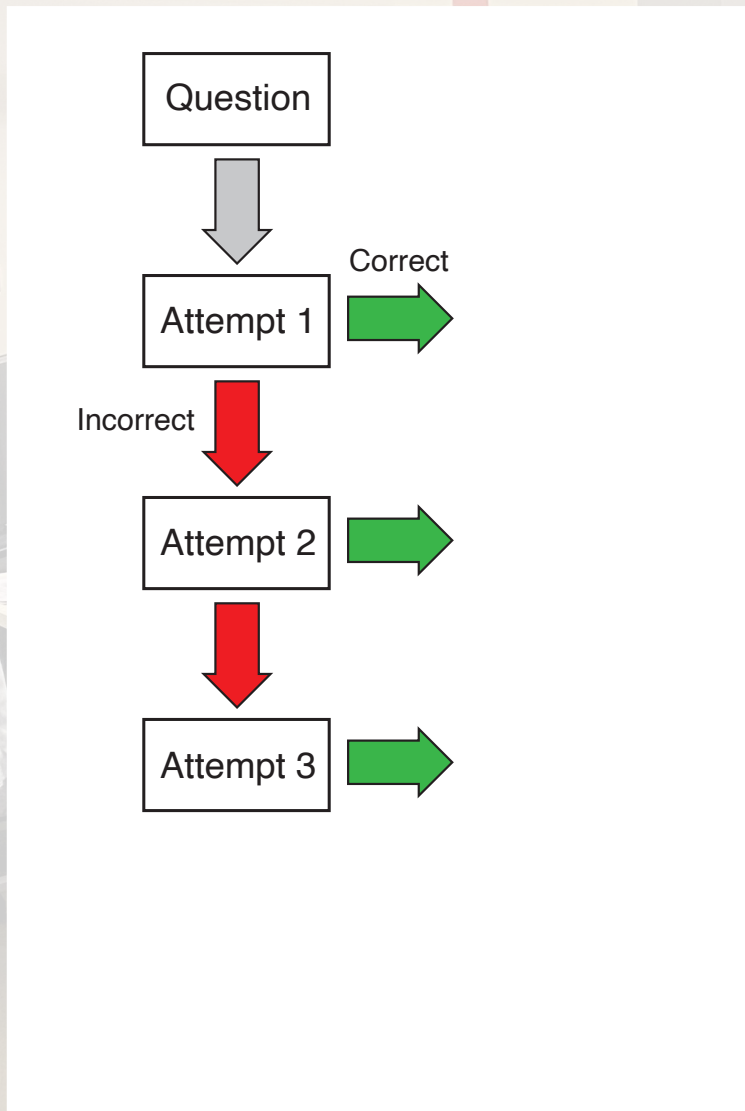


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: attempts & points

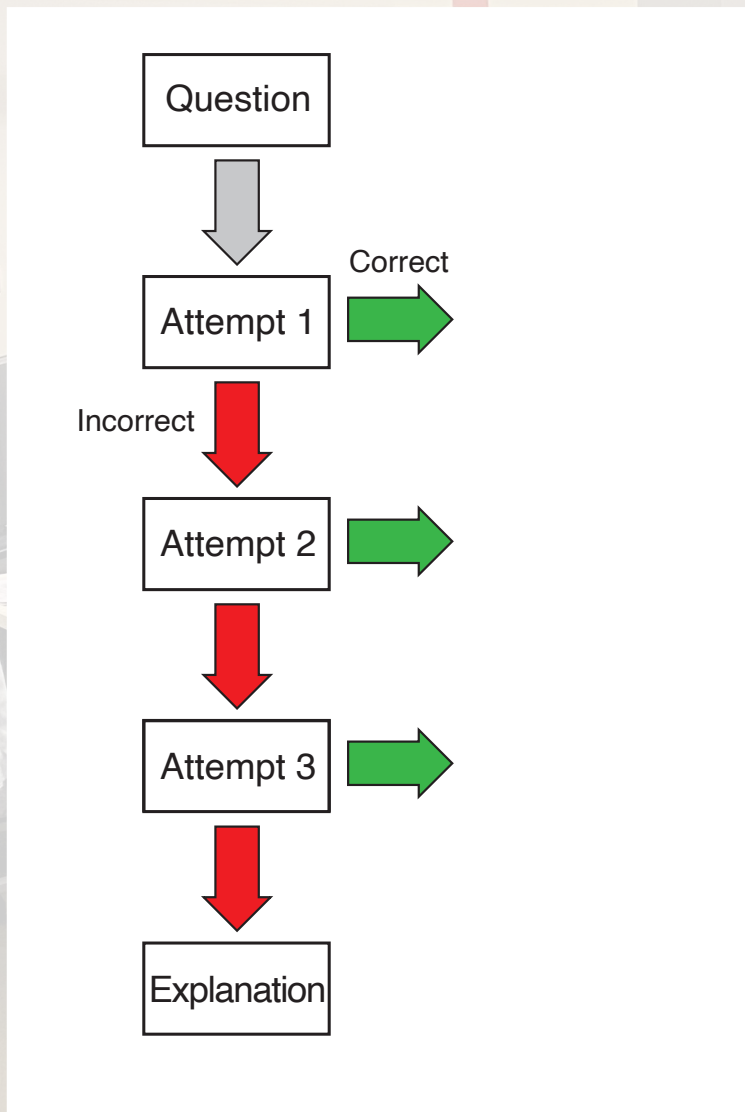


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: attempts & points

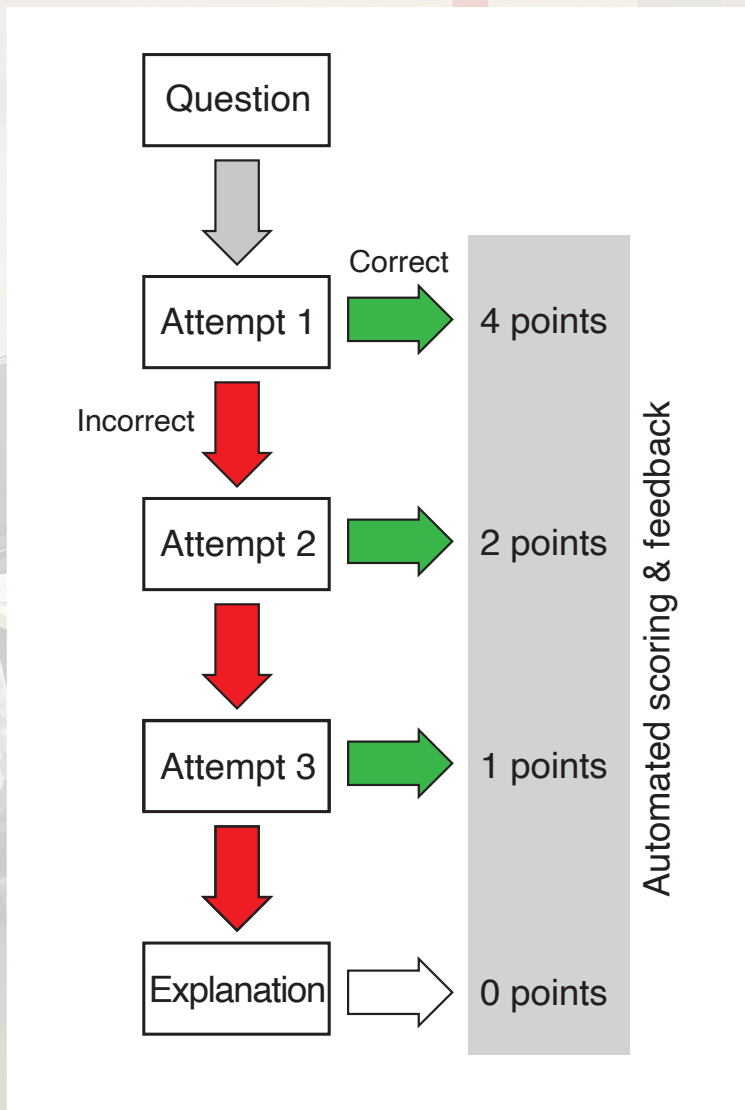


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: attempts & points

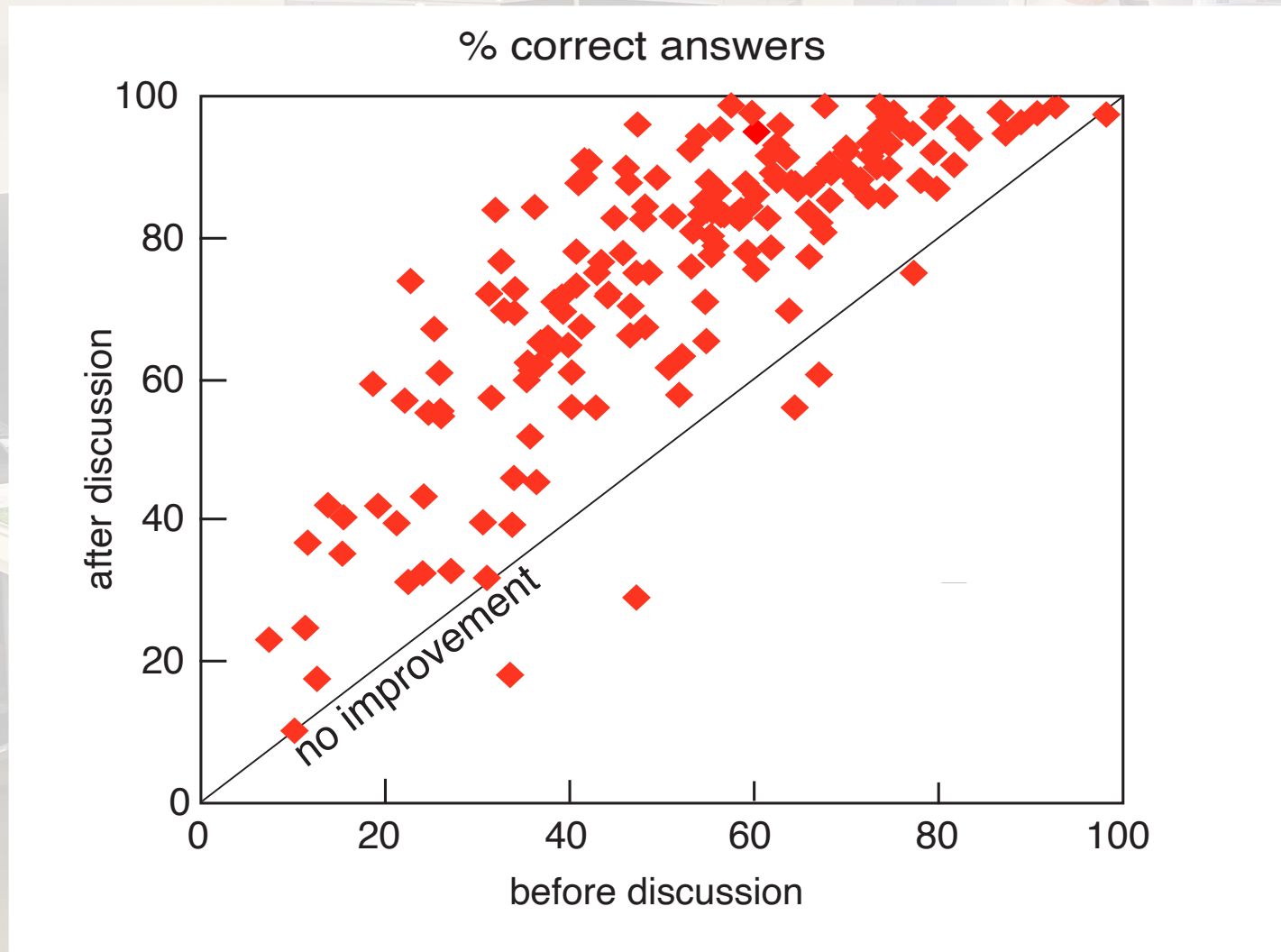


① pandemic lessons

② new normal

③ self-paced PI

self-paced vs. in-class PI

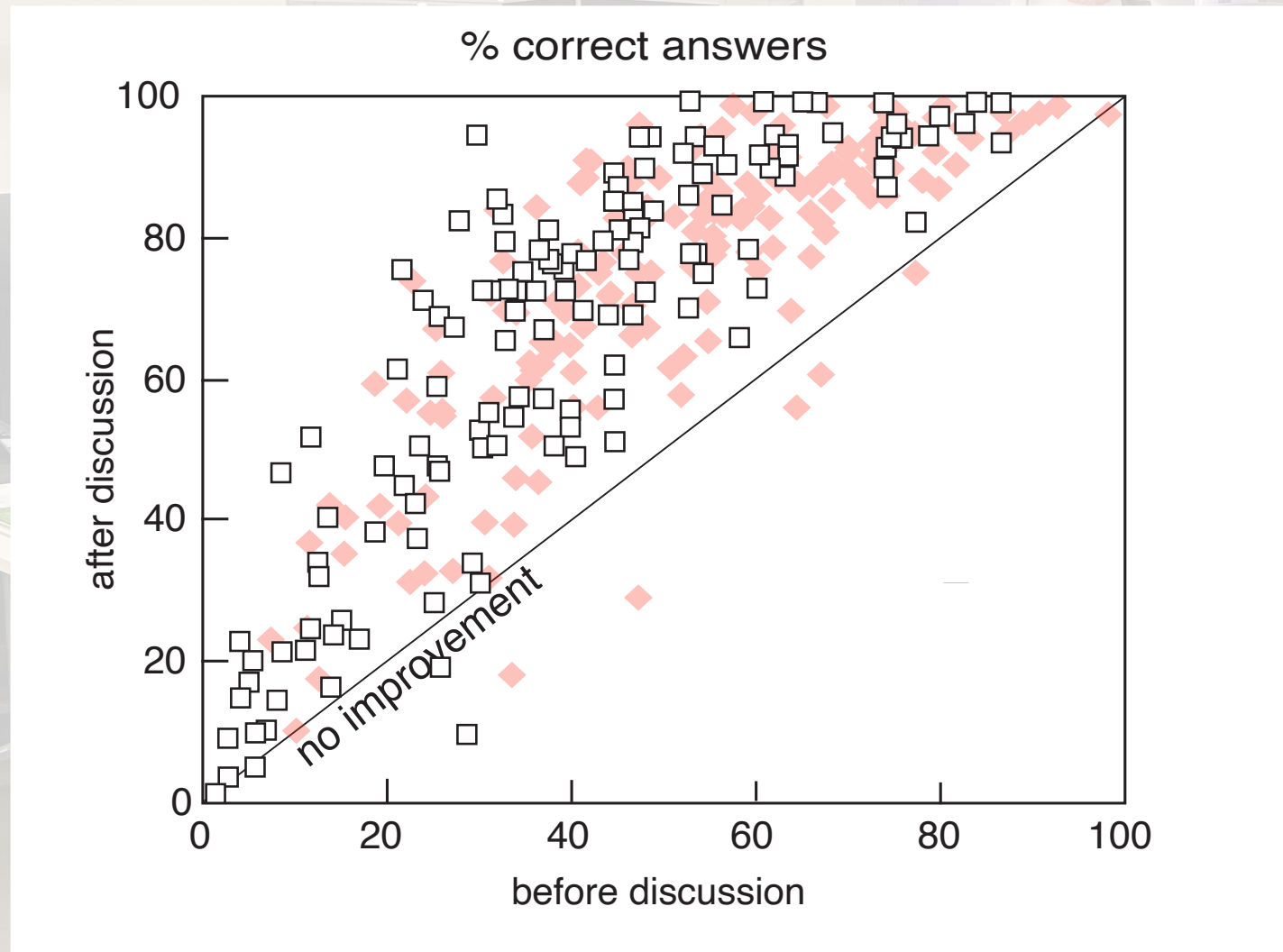


① pandemic lessons

② new normal

③ self-paced PI

self-paced vs. in-class PI

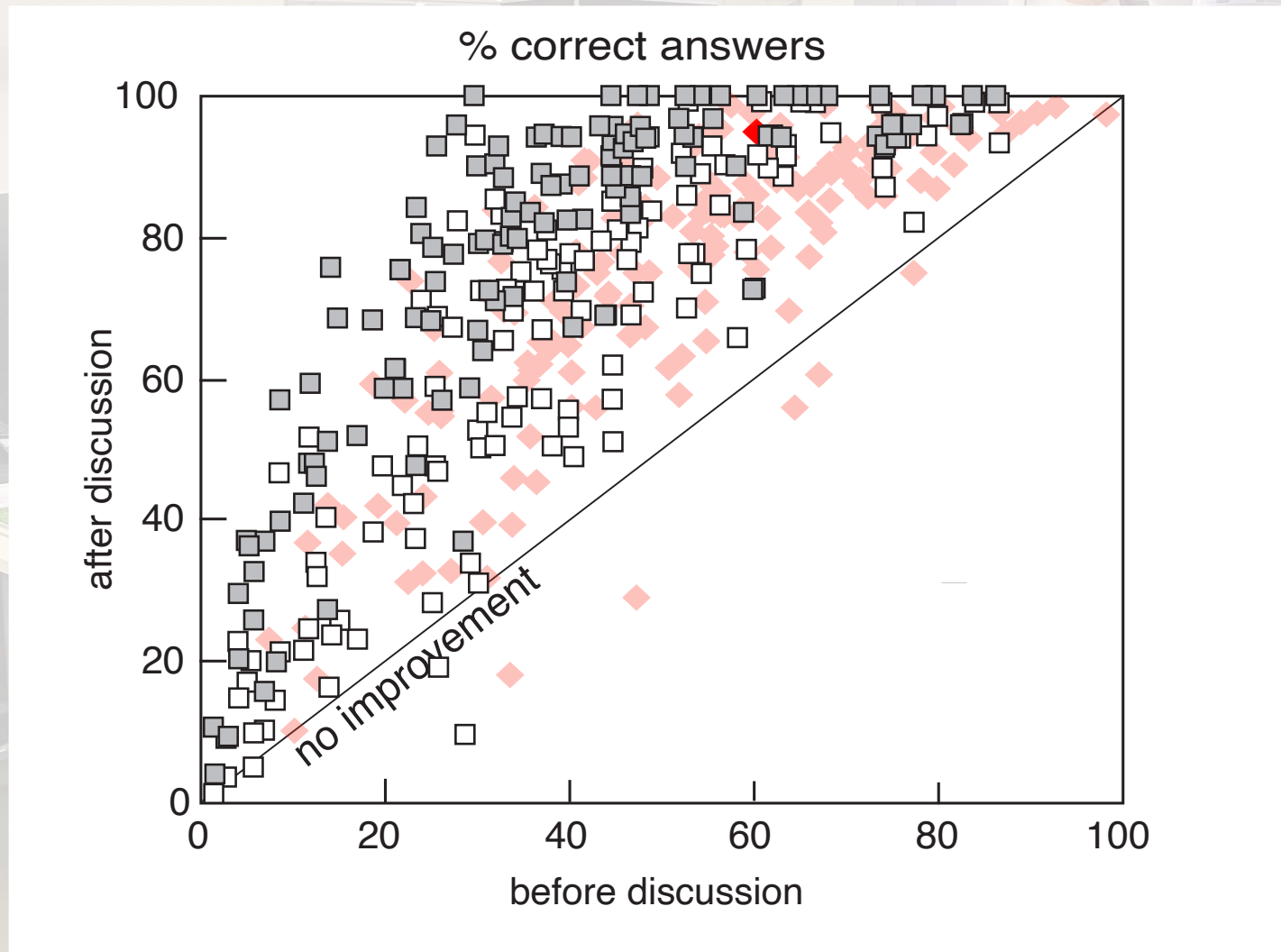


① pandemic lessons

② new normal

③ self-paced PI

self-paced vs. in-class PI

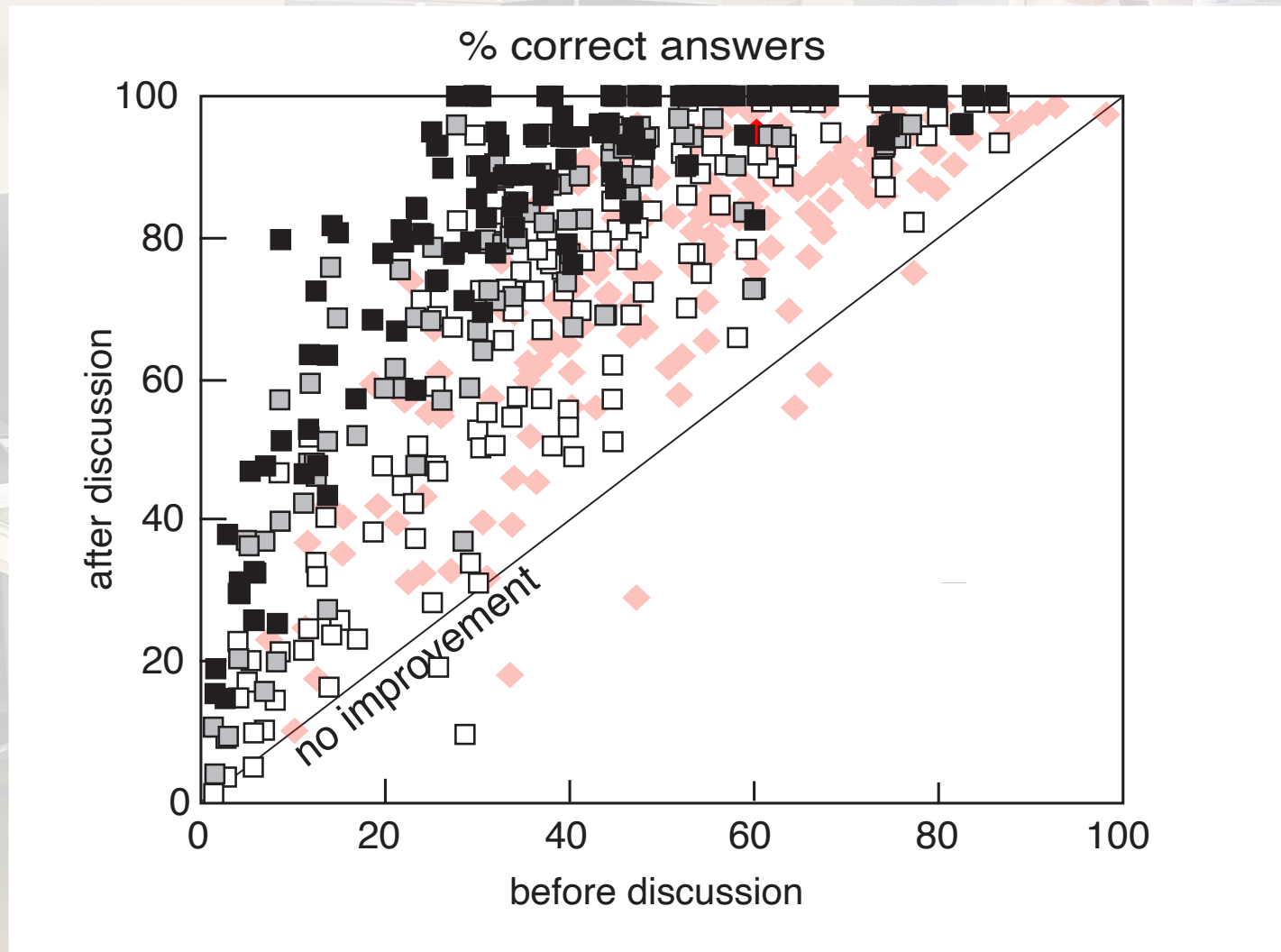


① pandemic lessons

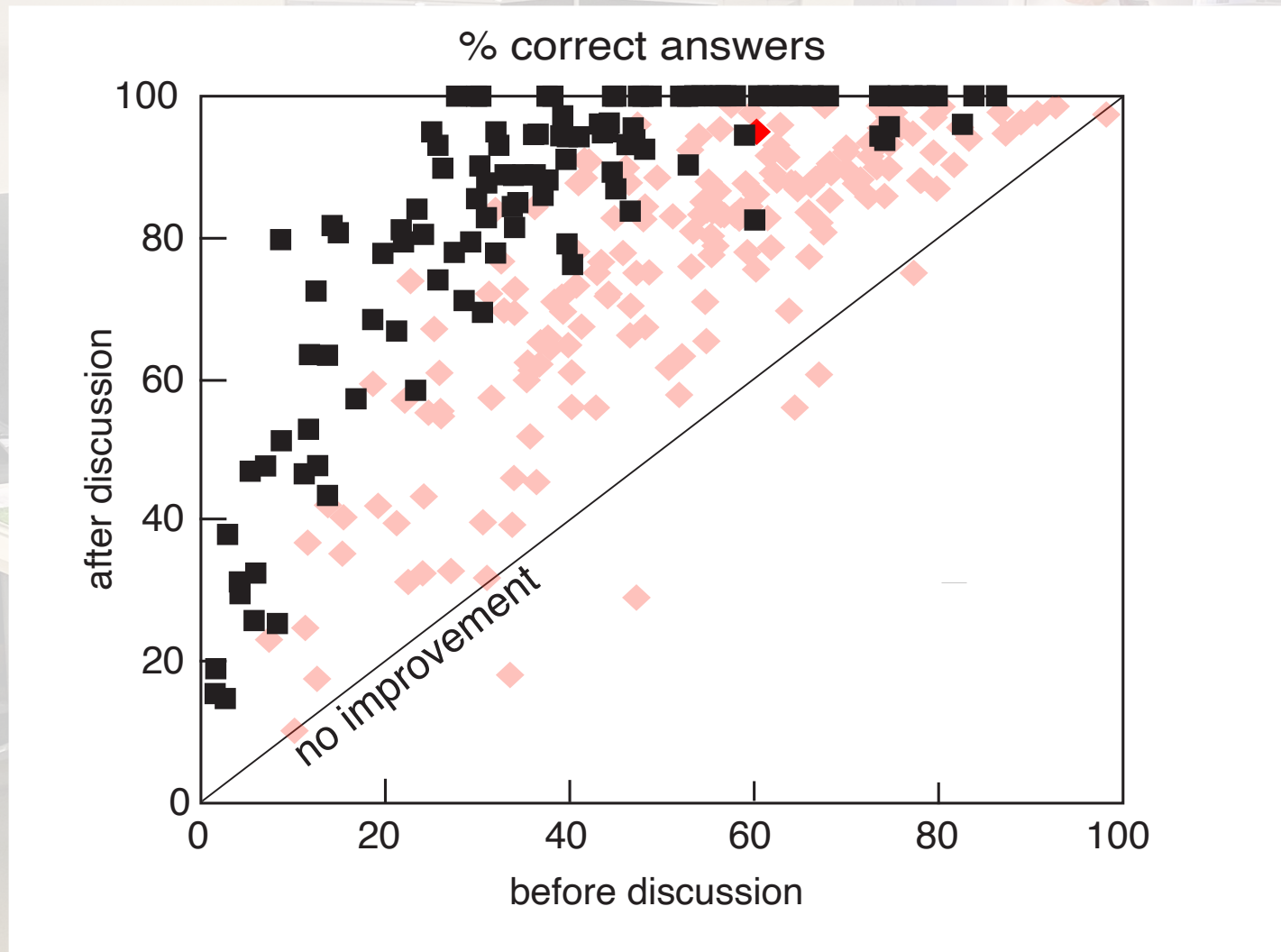
② new normal

③ self-paced PI

self-paced vs. in-class PI



self-paced vs. in-class PI

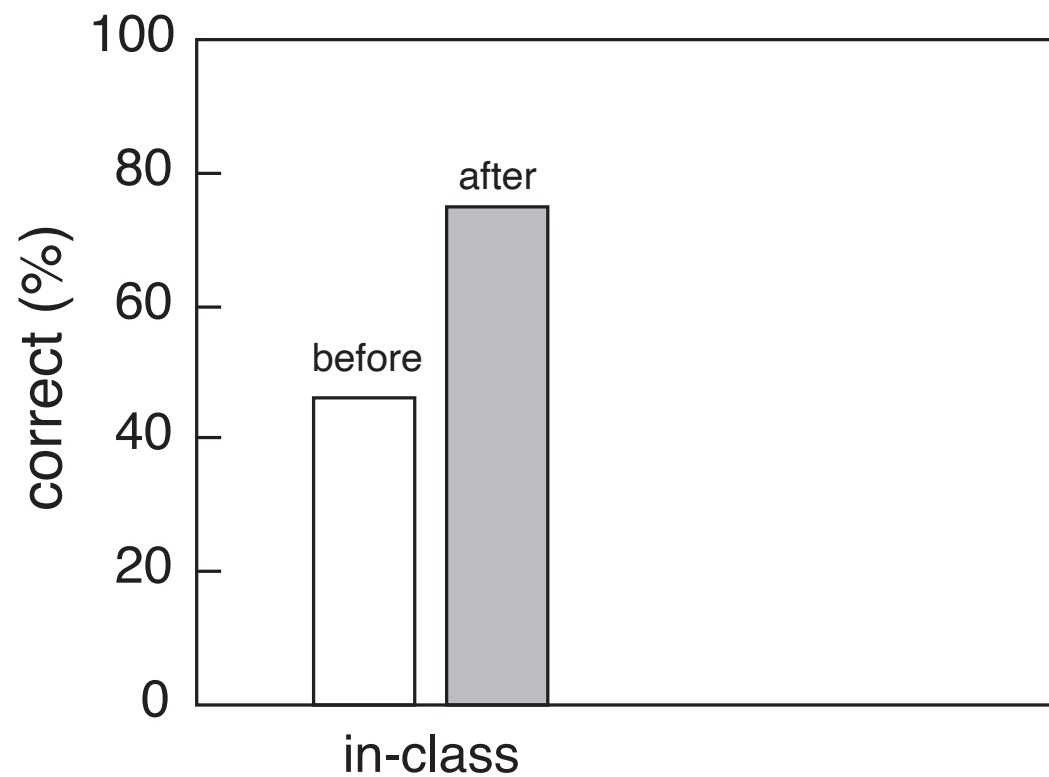


① pandemic lessons

② new normal

③ self-paced PI

self-paced vs. in-class PI

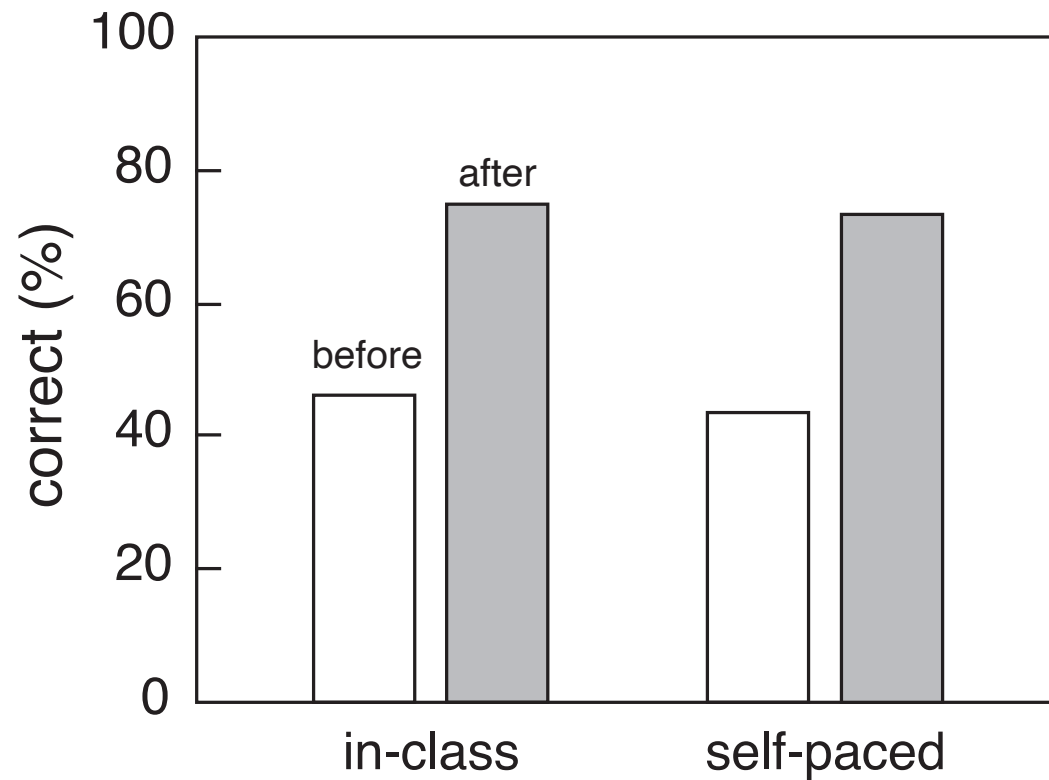


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced vs. in-class PI

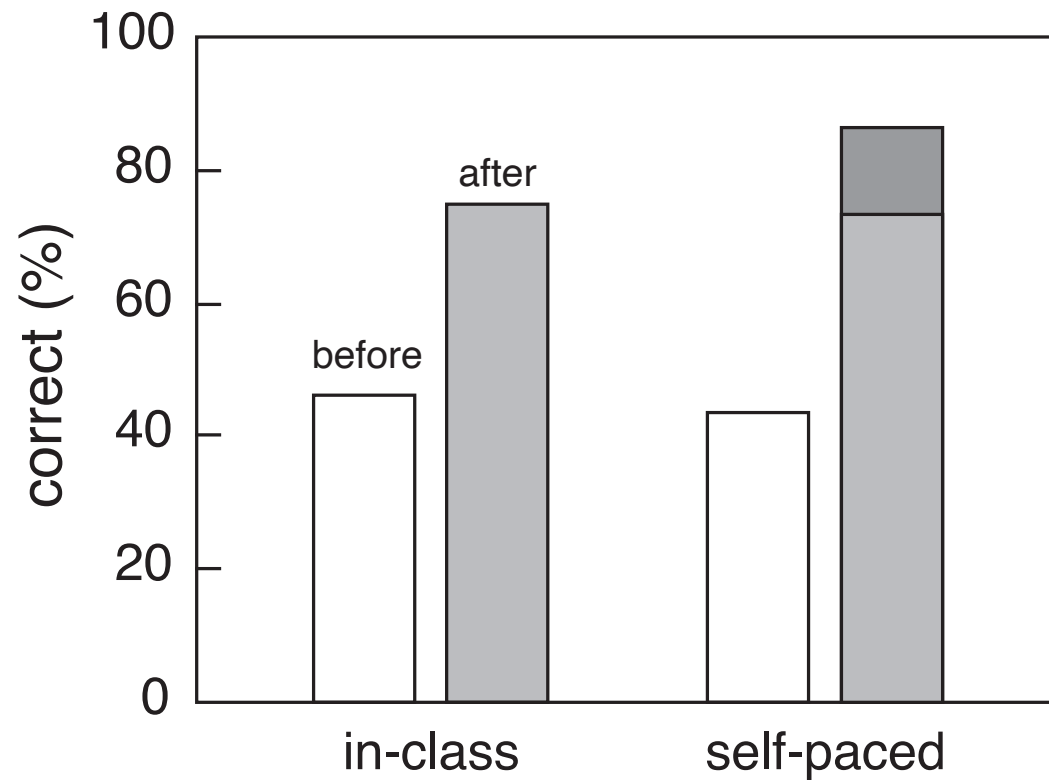


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced vs. in-class PI

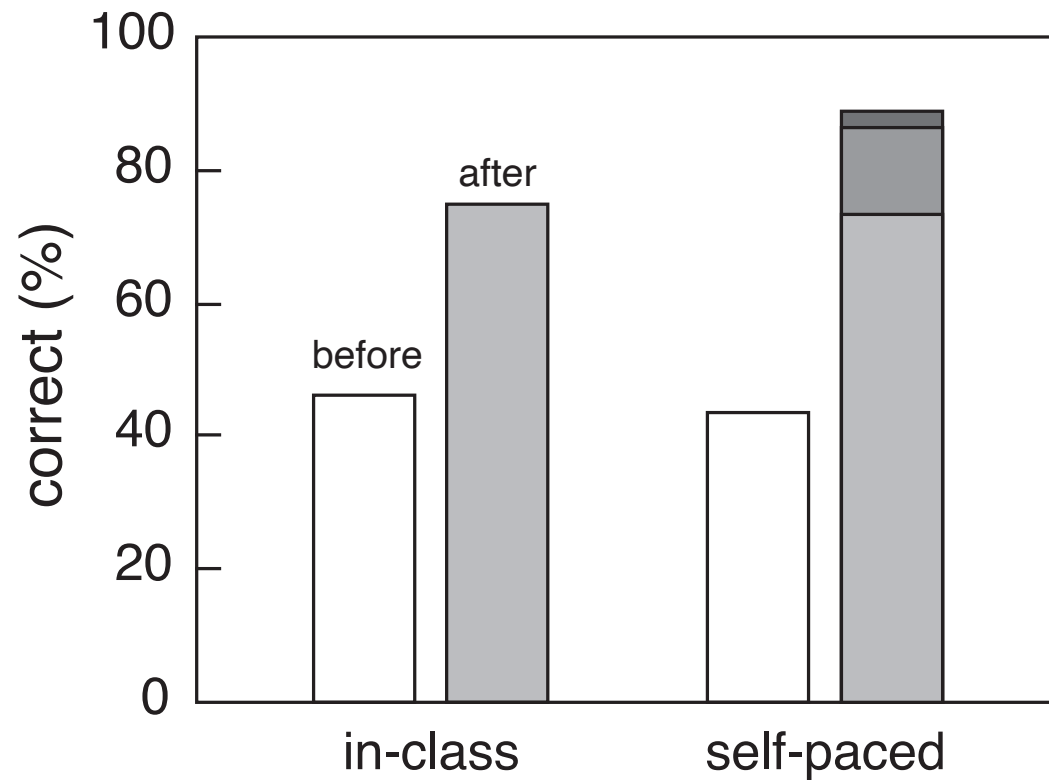


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced vs. in-class PI



1 pandemic lessons

2 new normal

3 self-paced PI



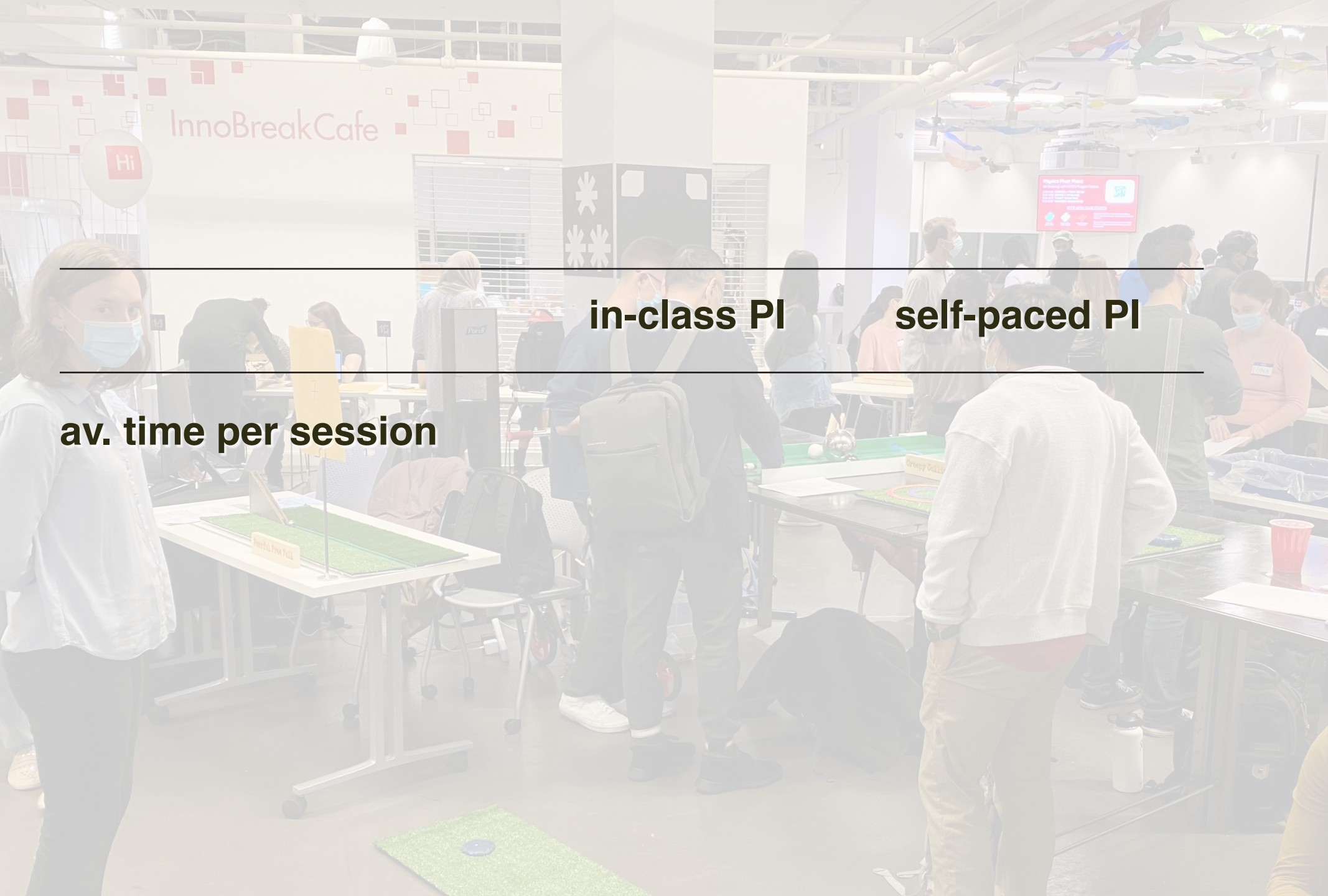
in-class PI

self-paced PI

① pandemic lessons

② new normal

③ self-paced PI



in-class PI

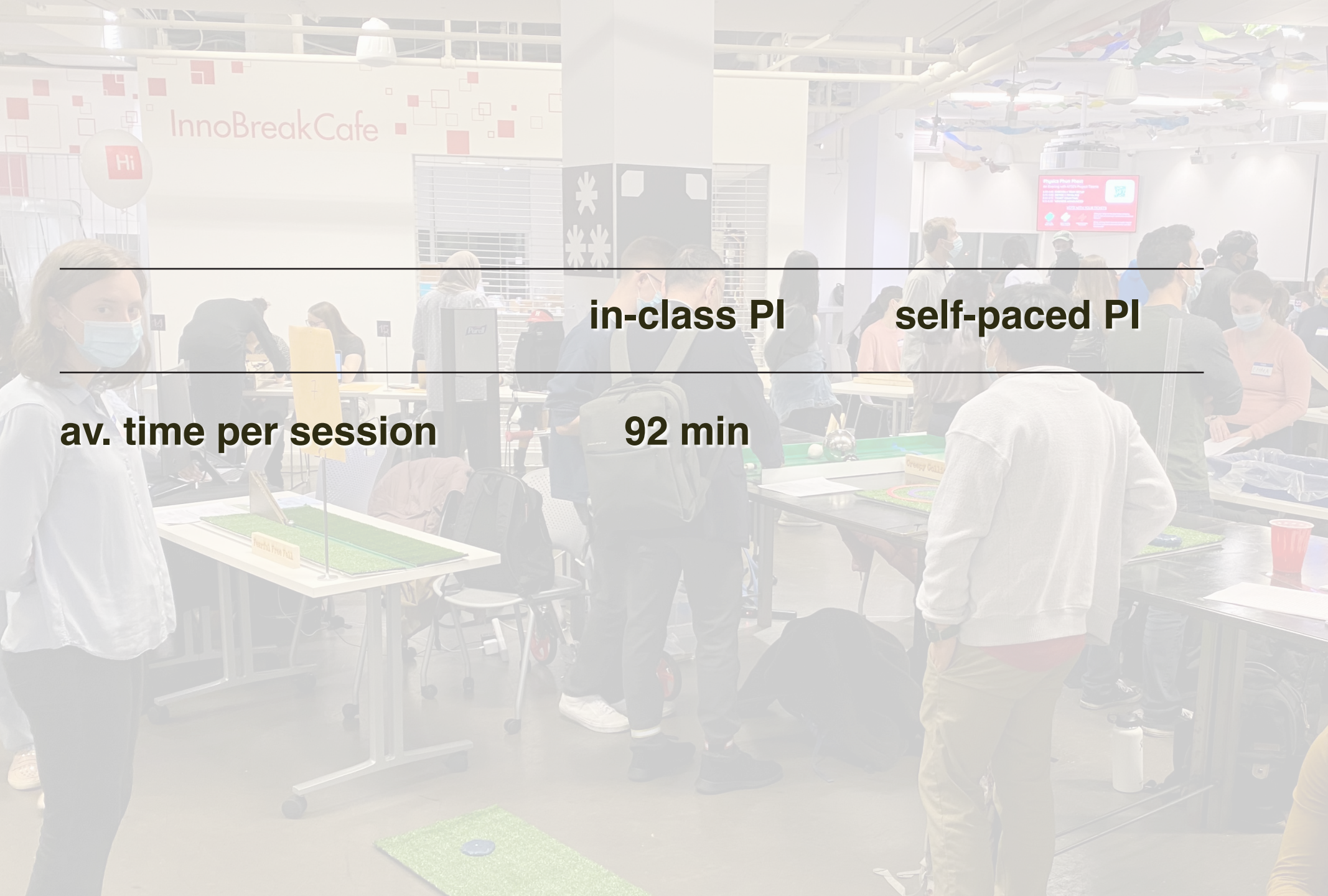
self-paced PI

av. time per session

① pandemic lessons

② new normal

③ self-paced PI



in-class PI

self-paced PI

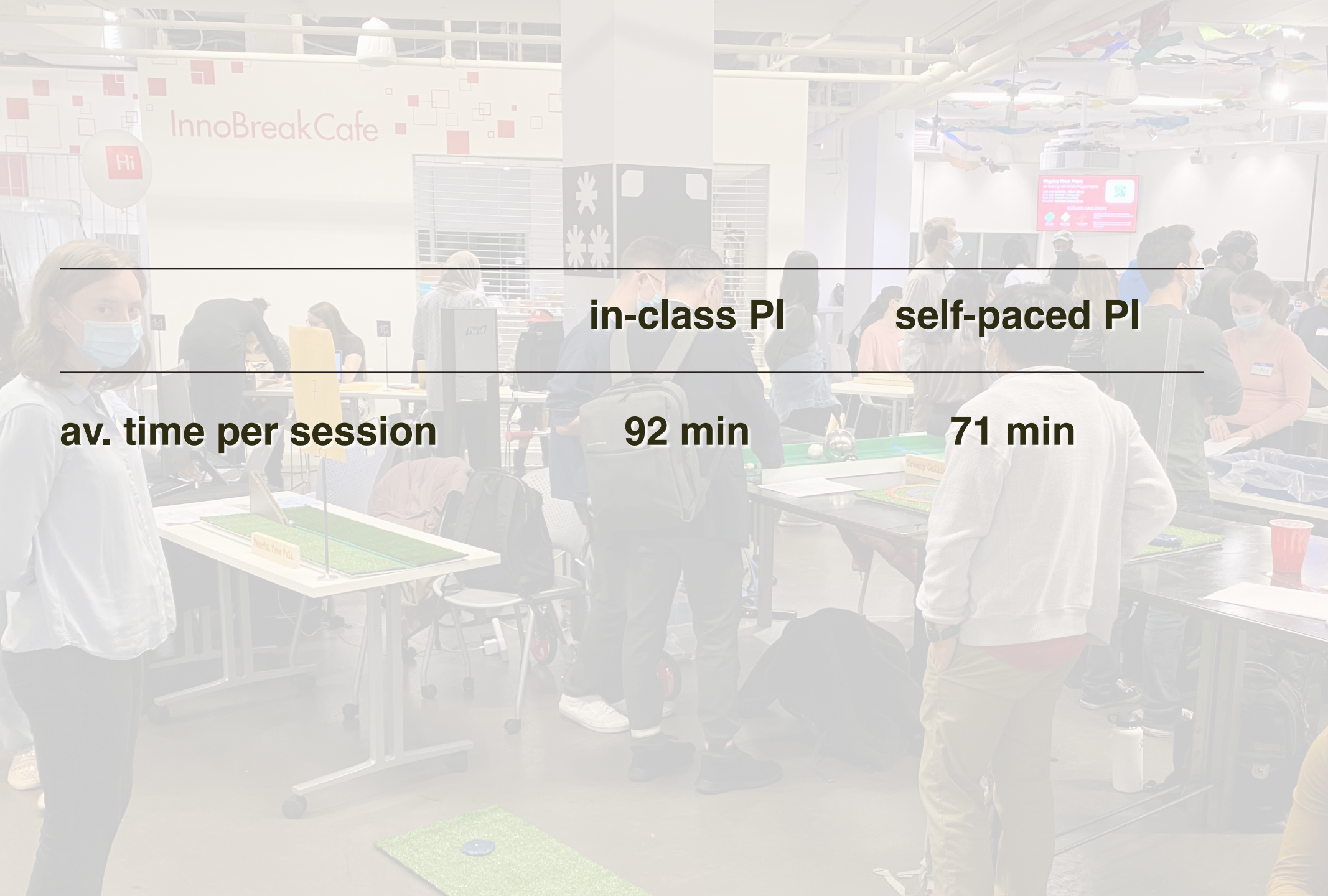
av. time per session

92 min

1 pandemic lessons

2 new normal

3 self-paced PI



in-class PI

self-paced PI

av. time per session

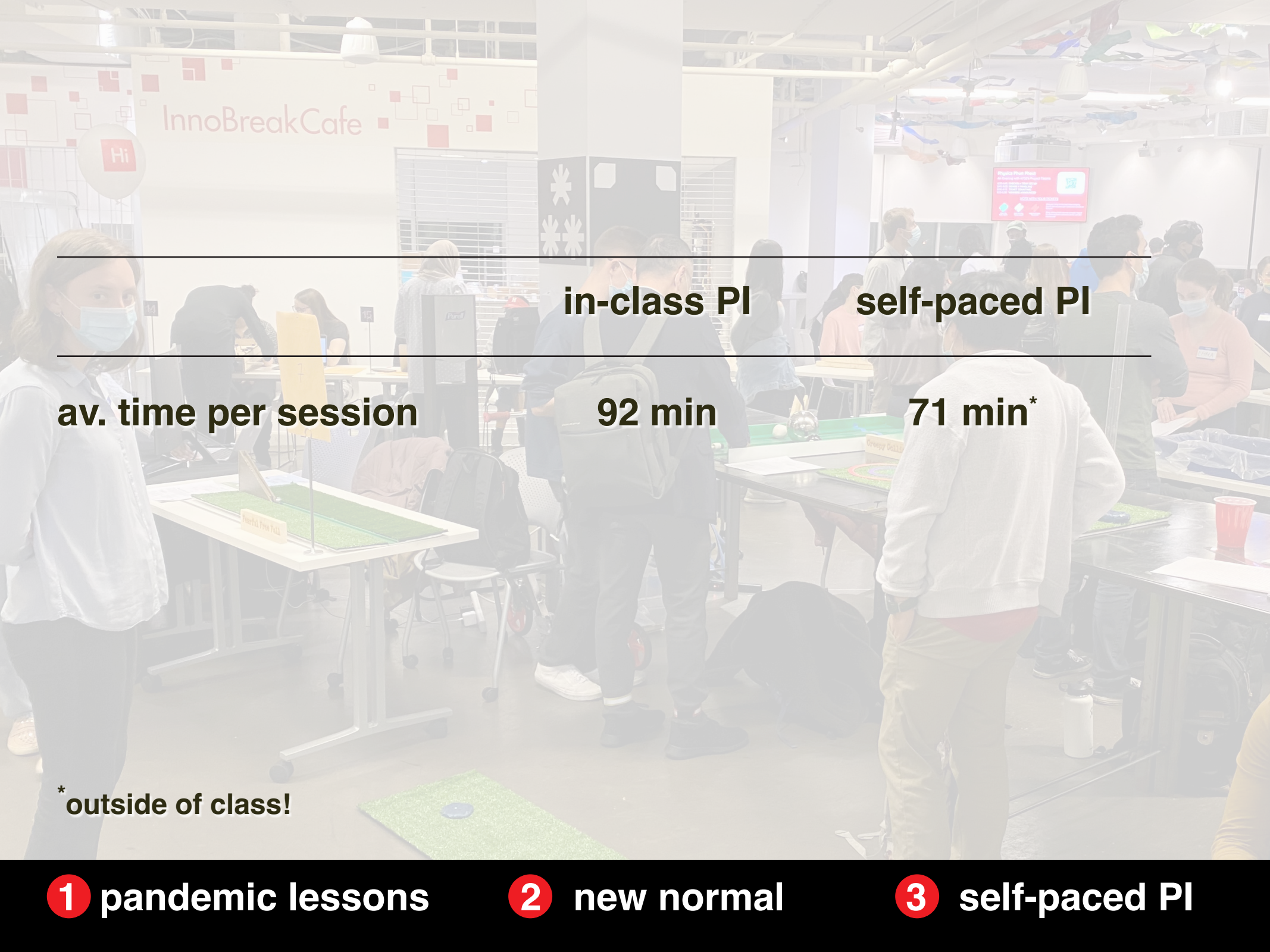
92 min

71 min

① pandemic lessons

② new normal

③ self-paced PI



in-class PI

self-paced PI

av. time per session

92 min

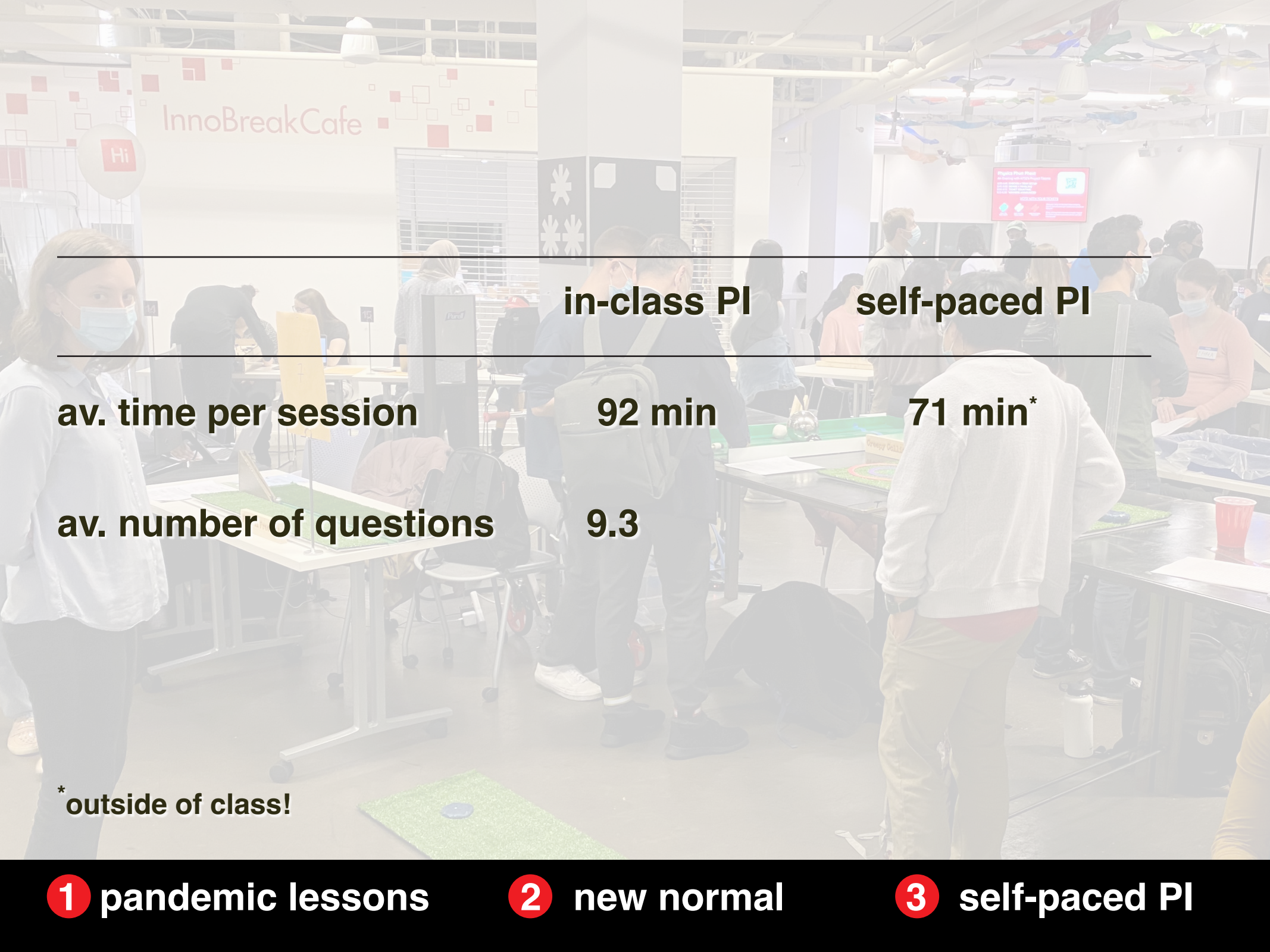
71 min*

***outside of class!**

1 pandemic lessons

2 new normal

3 self-paced PI



in-class PI

self-paced PI

av. time per session

92 min

71 min*

av. number of questions

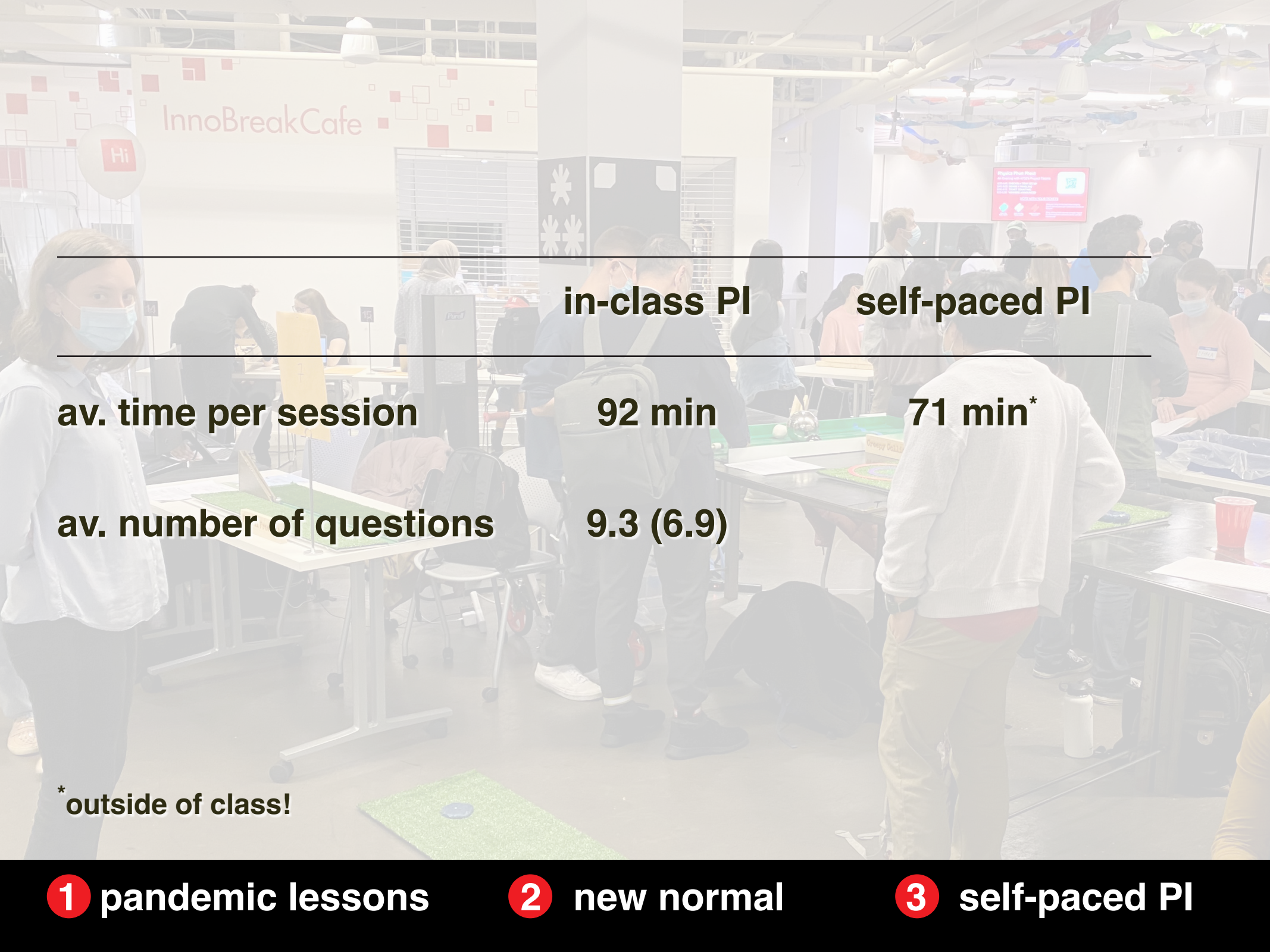
9.3

***outside of class!**

1 pandemic lessons

2 new normal

3 self-paced PI



InnoBreakCafe

in-class PI

self-paced PI

av. time per session

92 min

71 min*

av. number of questions

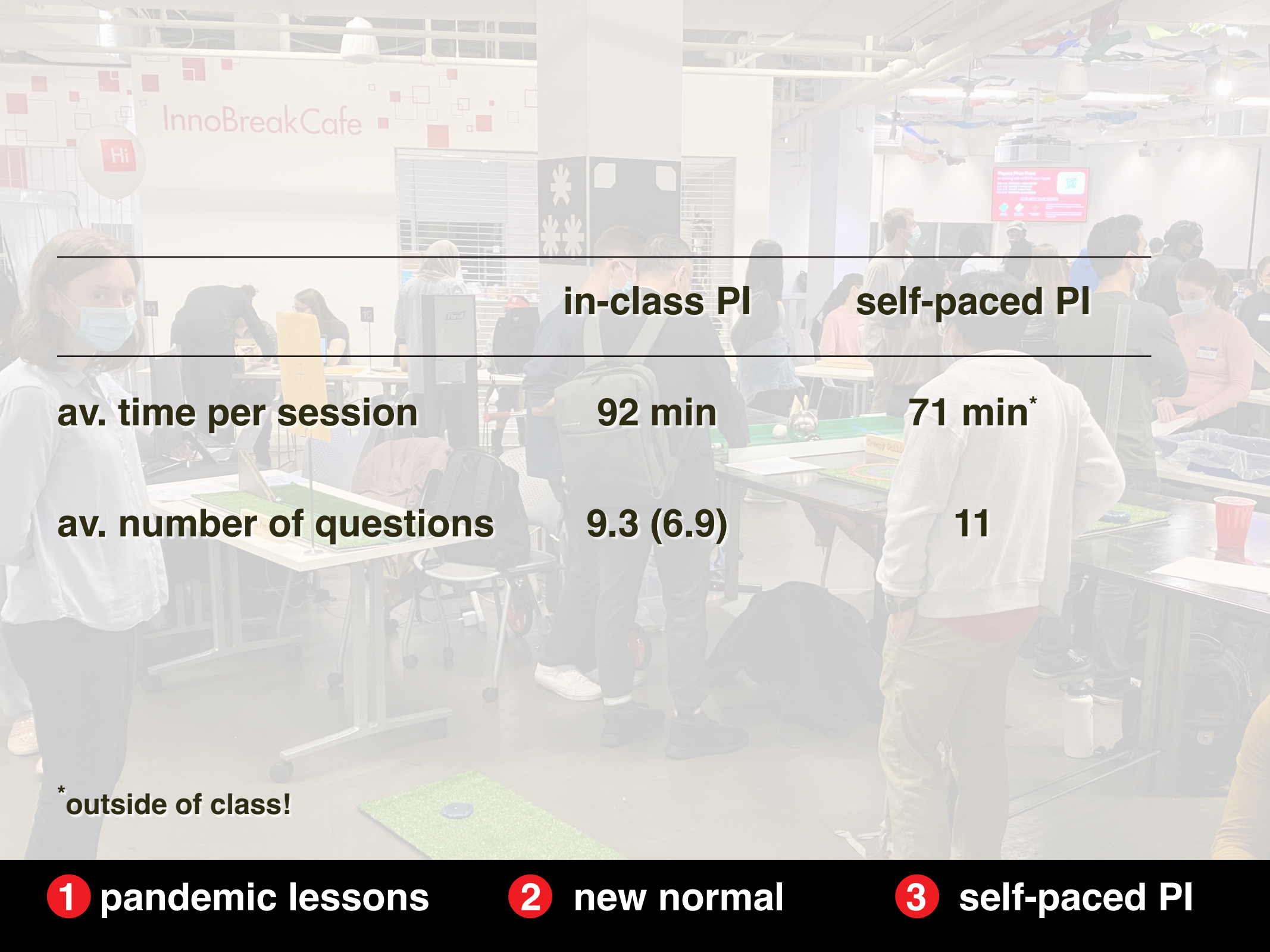
9.3 (6.9)

*** outside of class!**

1 pandemic lessons

2 new normal

3 self-paced PI



in-class PI

self-paced PI

av. time per session

92 min

71 min*

av. number of questions

9.3 (6.9)

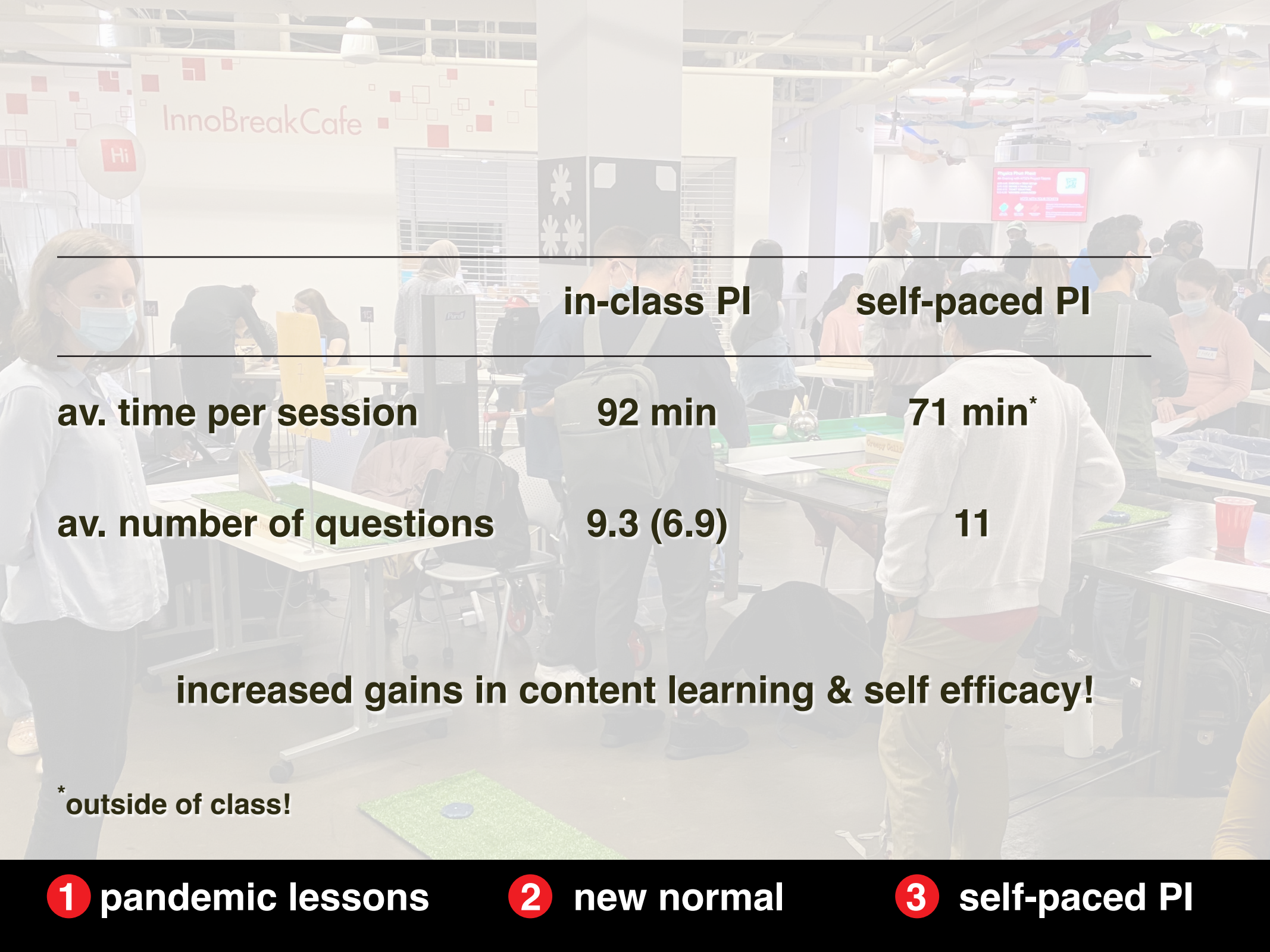
11

*** outside of class!**

1 pandemic lessons

2 new normal

3 self-paced PI



in-class PI

self-paced PI

av. time per session

92 min

71 min*

av. number of questions

9.3 (6.9)

11

increased gains in content learning & self efficacy!

***outside of class!**

1 pandemic lessons

2 new normal

3 self-paced PI



less time, more learning!

- 1 pandemic lessons**
- 2 new normal**
- 3 self-paced PI**



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question, it will count for your entire team (you, Destiny Rochester, Julia Welsh, and Dagmawi Misgano). Only one question (otherwise it will count as multiple attempts).

Jump to ▼ 1 2 3 4 5 6 7 8 9 10



dy is height h , what minimum length must the mirror be in order for you to see your entire body in the mirror?

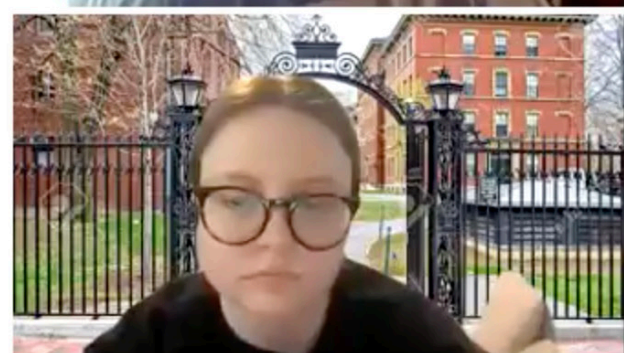
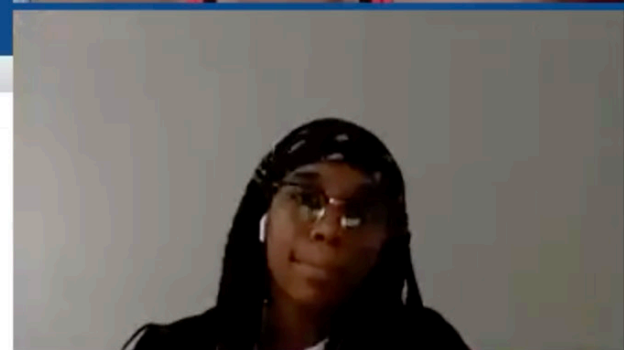
If answers other than expressions are entered (such as equations, inequalities, or number sets), they will be marked

ctions, log, ln and exp, for example, $\sin(x)$, $\ln(y)$, $\exp(2)$. Inverse trigonometric functions are supported only in form of $\exp(1)$ for Euler's number. $\log(z)$ presents the logarithm of z to base 10, while $\ln(z)$ to base $\exp(1)$ and $\log(z,2)$ to base

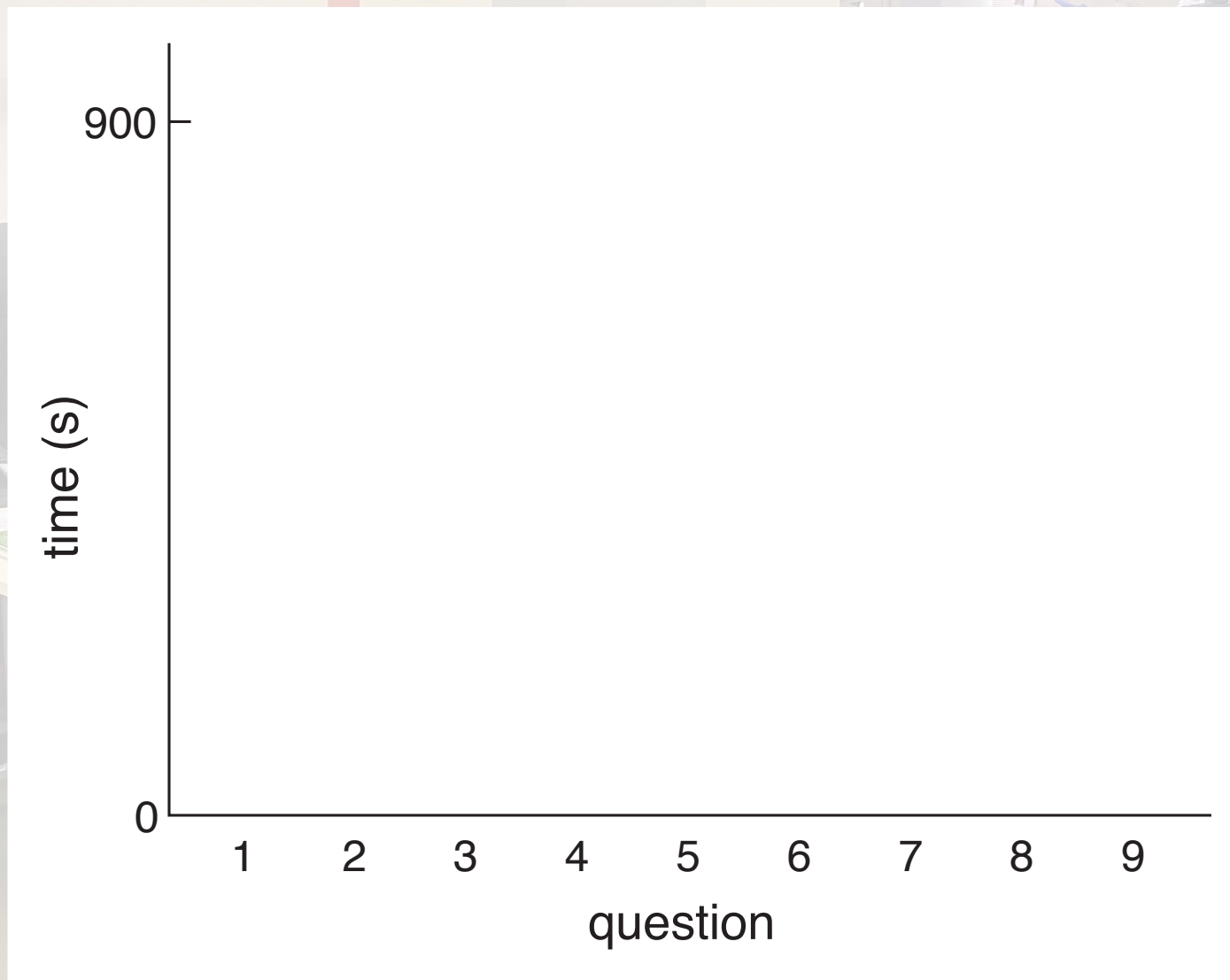
ts so far in team round [Score details](#)

[Send a message to the instructor](#)

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self-paced PI: how is time spent?

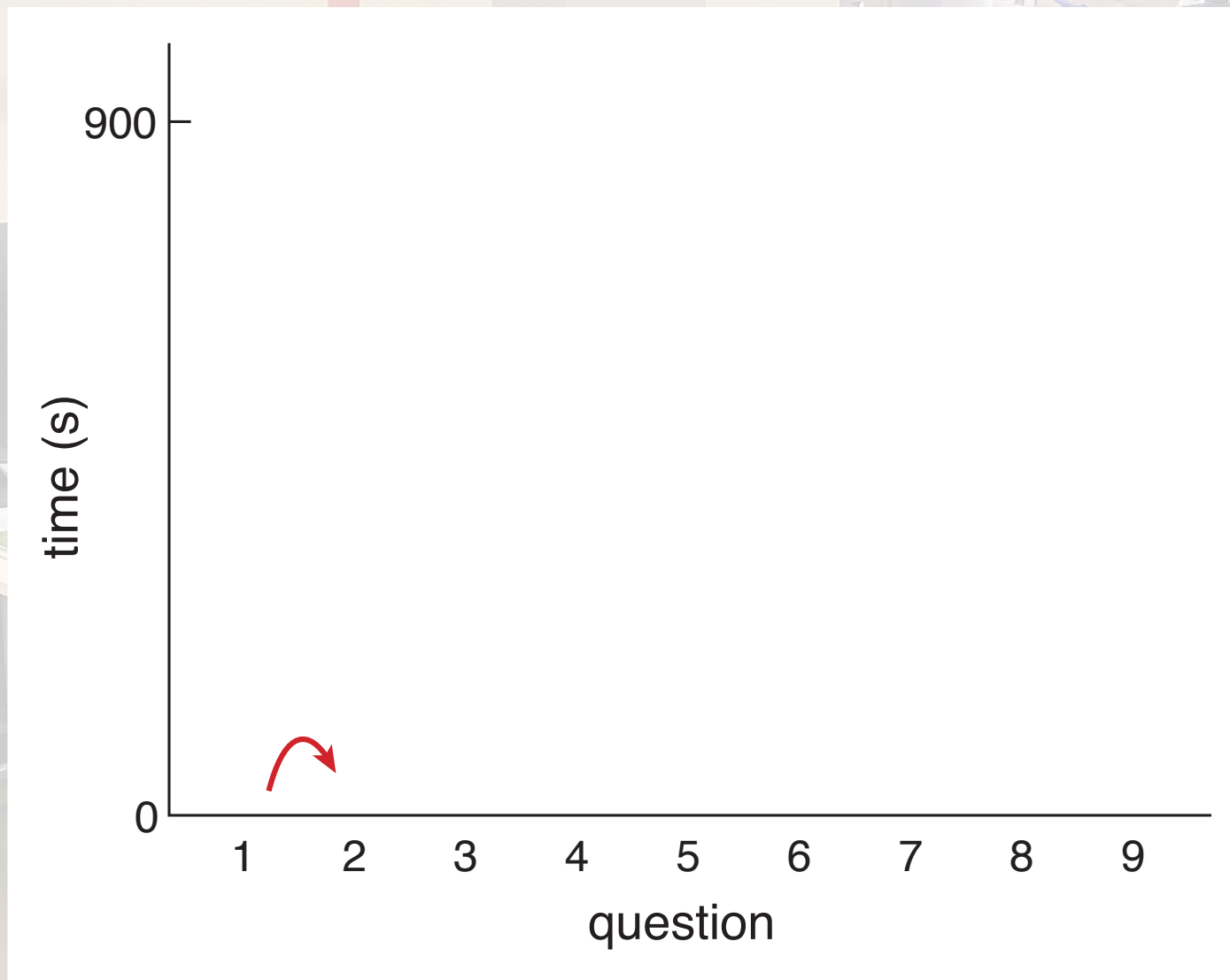


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: how is time spent?

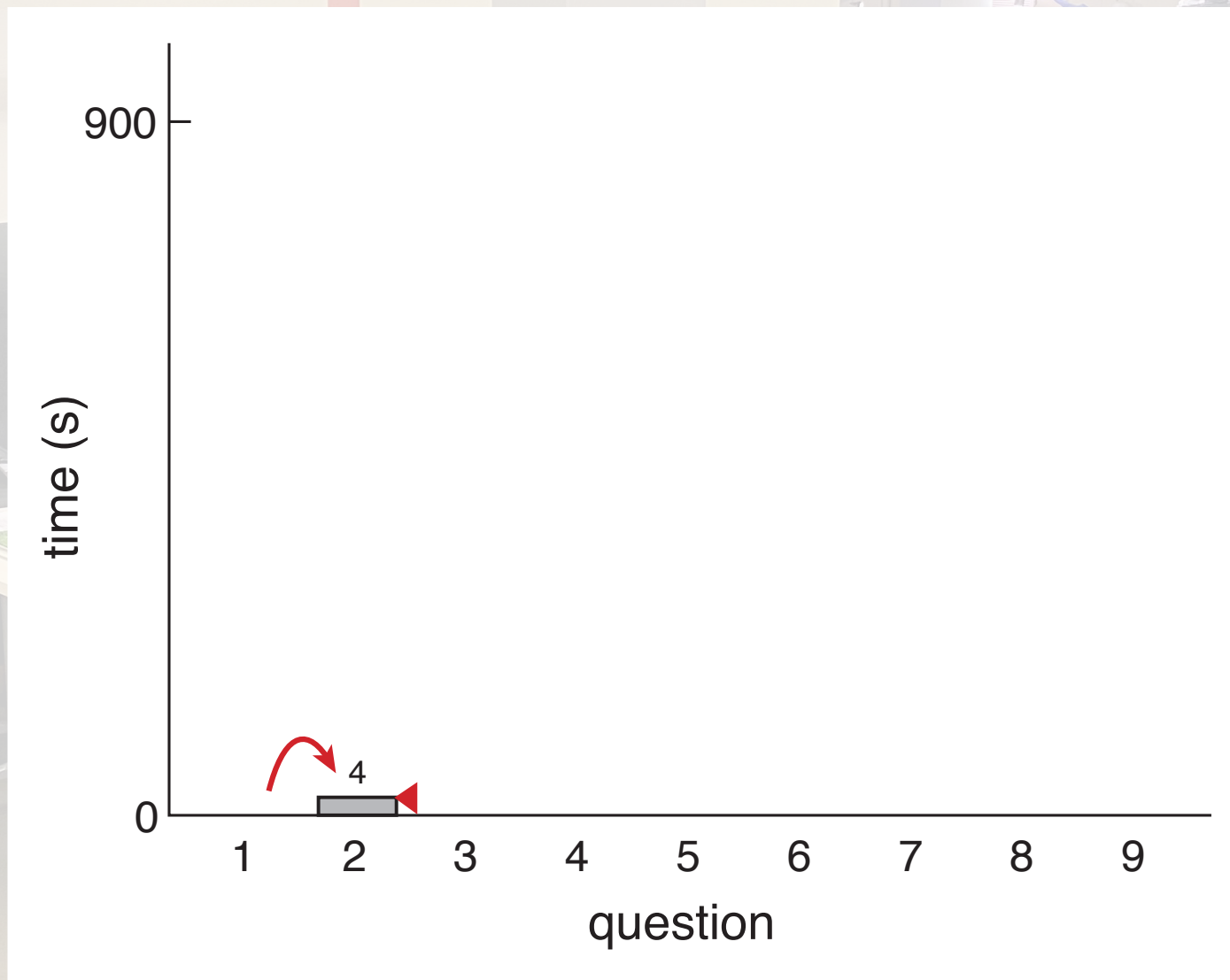


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: how is time spent?

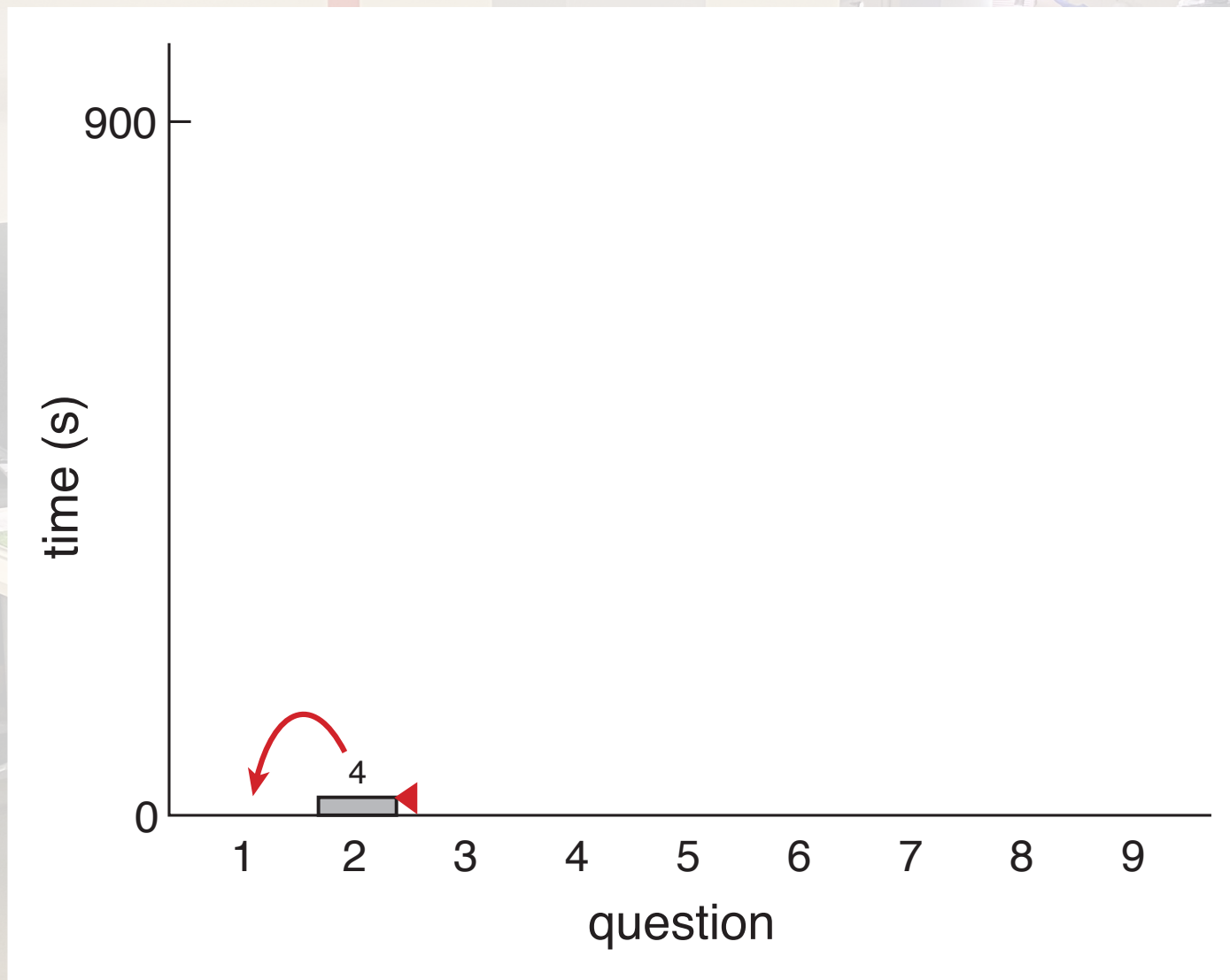


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: how is time spent?

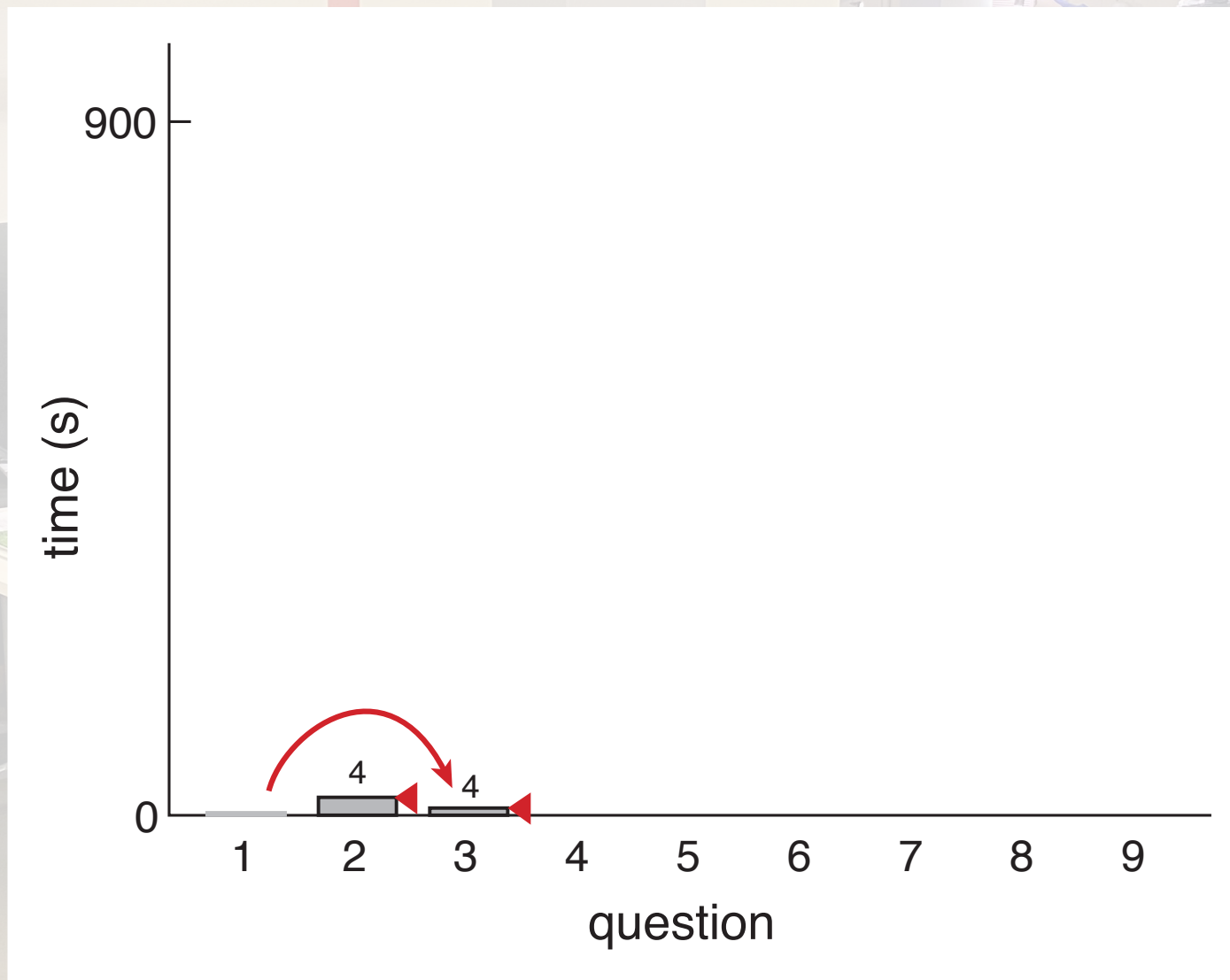


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: how is time spent?

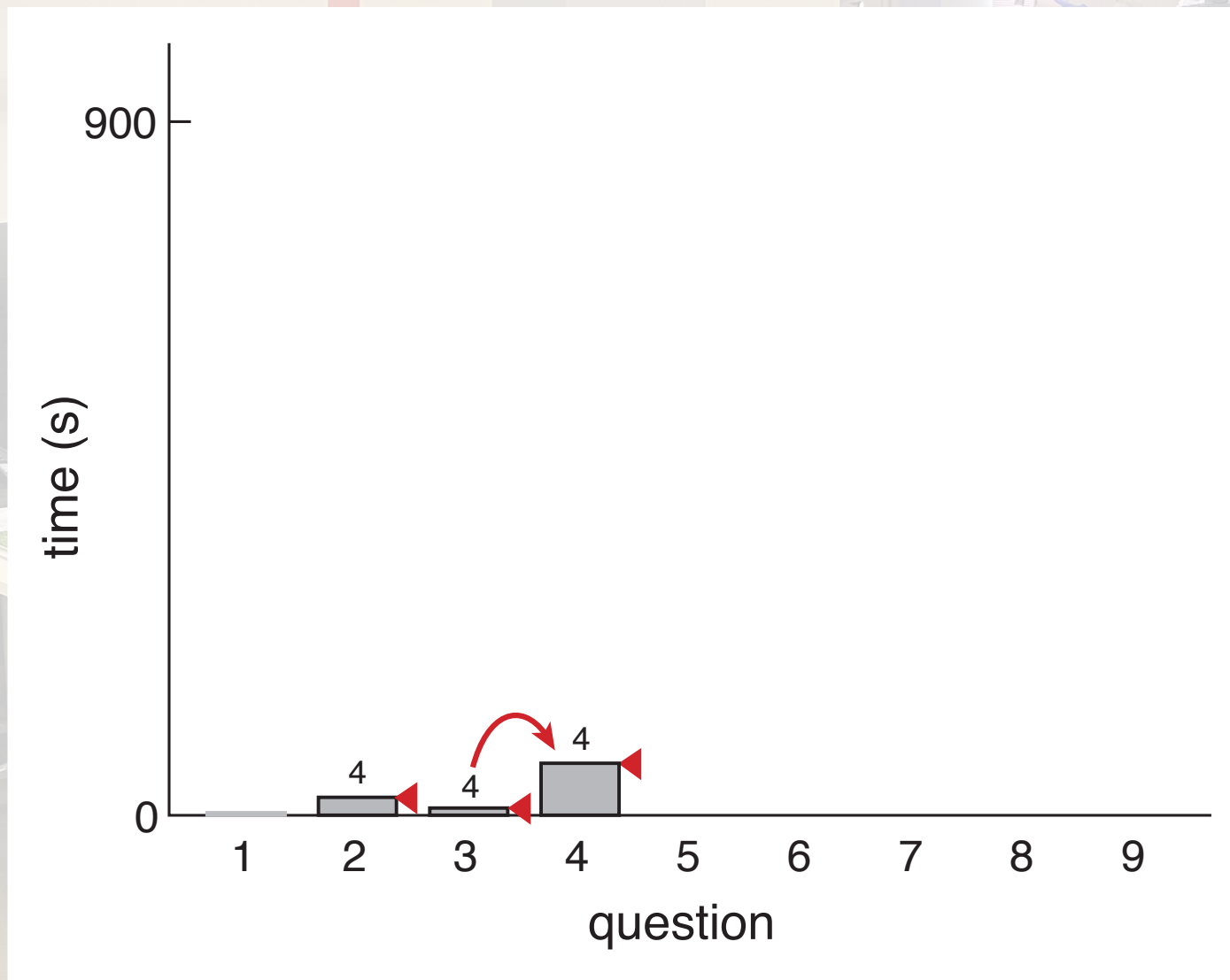


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: how is time spent?

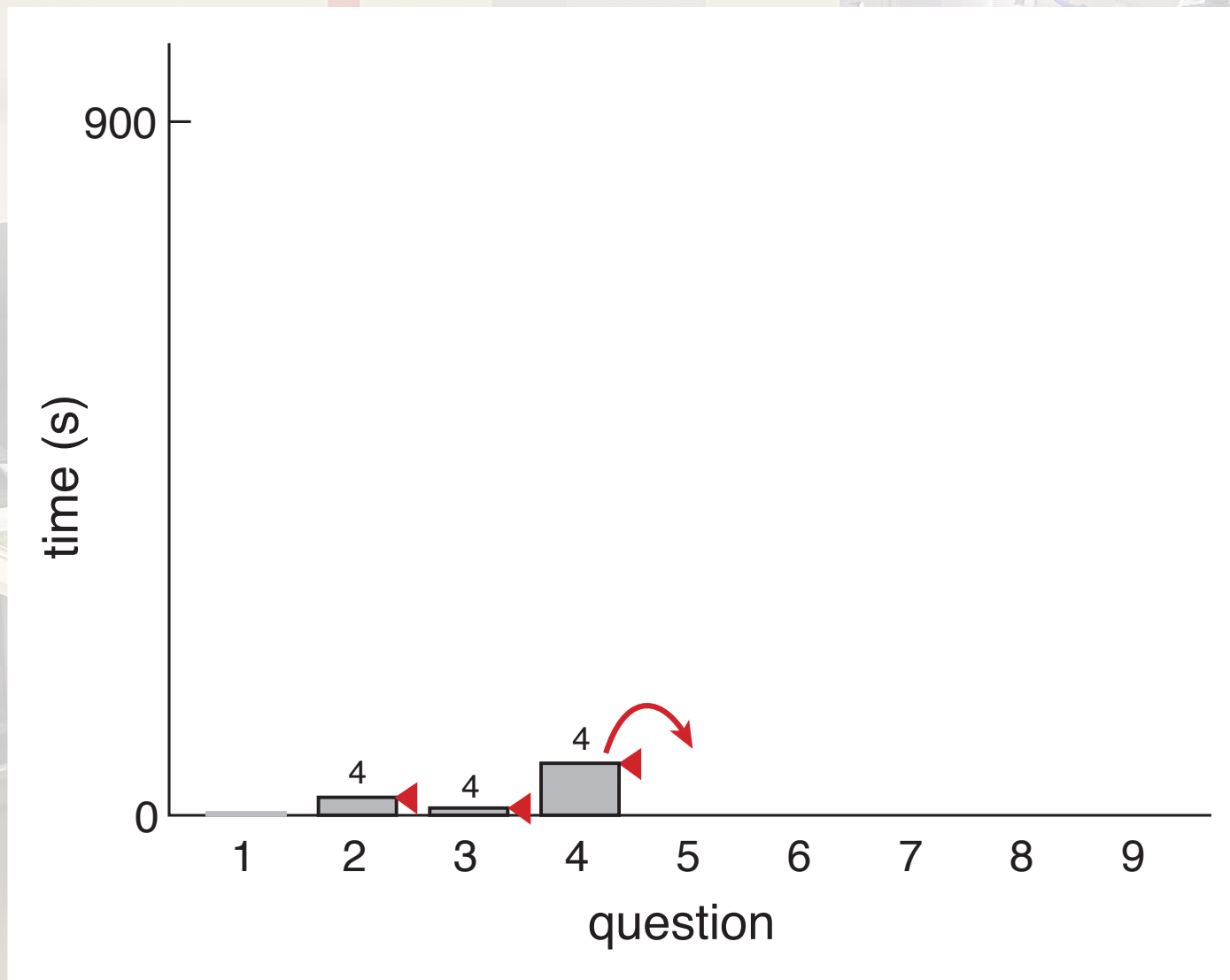


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: how is time spent?

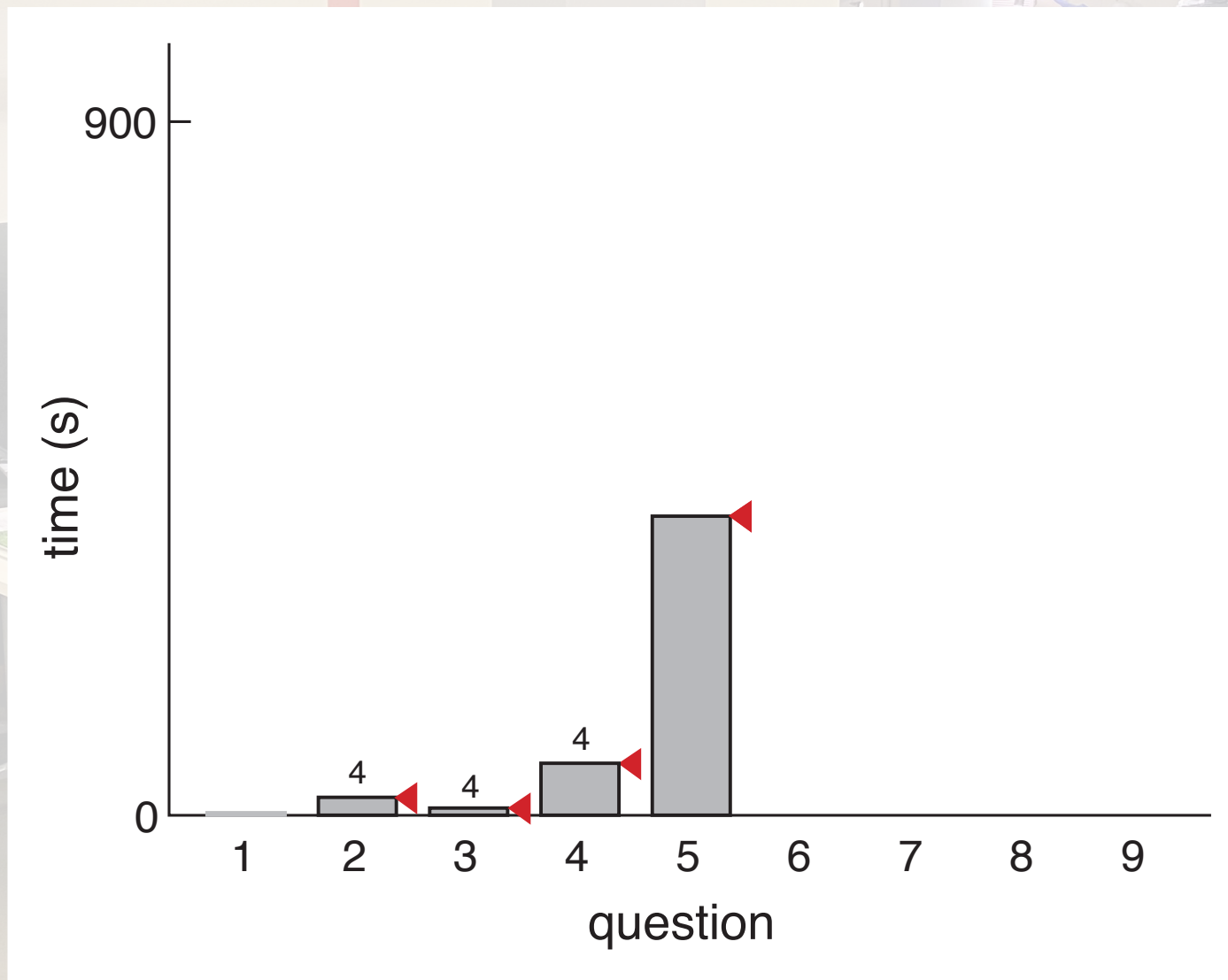


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: how is time spent?

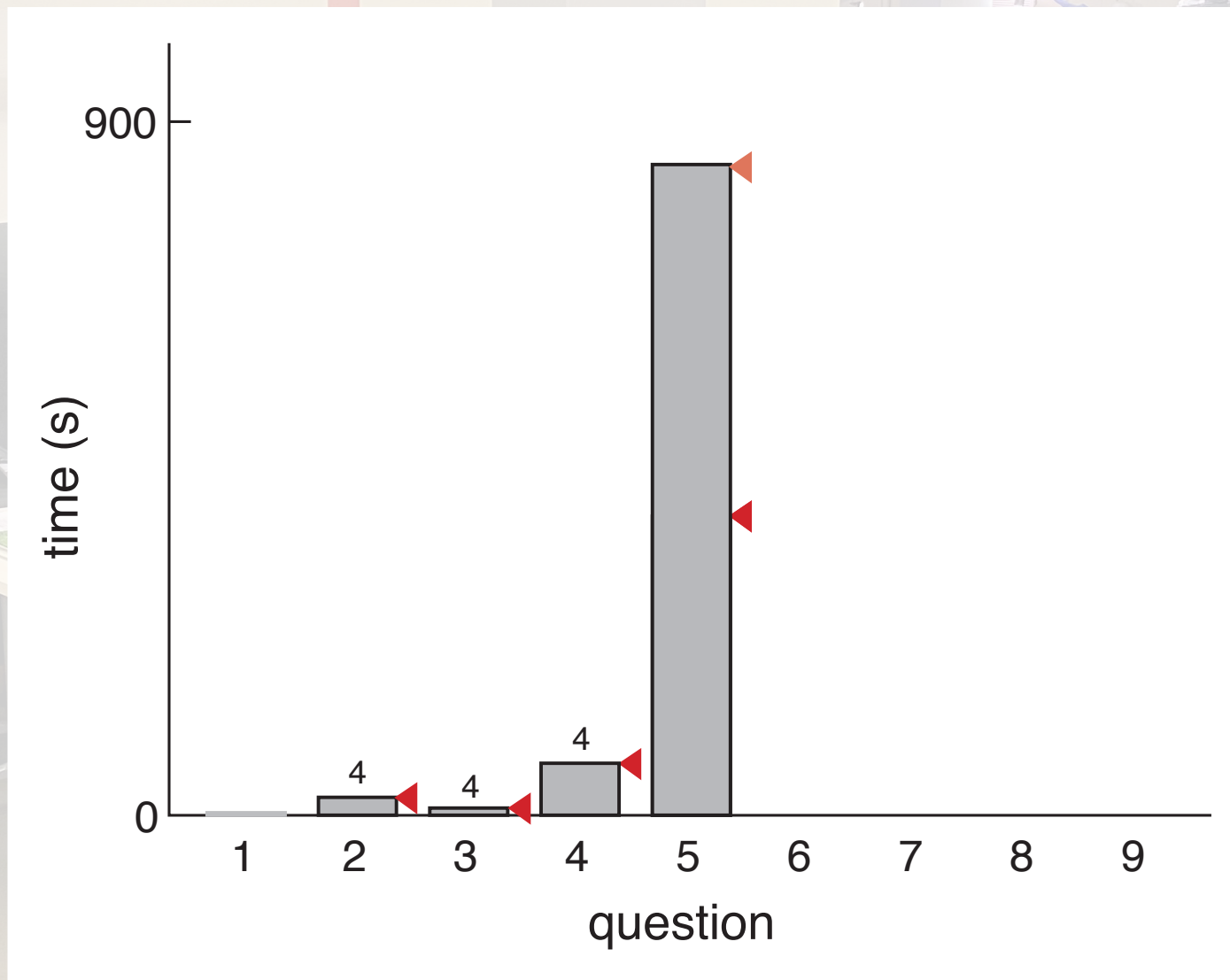


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: how is time spent?

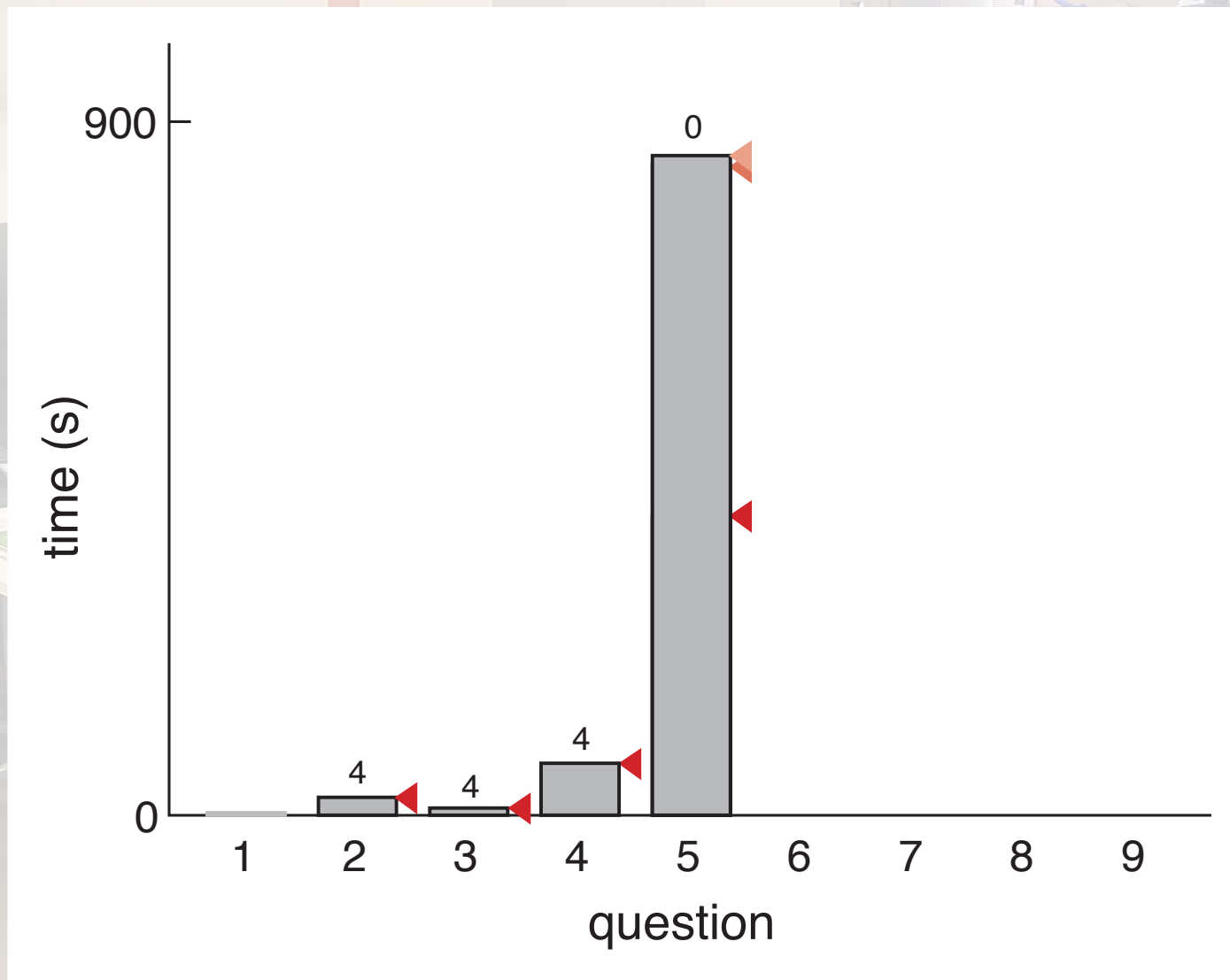


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: how is time spent?

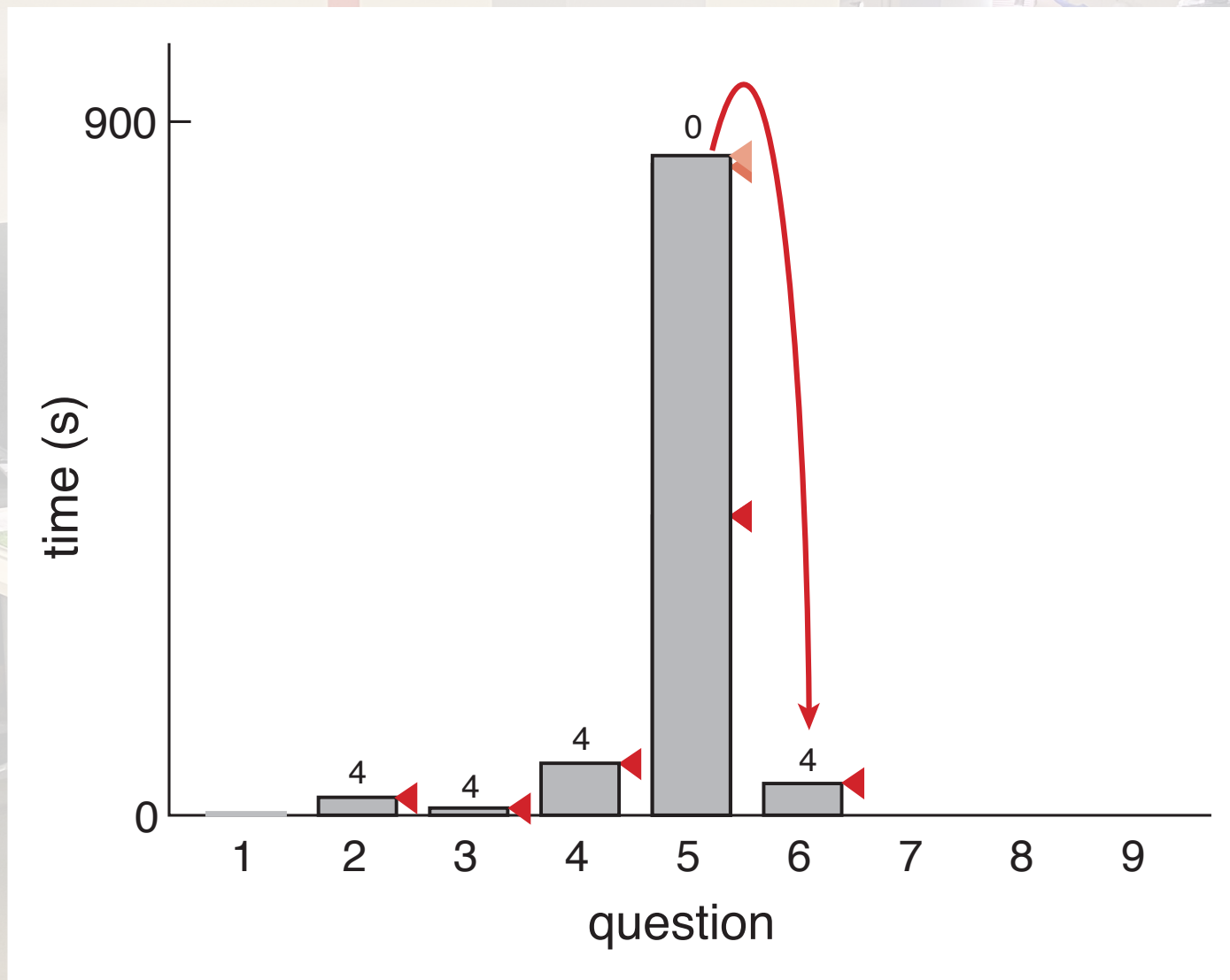


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: how is time spent?

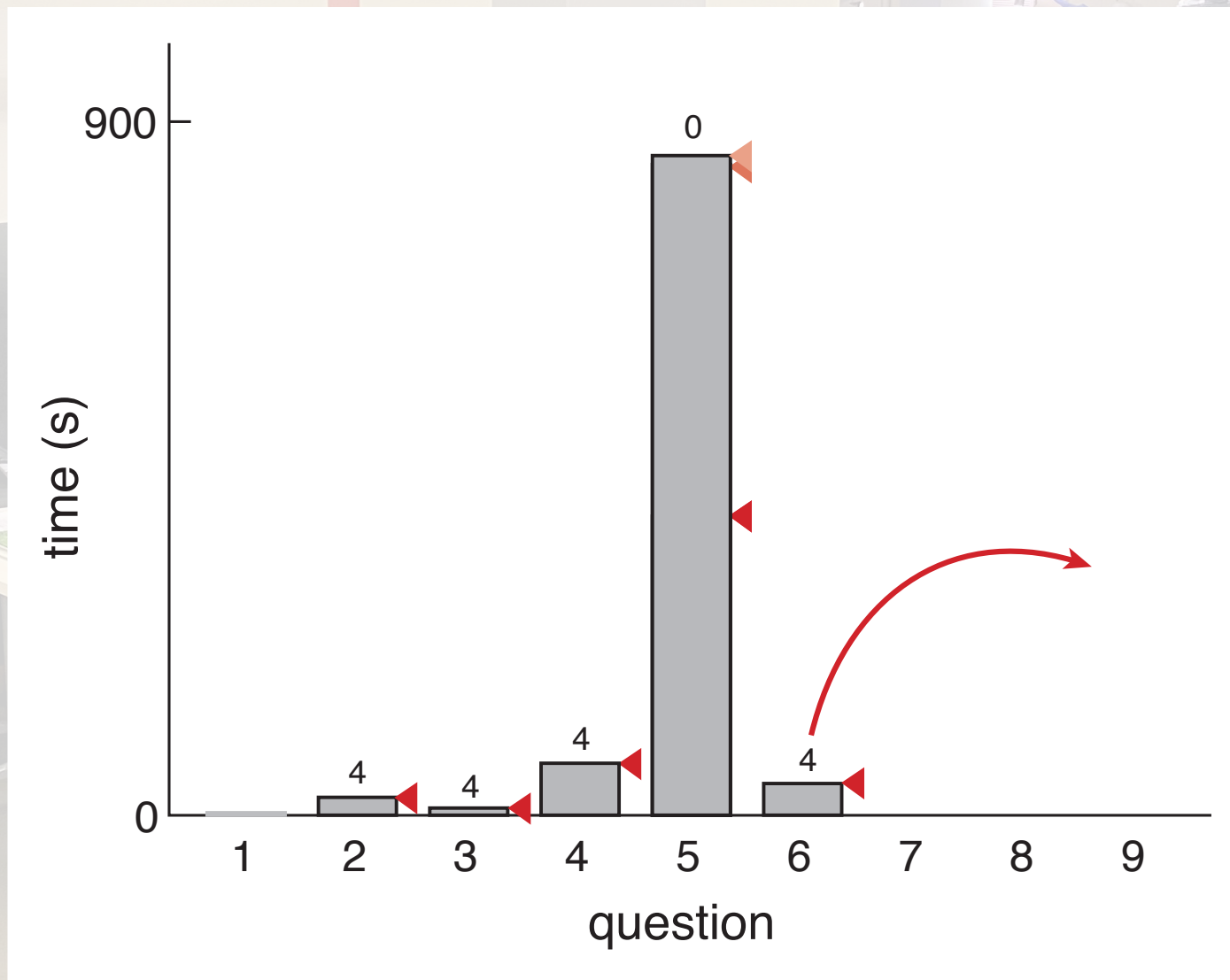


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: how is time spent?

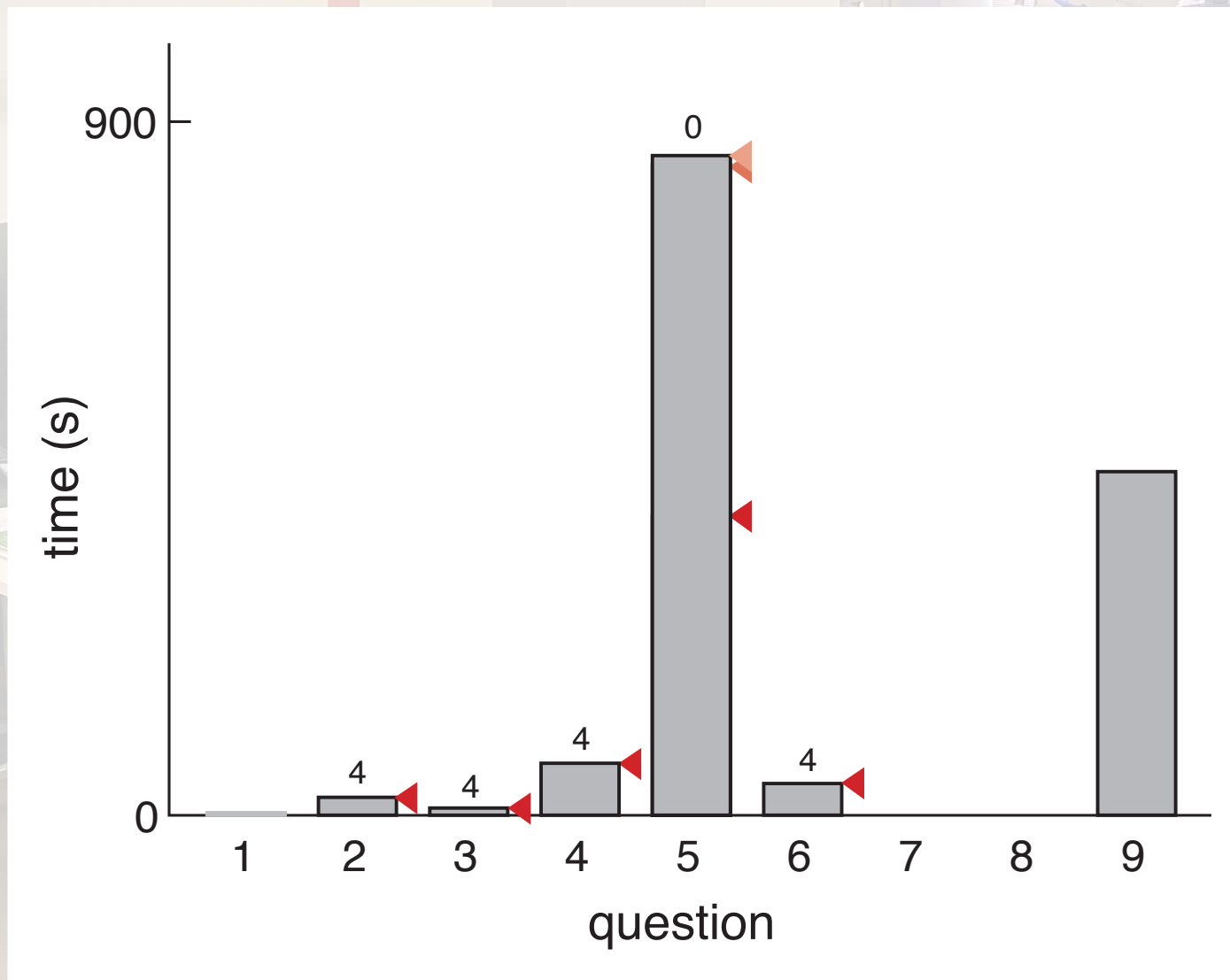


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: how is time spent?

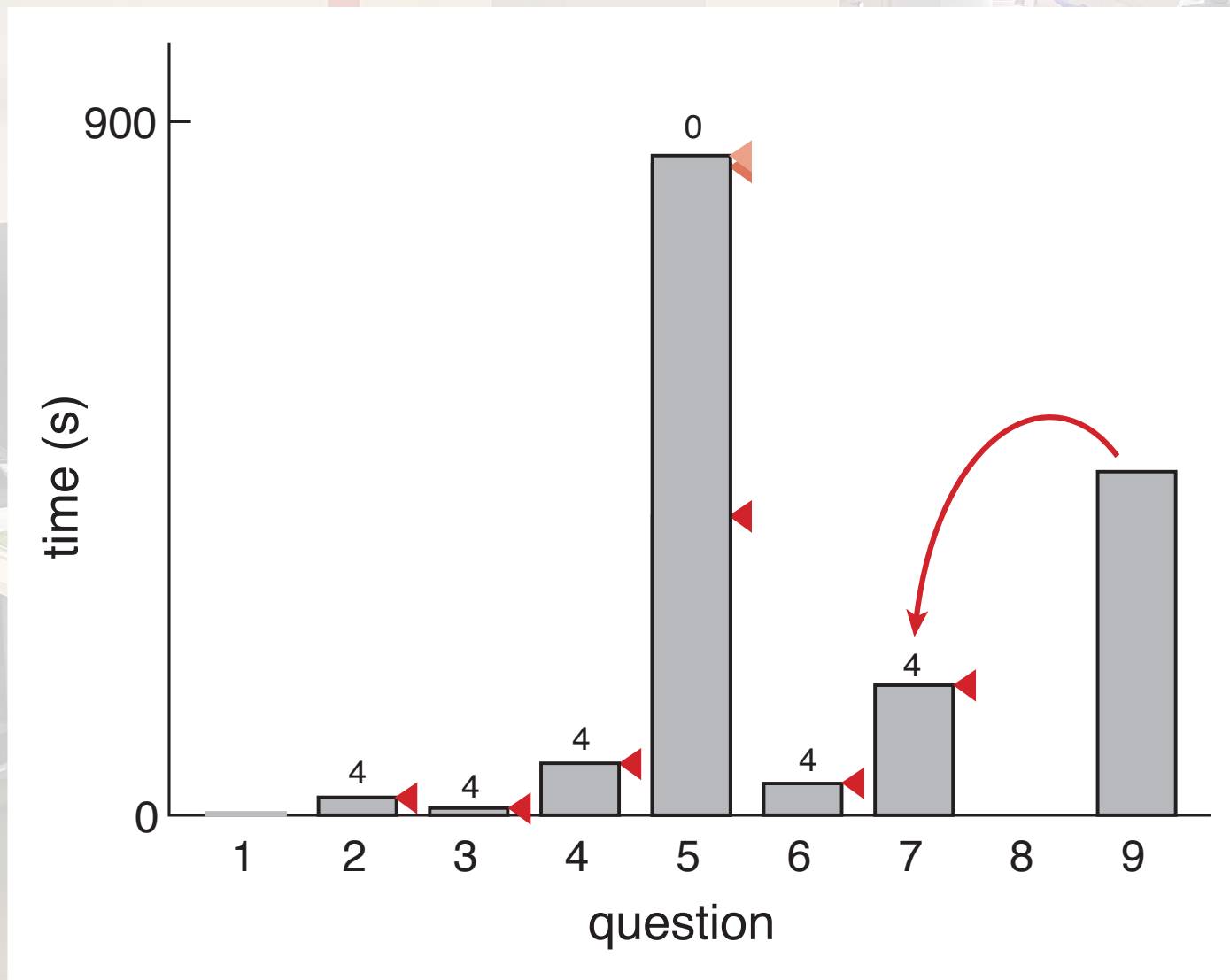


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: how is time spent?

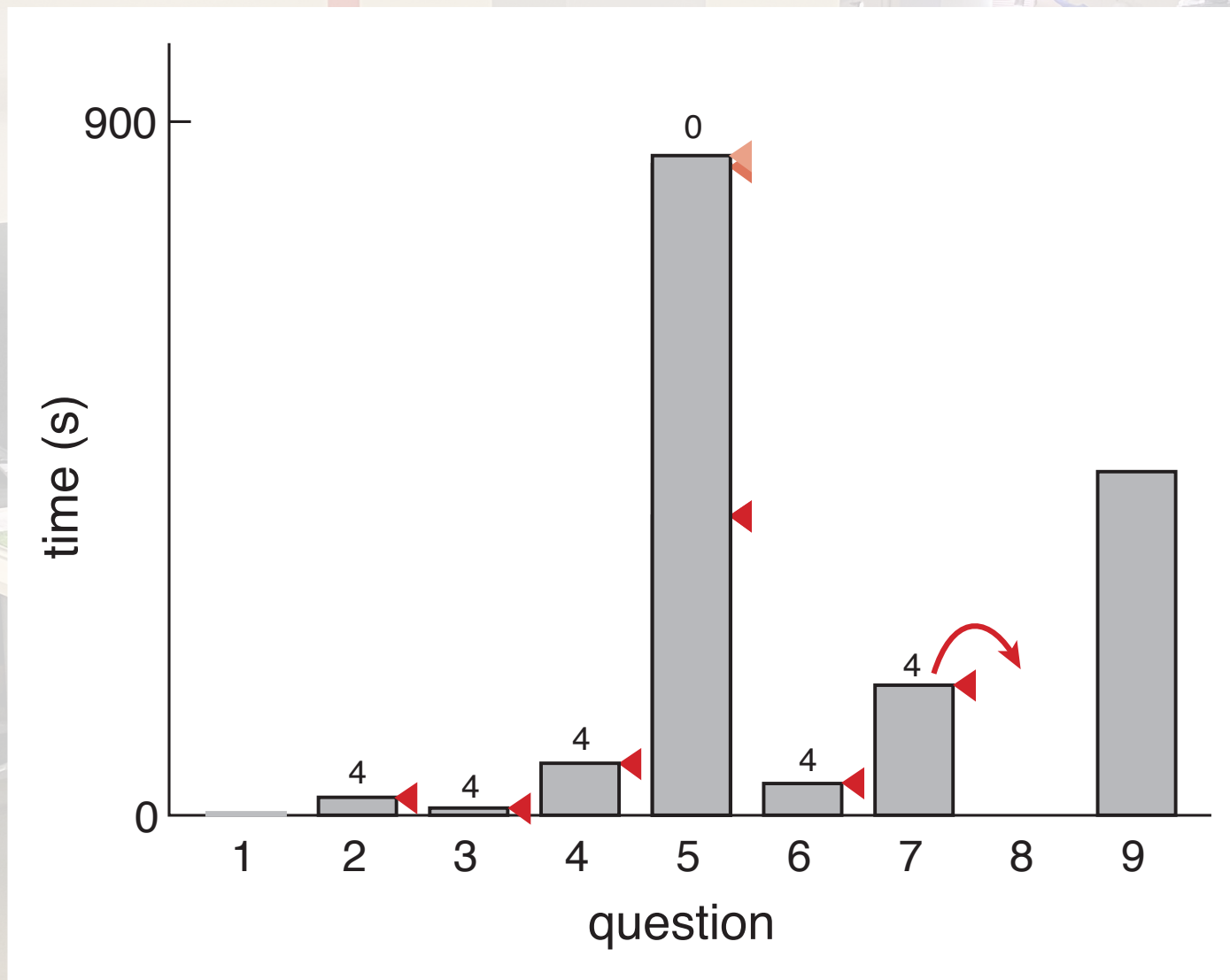


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: how is time spent?

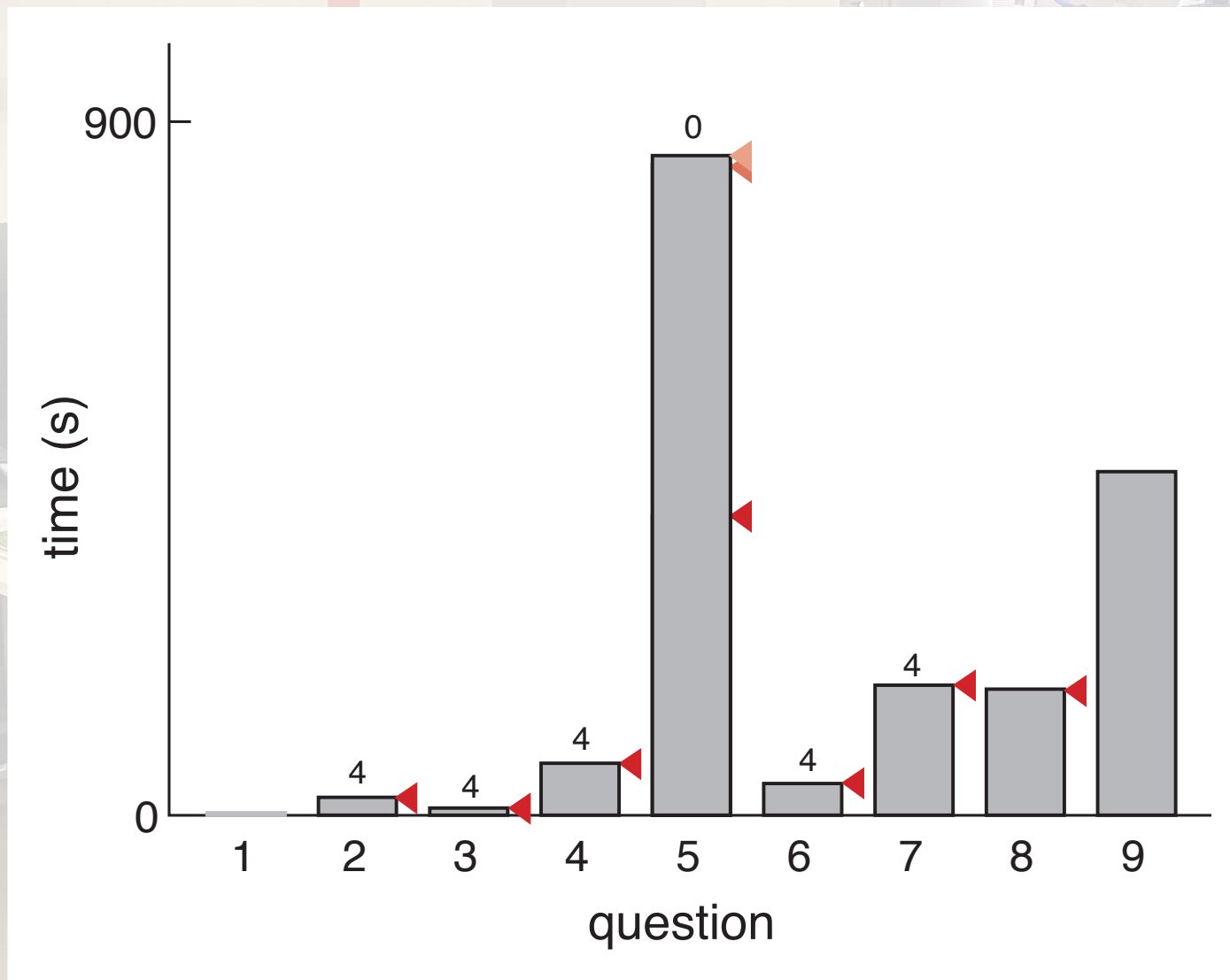


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: how is time spent?

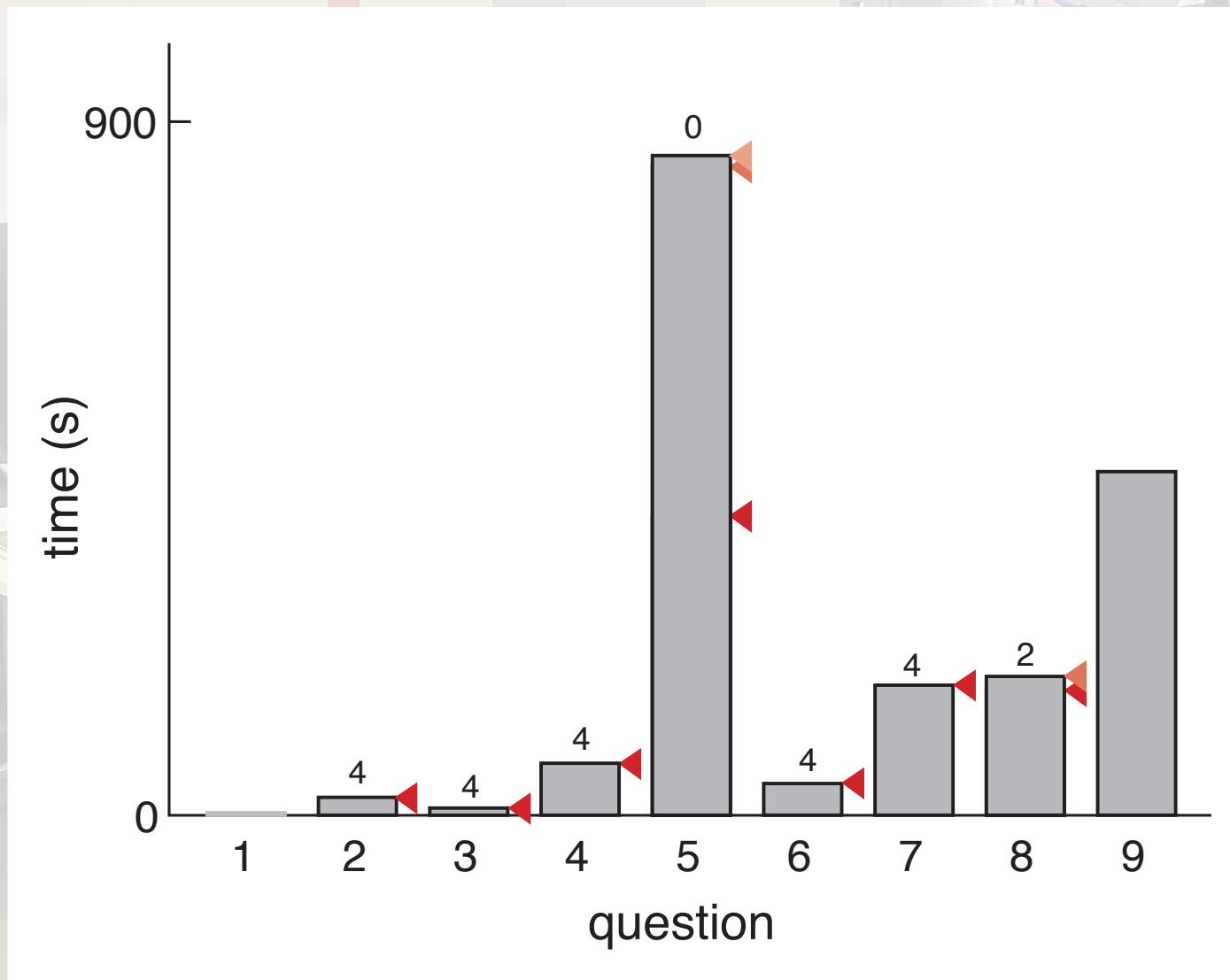


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: how is time spent?

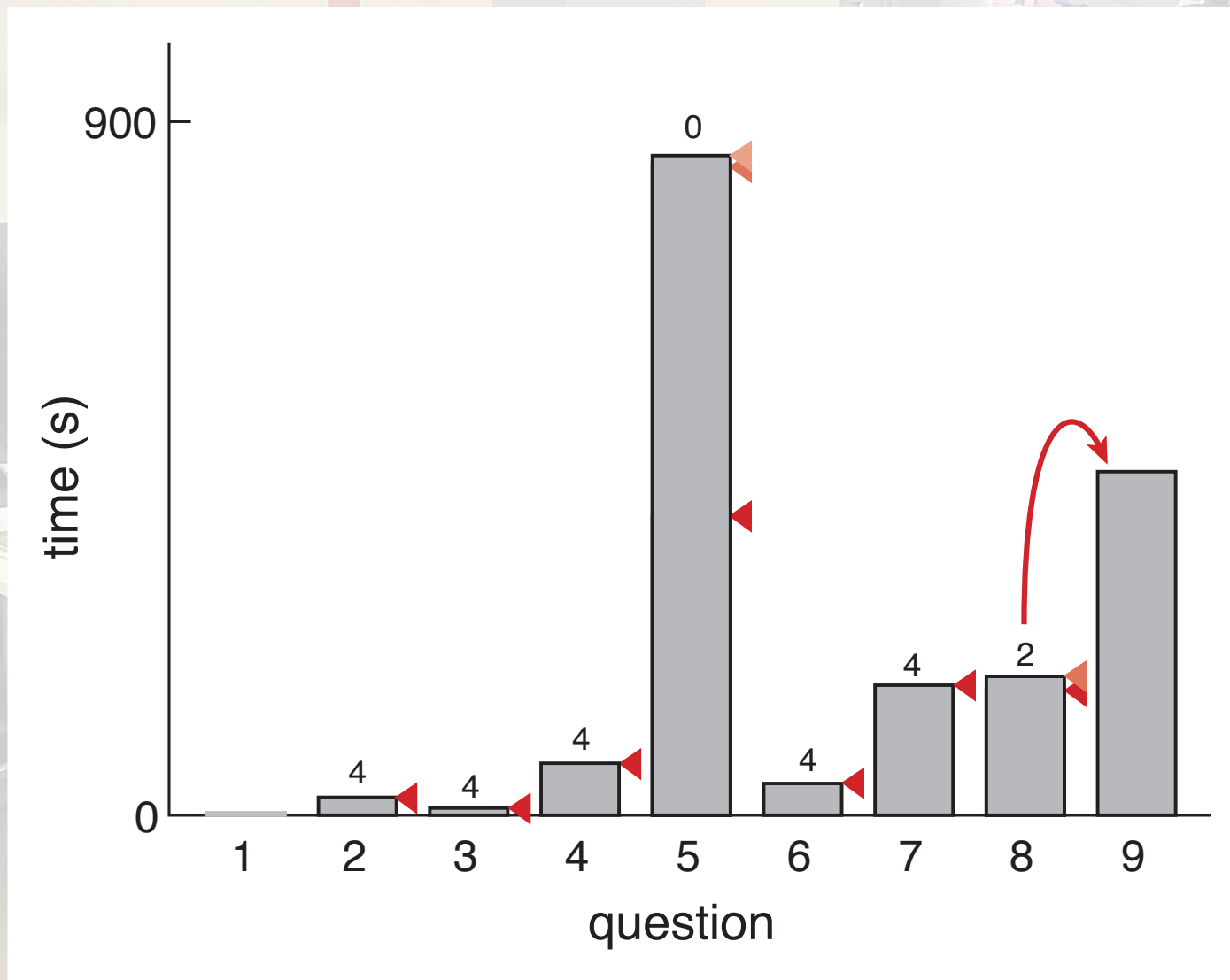


1 pandemic lessons

2 new normal

3 self-paced PI

self-paced PI: how is time spent?

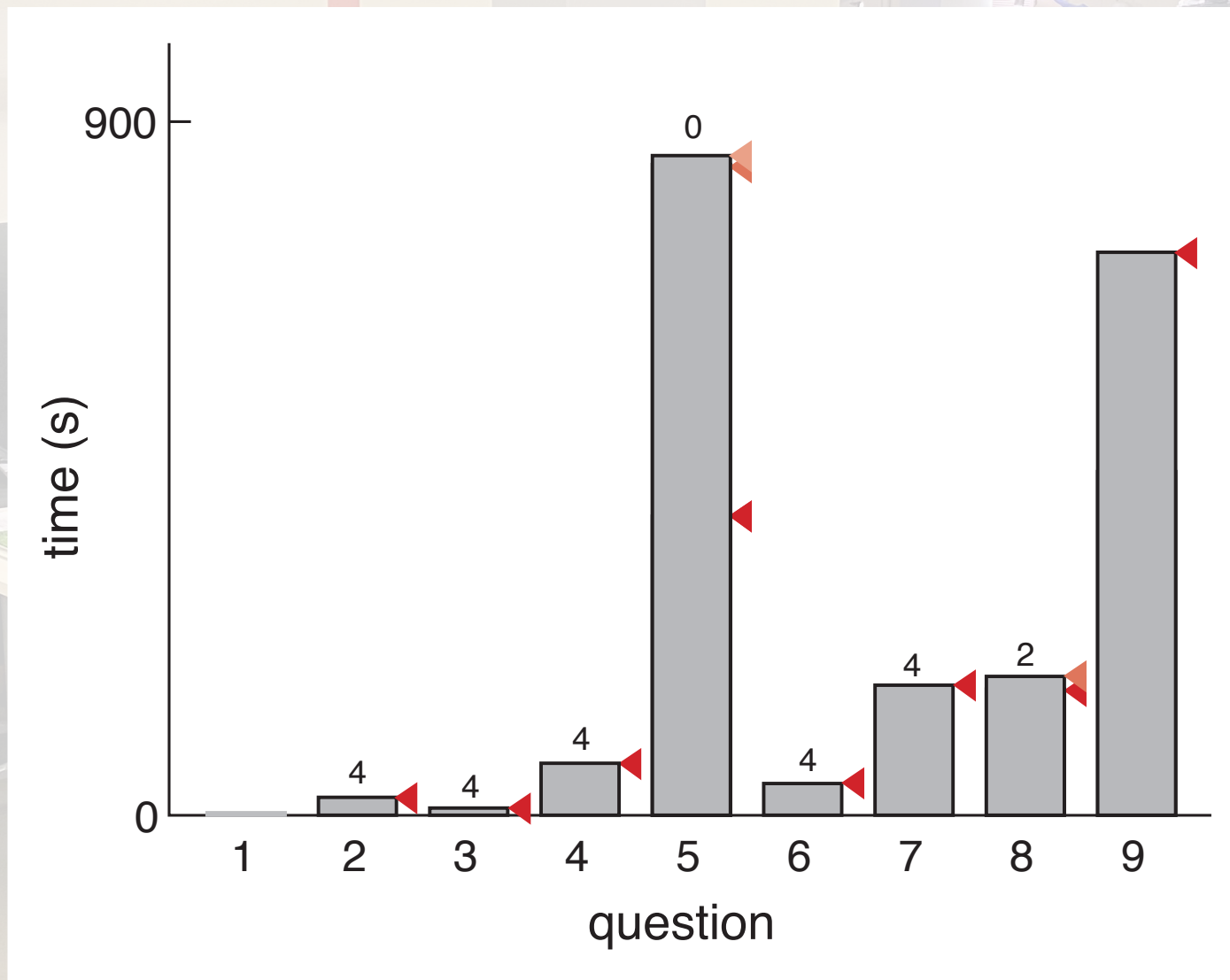


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: how is time spent?

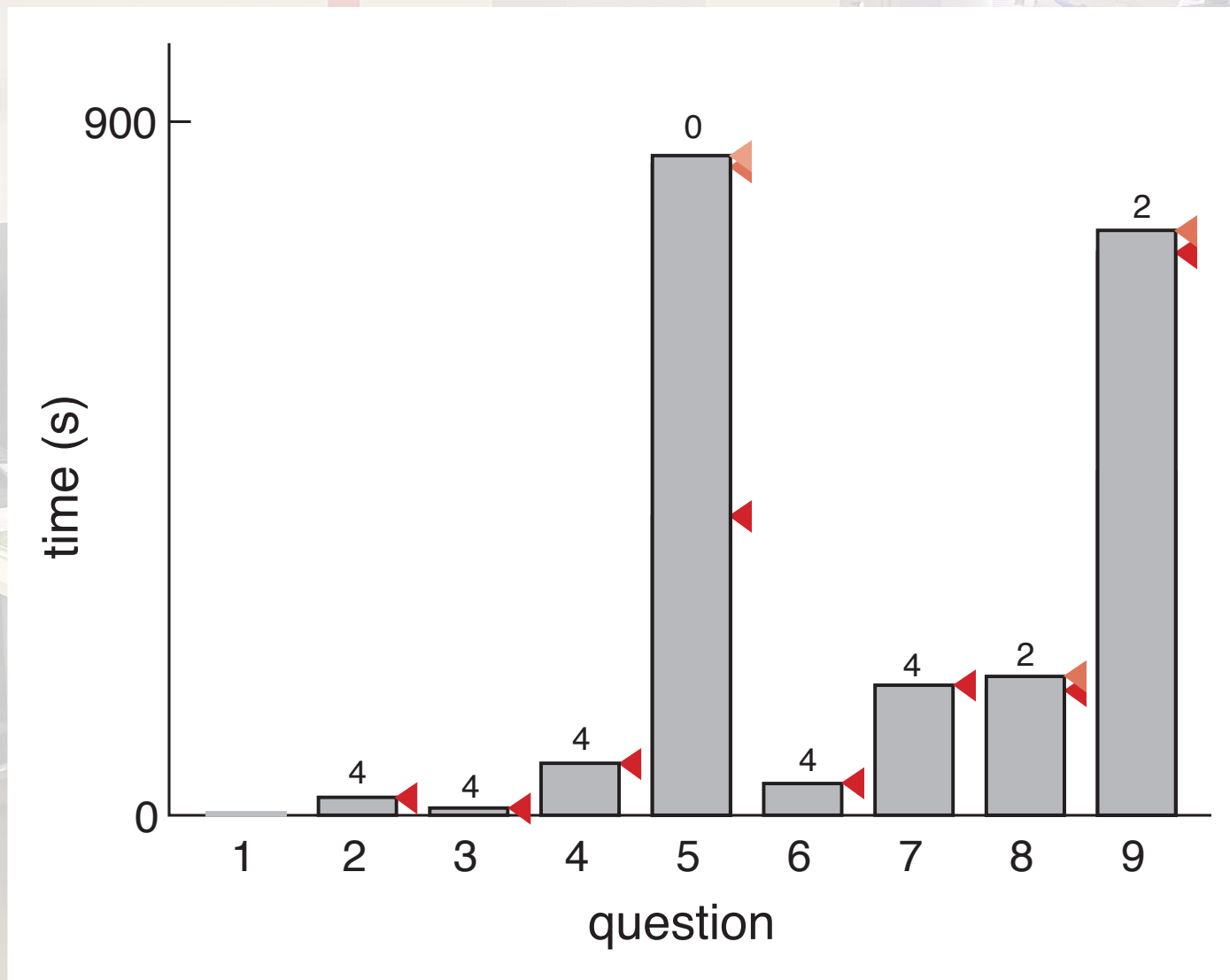


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: how is time spent?

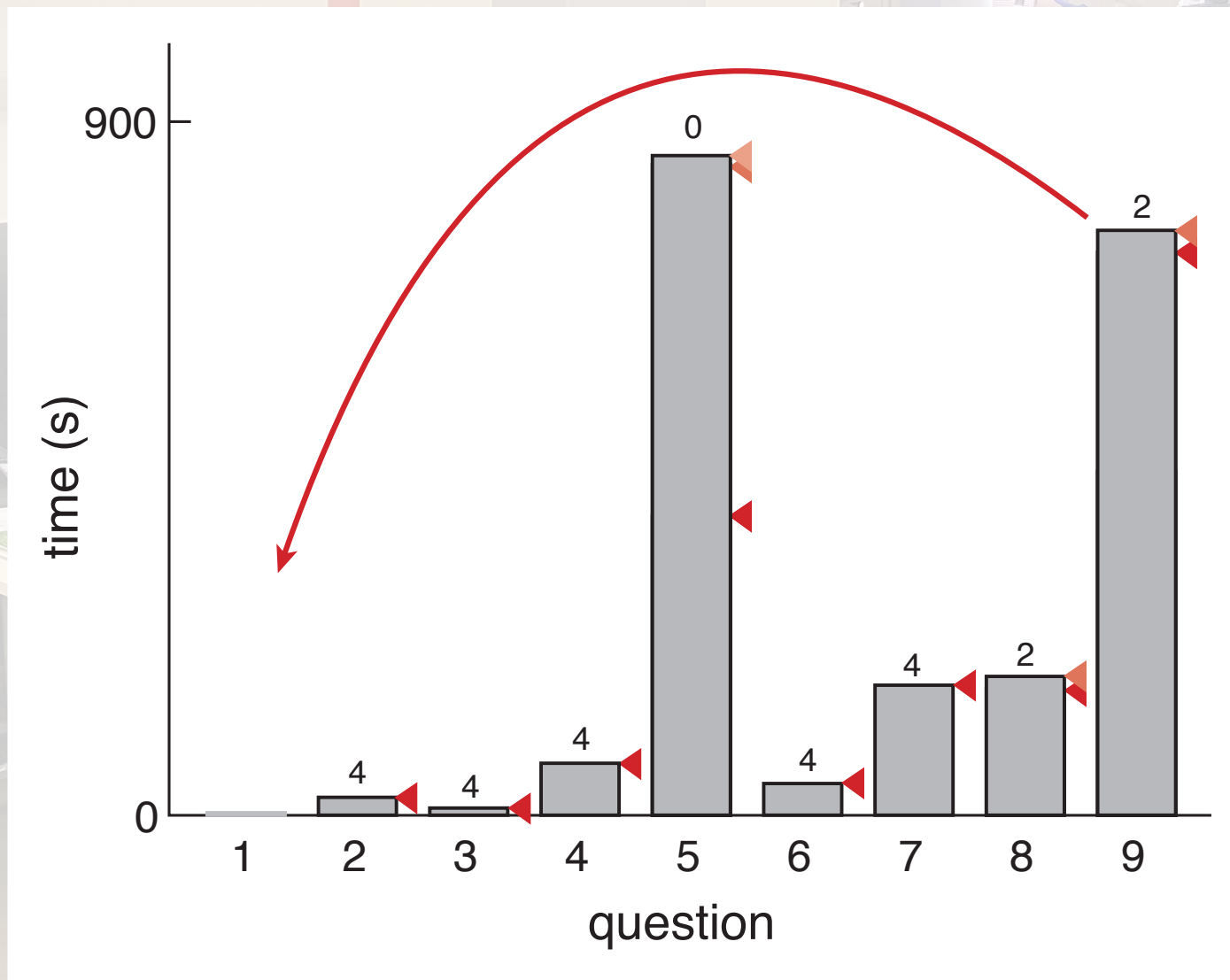


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: how is time spent?

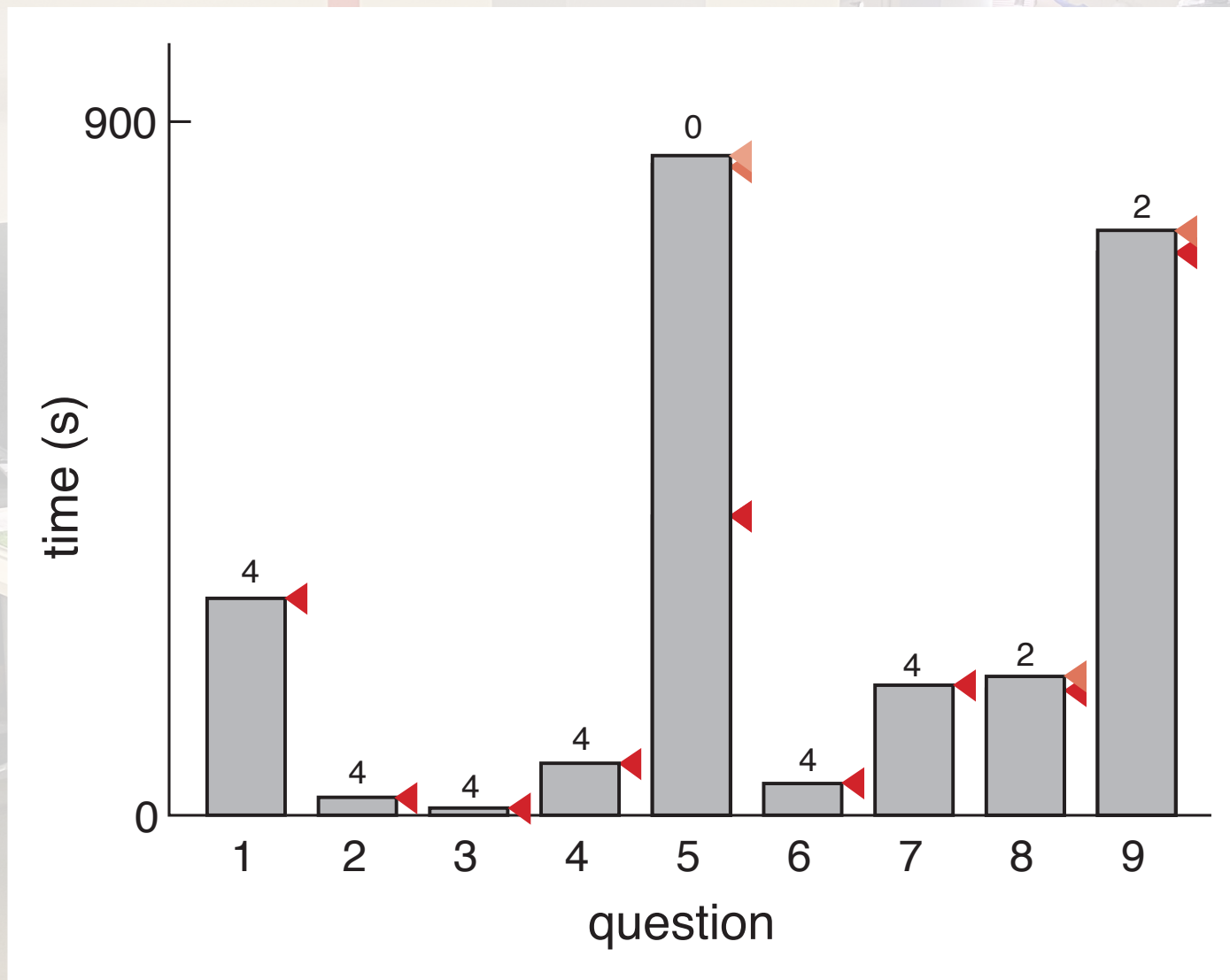


① pandemic lessons

② new normal

③ self-paced PI

self-paced PI: how is time spent?

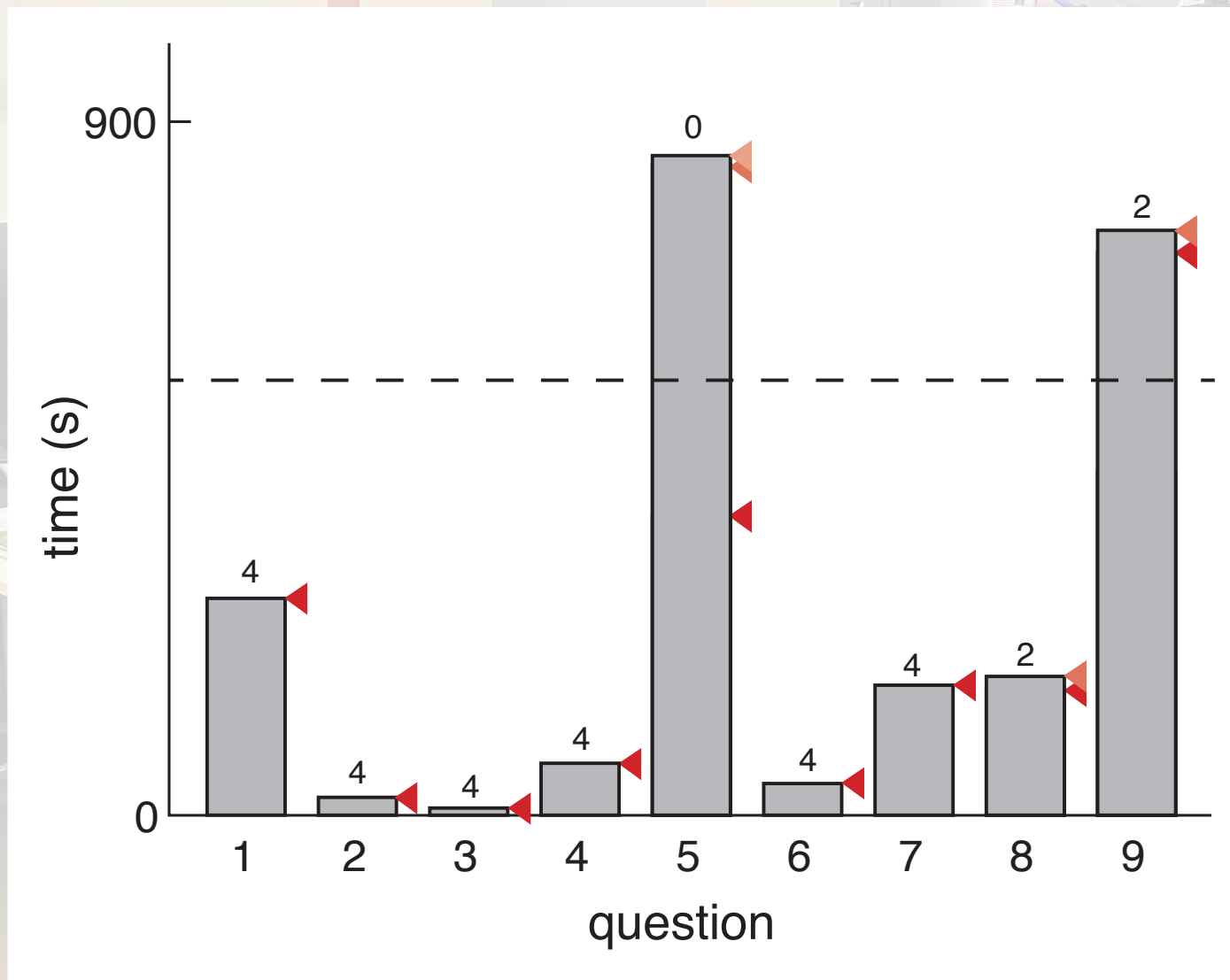


① pandemic lessons

② new normal

③ self-paced PI

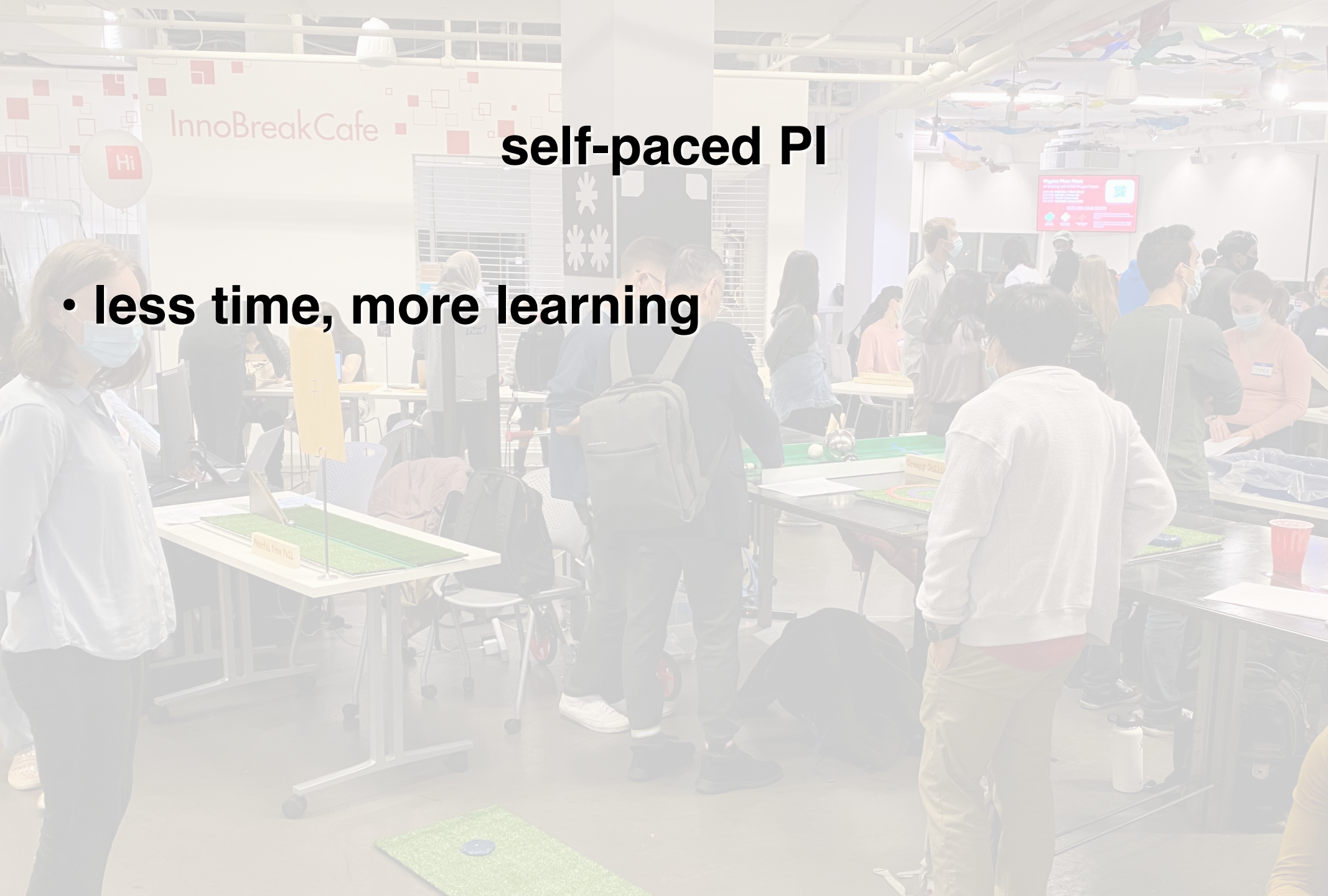
self-paced PI: how is time spent?



① pandemic lessons

② new normal

③ self-paced PI



self-paced PI

- **less time, more learning**

1 pandemic lessons

2 new normal

3 self-paced PI



InnoBreakCafe


self-paced PI

- **less time, more learning**
- **better integration with reading**

1 pandemic lessons

2 new normal

3 self-paced PI



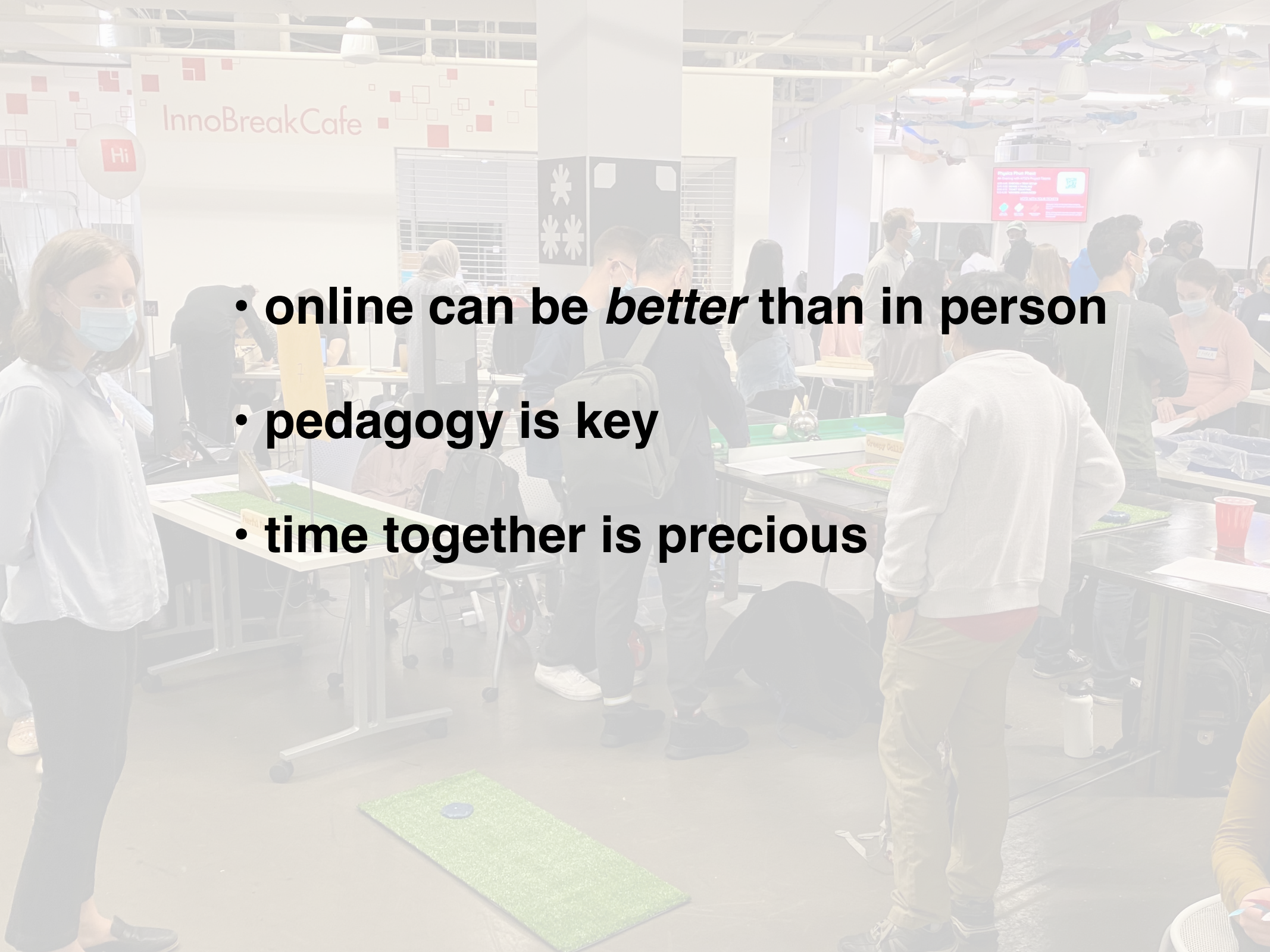
self-paced PI

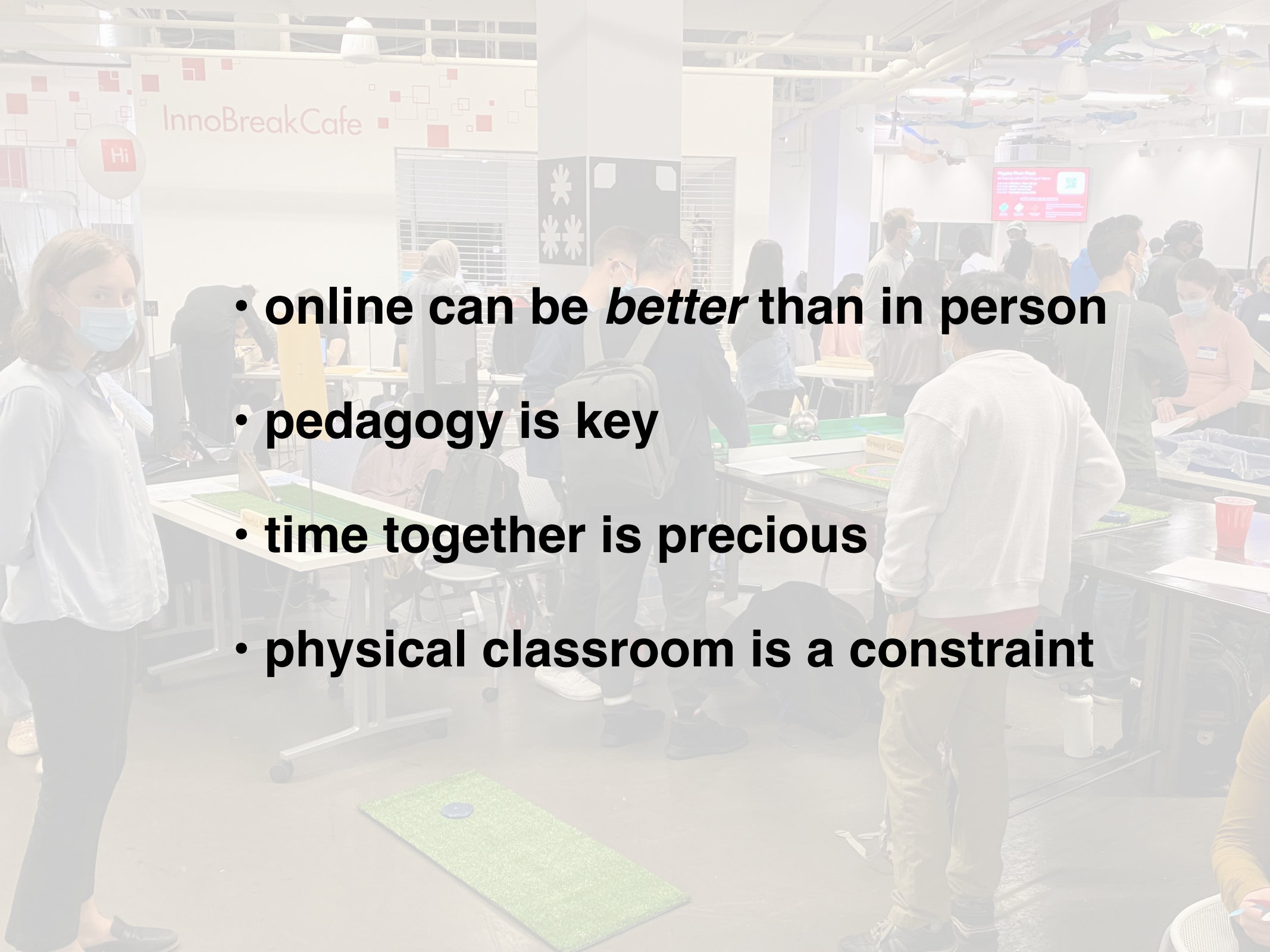
- **less time, more learning**
- **better integration with reading**
- **free up class time for other learning activities**

1 pandemic lessons

2 new normal

3 self-paced PI

- 
- The background image shows a large, open-plan indoor space, likely a co-working area or event hall. In the upper left, a sign reads 'InnoBreakCafe' with a 'Hi' icon. People are gathered around tables, some working on laptops, others in discussion. A man in a grey hoodie and khaki pants is in the foreground, looking towards the right. A woman in a light blue shirt and dark pants is on the left, looking towards the camera. The overall atmosphere is collaborative and professional.
- online can be *better* than in person
 - pedagogy is key
 - time together is precious

- 
- The background image shows a large, open-plan indoor space, likely a co-working area or event hall, with a high ceiling and exposed ductwork. In the upper left, a sign reads "InnoBreakCafe" with a red "Hi" balloon nearby. People are gathered around long tables, some working on laptops, others in discussion. A man in a white shirt and blue mask stands in the foreground on the left. A man with a backpack stands in the center. A woman in a pink shirt and blue mask is on the right. A red sign with a QR code is visible in the background. The overall atmosphere is one of active collaboration and learning.
- online can be *better* than in person
 - pedagogy is key
 - time together is precious
 - physical classroom is a constraint

InnoBreakCafe

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