Lessons from online teaching and the new normal

Digital Transformation and AI in Higher Education
Project VISION
28 June 2023

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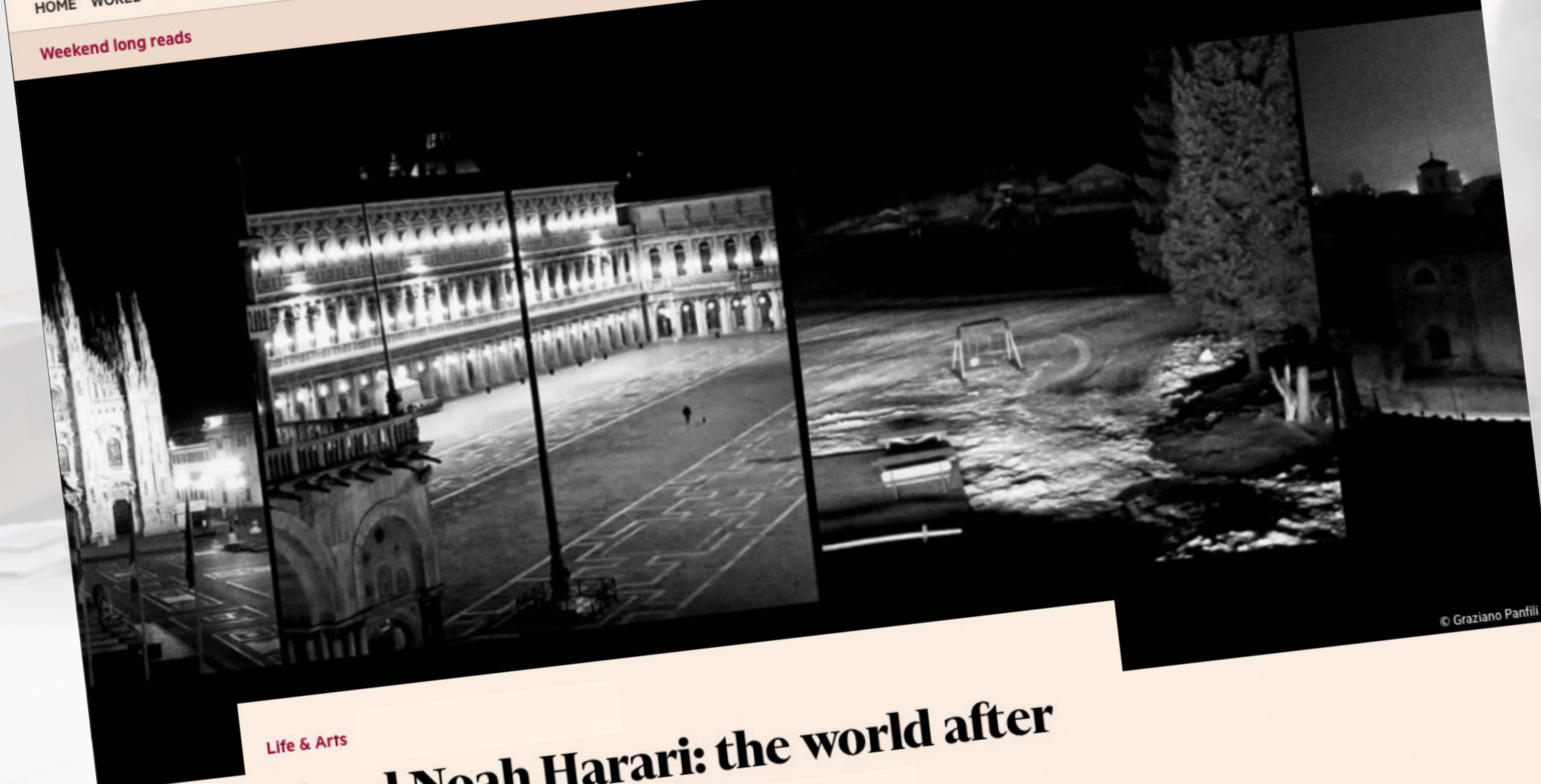

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Life & Arts

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
years to come. They will shape not just our

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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...We must act

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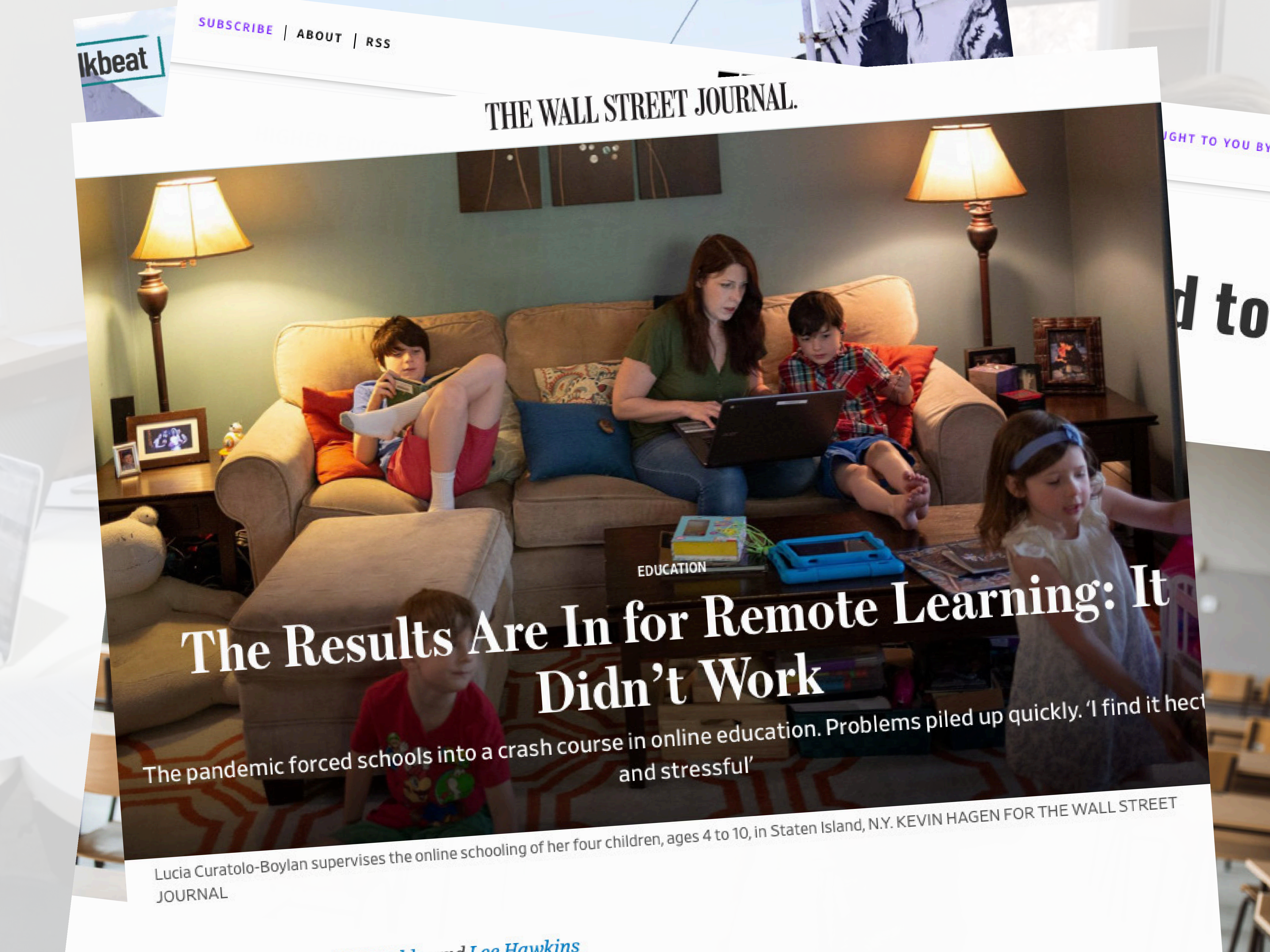
countries se

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.

Will online teaching become a fixture of life?

Yuval Noah Harari MARCH 20 2020

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 ... years to come. They will shape not just our ... We must act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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
Lee Hawkins


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Dunk Tank
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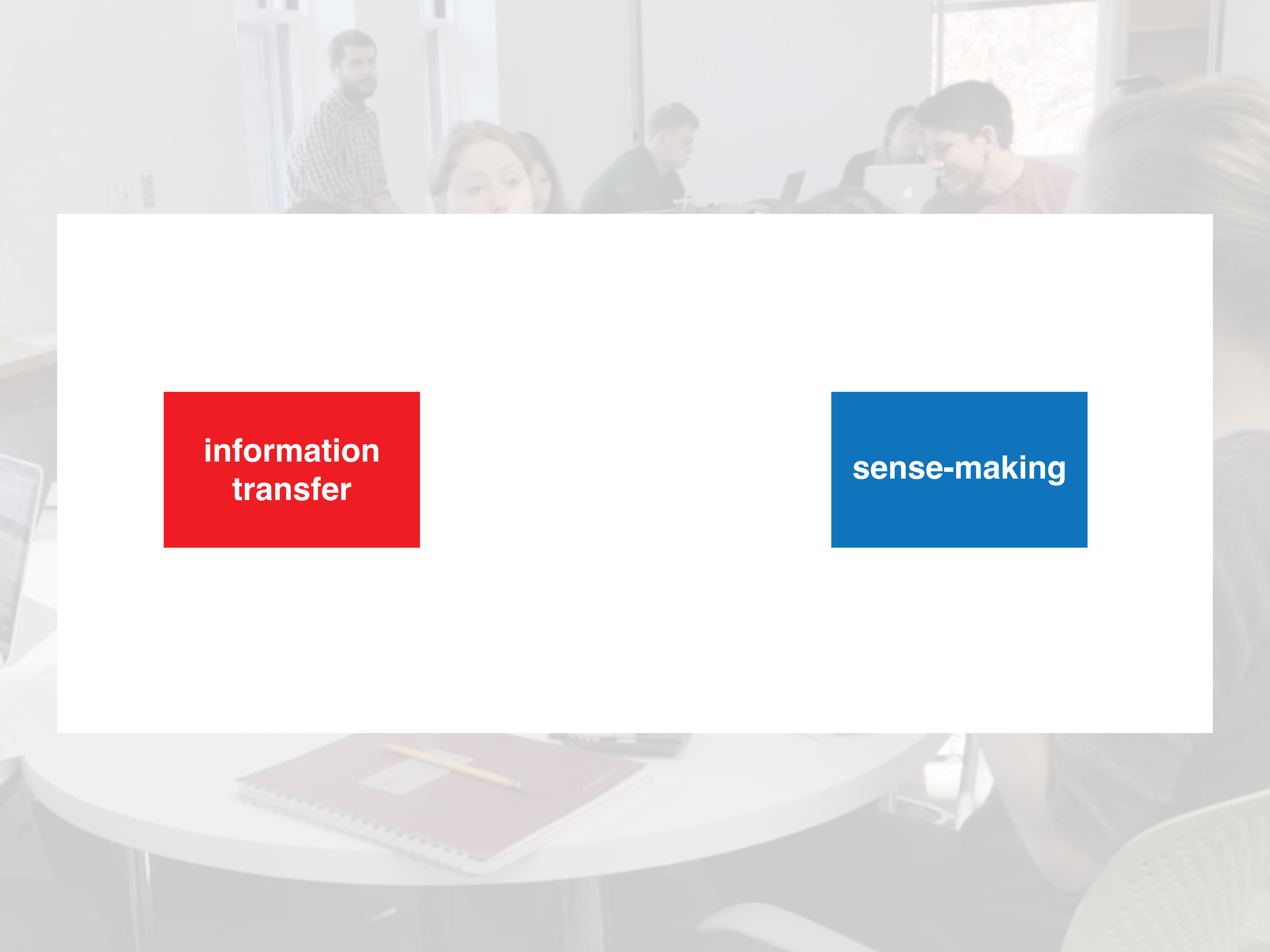
The reason? Bad pedagogy!


information transfer
sense-making

Traditional model

class

information transfer

home

sense-making

Traditional model

class	**home**
information transfer	**sense-making**
instructor-paced synchronous lecture	self-paced asynchronous homework/study

Traditional model online

class

information transfer

instructor-paced
synchronous
lecture

home

sense-making

self-paced
asynchronous
homework/study

Traditional model online

class	home	home
information transfer	**information transfer**	**sense-making**
instructor-paced synchronous lecture	instructor-paced synchronous **online** lecture	self-paced asynchronous homework/study

Traditional model online

class	home	home
information transfer	**information transfer**	**sense-making**
instructor-paced synchronous lecture	instructor-paced **a**synchronous **recorded** lecture	self-paced asynchronous home work/study

Traditional model online

class	home	home
information transfer	**information transfer**	**sense-making**
instructor-paced synchronous lecture	instructor-paced **a**synchronous **recorded** lecture	self-paced asynchronous home work/study

all alone!

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

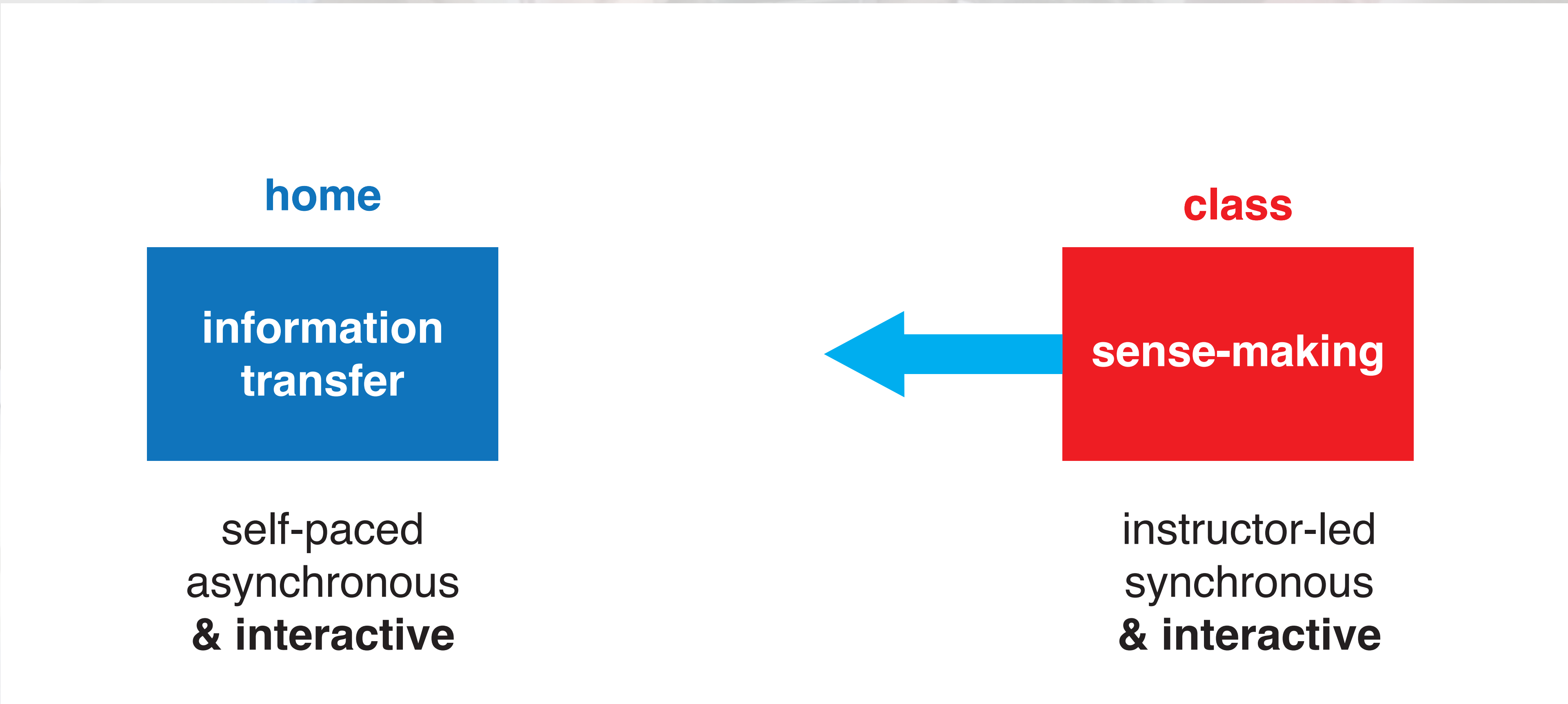
self-paced
asynchronous
& interactive

class

sense-making

instructor-led
synchronous
& interactive

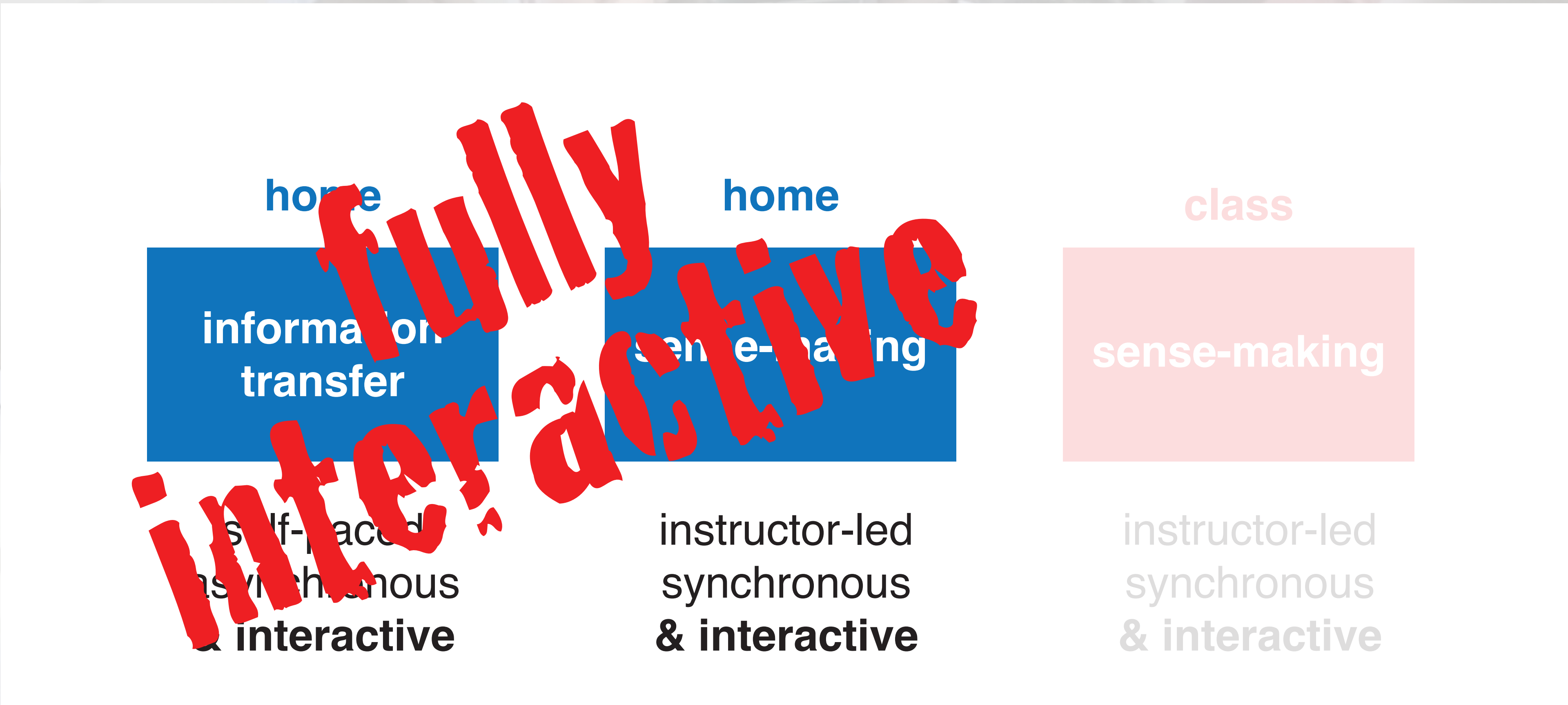
Flipped model online



Flipped model online

home	home	class
information transfer	**sense-making**	**sense-making**
self-paced asynchronous **& interactive**	instructor-led synchronous **& interactive**	instructor-led synchronous **& interactive**

Flipped model online



1 pandemic lessons

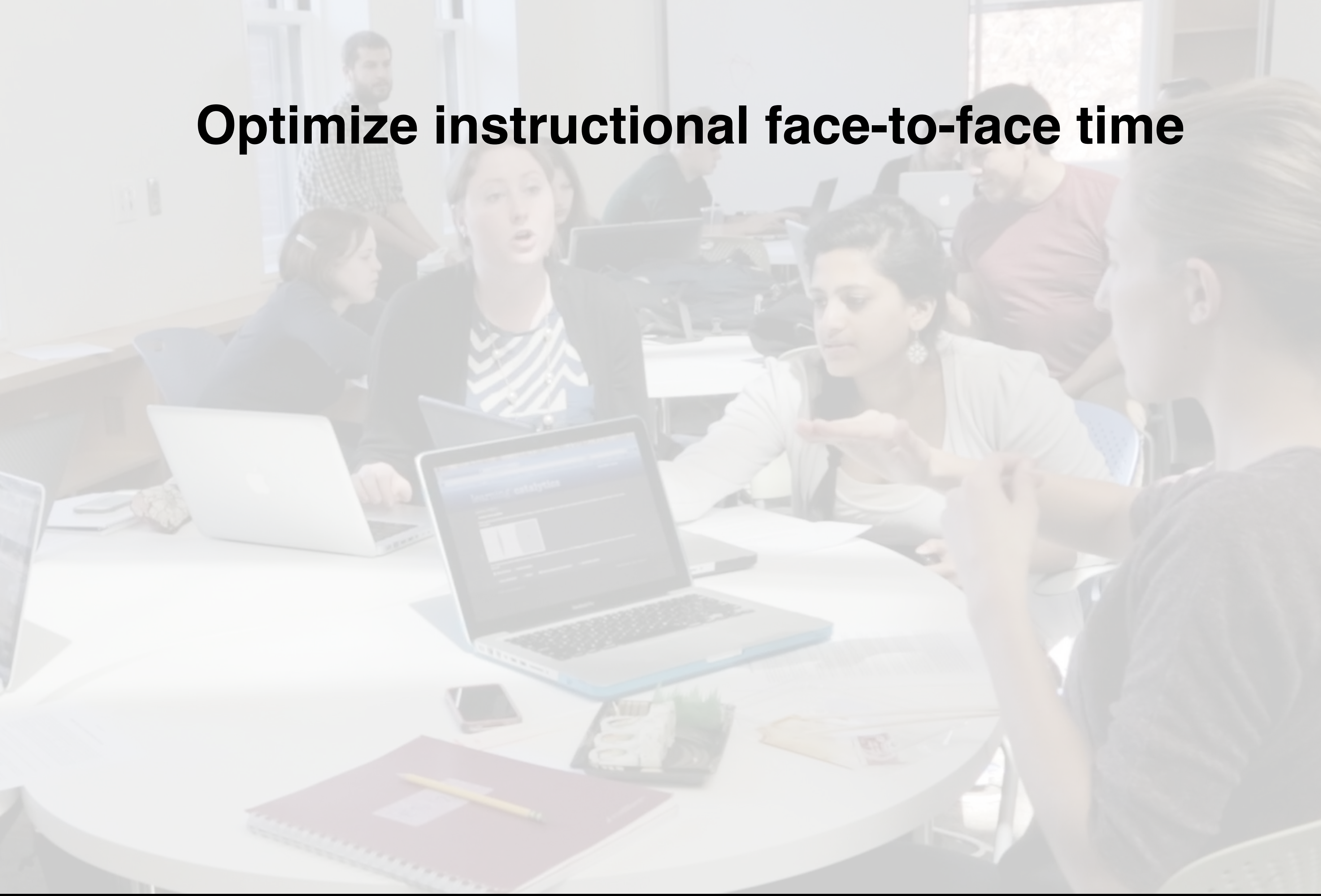
1 **pandemic lessons** 2 **new normal**

1 pandemic lessons

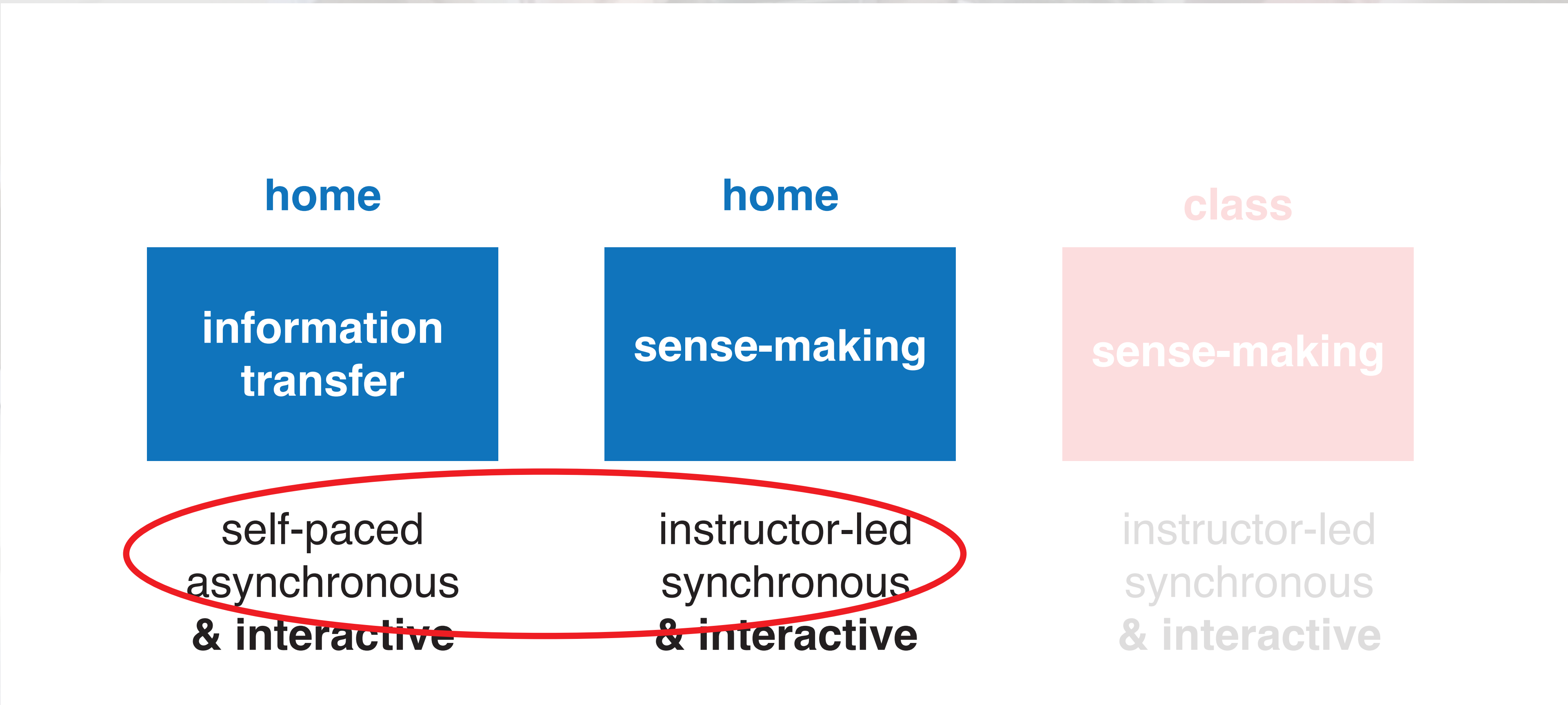
2 new normal

3 self-paced PI

Optimize instructional face-to-face time



Optimize instructional face-to-face time



1 pandemic lessons

Optimize instructional face-to-face time

synchronous ⟷ asynchronous

Optimize instructional face-to-face time

synchronous ⟷ asynchronous

everybody together
at the same *time*

Optimize instructional face-to-face time

synchronous ⟷ asynchronous

instructor-paced ⟷ self-paced

Optimize instructional face-to-face time

synchronous ⟷ asynchronous

instructor-paced ⟷ self-paced

everybody together
at the same *pace*

Optimize instructional face-to-face time

lecture

synchronous	⟷	asynchronous
instructor-paced	⟷	self-paced

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

lab

synchronous ⟷ asynchronous

instructor-paced ⟷ self-paced

Optimize instructional face-to-face time

homework/study

synchronous ⟷ **asynchronous**

instructor-paced ⟷ **self-paced**

Optimize instructional face-to-face time

synchronous → asynchronous

instructor-paced ↔ self-paced

Optimize instructional face-to-face time

synchronous → asynchronous

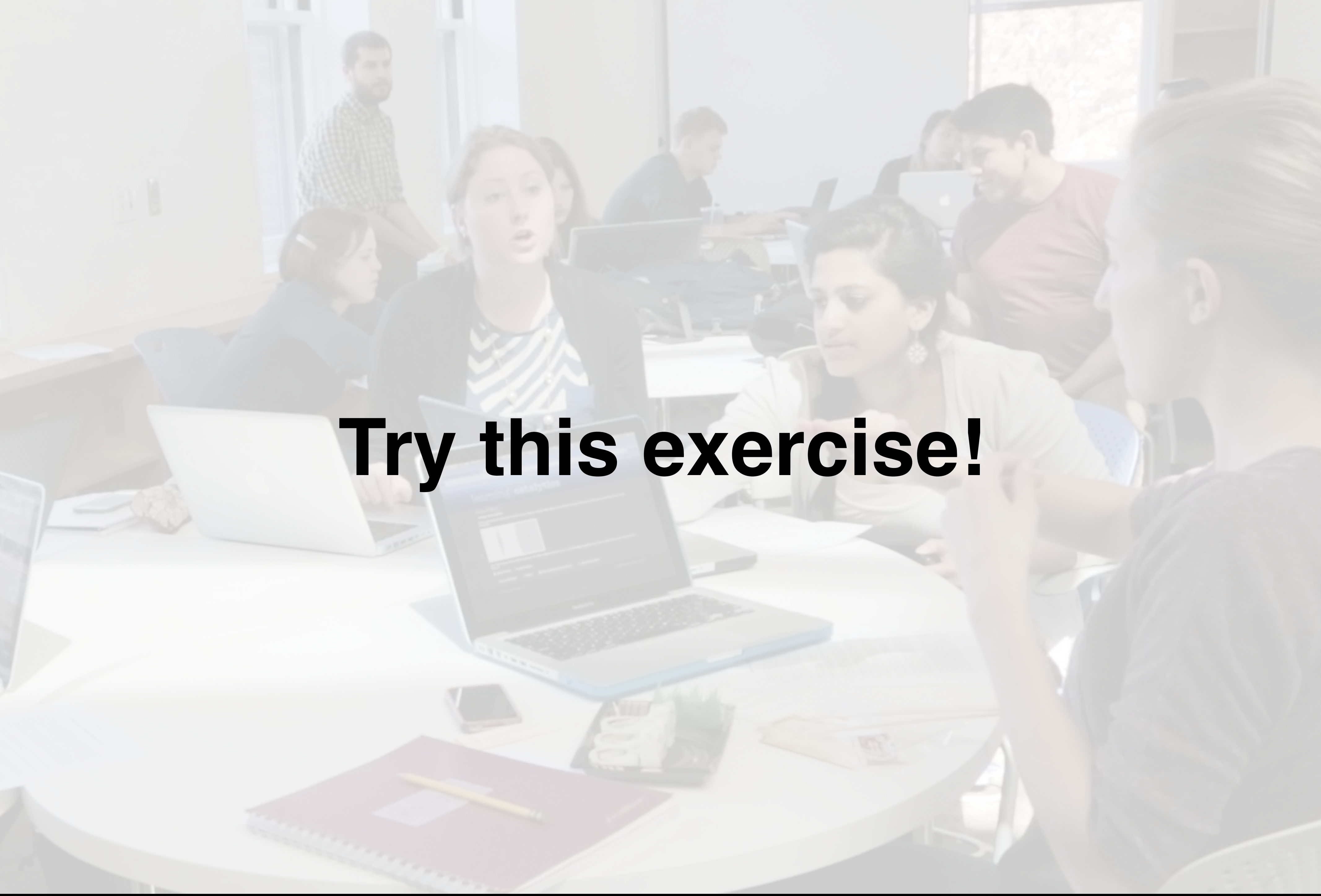
instructor-paced → self-paced

Optimize instructional face-to-face time

synchronous → asynchronous

instructor-paced → self-paced

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		synchronous
individual work	▶	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 | **synchronous**

individual work ▶ **team work** ▶ **team check**

Optimize team face-to-face time

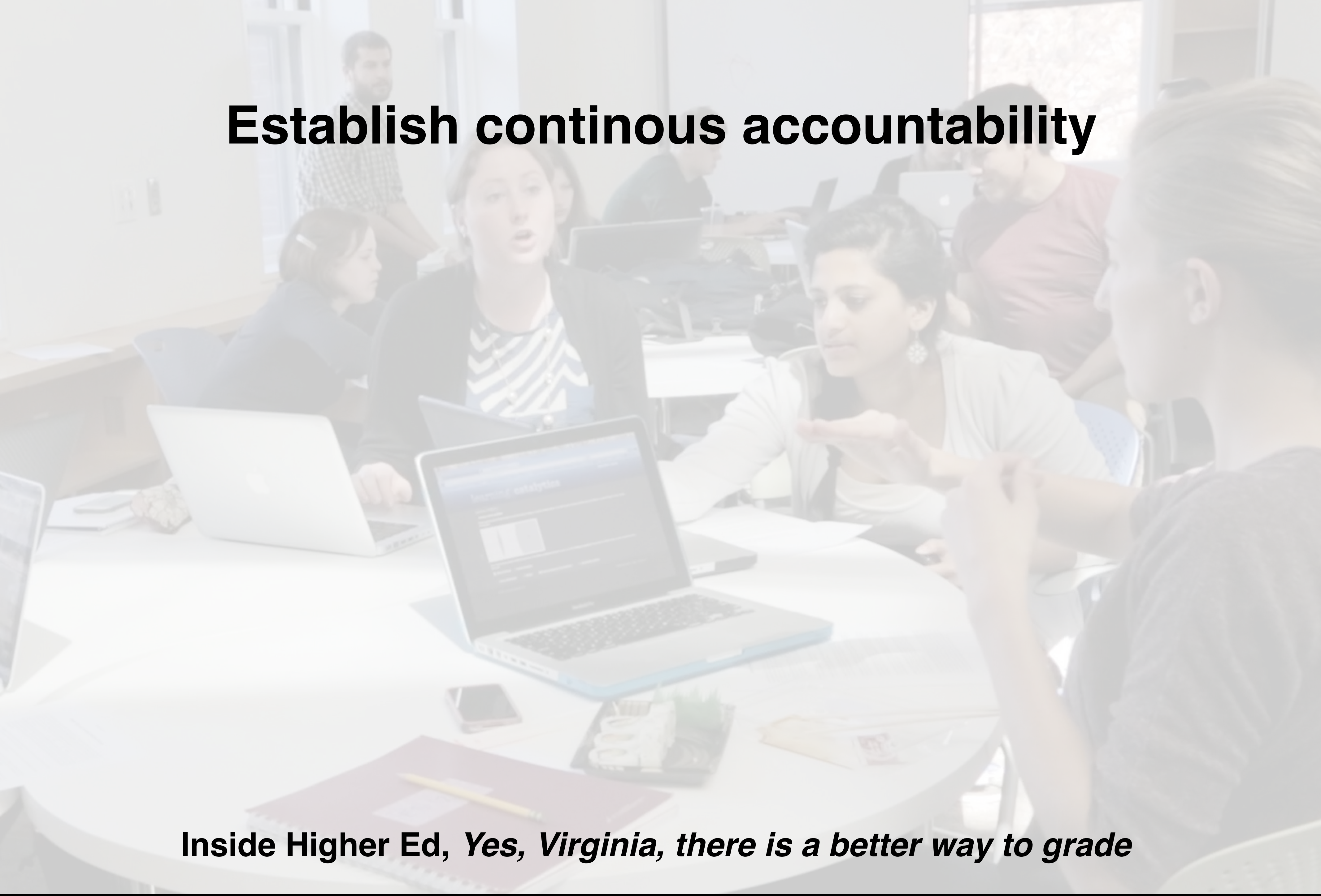
synchronous

collaborative work

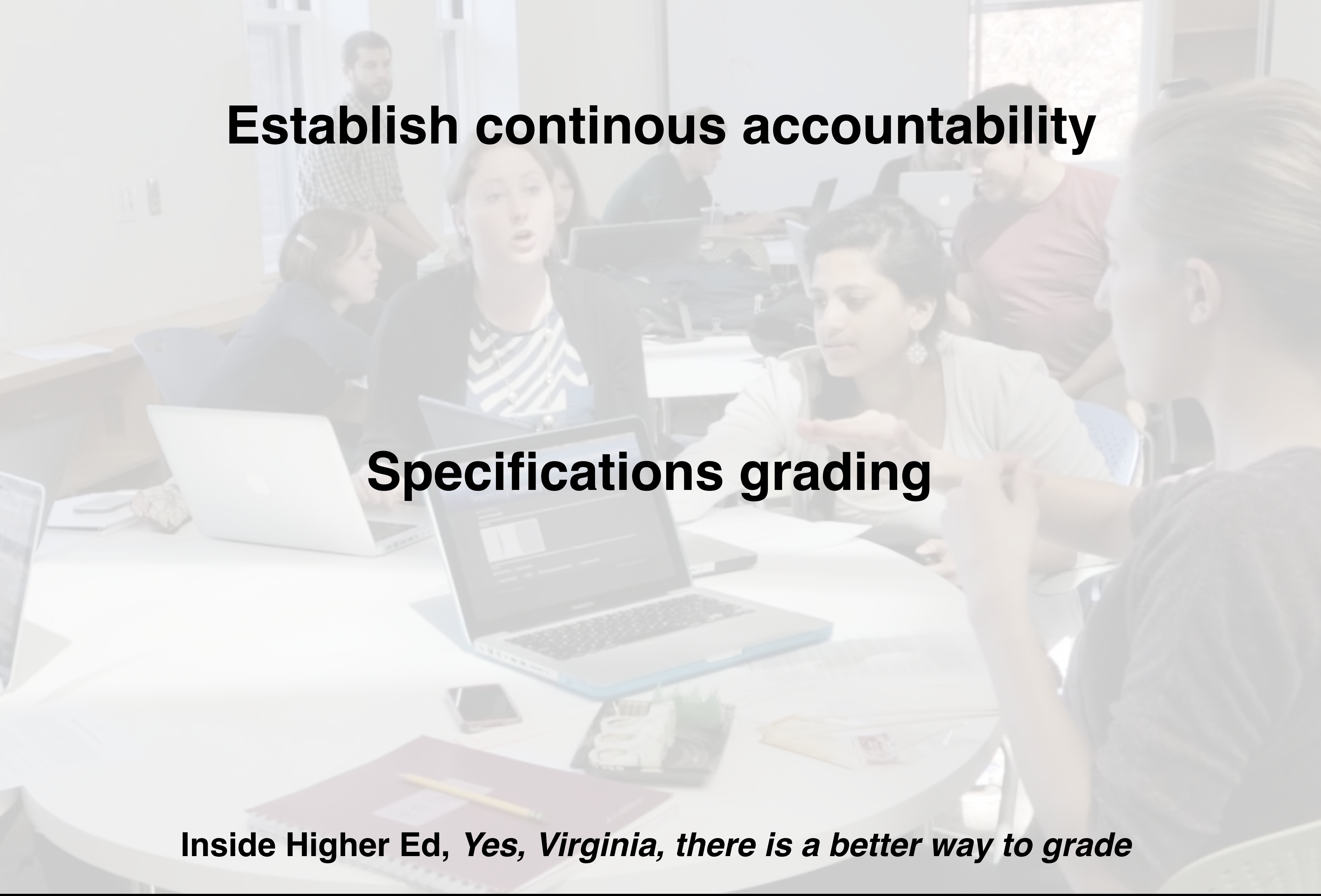
- not all students engaged
- inefficient team work
- poor use of staff time
- no quality control

asynchronous		**synchronous**		
individual work	▶	team work	▶	team check
all engaged		efficient team		quality control

Establish continous accountability



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

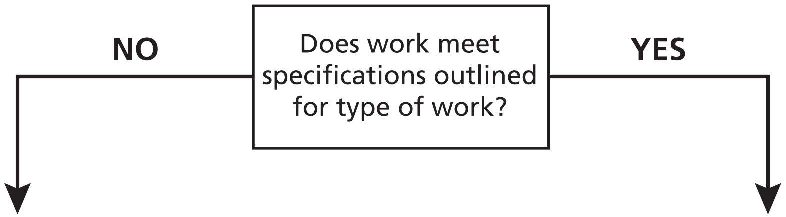


Establish continous accountability

Specifications grading

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

Establish continous accountability



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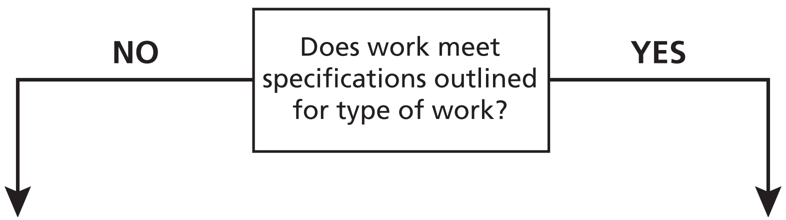
Establish continous accountability



if specifications not met, can try again

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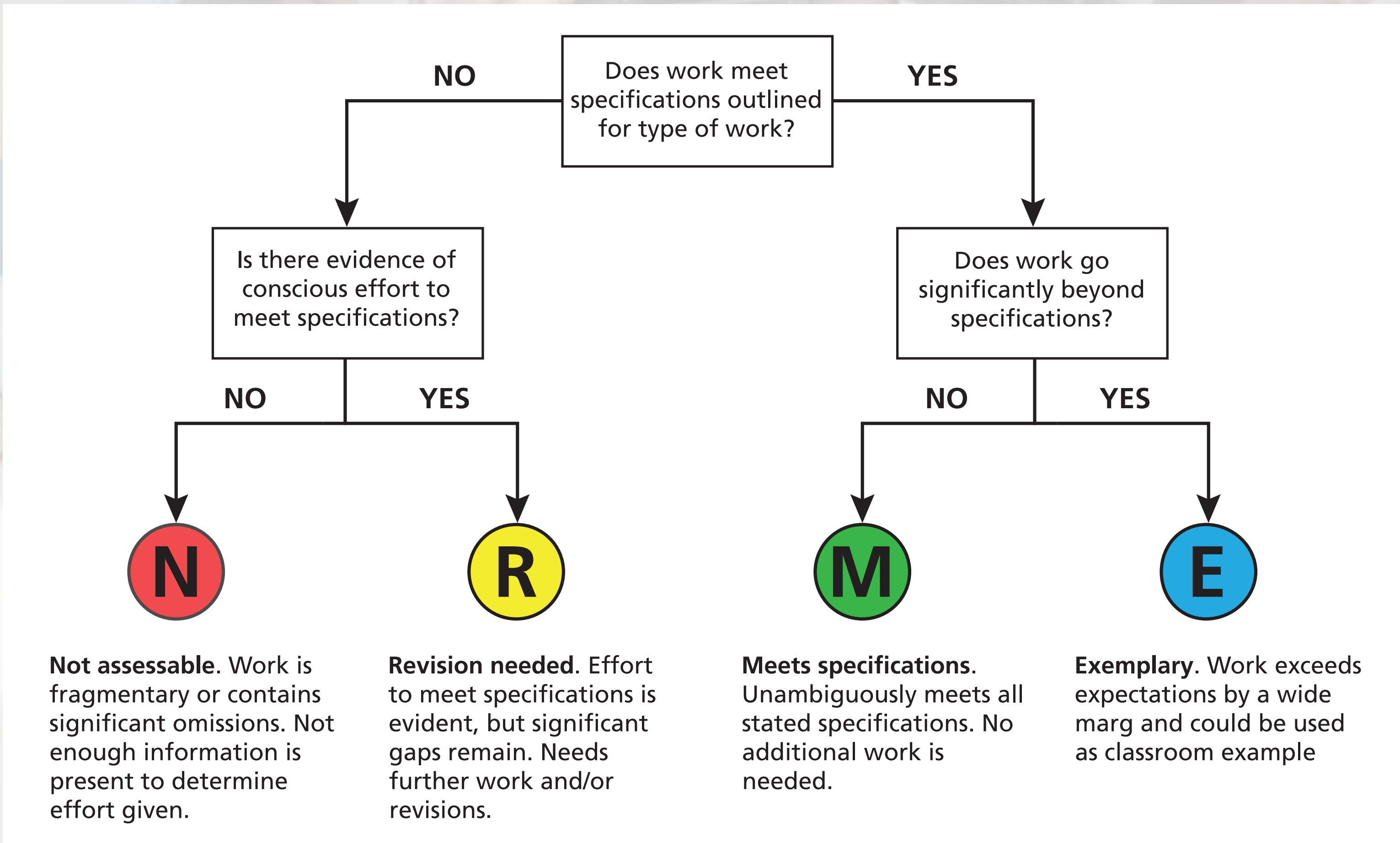
Establish continous accountability



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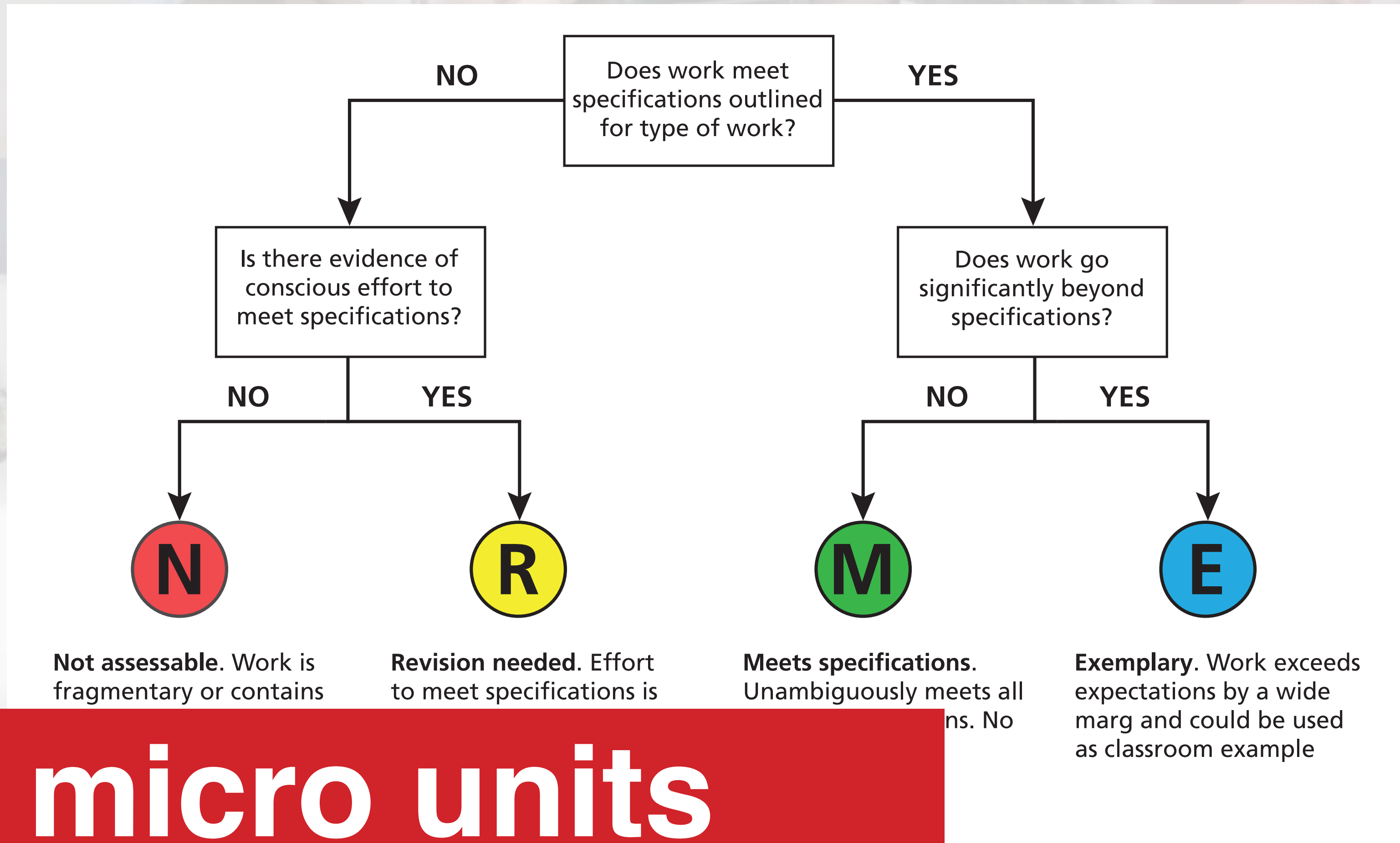
Establish continous accountability



70 micro units

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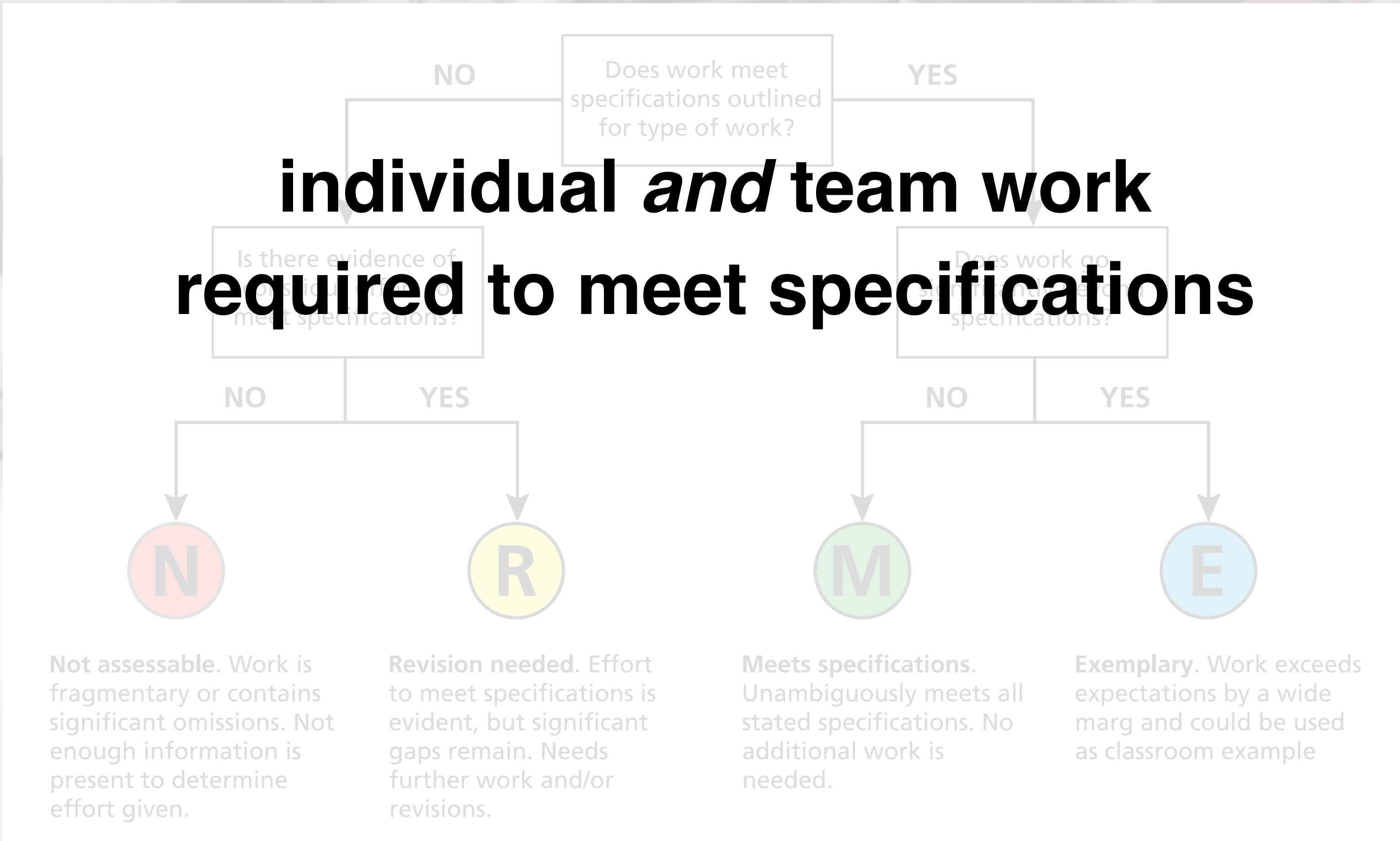
1 pandemic lessons

Establish continous accountability



individual *and* team work required to meet specifications

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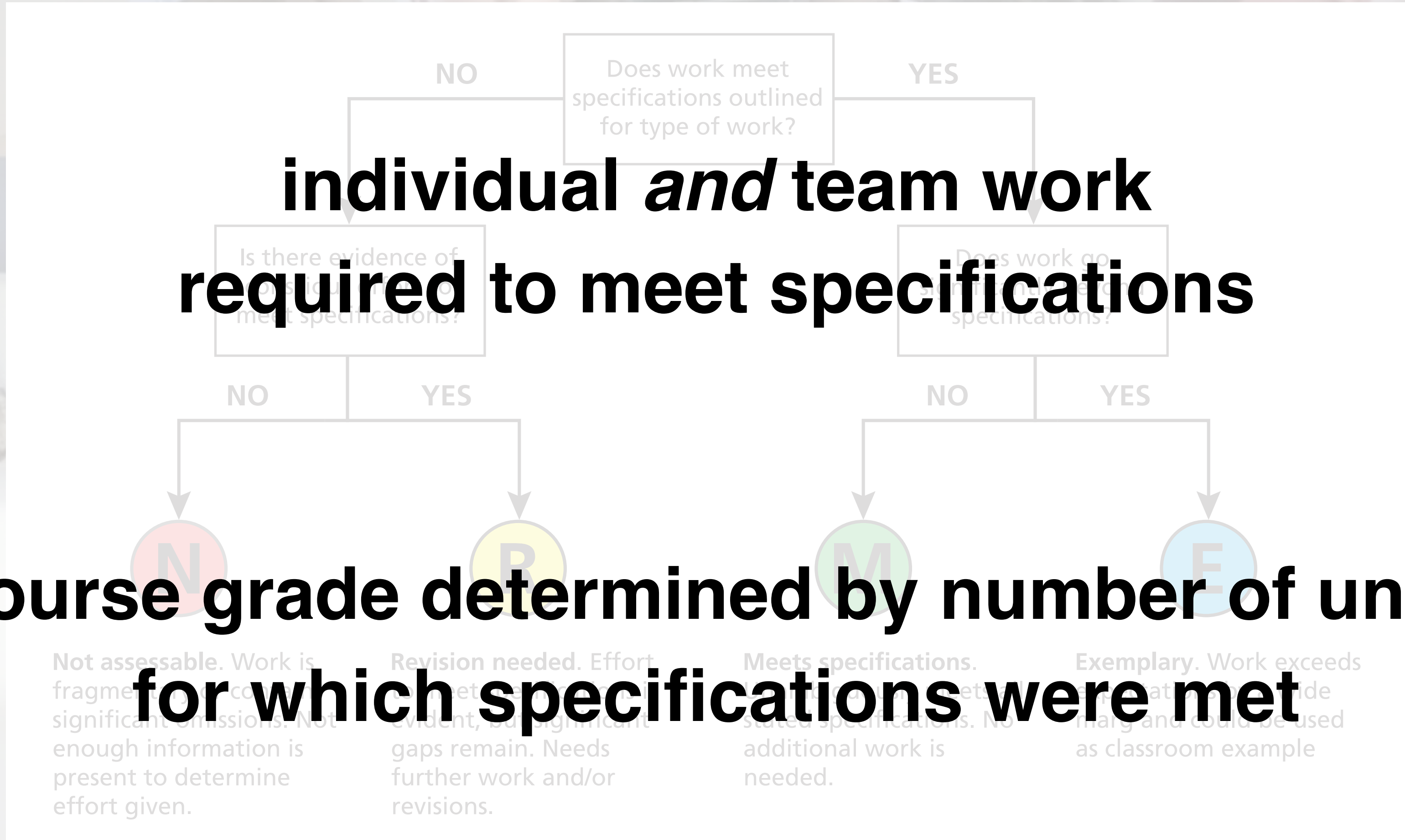
1 pandemic lessons

Establish continous accountability



individual *and* team work required to meet specifications

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

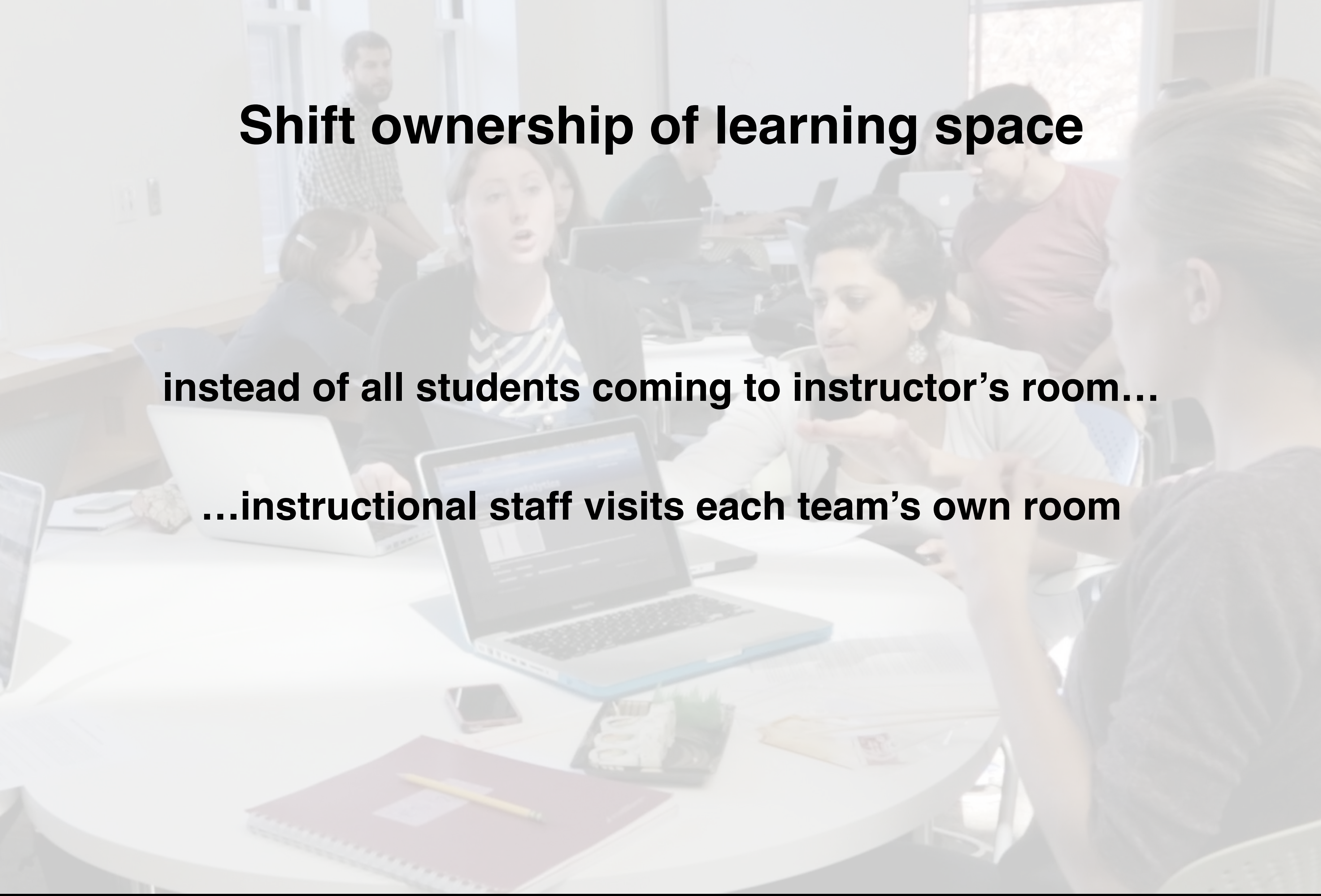
Inside Higher Ed, *Yes, Virginia, there is a better way to grade*

1 pandemic lessons

Shift ownership of learning space

instead of all students coming to instructor's room…

1 pandemic lessons



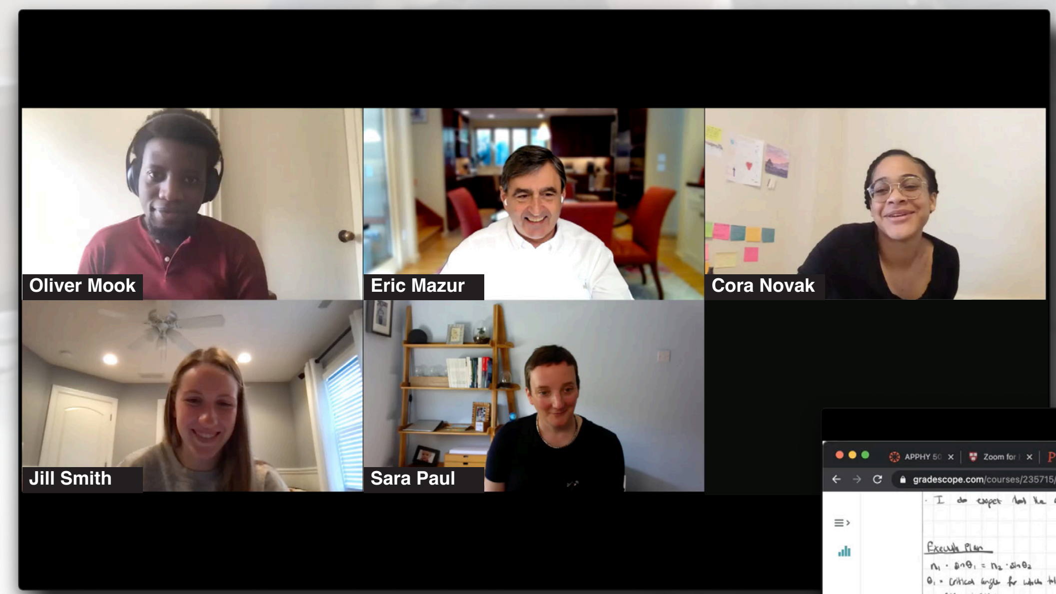
Shift ownership of learning space

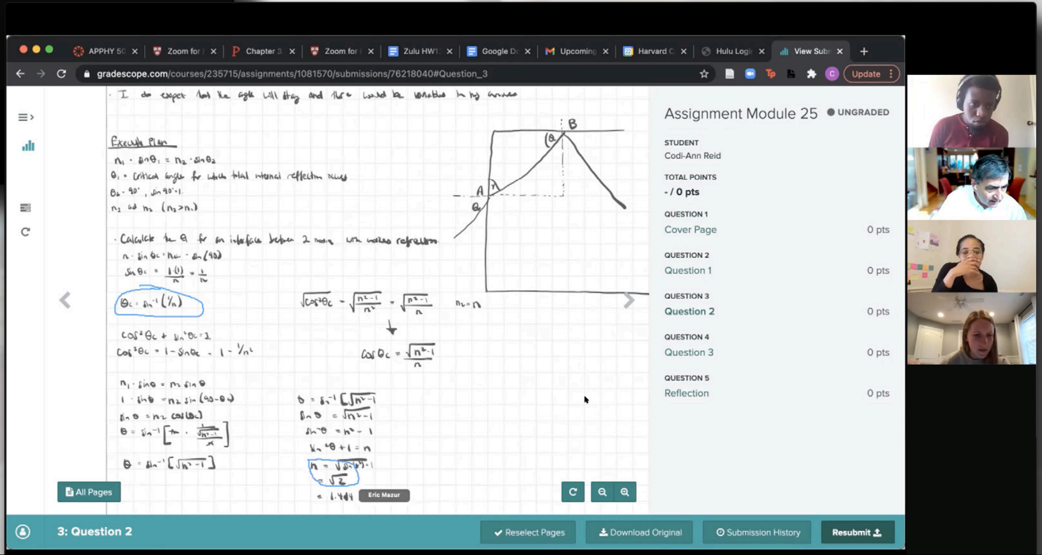
instead of all students coming to instructor's room…

…instructional staff visits each team's own room

Shift ownership of learning space

80 students in one room → 20 rooms with 4 students

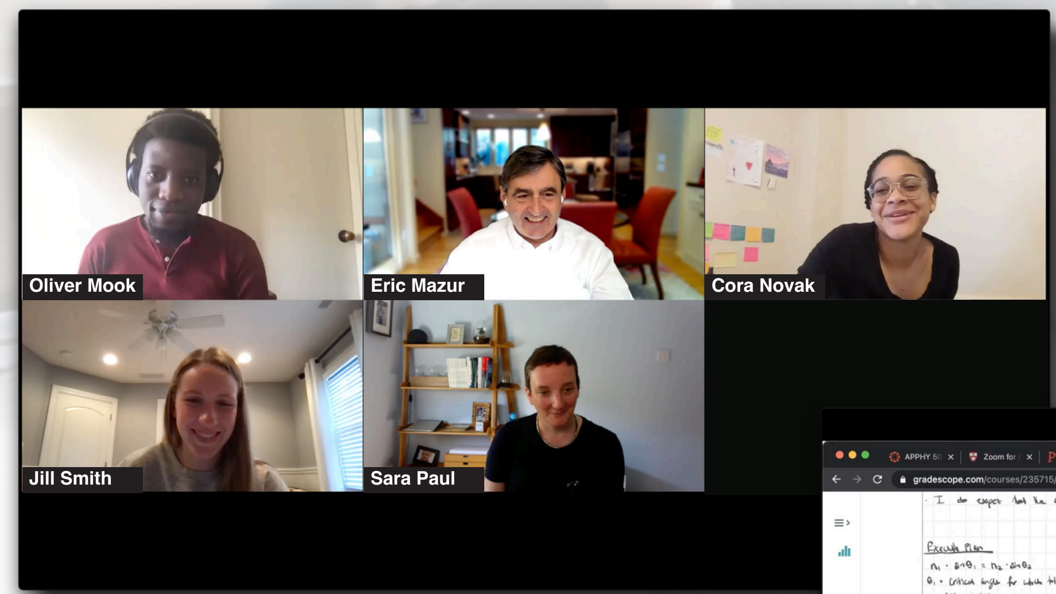


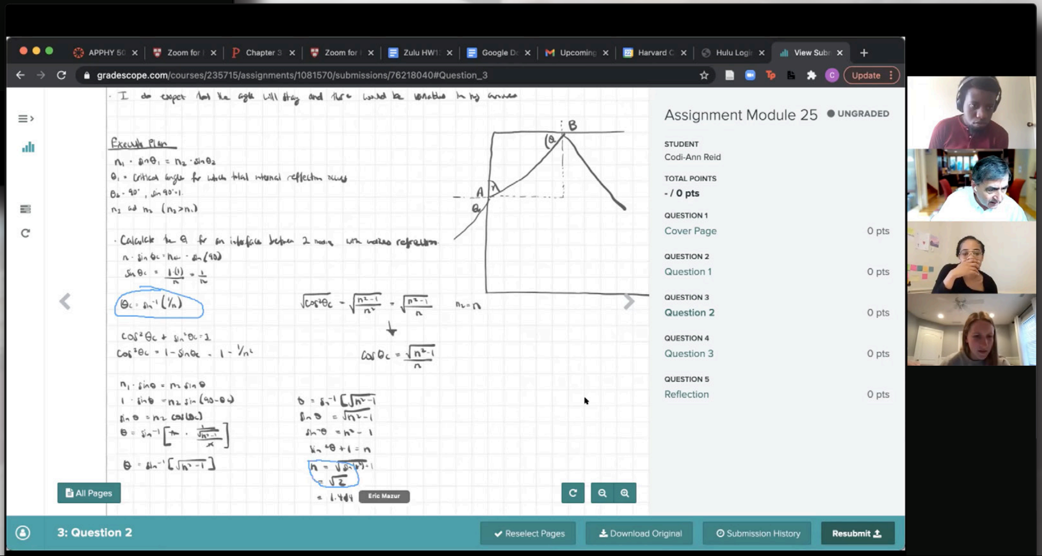


1 pandemic lessons

Shift ownership of learning space

every student on front row

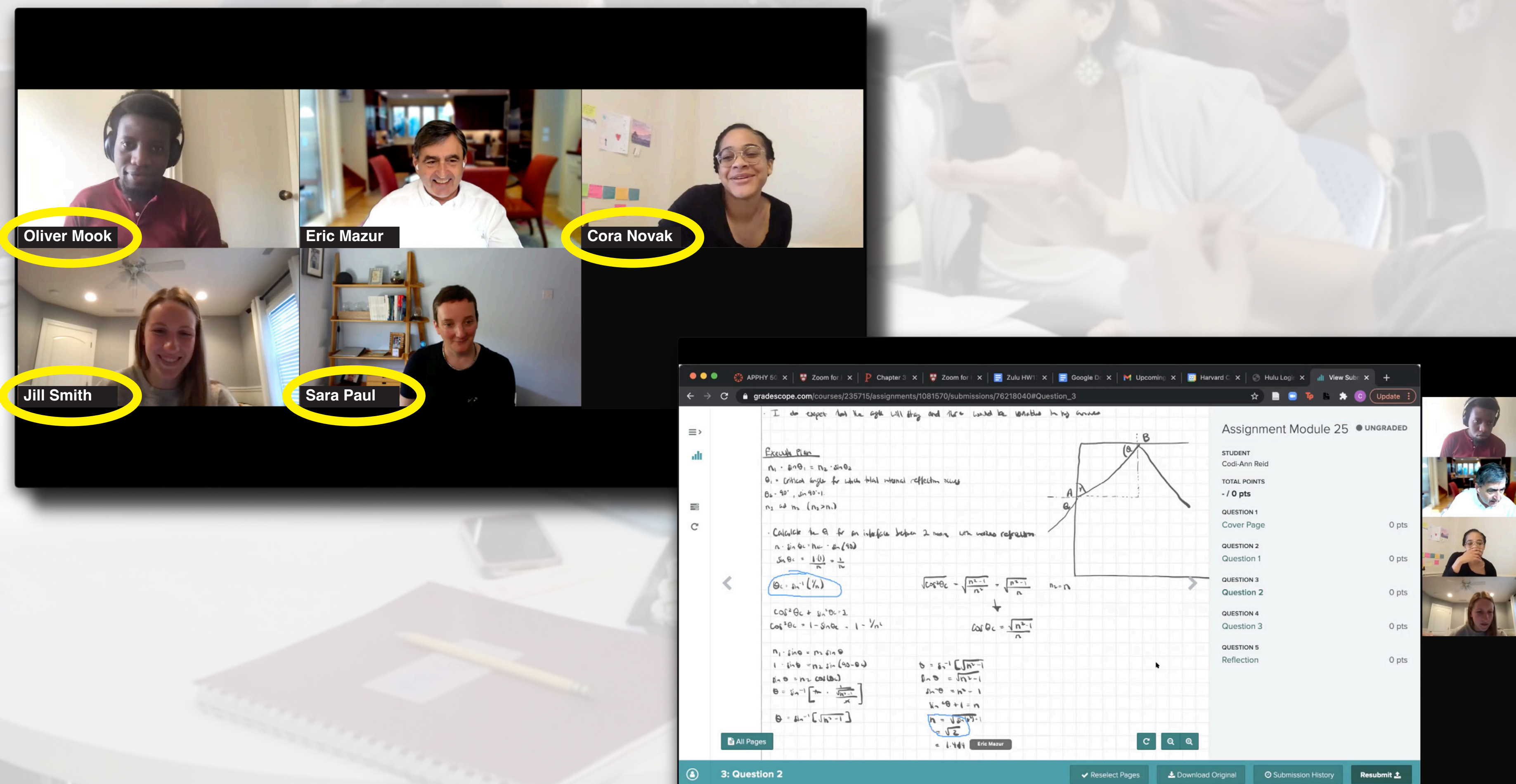


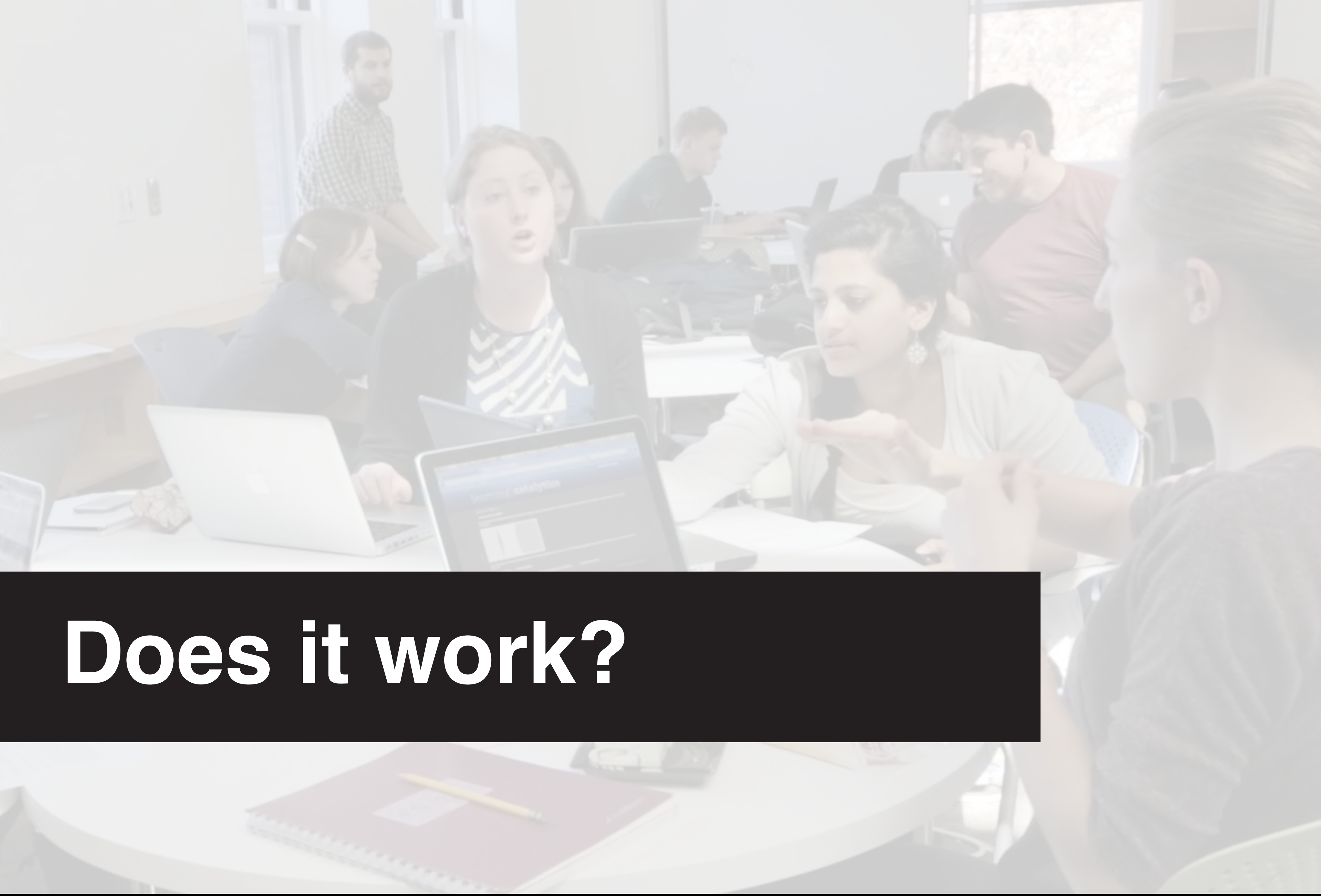


1 pandemic lessons

Shift ownership of learning space

every student on front row & address each by their name





Does it work?

Doubling of…

- content learning gains
- physics self-efficacy gains

What do students say?

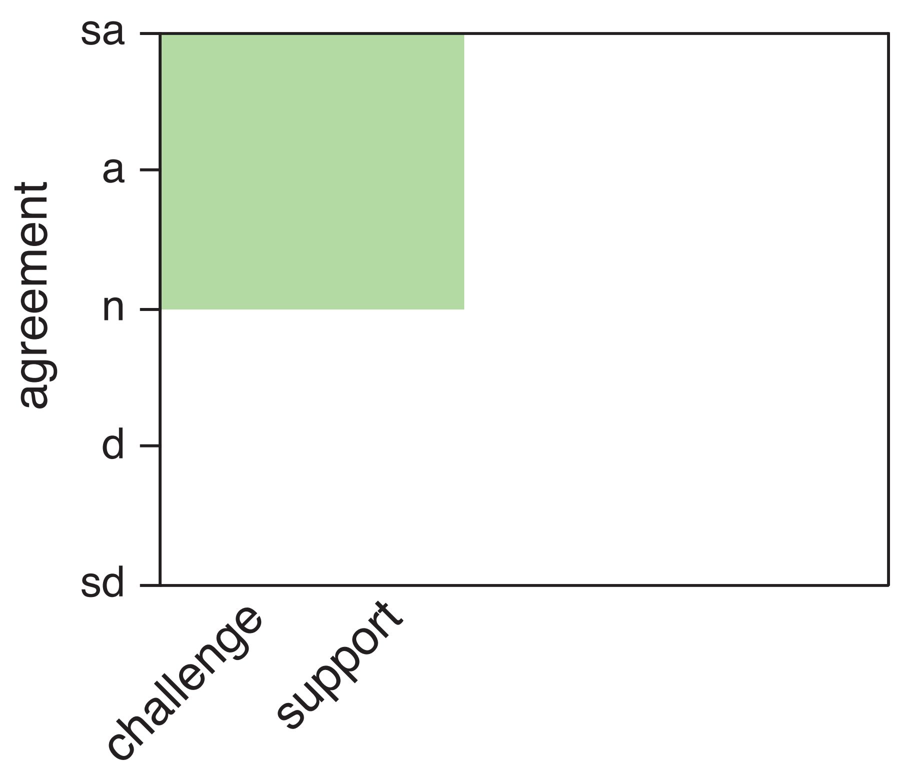
Agile Feedback Survey (Talbert)

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

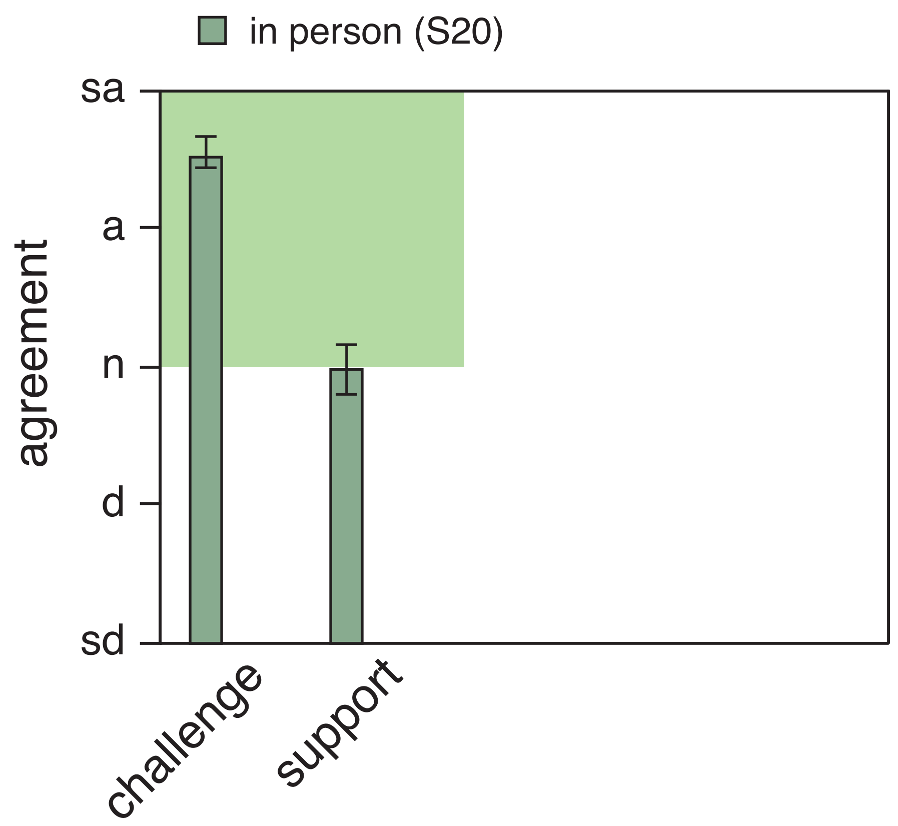
challenge vs. support

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

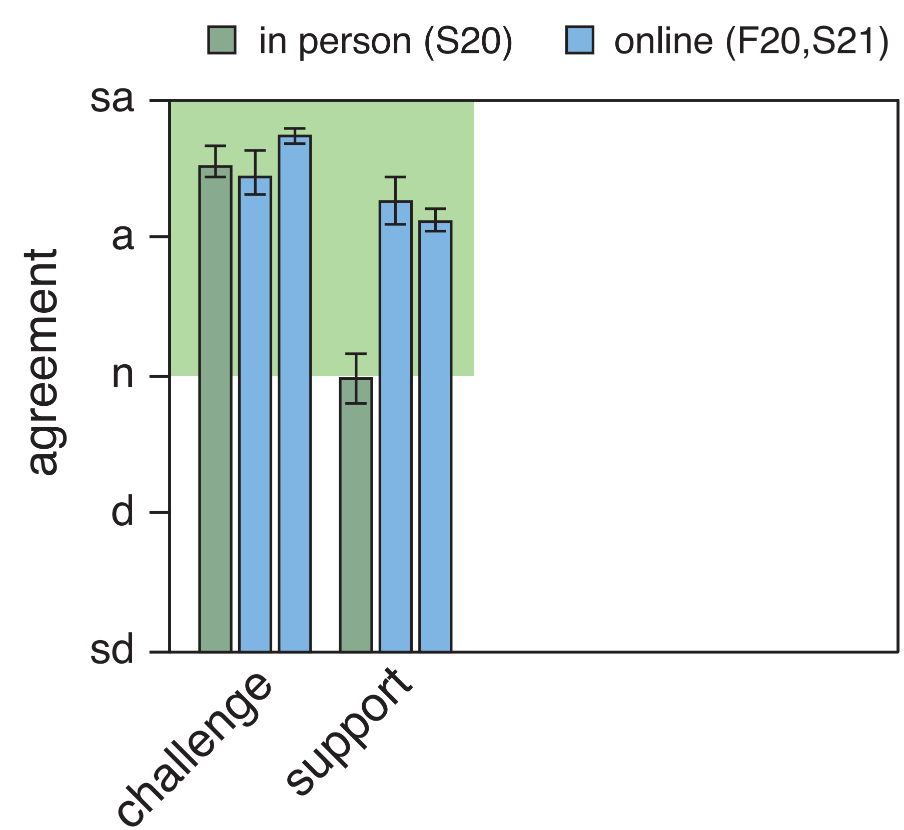
challenge vs. support



challenge vs. support



challenge vs. support

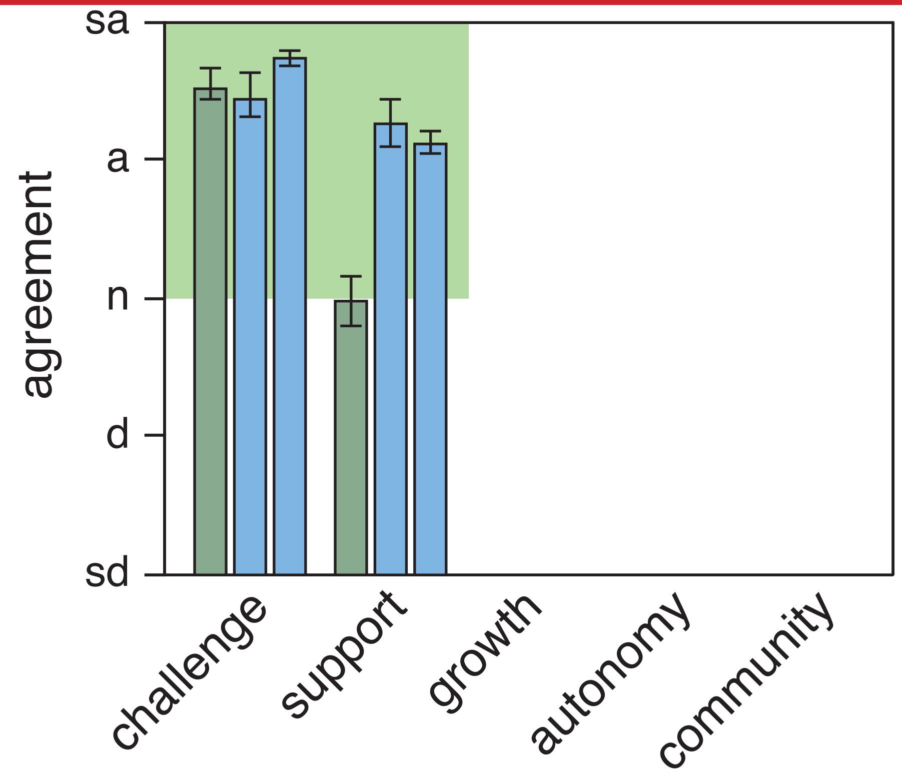


self-determination

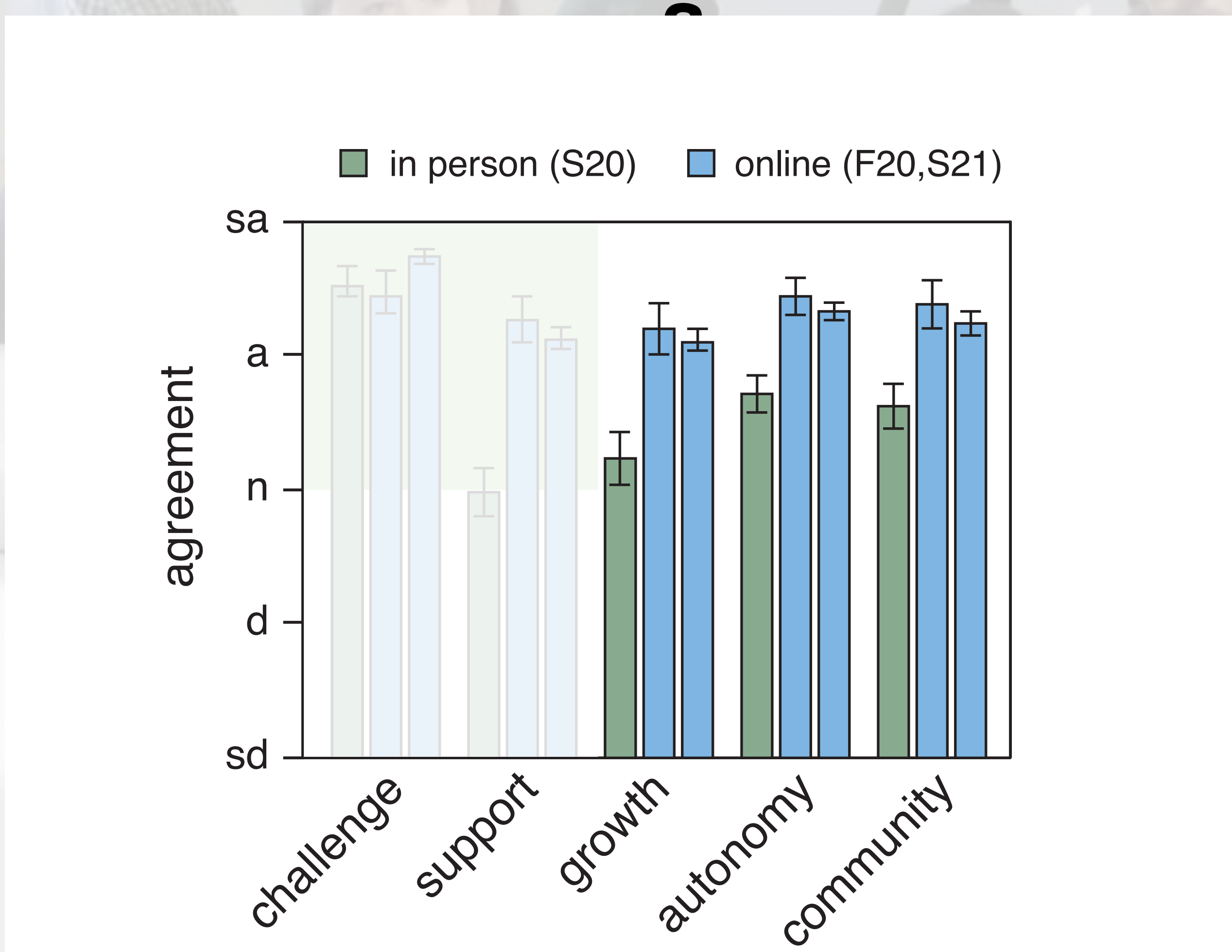
1. I was challenged intellectually (challenge)
2. I had plenty of support (support)
3. I am closer to mastering the ideas of the course now (growth)
4. I made progress because of my own efforts and choices (auton.)
5. I felt I was part of a community of learners (relatedness)

self-determination

What do you predict?



self-determination

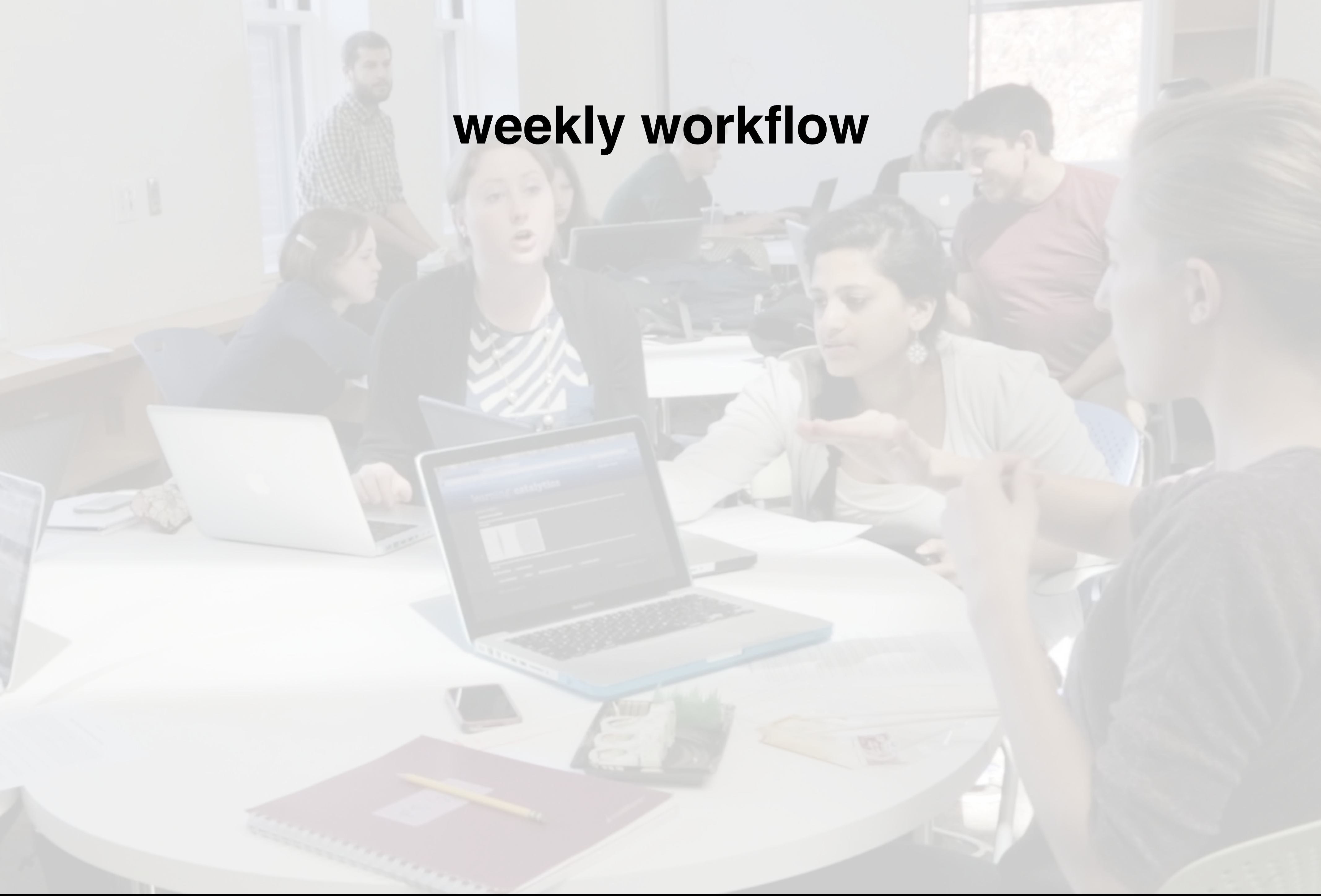


I did my best teaching *ever* online!

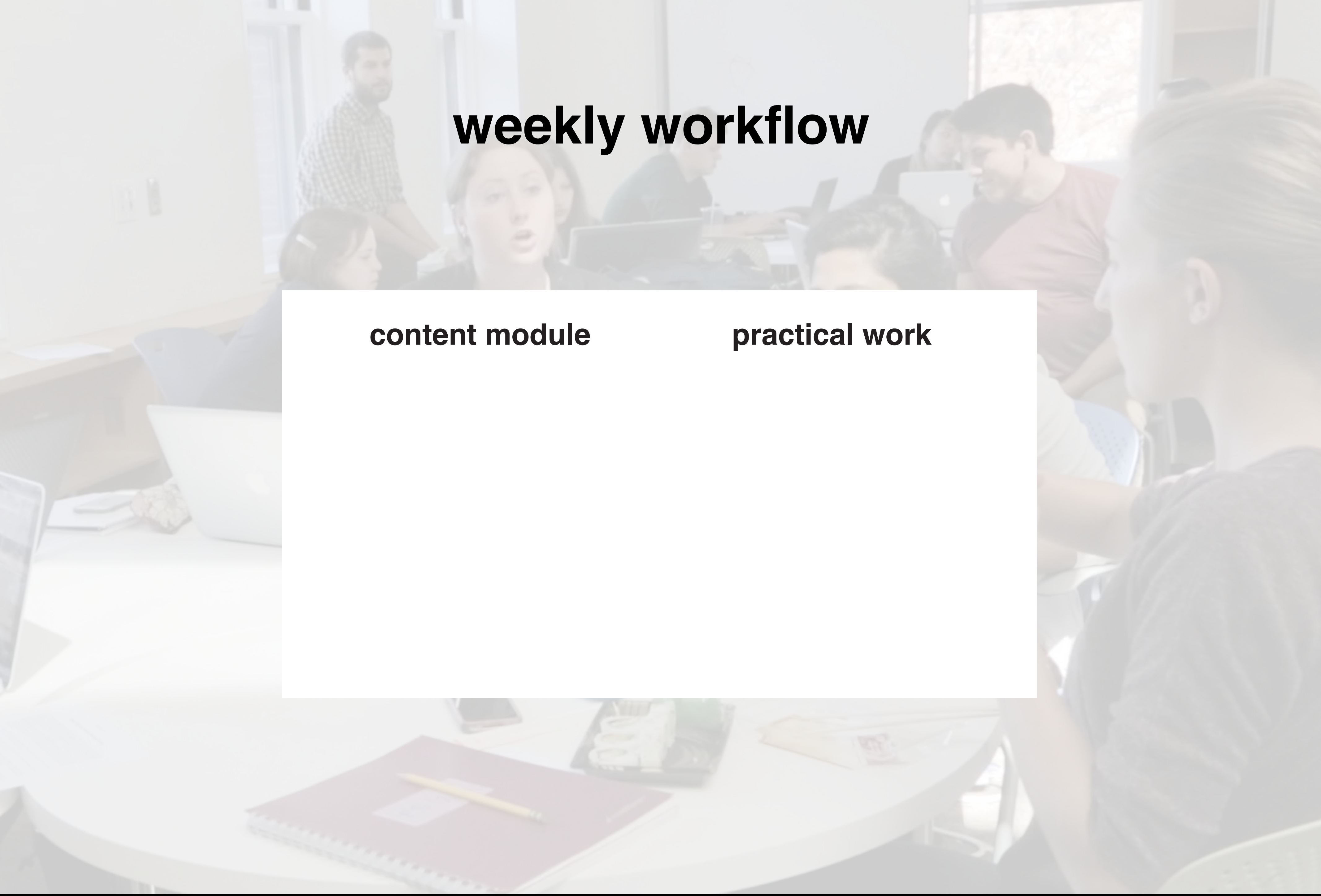
1 pandemic lessons

❶ **pandemic lessons** ❷ **new normal**

weekly workflow



❶ pandemic lessons **❷ new normal**

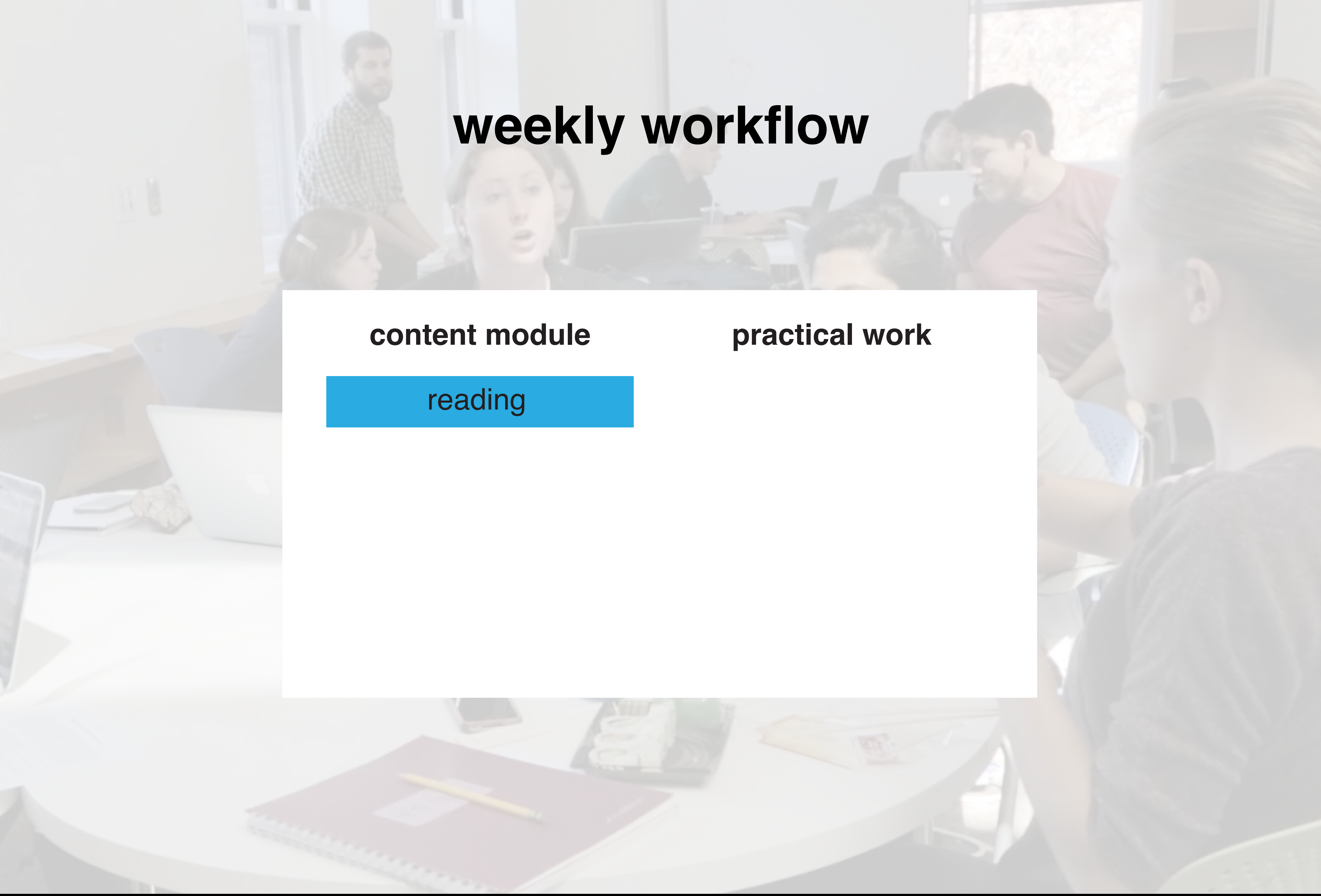


weekly workflow

content module	practical work

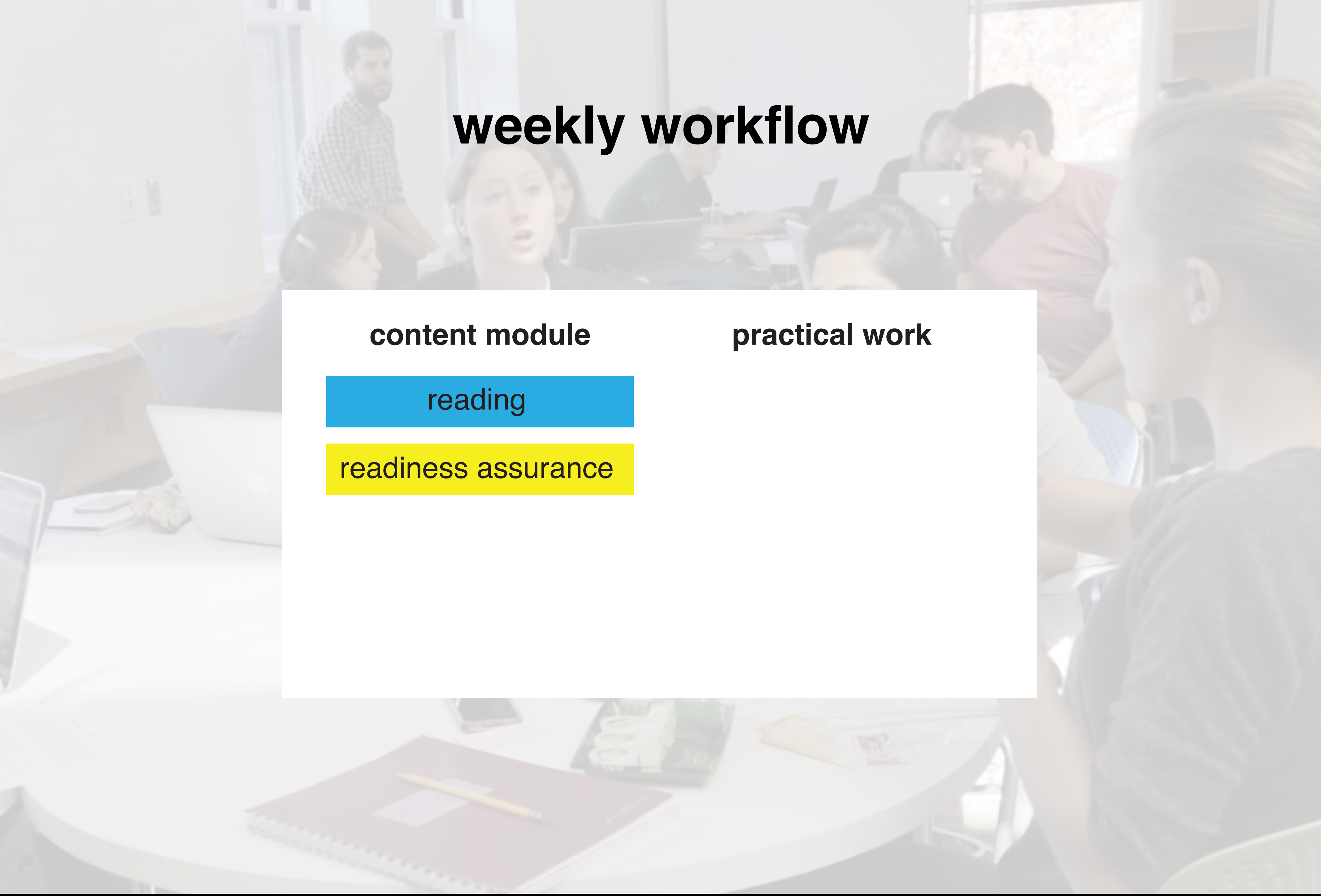
❶ pandemic lessons ❷ new normal

weekly workflow



content module	practical work
reading	

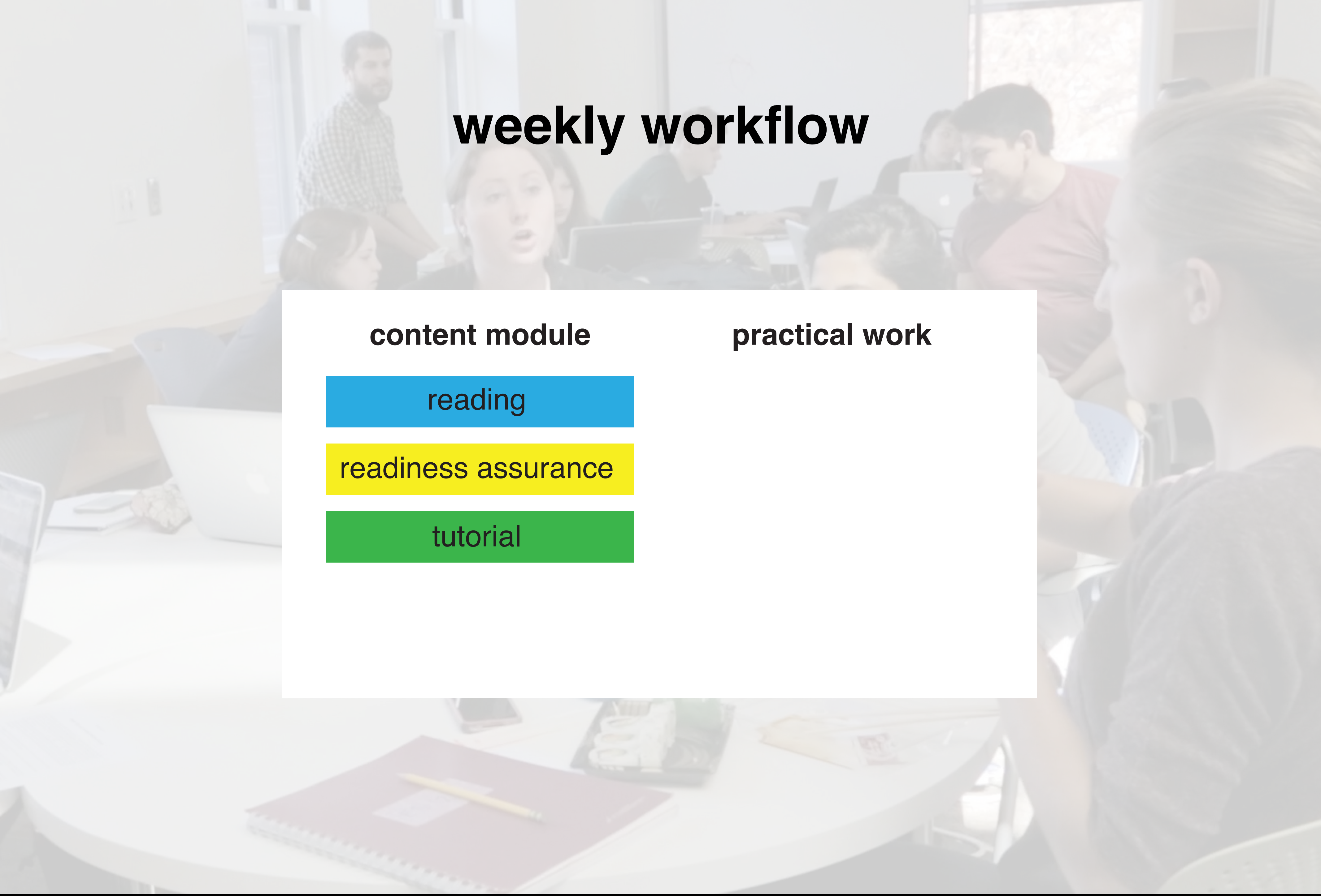
1 pandemic lessons   2 new normal



weekly workflow

content module	practical work
reading	
readiness assurance	

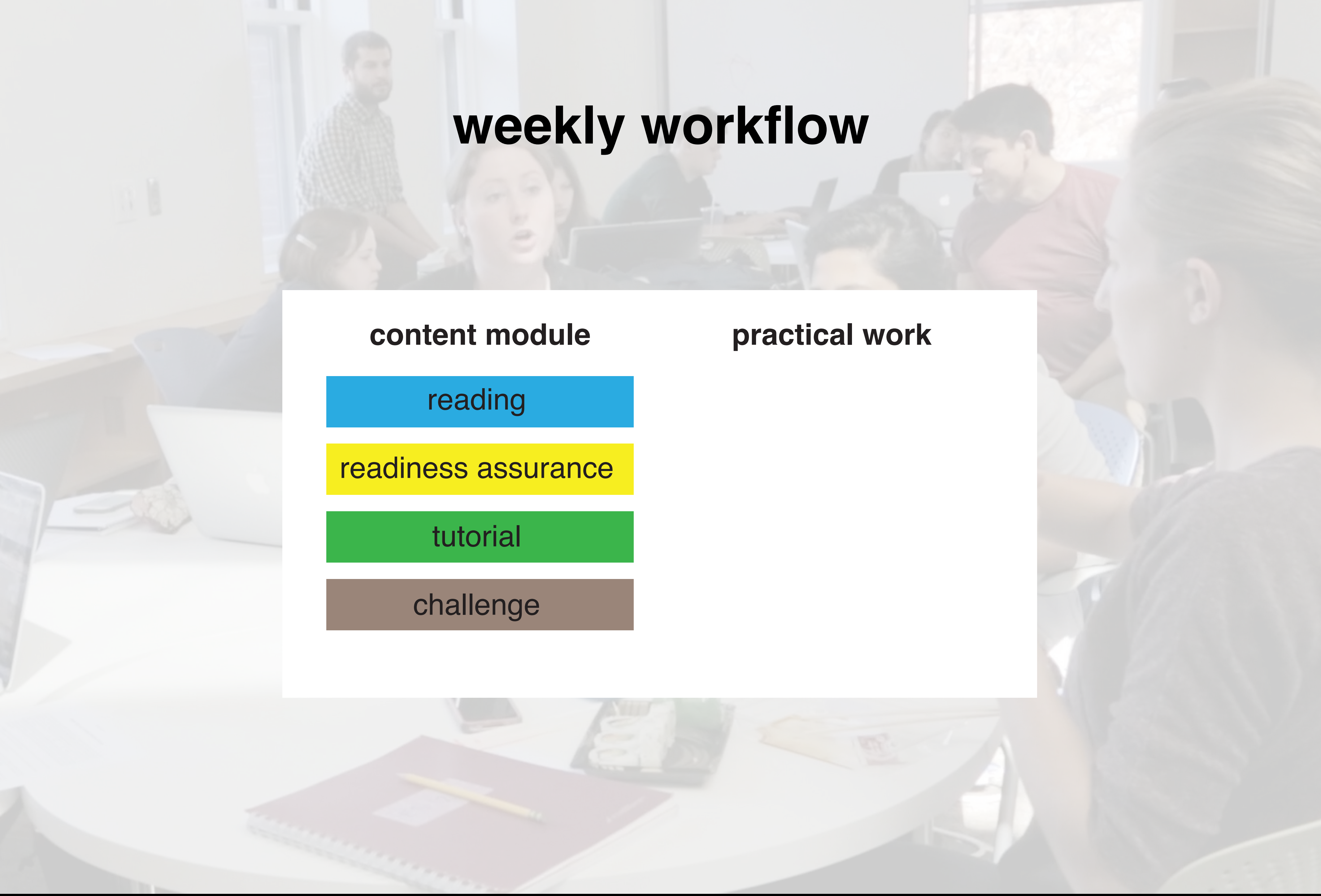
1 pandemic lessons 2 new normal



weekly workflow

content module	practical work
reading	
readiness assurance	
tutorial	

1 pandemic lessons **2 new normal**

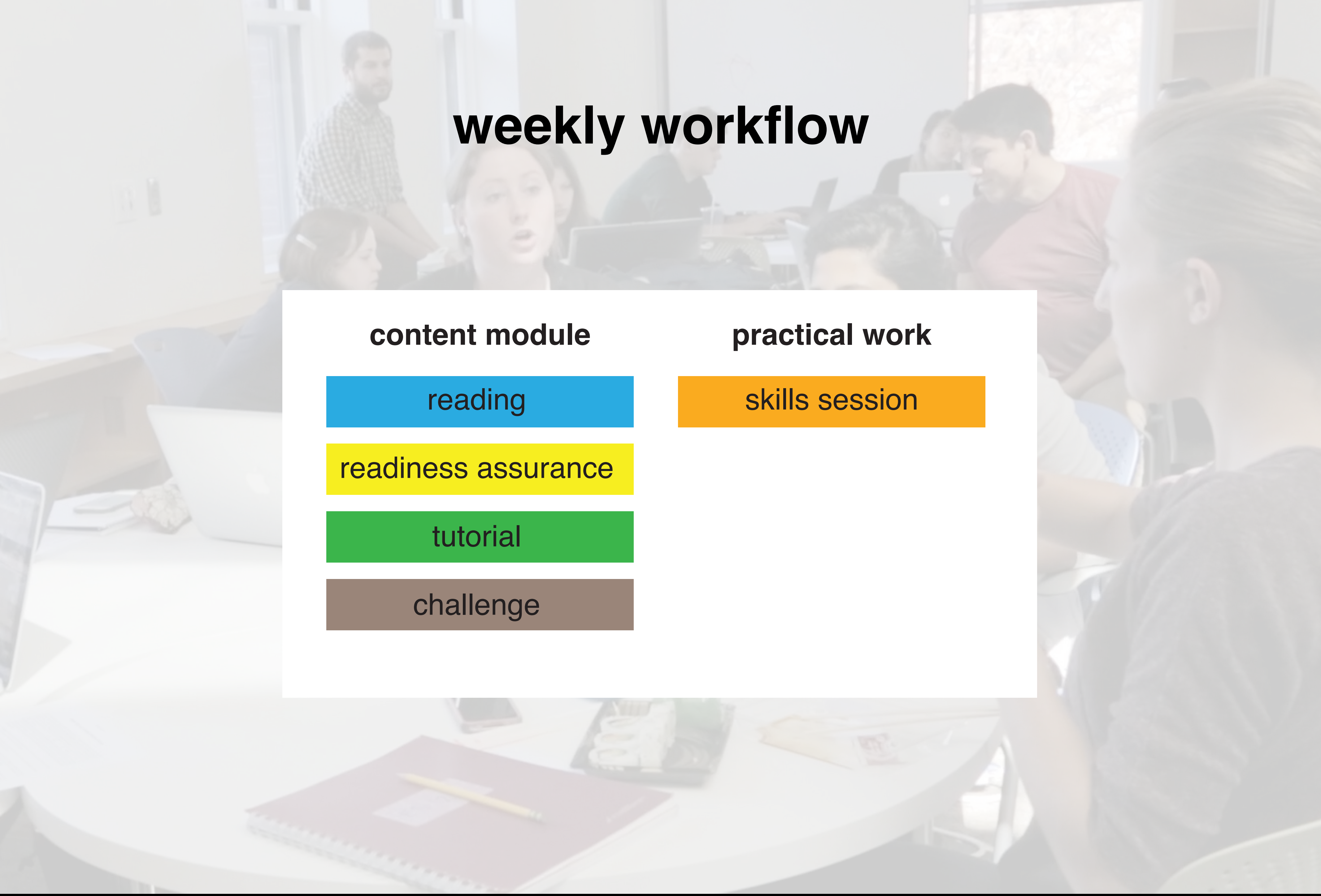


weekly workflow

content module	practical work
reading	
readiness assurance	
tutorial	
challenge	

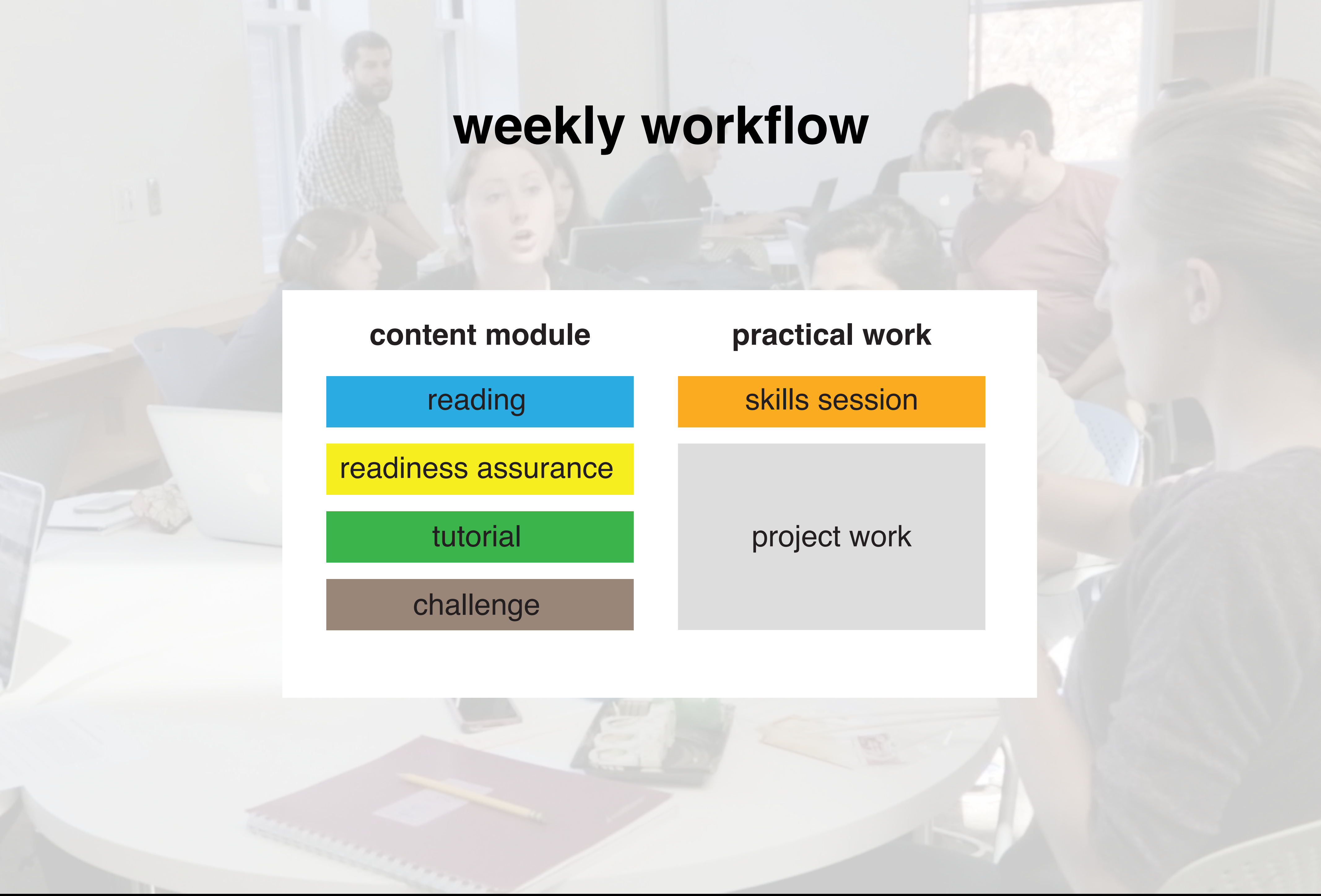
1 pandemic lessons   2 new normal

weekly workflow



content module	practical work
reading	skills session
readiness assurance	
tutorial	
challenge	

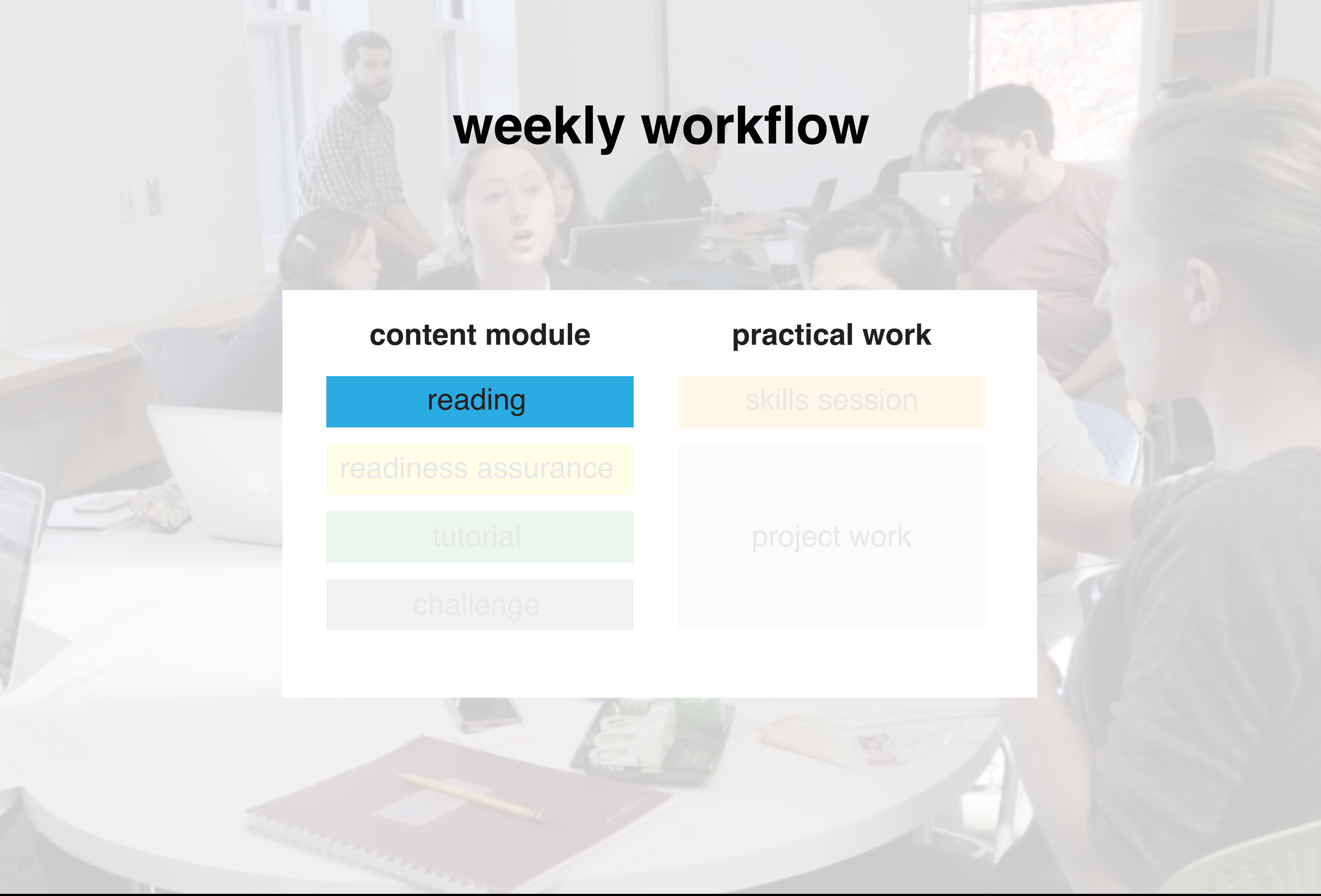
1 **pandemic lessons** 2 **new normal**



weekly workflow

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

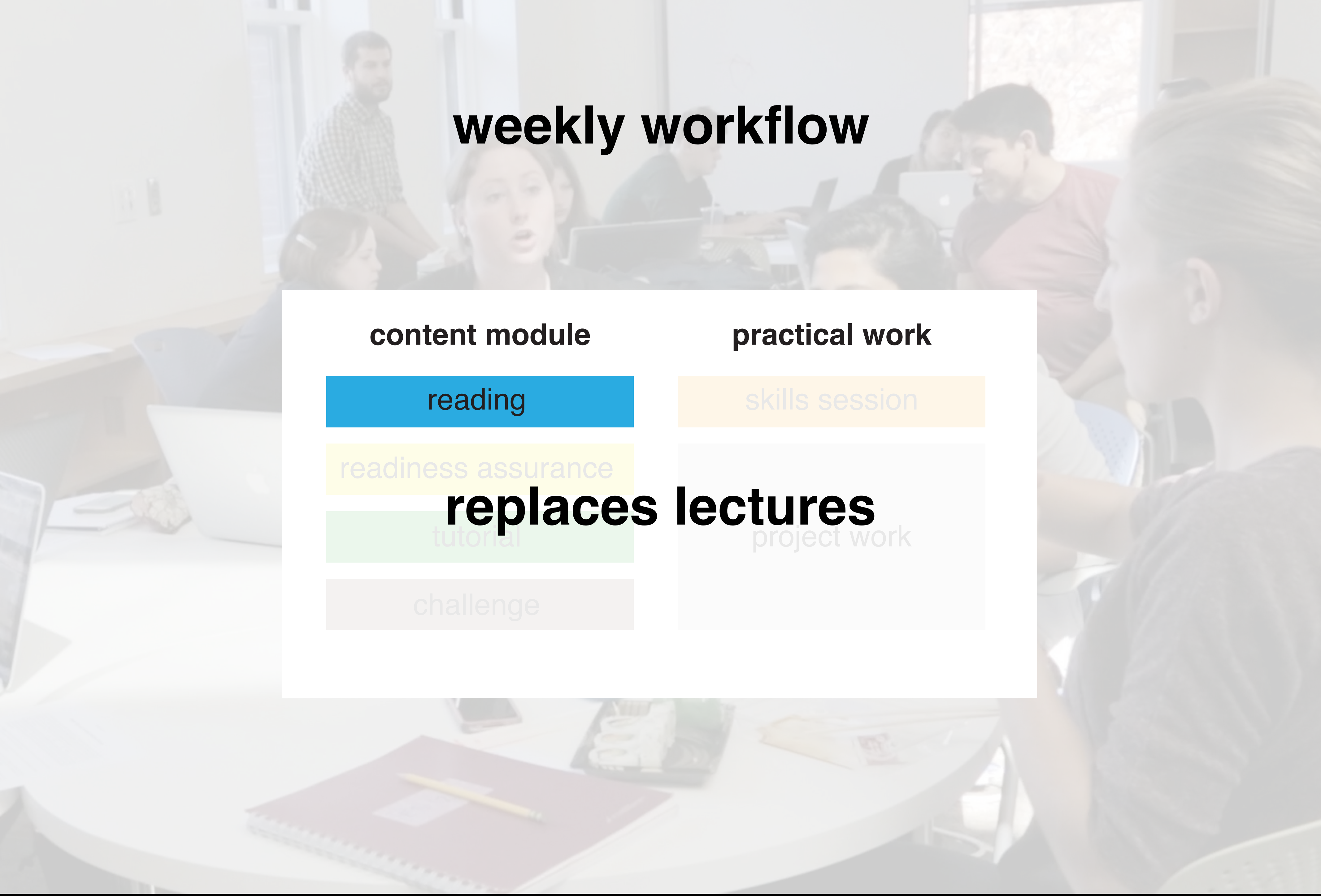
1 pandemic lessons **2 new normal**



weekly workflow

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

1 pandemic lessons **2 new normal**

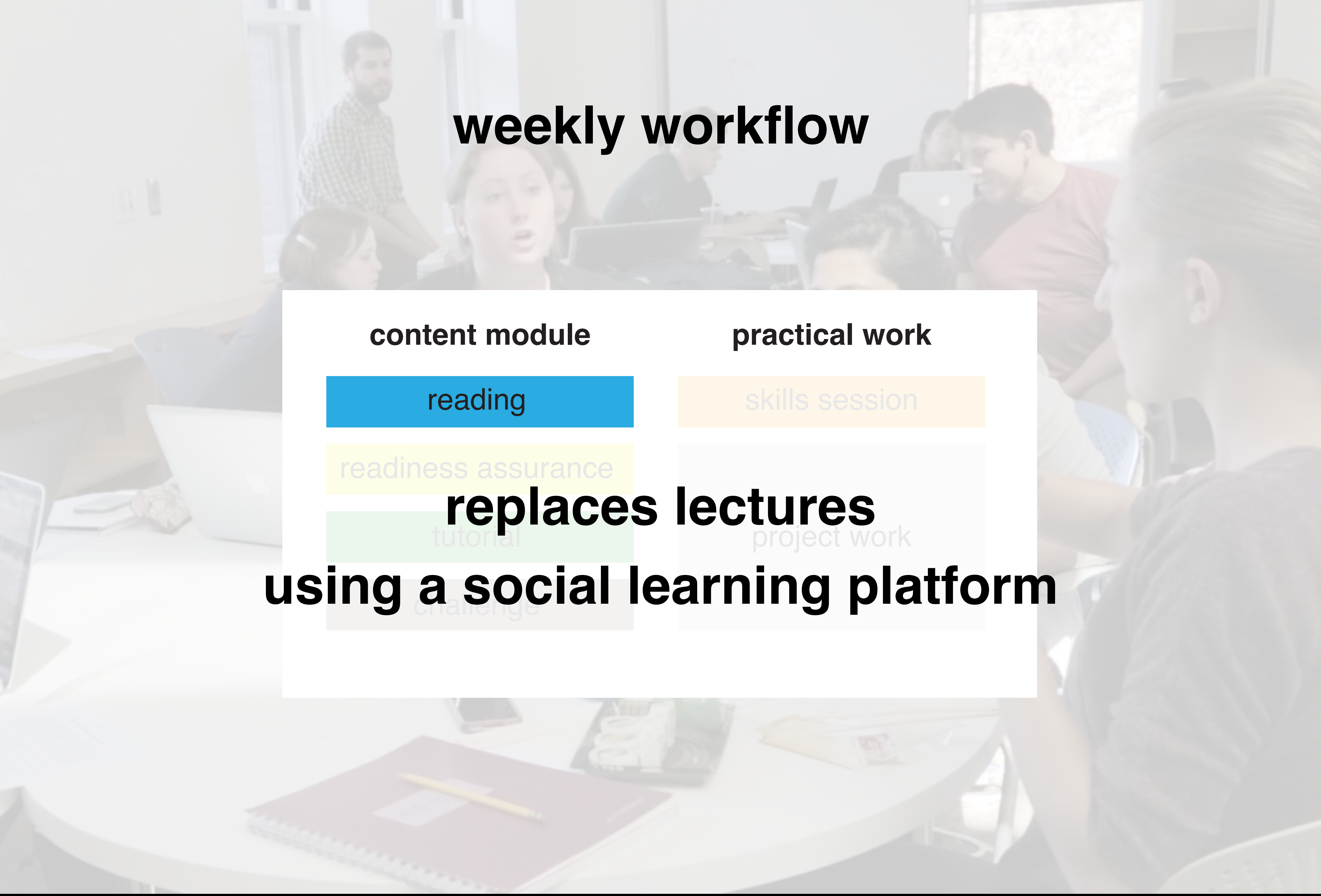


weekly workflow

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

replaces lectures

❶ pandemic lessons ❷ new normal



weekly workflow

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

replaces lectures

using a social learning platform


weekly workflow
content module
practical work
reading
skills session
readiness assurance
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project work
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Perusall Webinar demo » Mazur Chapter 4 Sample All comments Page 2 Eric Mazur

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.

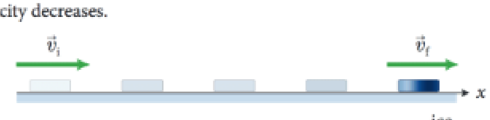
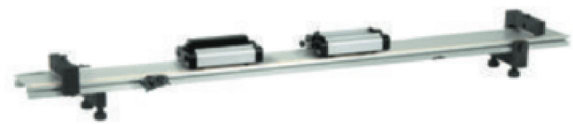


Figure 4.2 Low-friction track and carts used in the experiments described in this chapter.



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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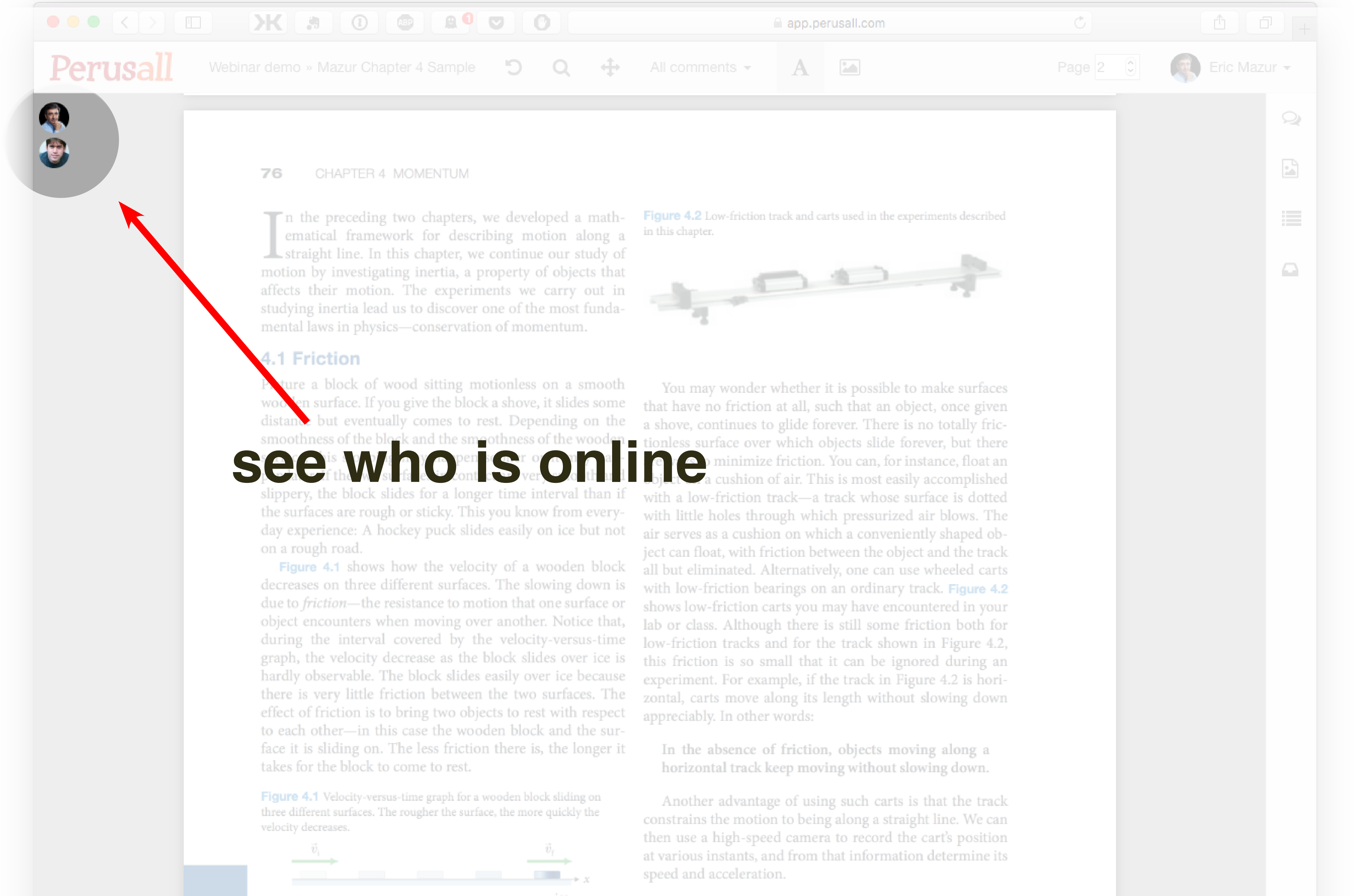

1 pandemic lessons 2 new normal

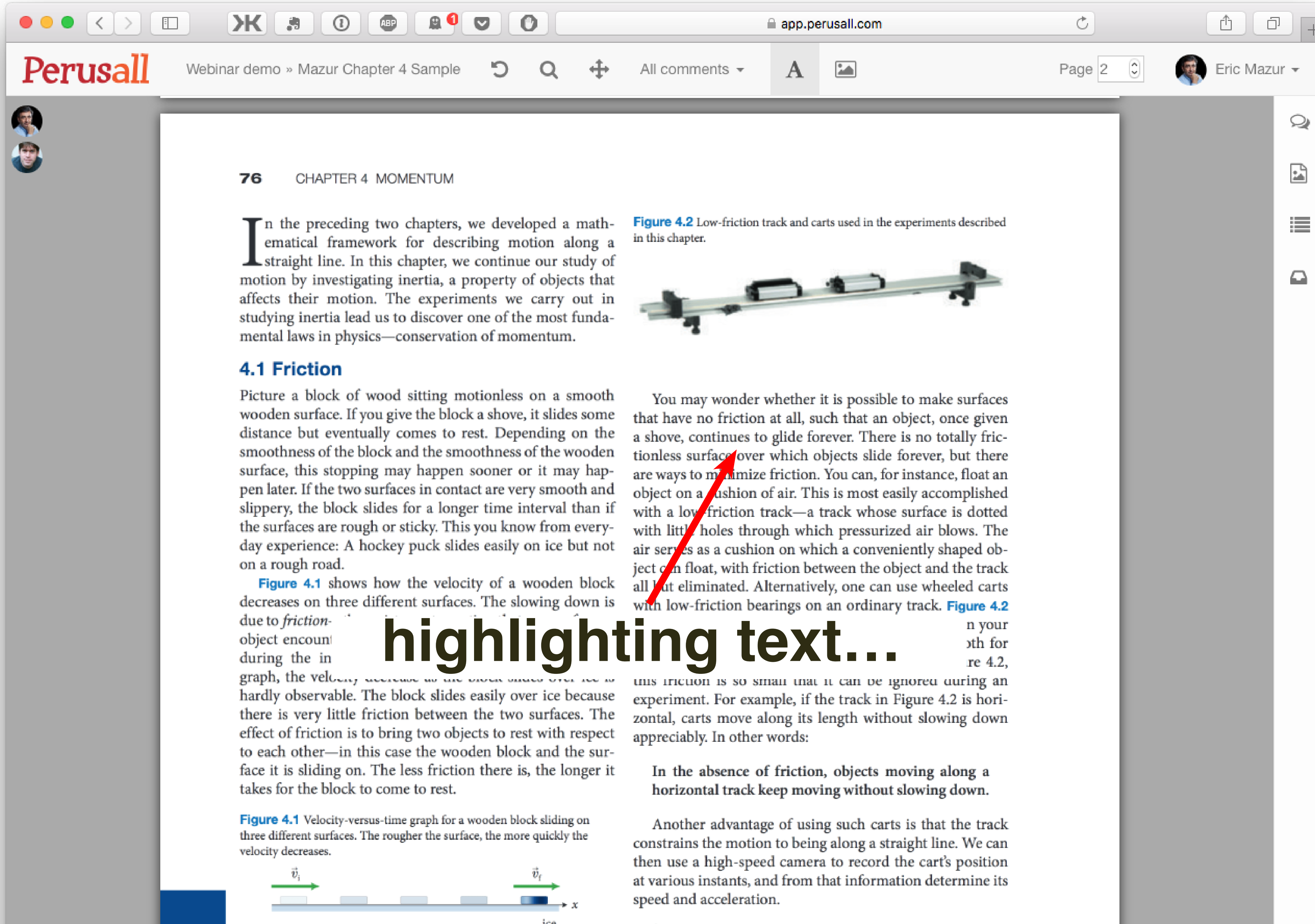

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Figure 4.1 shows how the velocity of a wooden block decreases on three different surfaces. The slowing down is due to *friction*- ... object encoun... during the in... graph, the veloc... hardly observable. The block slides easily over ice because 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.

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$\vec{v}_i$ $\vec{v}_f$ x ice

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highlighting text...

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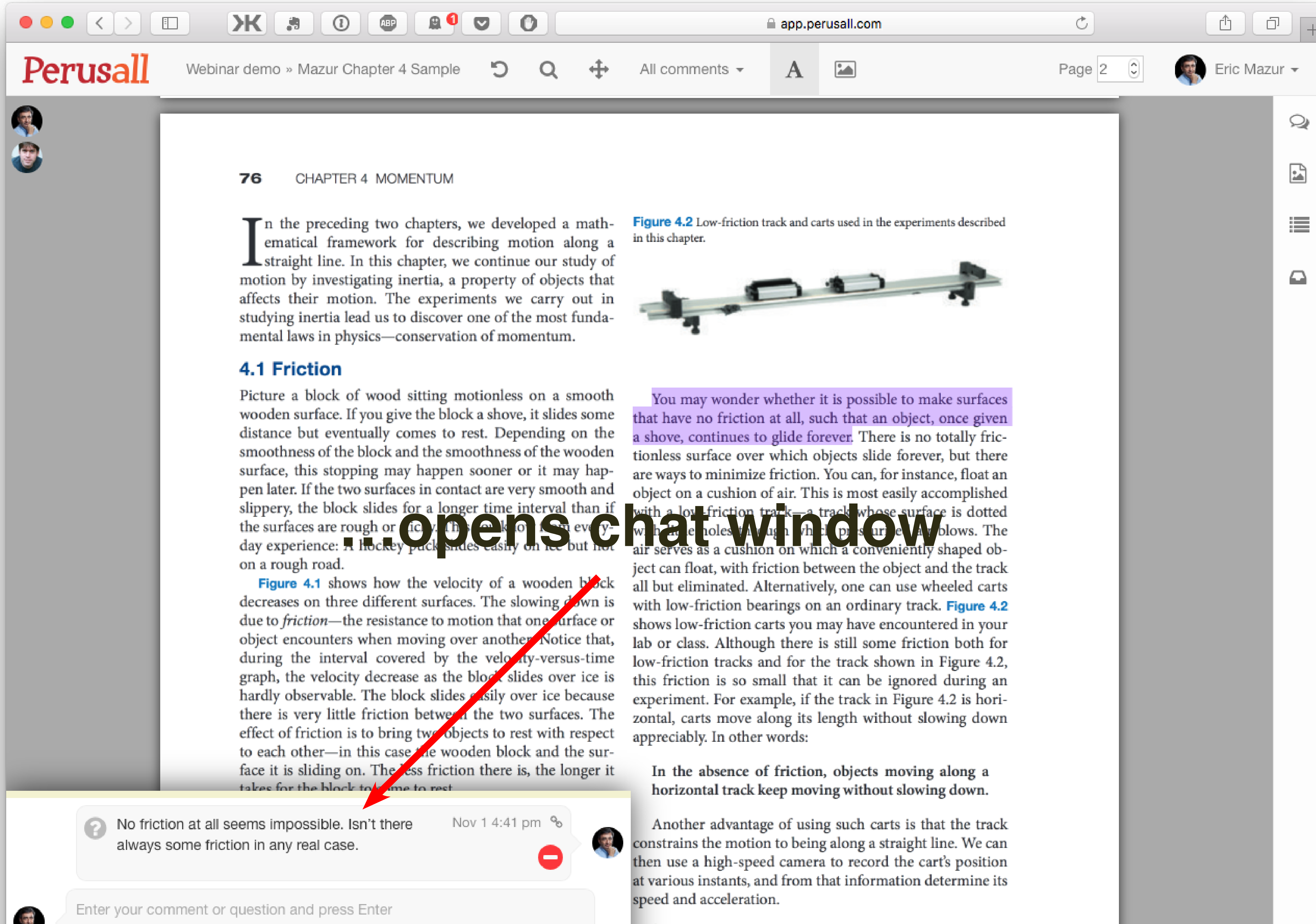

76 CHAPTER 4 MOMENTUM

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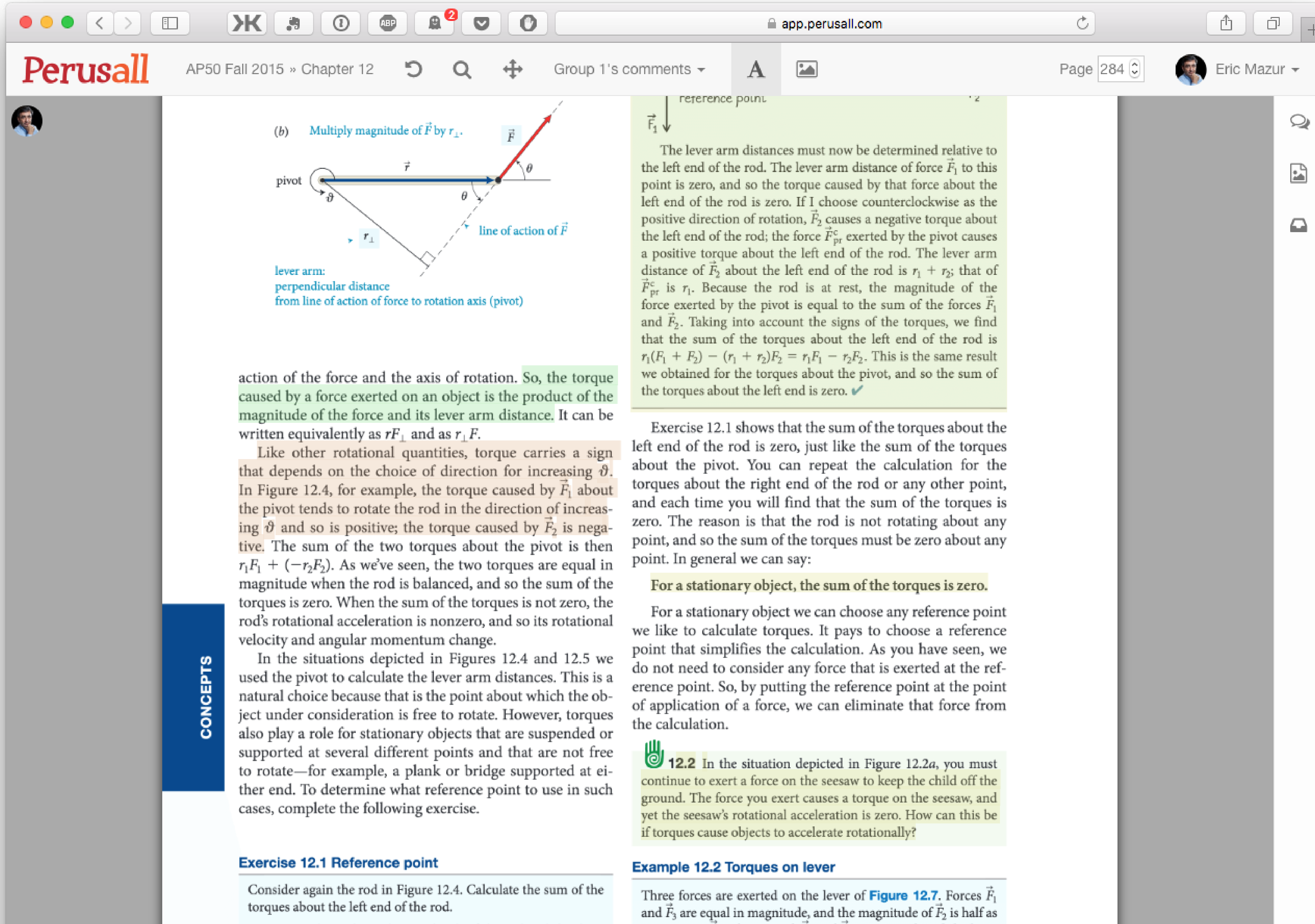

reference point

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 $\vec{F}^c_{pr}$ 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 $\vec{F}^c_{pr}$ 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. ✔

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

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 12.2*a*, 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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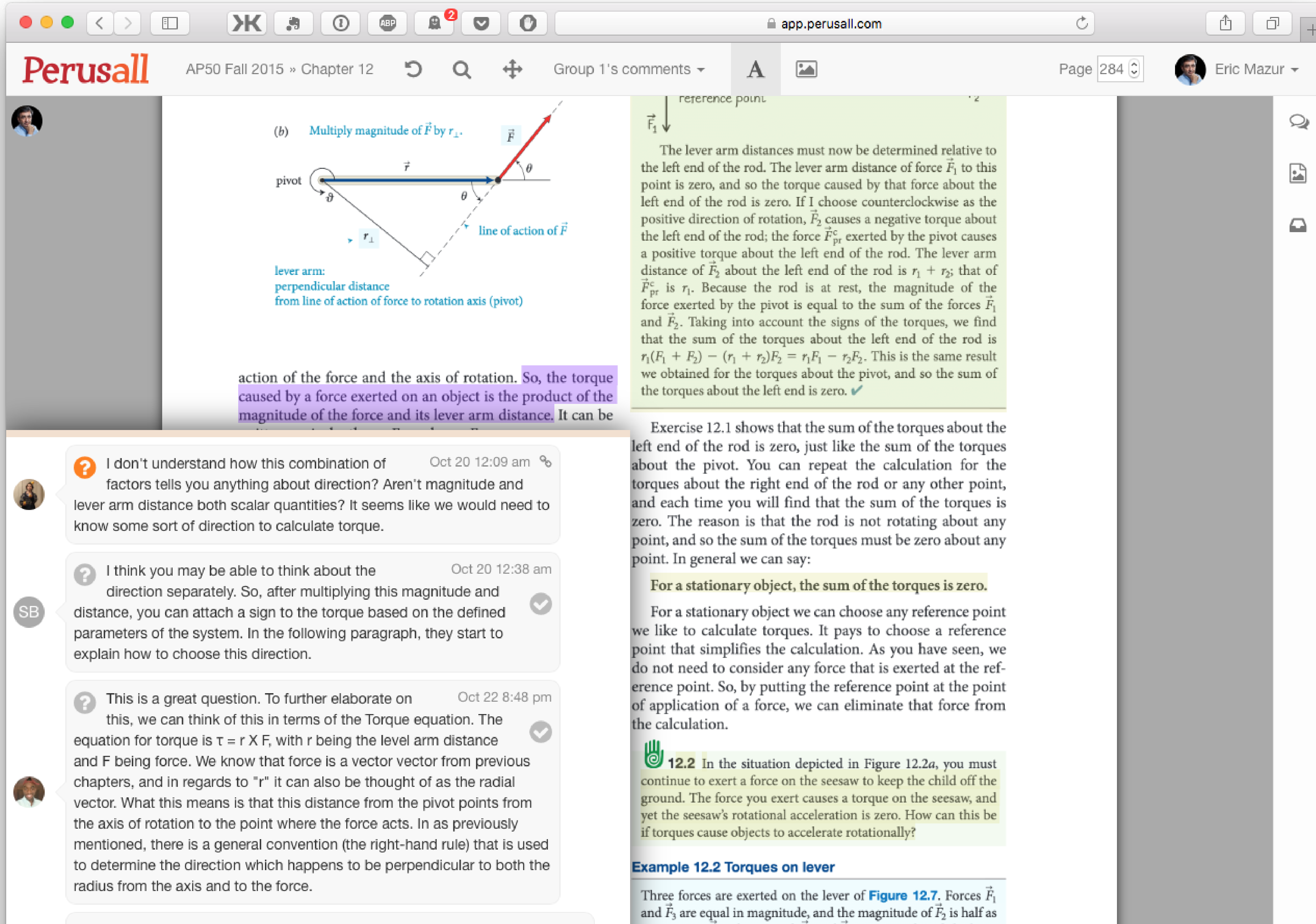

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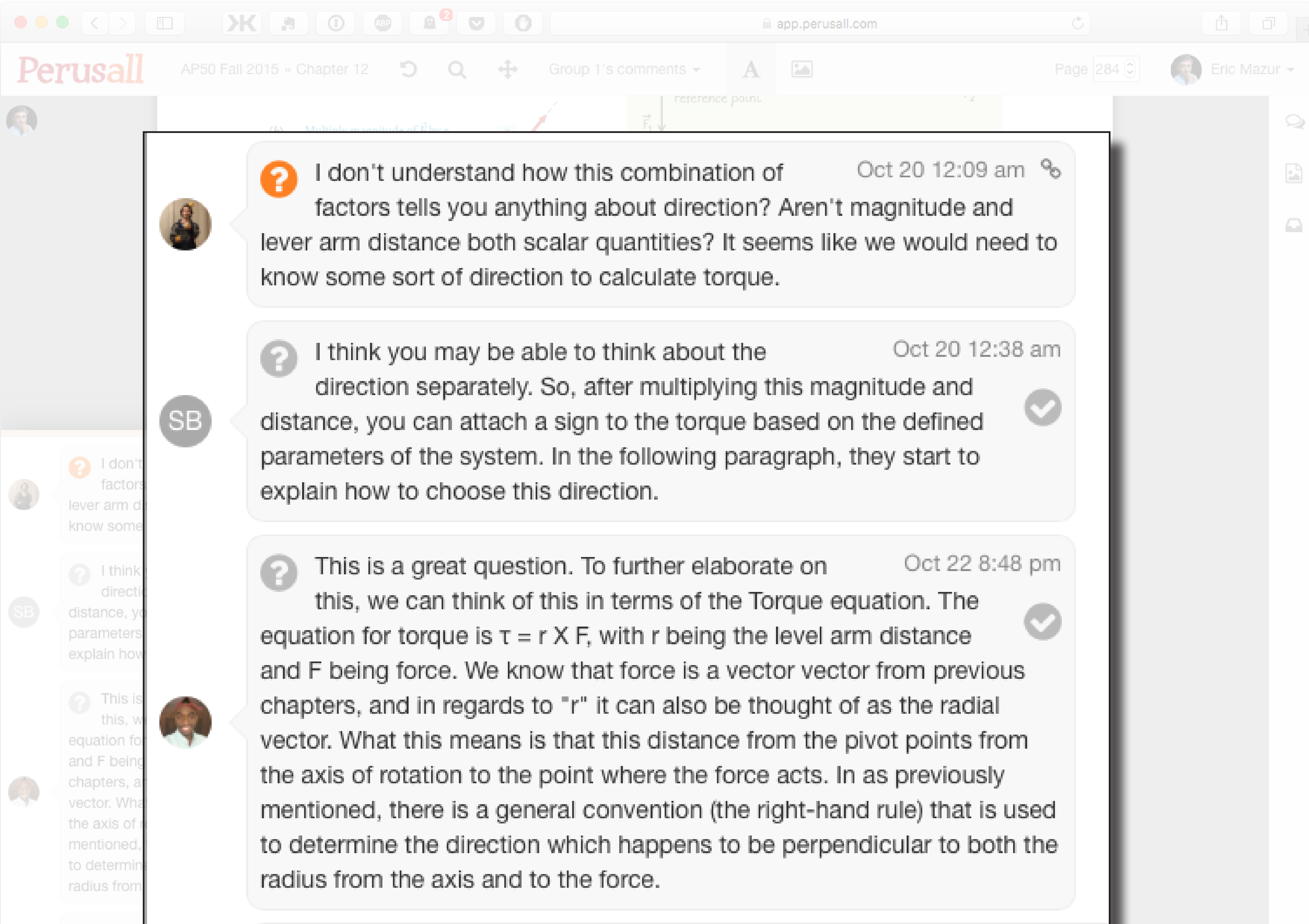

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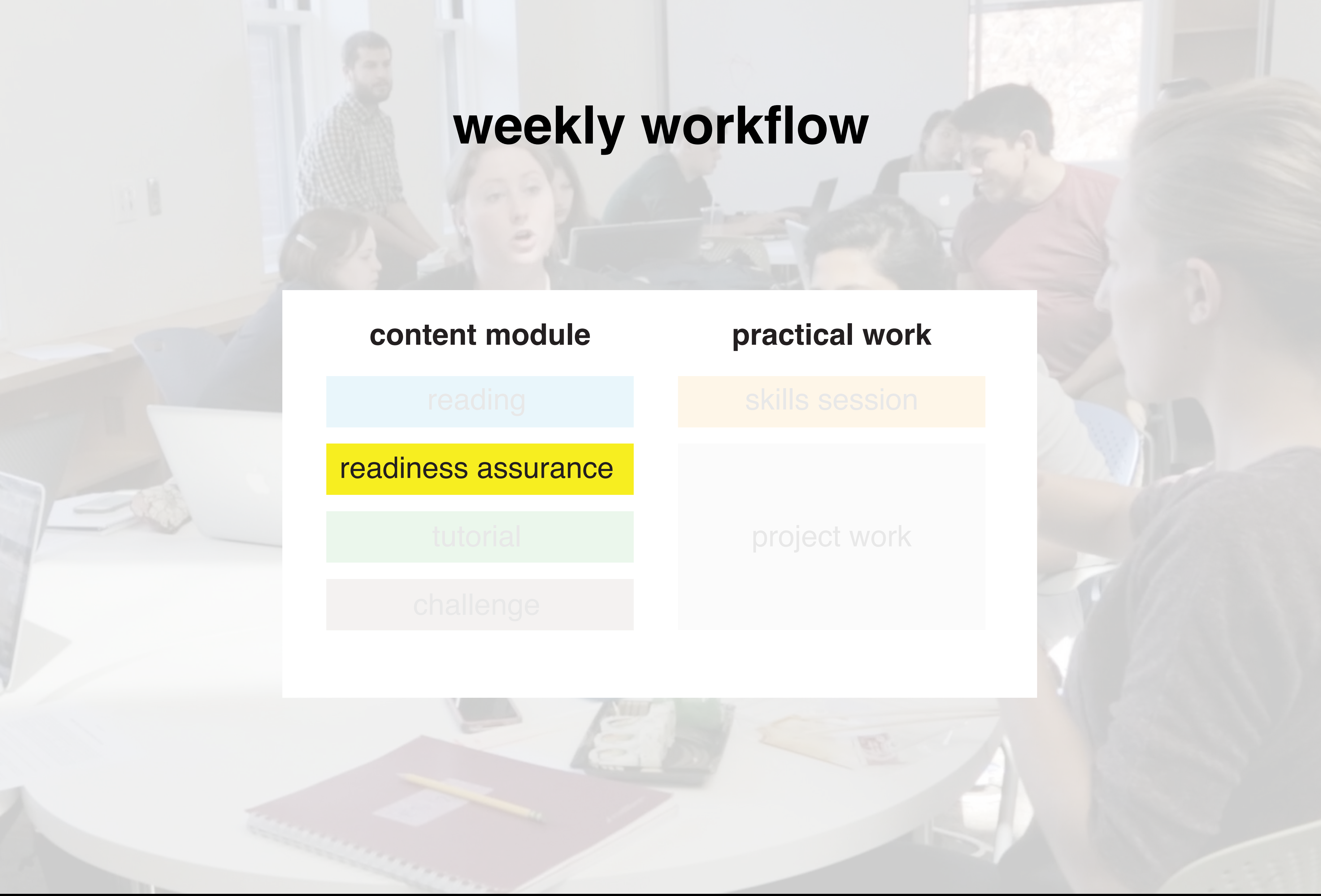

weekly workflow

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

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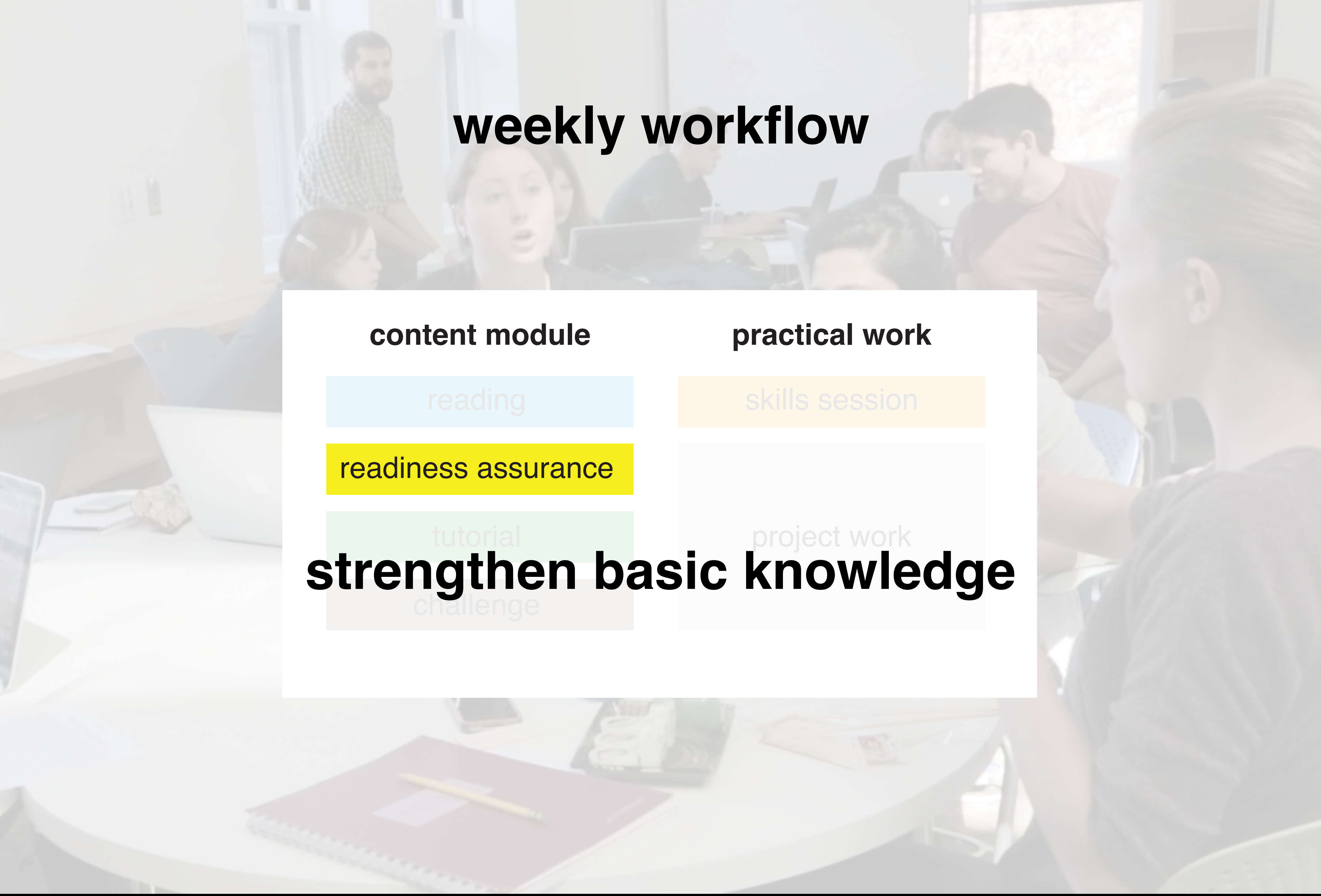

weekly workflow

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

strengthen basic knowledge

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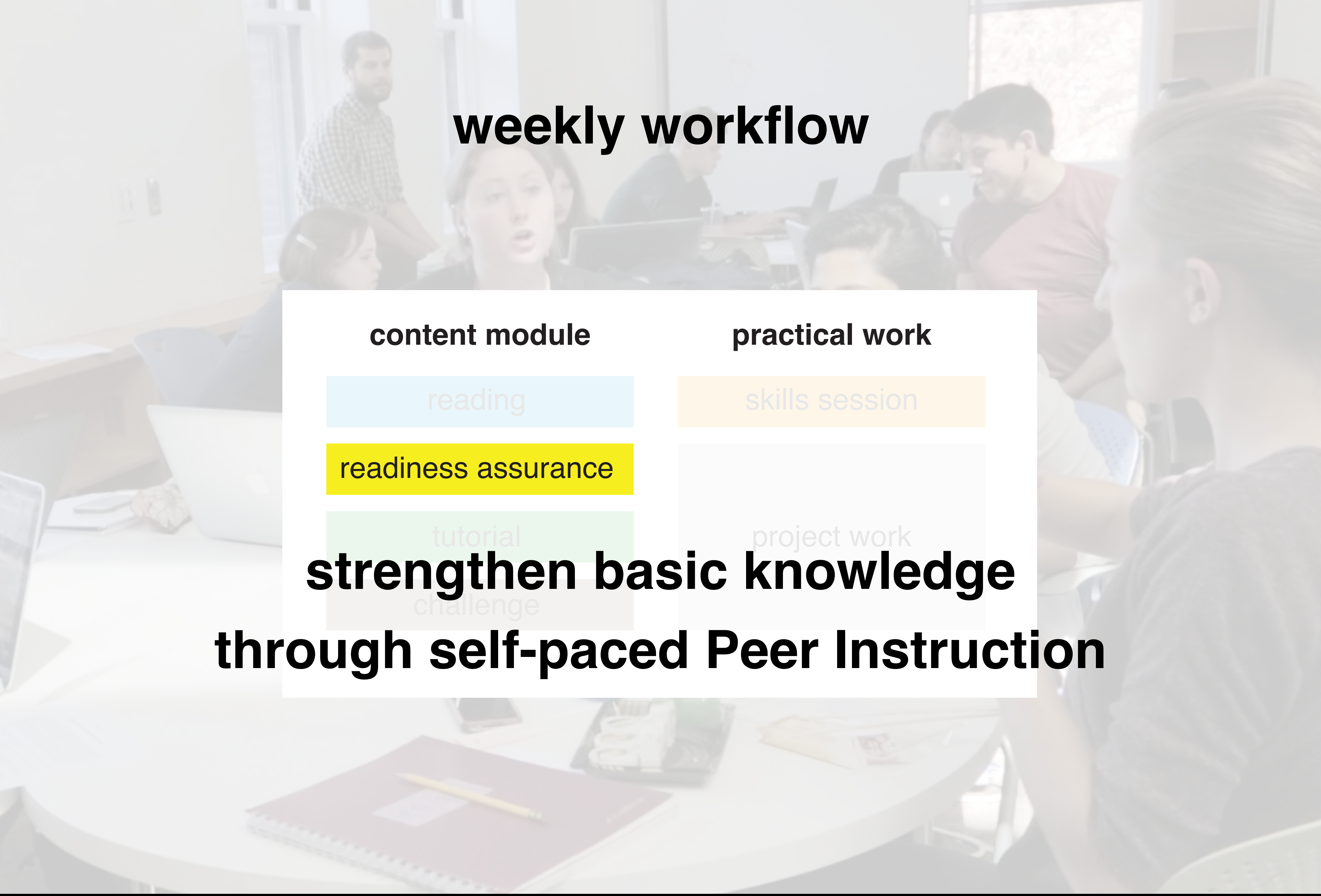
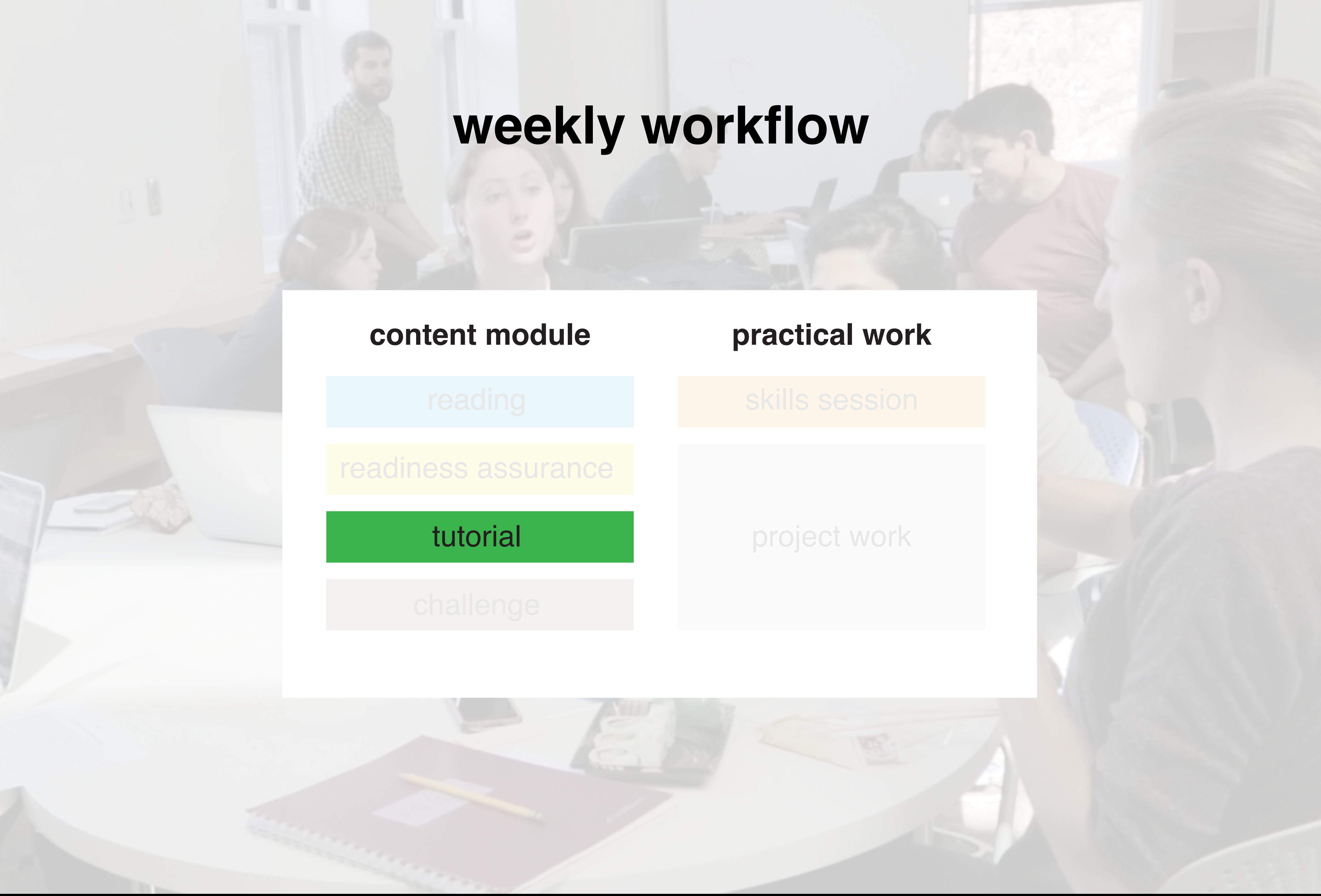


weekly workflow

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

strengthen basic knowledge through self-paced Peer Instruction



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weekly workflow
content module
practical work
reading
skills session
readiness assurance
tutorial
project work
challenge
resolve common misconceptions
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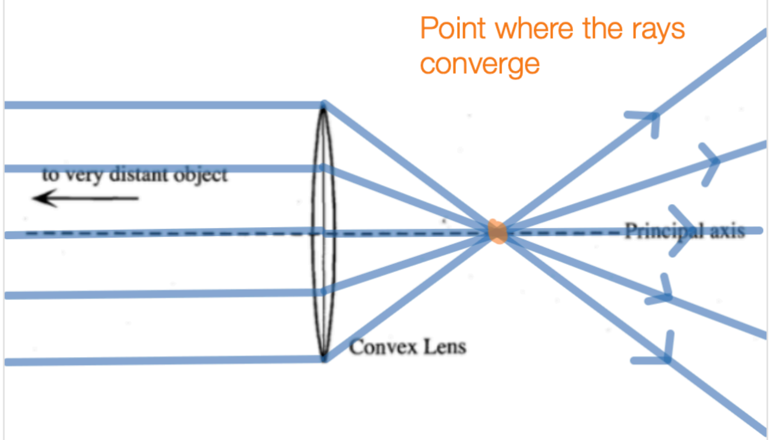
2 new normal

Part 2. Ray tracing and convex lenses



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

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.

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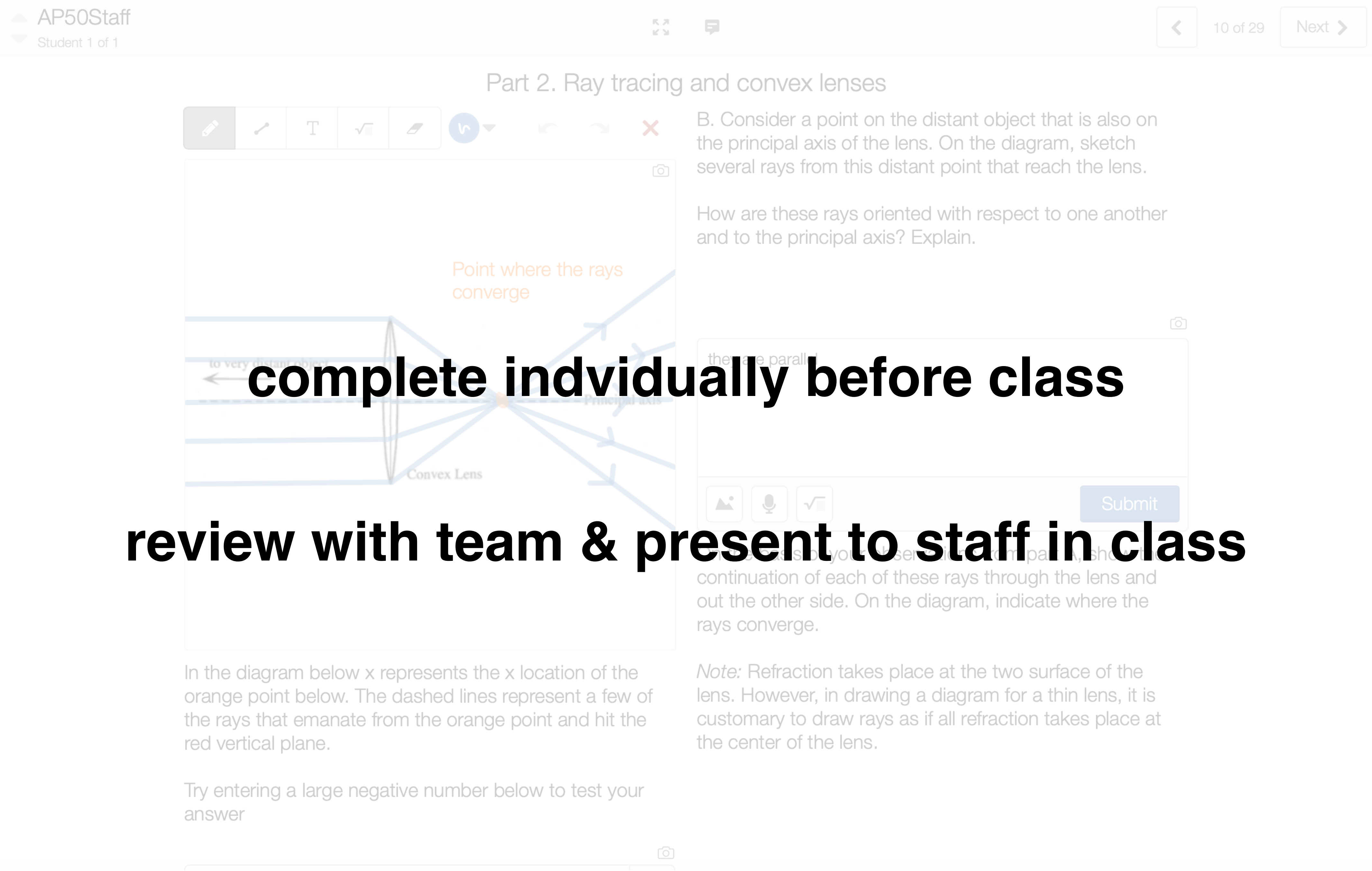

complete indvidually before class

review with team & present to staff in class

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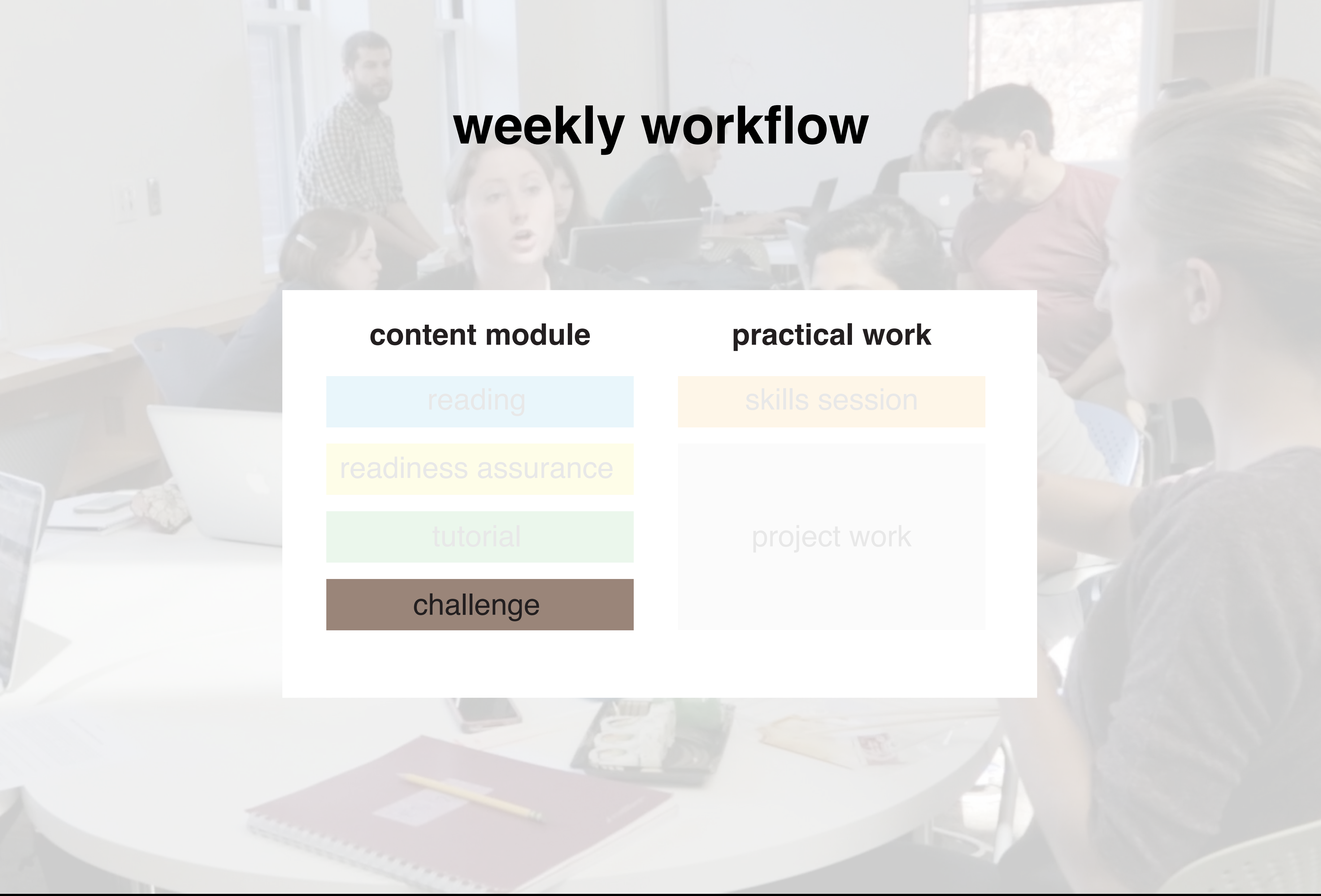

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content module	practical work
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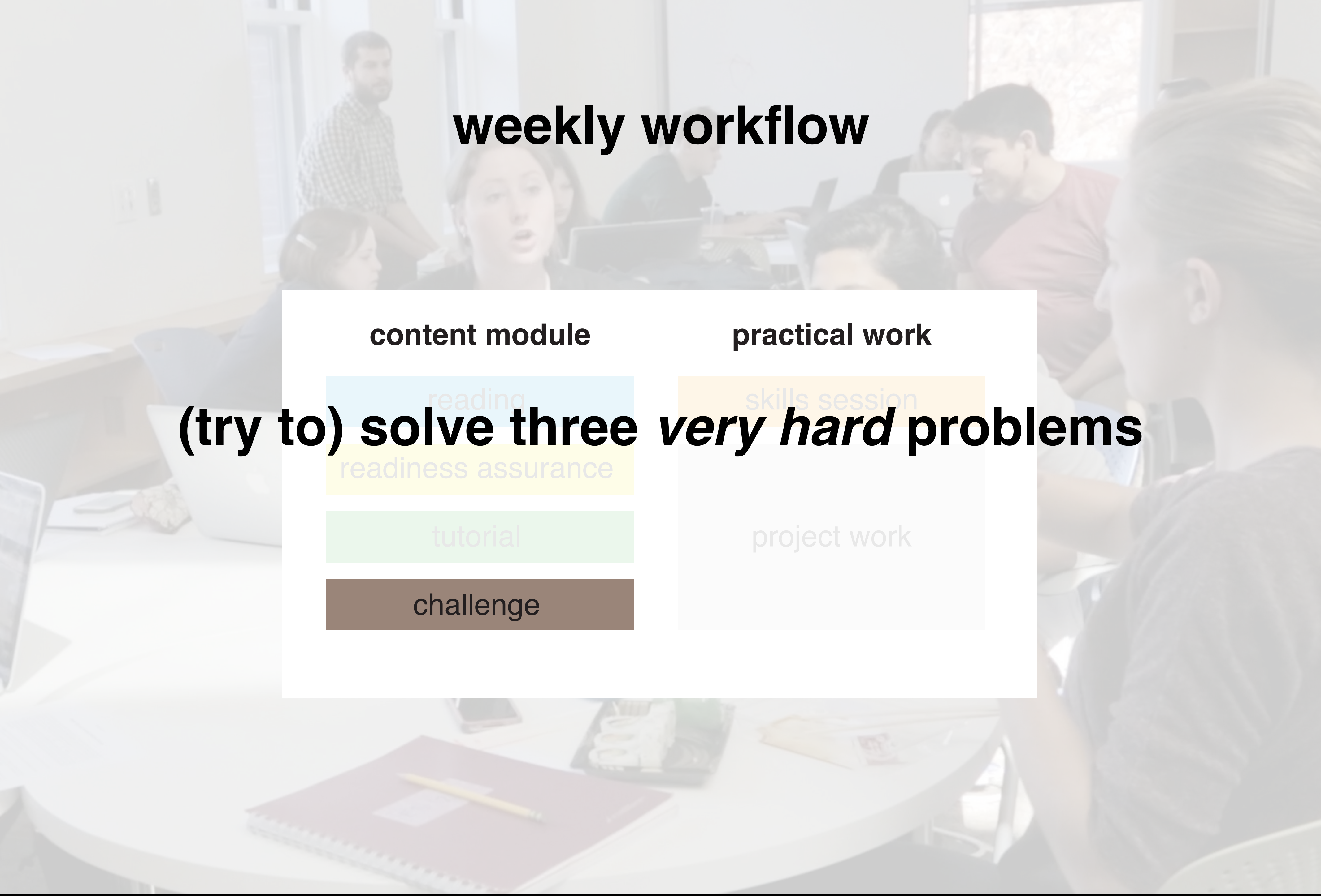

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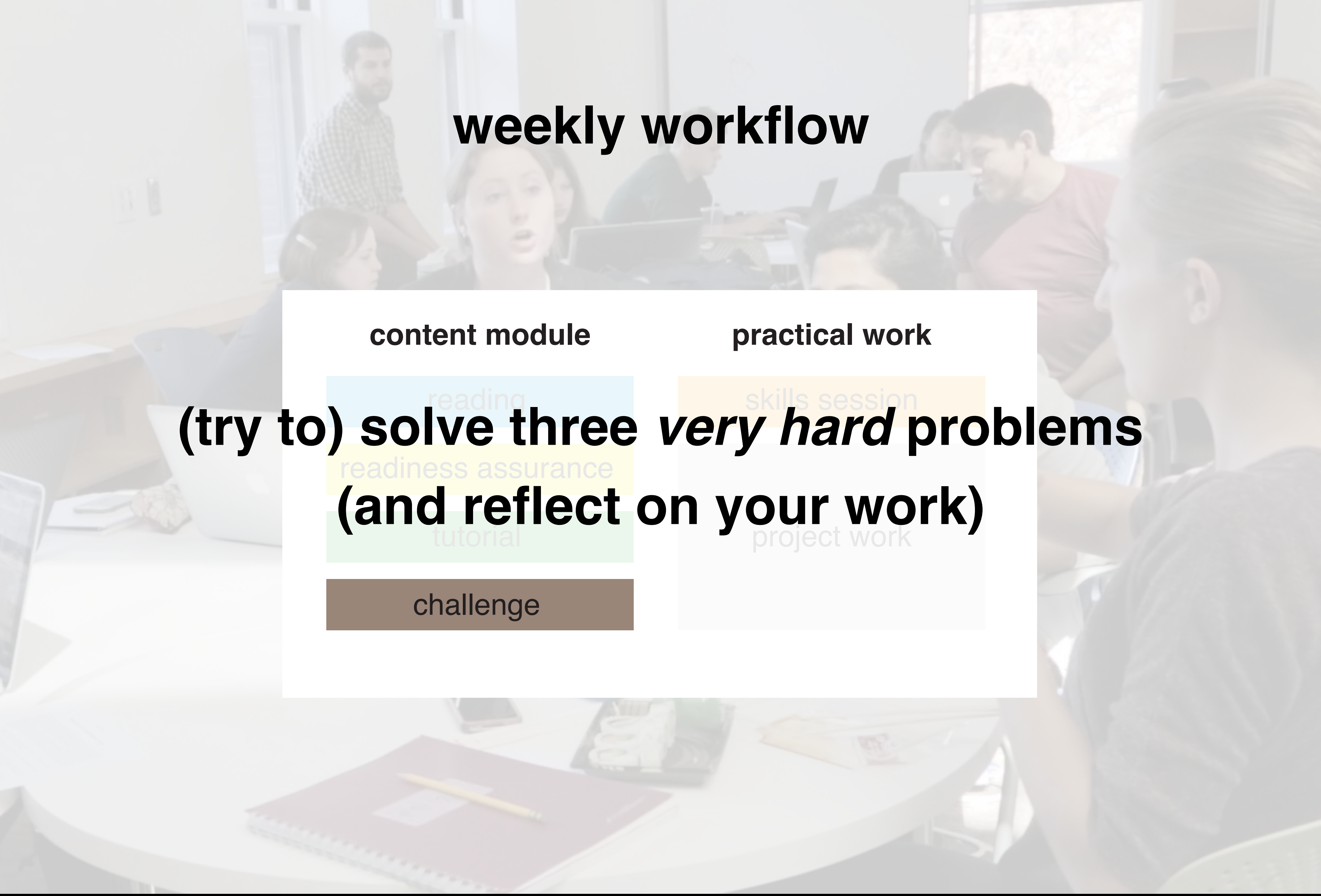

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content module	practical work
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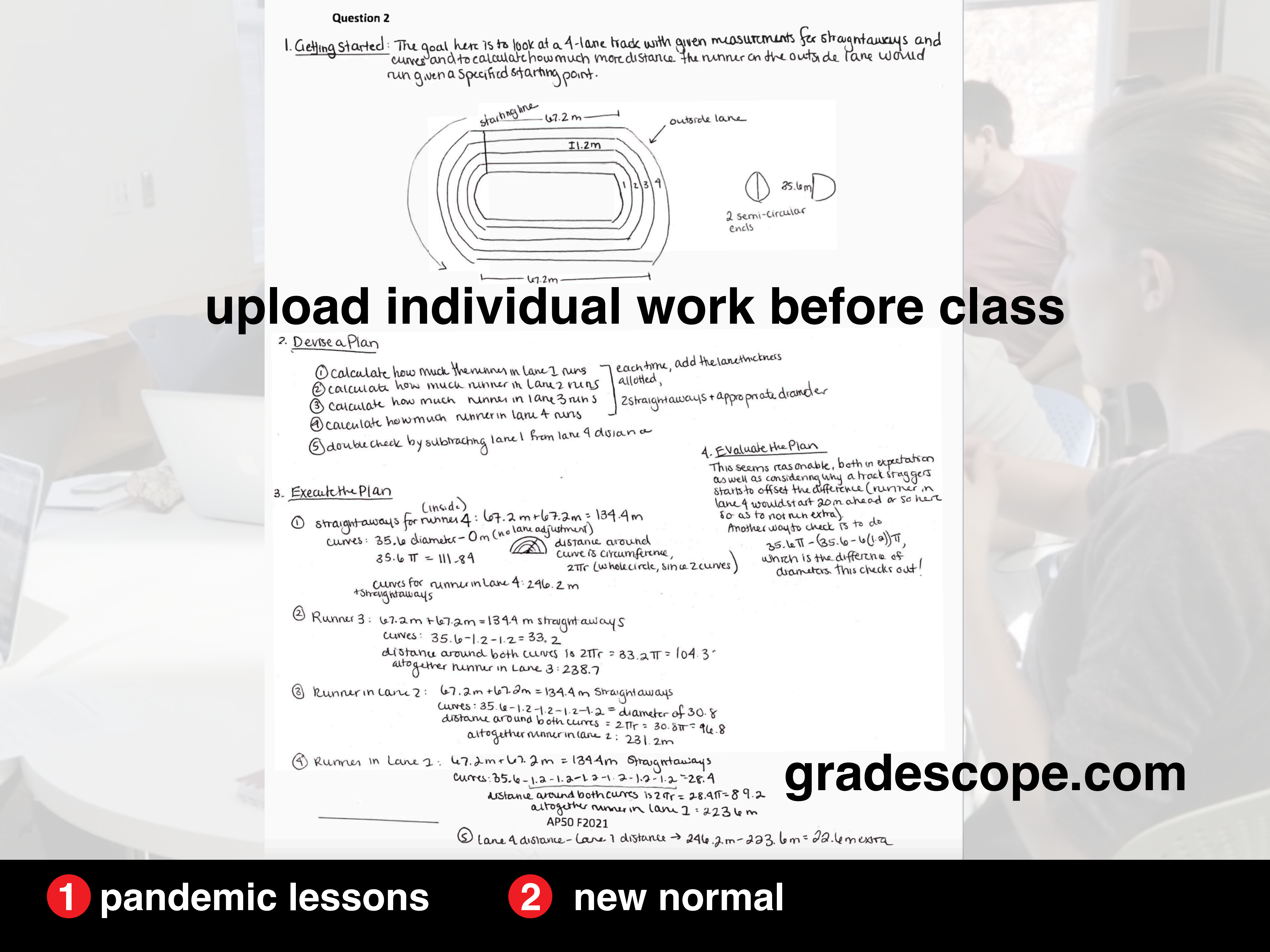
(try to) solve three *very hard* problems

(and reflect on your work)


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.
starting line
67.2 m
outside lane
11.2m
1 2 3 4
35.6m
2 semi-circular ends
67.2m
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
each time, add the lane thickness allotted, 2 straightaways + appropriate diameter
⑤ double check by subtracting lane 1 from lane 4 distance
3. Execute the Plan
① straightaways for runner 4 (inside): 67.2m + 67.2m = 134.4m
curves: 35.6 diameter − 0m (no lane adjustment)
35.6 π = 111.84
distance around curve is circumference, 2πr (whole circle, since 2 curves)
curves for runner in Lane 4 + straightaways: 246.2 m
② Runner 3: 67.2m + 67.2m = 134.4 m straightaways
curves: 35.6 − 1.2 − 1.2 = 33.2
distance around both curves is 2πr = 33.2π = 104.3
altogether runner in Lane 3: 238.7
③ Runner in Lane 2: 67.2m + 67.2m = 134.4m Straightaways
curves: 35.6 − 1.2 − 1.2 − 1.2 − 1.2 = diameter of 30.8
distance around both curves = 2πr = 30.8π = 96.8
altogether runner in lane 2: 231.2m
④ Runner in Lane 1: 67.2m + 67.2m = 134.4m Straightaways
curves: 35.6 − 1.2 − 1.2 − 1.2 − 1.2 − 1.2 − 1.2 = 28.4
distance around both curves is 2πr = 28.4π = 89.2
altogether runner in lane 1: 223.6m
⑤ Lane 4 distance − Lane 1 distance → 246.2m − 223.6m = 22.6m extra
4. Evaluate the Plan
This seems reasonable, both in expectation as well as considering why a track staggers starts to offset the difference (runner in lane 4 would start 20m ahead or so here so as to not run extra).
Another way to check is to do 35.6π − (35.6 − 6(1.2))π, which is the difference of diameters. This checks out!
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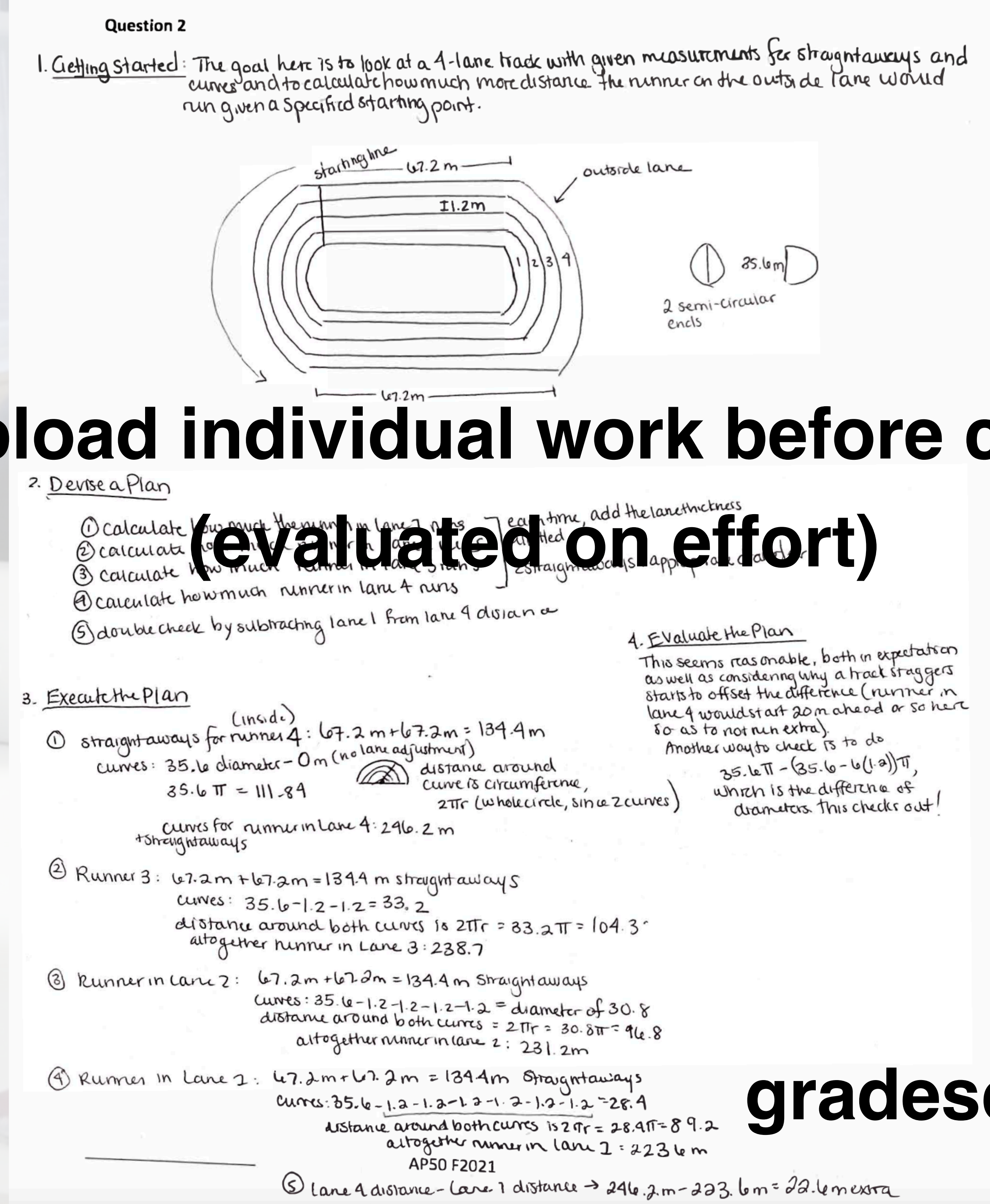

upload individual work before class

(evaluated on effort)

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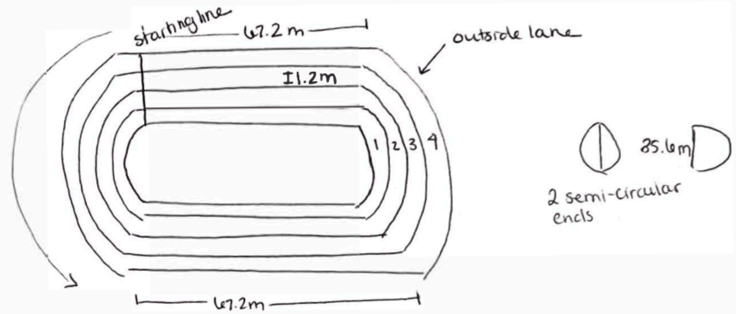

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This seems reasonable, both in expectation as well as considering why a track staggers starts to offset the difference (runner in lane 4 would start 20 m ahead or so here so as to not run extra).
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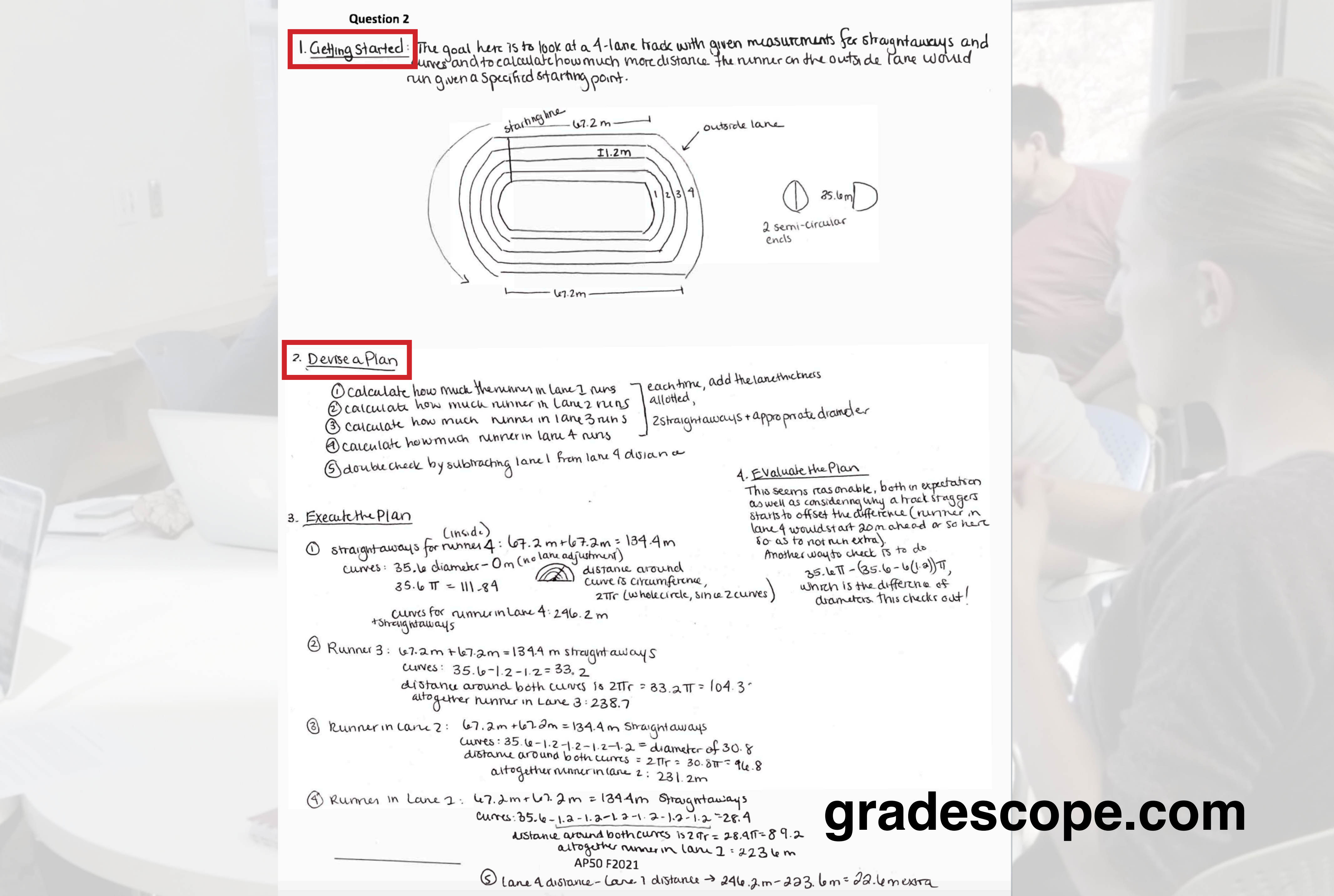
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+straightaways

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4. Evaluate the Plan

This seems reasonable, both in expectation as well as considering why a track staggers starts to offset the difference (runner in lane 4 would start 20m ahead or so here so as to not run extra).
Another way to check is to do 35.6π − (35.6 − 6(1.2))π, which is the difference of diameters. This checks out!

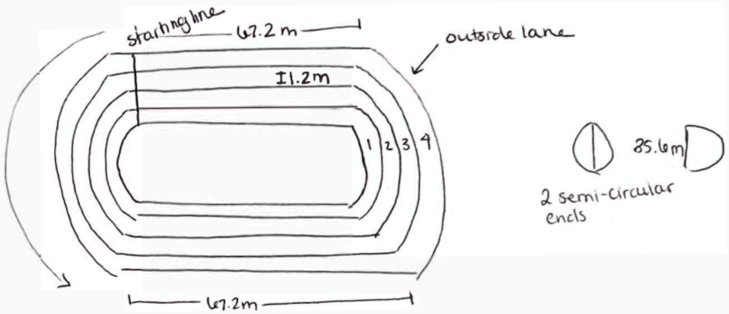
APS0 F2021

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.



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. double check by subtracting lane 1 from lane 4 distance

3. Execute the Plan

(1) straightaways for runner 4 (inside): 67.2 m + 67.2m = 134.4m
curves: 35.6 diameter - 0 m (no lane adjustment)
35.6 π = 111.84
distance around curve is circumference, 2πr (whole circle, since 2 curves)
curves for runner in Lane 4 + straightaways: 246.2 m

(2) Runner 3: 67.2m + 67.2m = 134.4 m straightaways
curves: 35.6 - 1.2 - 1.2 = 33.2
distance around both curves is 2πr = 33.2π = 104.3
altogether runner in Lane 3: 238.7

(3) Runner in Lane 2: 67.2m + 67.2m = 134.4 m Straightaways
curves: 35.6 - 1.2 - 1.2 - 1.2 - 1.2 = diameter of 30.8
distance around both curves = 2πr = 30.8π = 96.8
altogether runner in lane 2: 231.2m

(4) Runner in Lane 1: 67.2m + 67.2m = 134.4m Straightaways
curves: 35.6 - 1.2 - 1.2 - 1.2 - 1.2 - 1.2 - 1.2 = 28.4
distance around both curves is 2πr = 28.4π = 89.2
altogether runner in lane 1: 223.6 m

(5) lane 4 distance - Lane 1 distance → 246.2m - 223.6m = 22.6m extra

4. Evaluate the Plan

This seems reasonable, both in expectation as well as considering why a track staggers 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
35.6π - (35.6 - 6(1.2))π,
which is the difference of diameters. This checks out!

AP50 F2021

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❶ pandemic lessons ❷ new normal

Question 2

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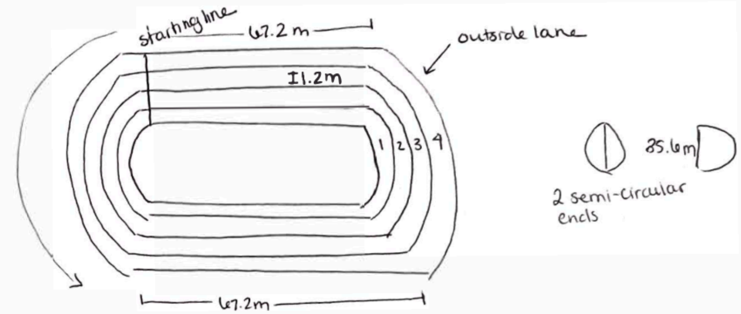

2. Devise a Plan

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. double check by subtracting lane 1 from lane 4 distance

3. Execute the Plan

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   curves: 35.6 diameter − 0 m (no lane adjustment)
   35.6 π = 111.84
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4. Runner in Lane 1: 67.2m + 67.2m = 134.4m Straightaways
   curves: 35.6 − 1.2 − 1.2 − 1.2 − 1.2 − 1.2 − 1.2 = 28.4
   distance around both curves is 2πr = 28.4π = 89.2
   altogether runner in lane 1: 223.6 m
5. Lane 4 distance − Lane 1 distance → 246.2m − 223.6m = 22.6m extra

4. Evaluate the Plan

This seems reasonable both in expectation as well as considering why a track staggers starts to offset the difference (runner in lane 4 would start 20m ahead or so here so as to not run extra).
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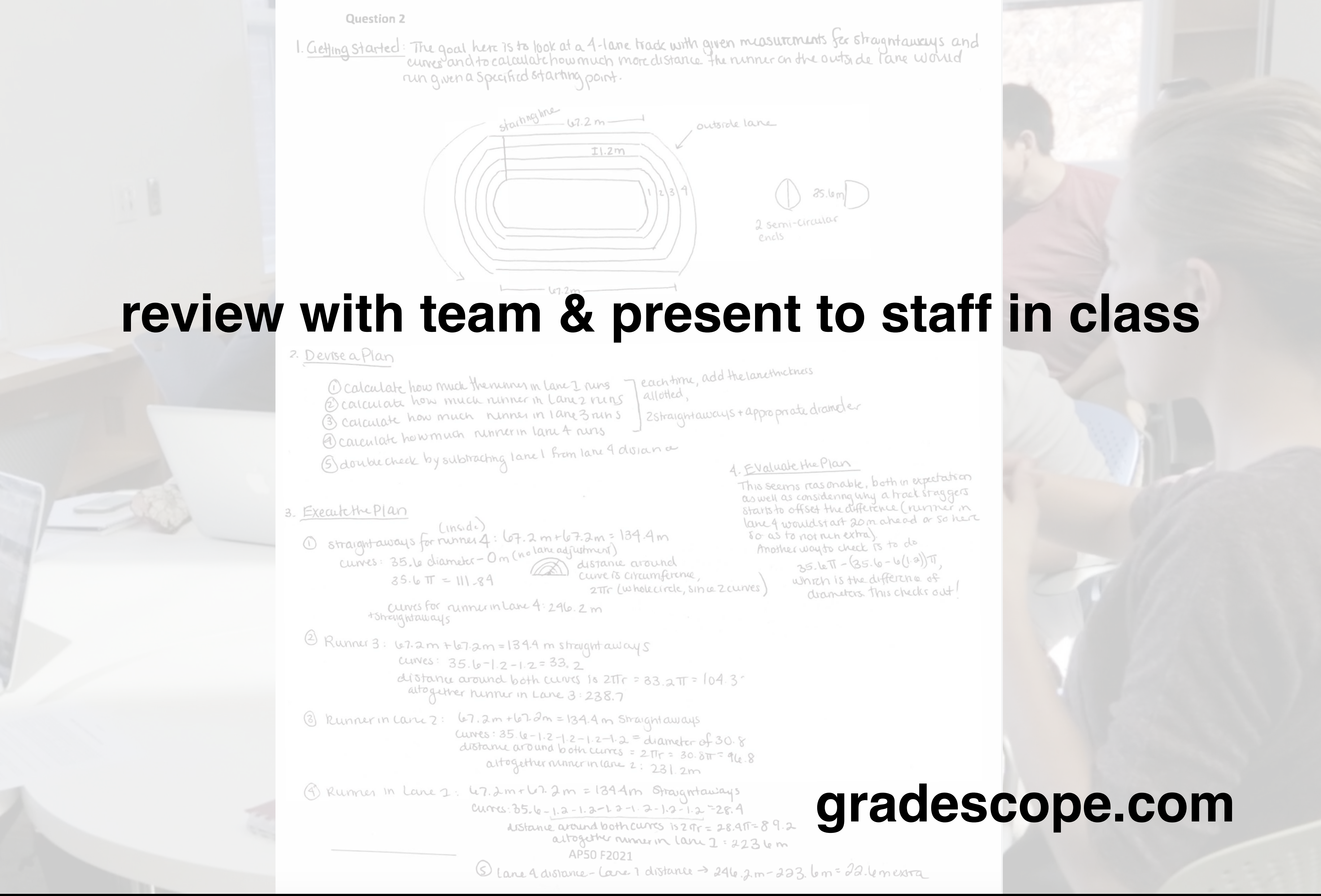
1 **pandemic lessons** 2 **new normal**


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.

starting line — 67.2 m — outside lane — 11.2m — 1 2 3 4 — 35.6m — 2 semi-circular ends — 67.2m

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 double check by subtracting lane 1 from lane 4 distance

3. Execute the Plan

① straightaways for (inside) runner 4: 67.2m + 67.2m = 134.4m
curves: 35.6 diameter − 0m (no lane adjustment)
35.6 π = 111.84
(distance around curve is circumference, 2πr (whole circle, since 2 curves))
curves for runner in Lane 4: 246.2 m
+ straightaways

② Runner 3: 67.2m + 67.2m = 134.4 m straightaways
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curves: 35.6 − 1.2 − 1.2 − 1.2 − 1.2 = diameter of 30.8
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④ Runner in Lane 1: 67.2m + 67.2m = 134.4m Straightaways
curves: 35.6 − 1.2 − 1.2 − 1.2 − 1.2 − 1.2 − 1.2 = 28.4
distance around both curves is 2πr = 28.4π = 89.2
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⑤ Lane 4 distance − Lane 1 distance → 246.2m − 223.6m = 22.6m extra

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This seems reasonable, both in expectation as well as considering why a track staggers starts to offset the difference (runner in lane 4 would start 20m ahead or so here so as to not run extra).
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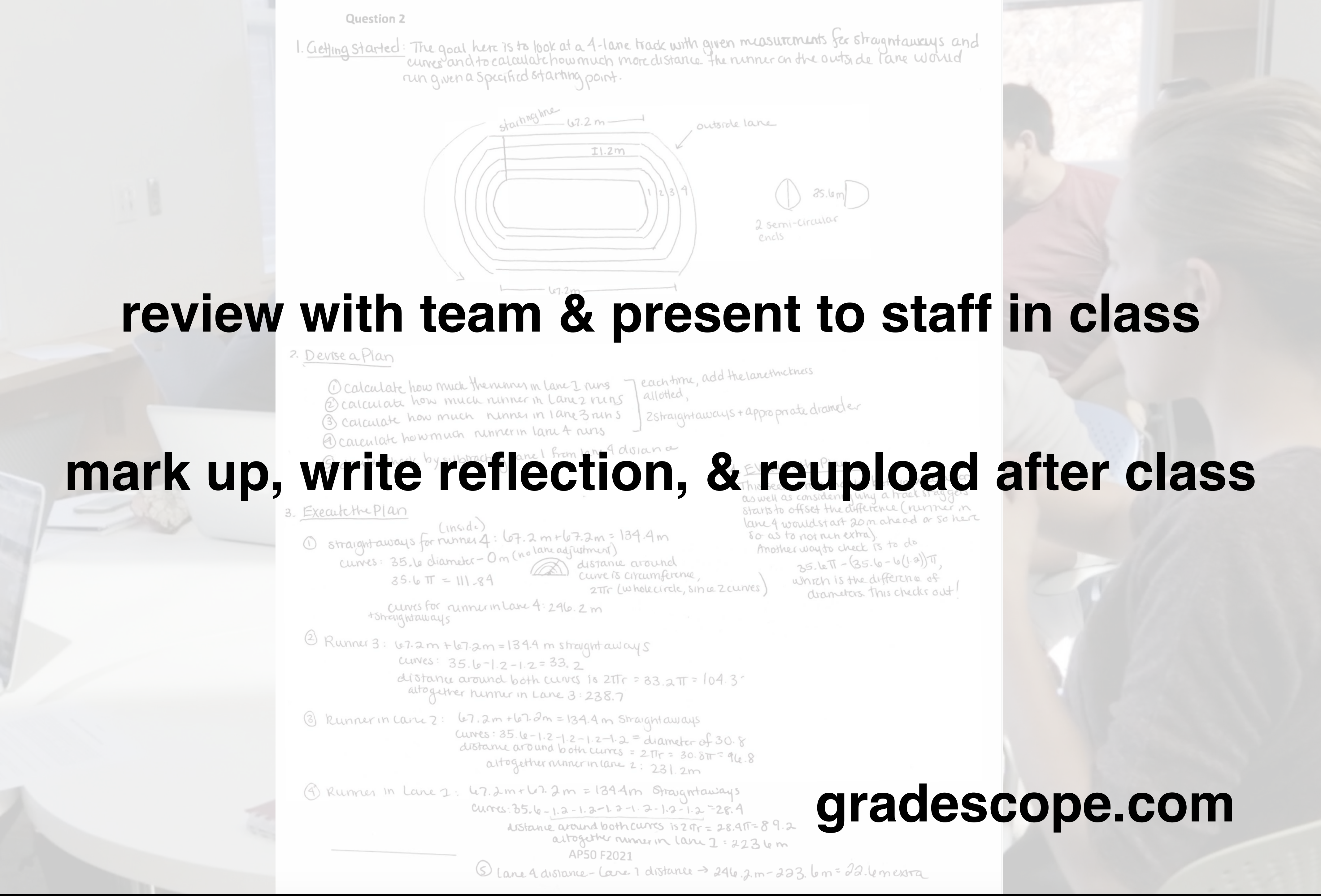
APSO F2021

1 pandemic lessons
2 new normal



review with team & present to staff in class

mark up, write reflection, & reupload after class

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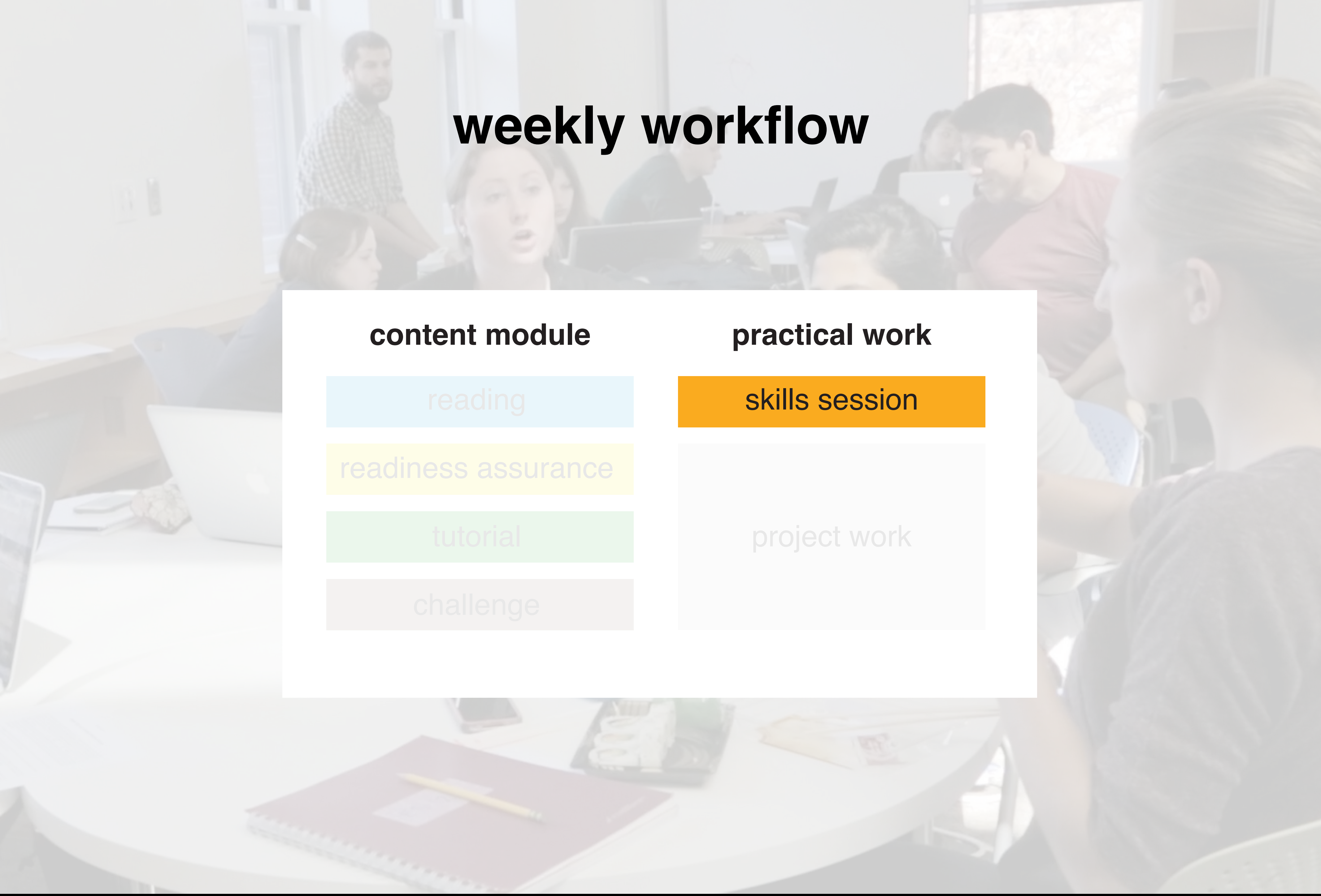
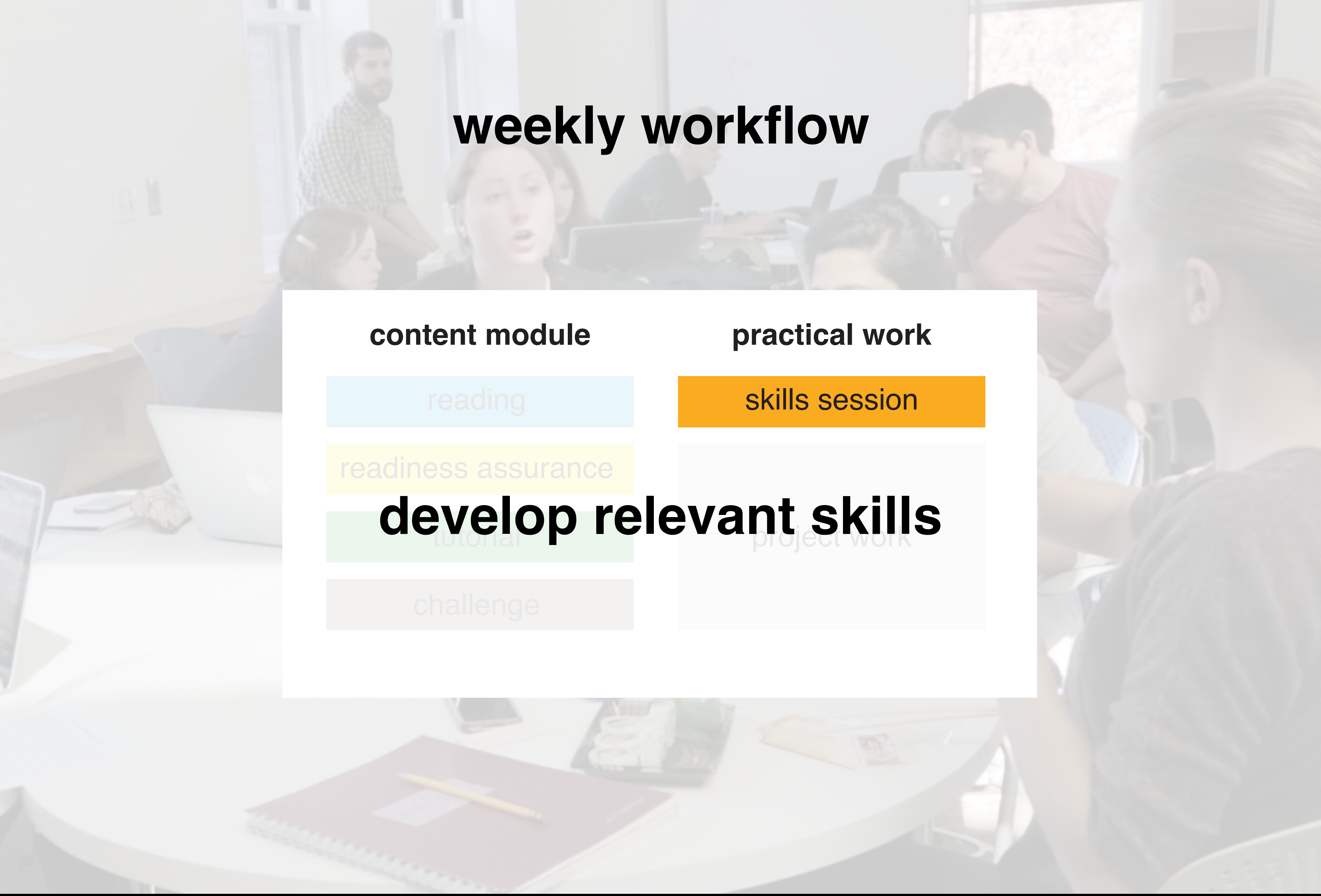
❶ pandemic lessons ❷ new normal



weekly workflow

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

❶ **pandemic lessons** ❷ **new normal**

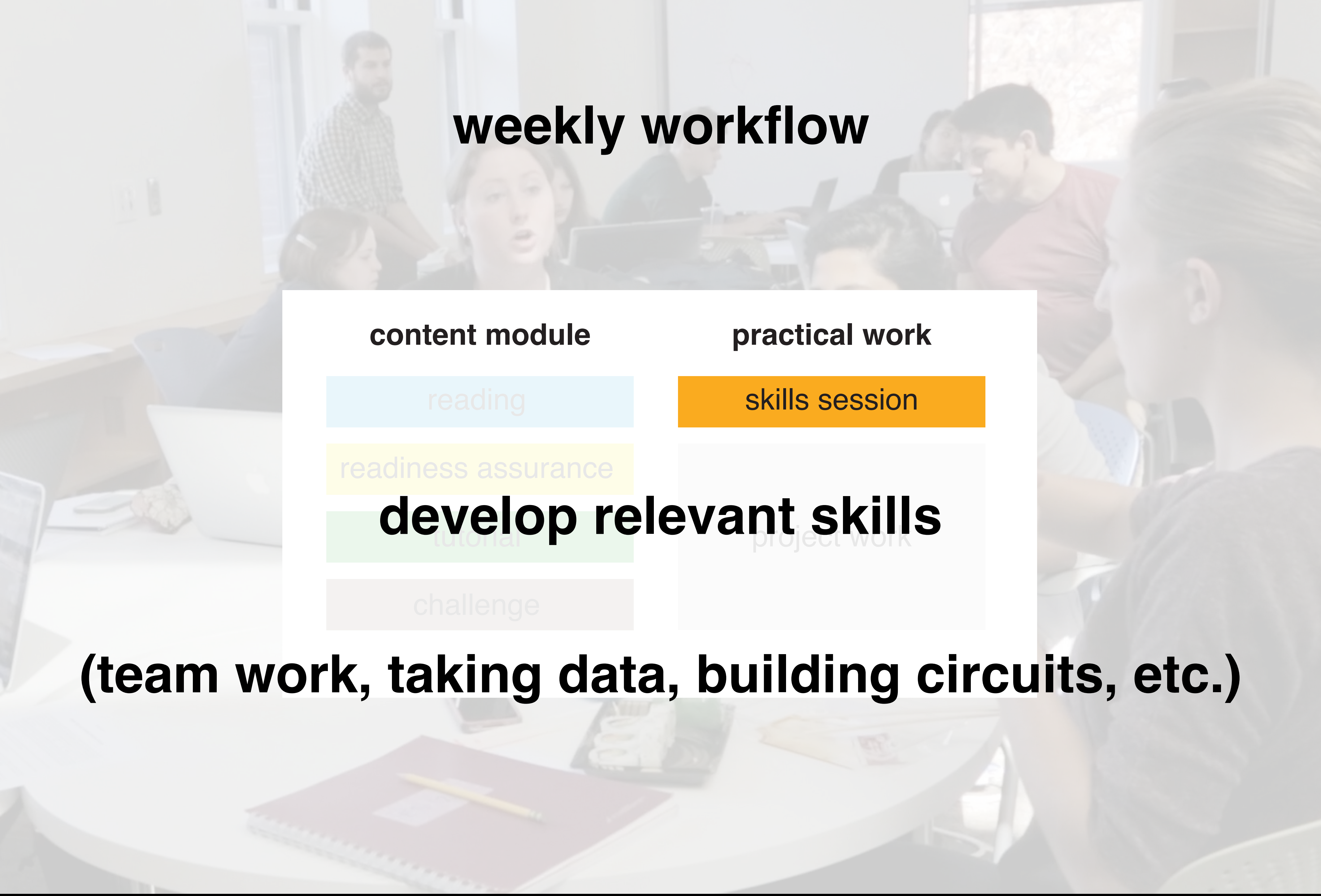


weekly workflow

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

develop relevant skills

❶ **pandemic lessons** ❷ **new normal**

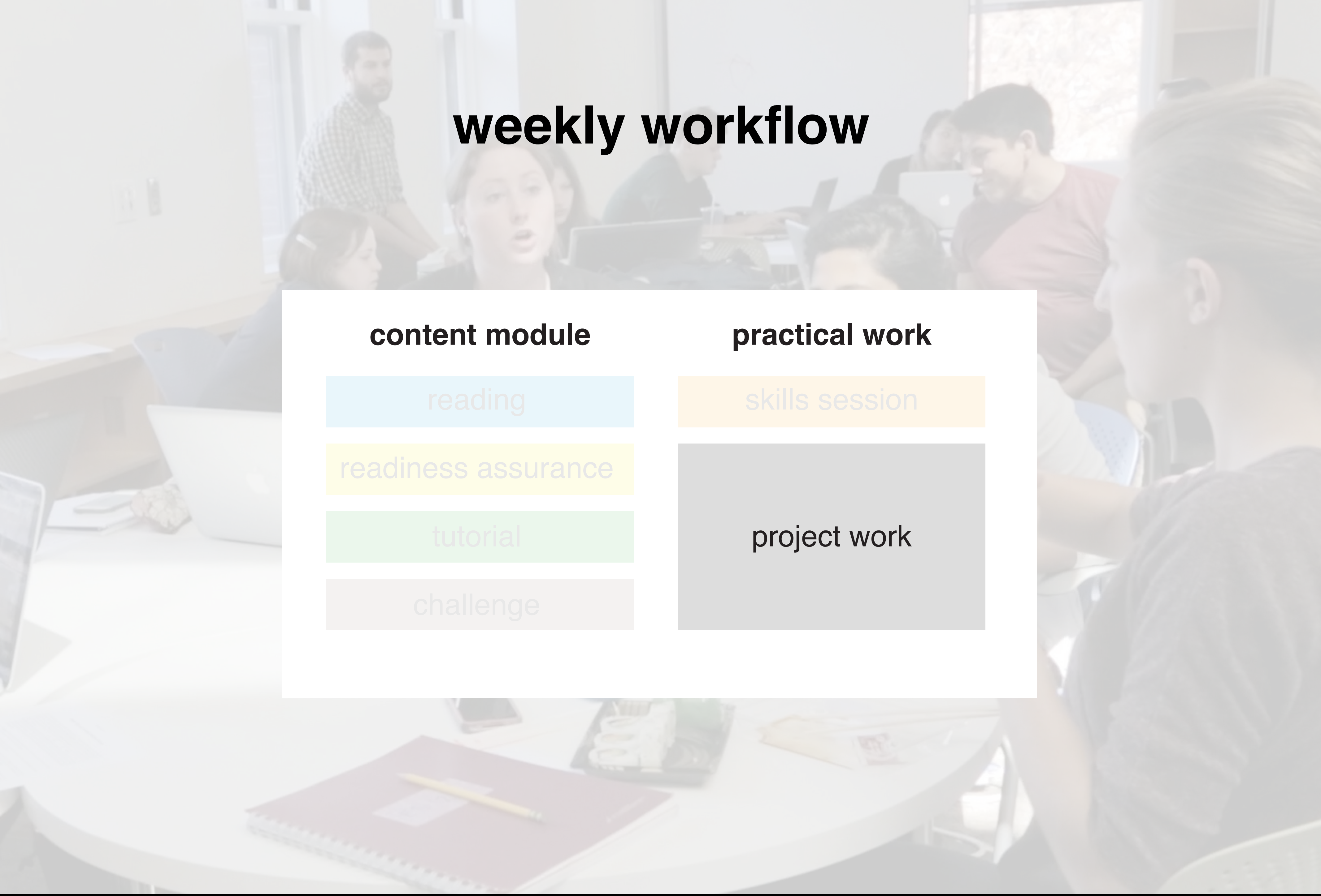


weekly workflow

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

develop relevant skills

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



weekly workflow

content module	practical work
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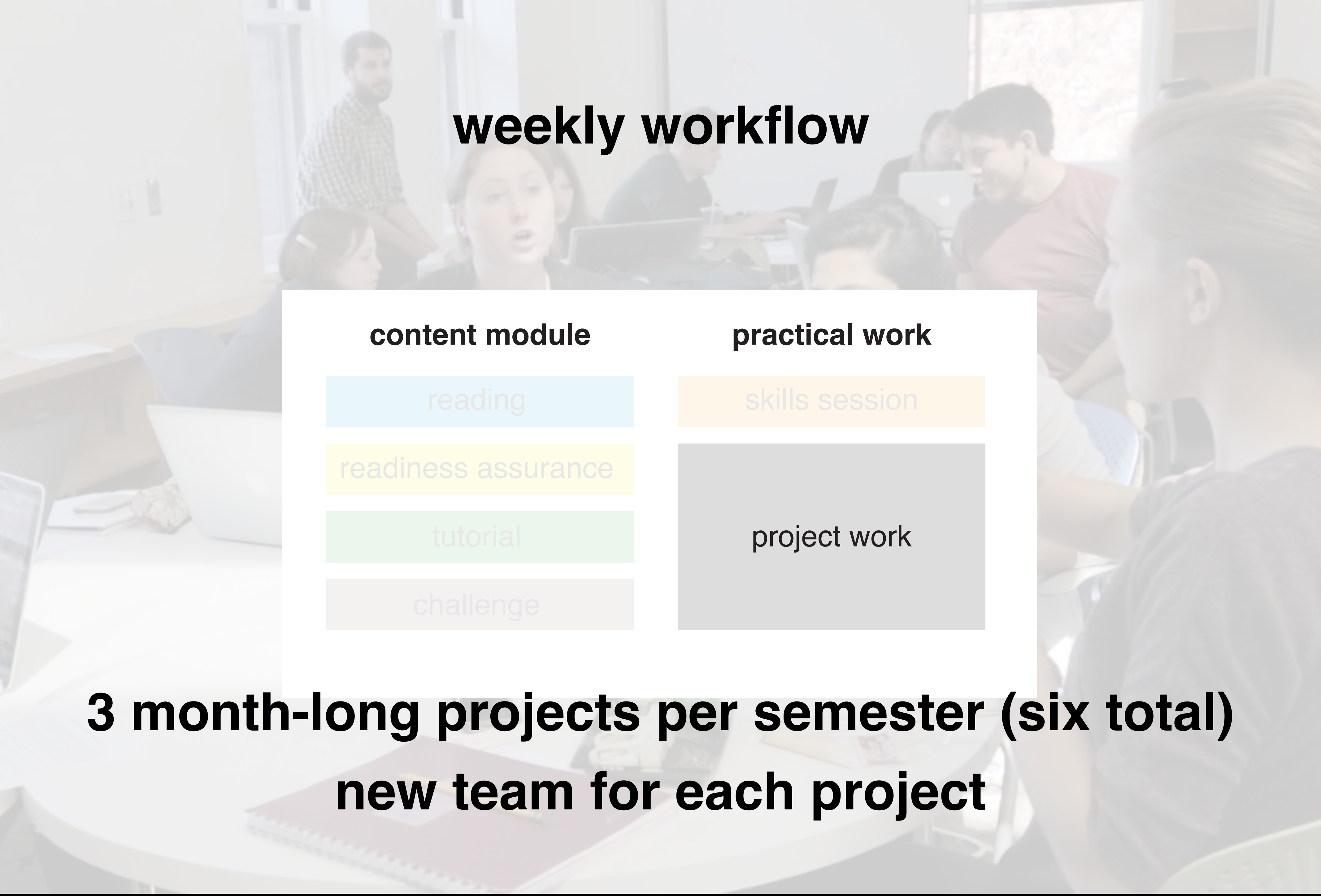
tutorial	
challenge	

1 pandemic lessons   2 new normal

weekly workflow

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

3 month-long projects per semester (six total)



weekly workflow

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

3 month-long projects per semester (six total)

new team for each project

1 pandemic lessons   2 new normal

classrooms are a constraint

❶ **pandemic lessons** ❷ **new normal**

learning space

content module	practical work
reading	skills session
readiness assurance	project work
tutorial	
challenge	

learning space

content module

reading

ONLINE

readiness assurance

tutorial

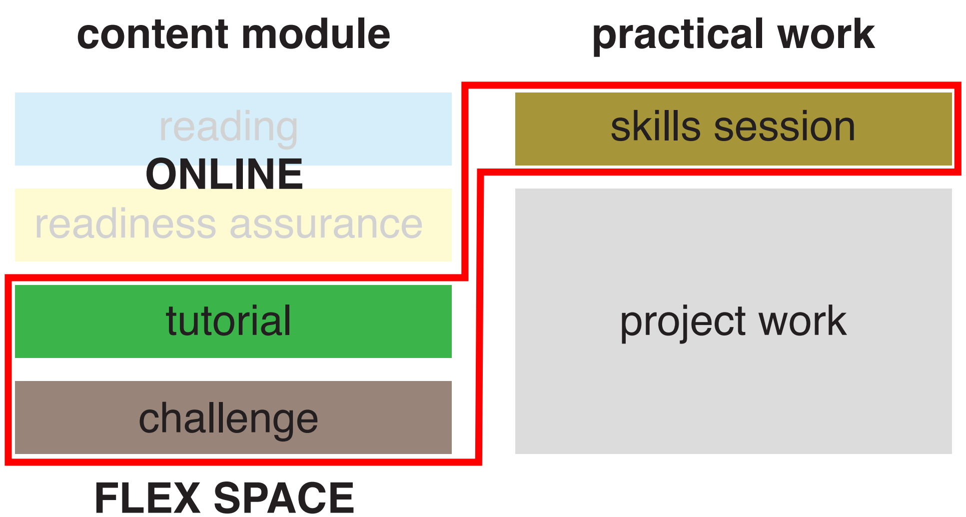
challenge

practical work

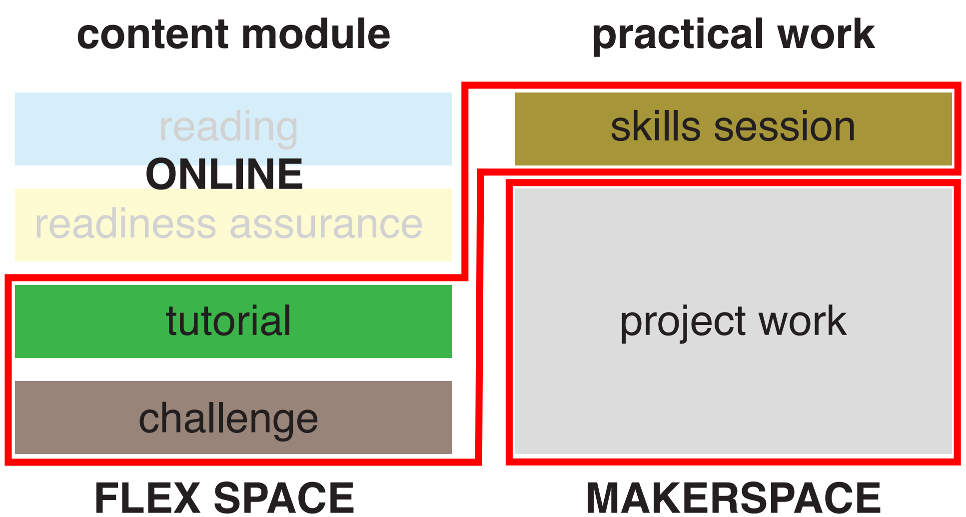
skills session

project work

learning space

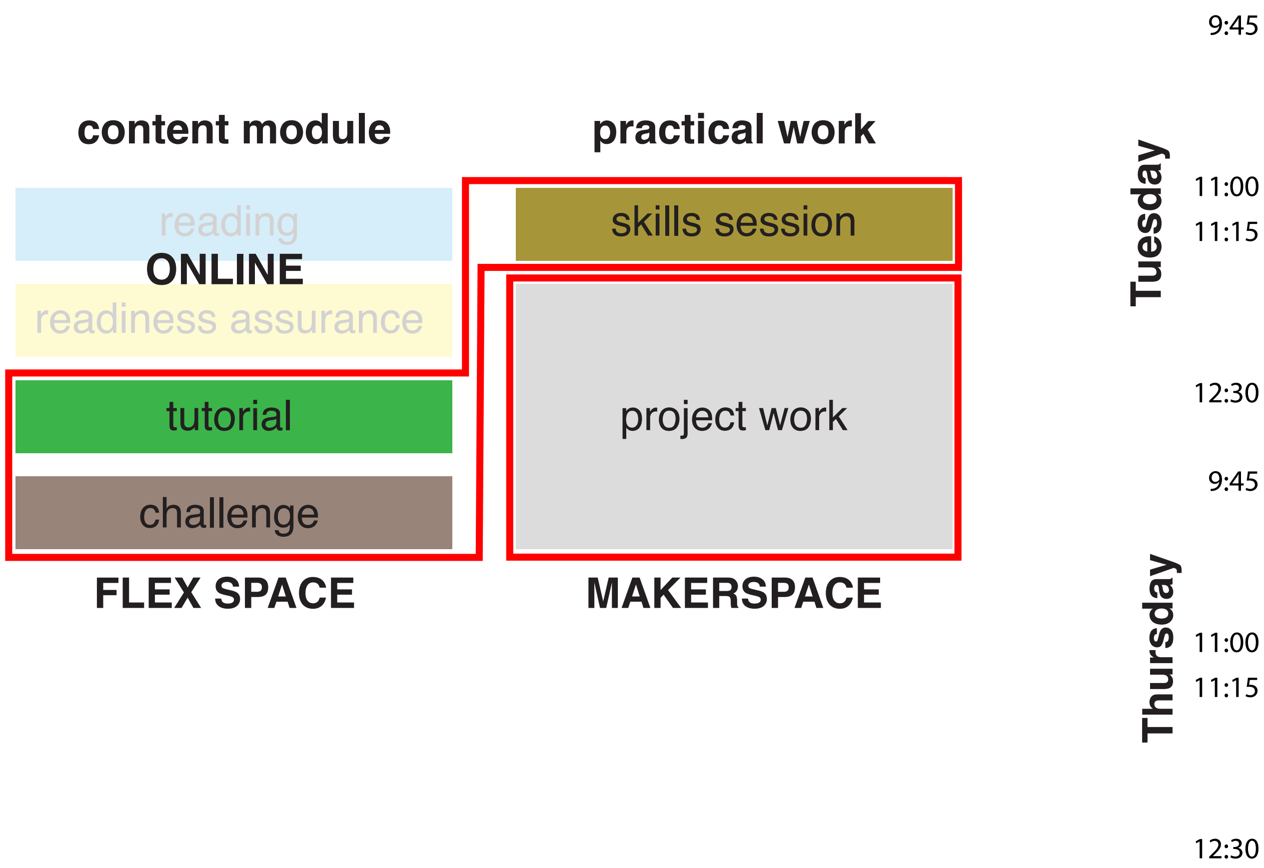


learning space



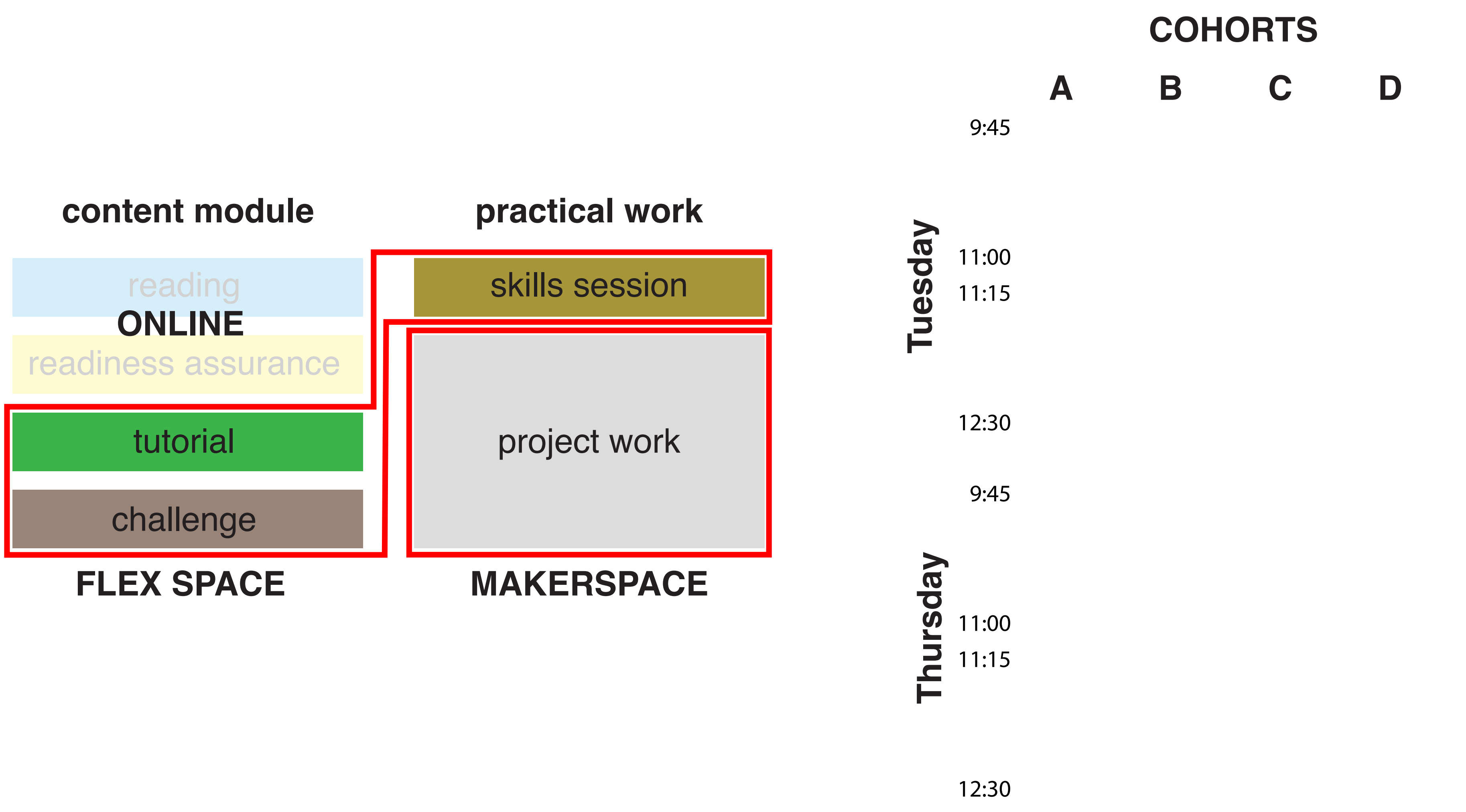
1 pandemic lessons **2 new normal**

learning space



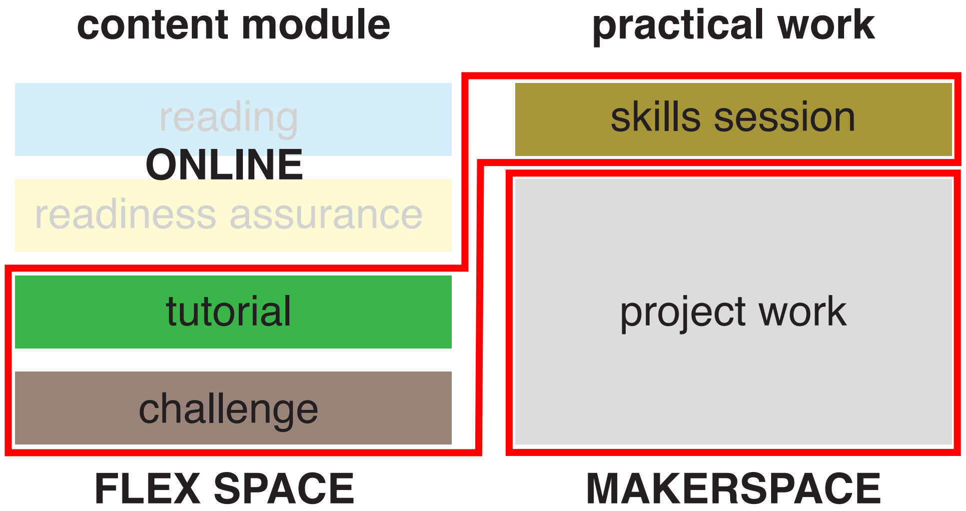
1 pandemic lessons 2 new normal

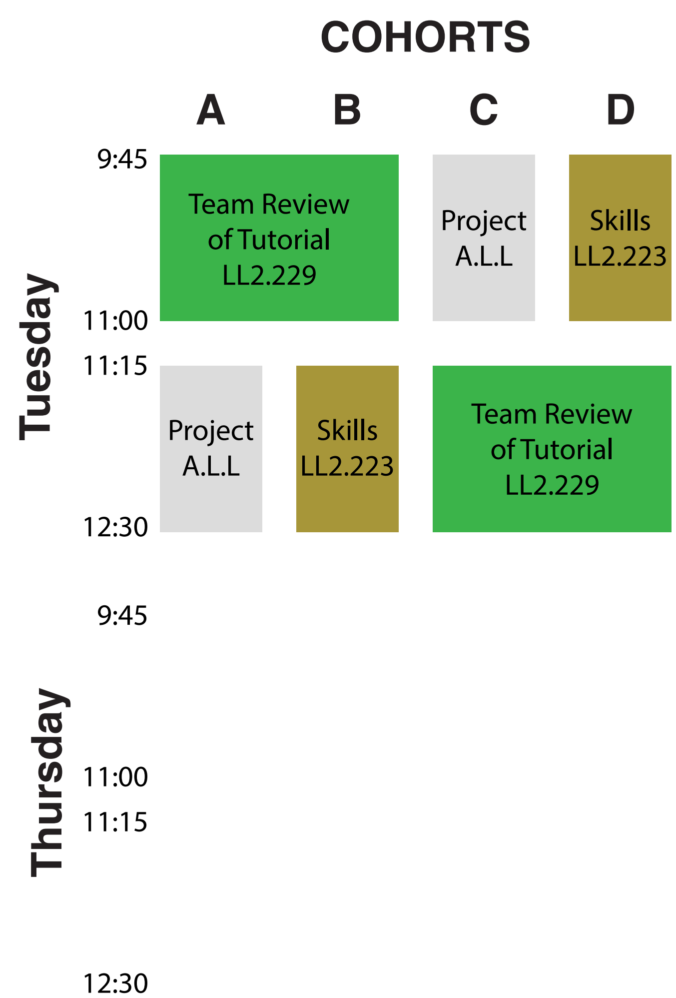
learning space



1 pandemic lessons 2 new normal

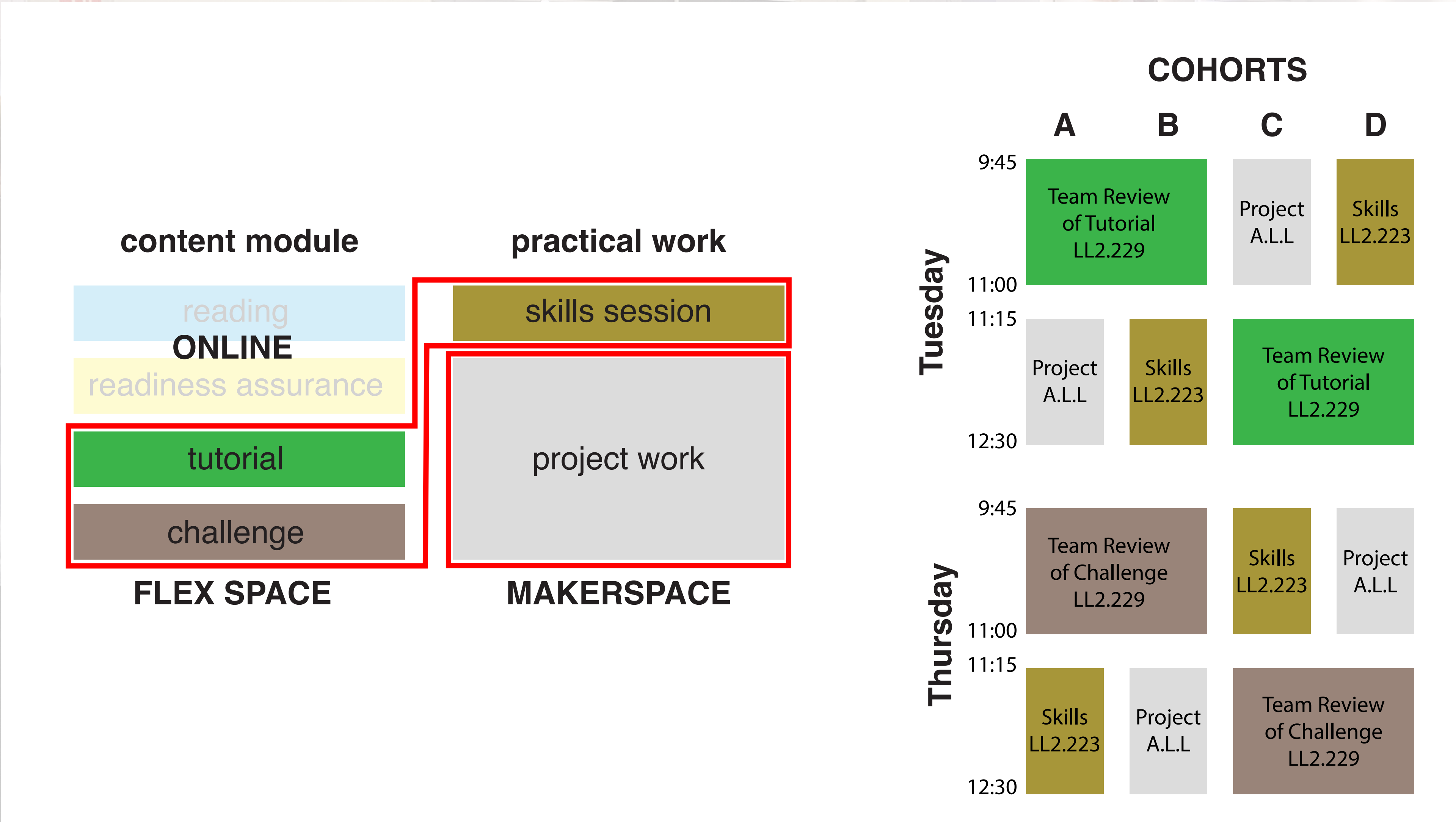
learning space





1 pandemic lessons 2 new normal

learning space



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

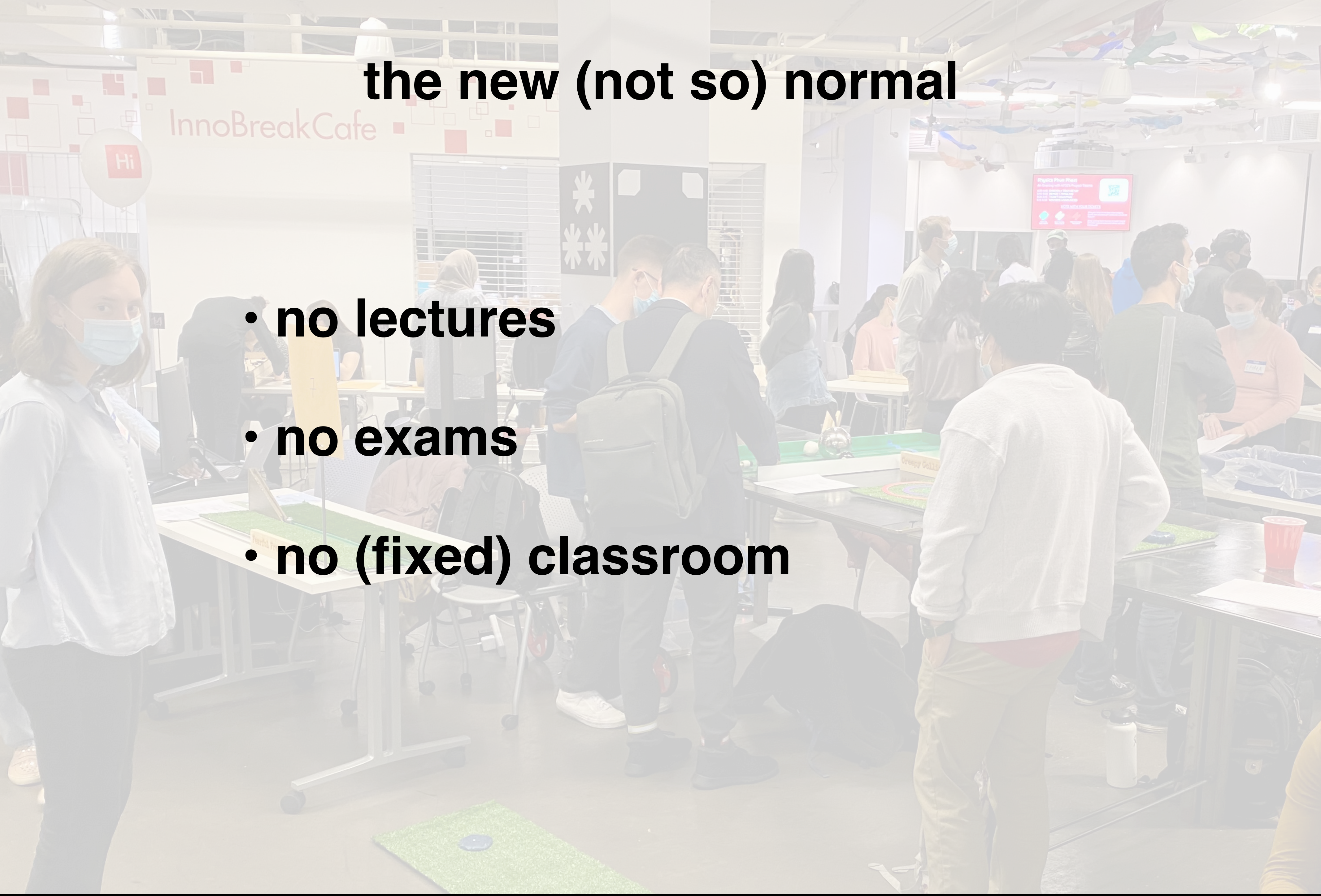
- no lectures

❶ pandemic lessons ❷ new normal

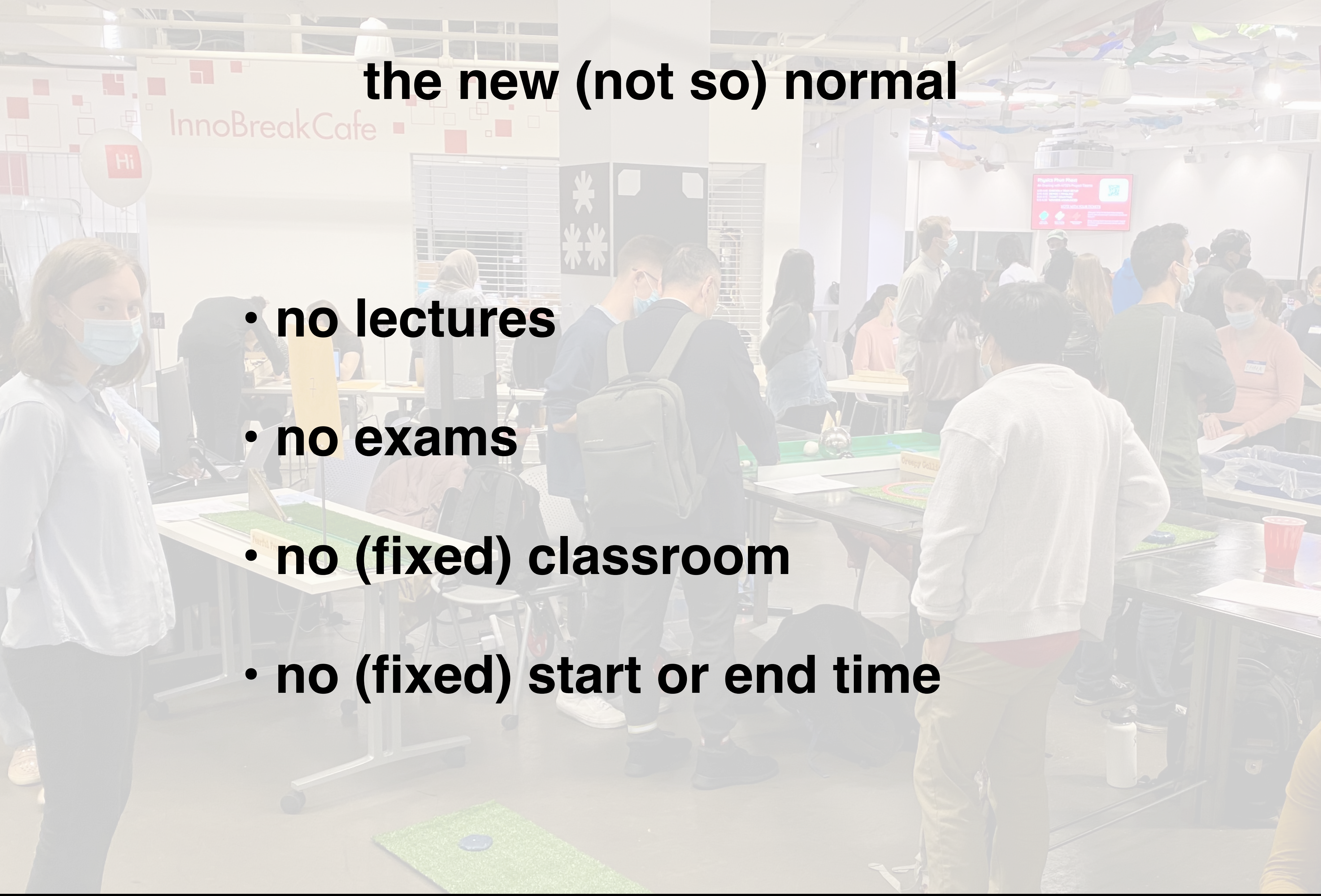
the new (not so) normal

- no lectures
- no exams

the new (not so) normal

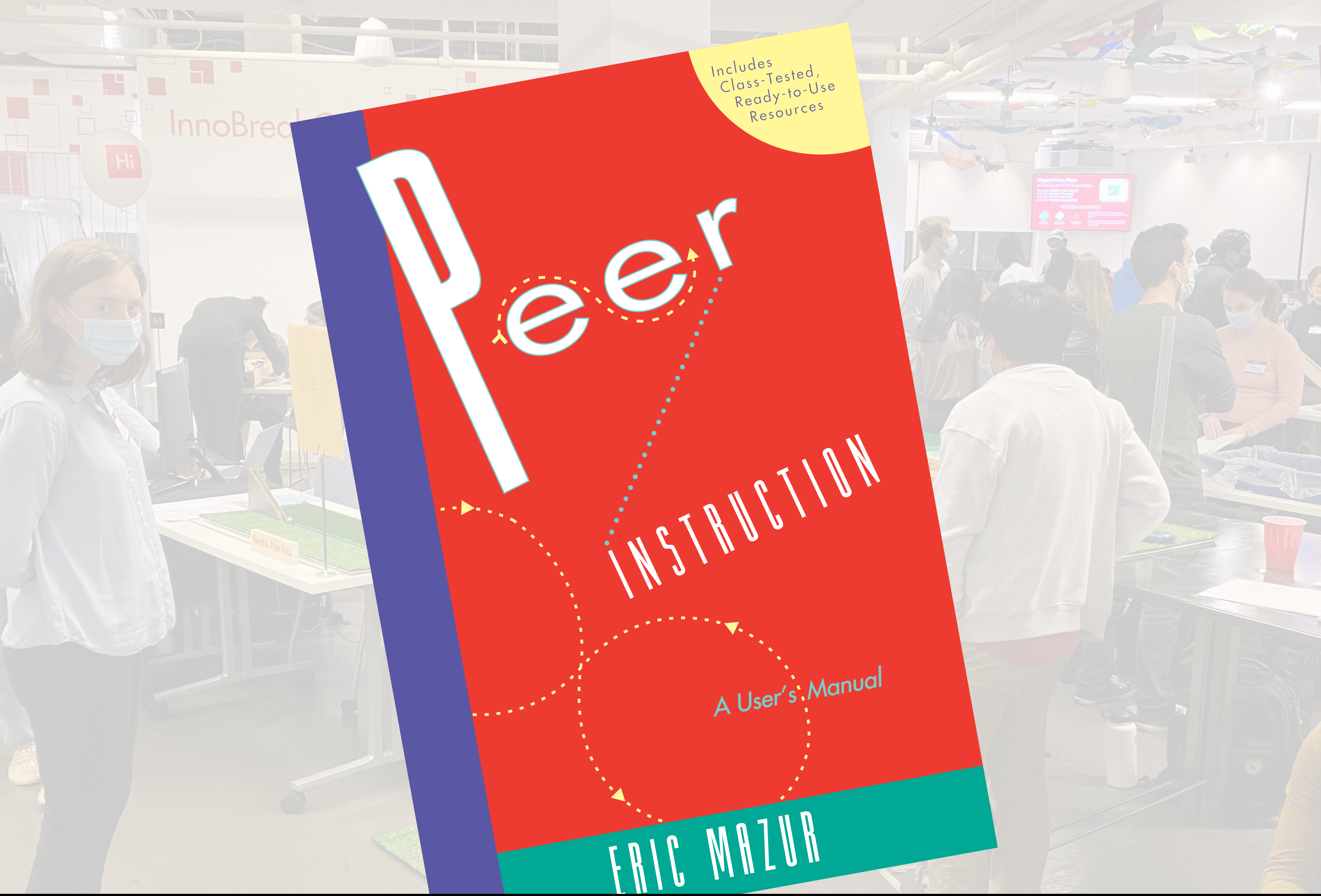


- no lectures
- no exams
- no (fixed) classroom

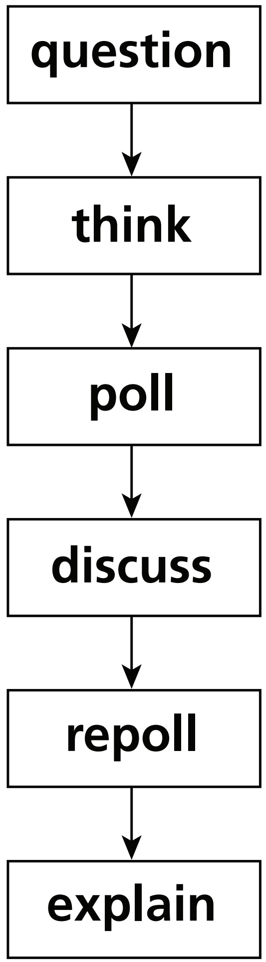


the new (not so) normal

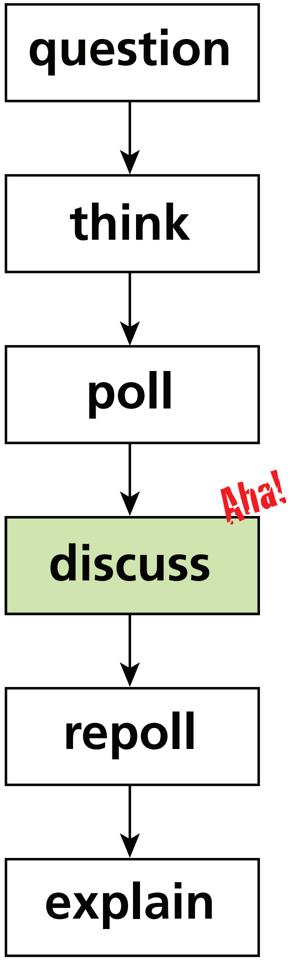
- no lectures
- no exams
- no (fixed) classroom
- no (fixed) start or end time



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



1 pandemic lessons 2 new normal 3 self-paced PI



1 pandemic lessons   2 new normal   3 self-paced PI

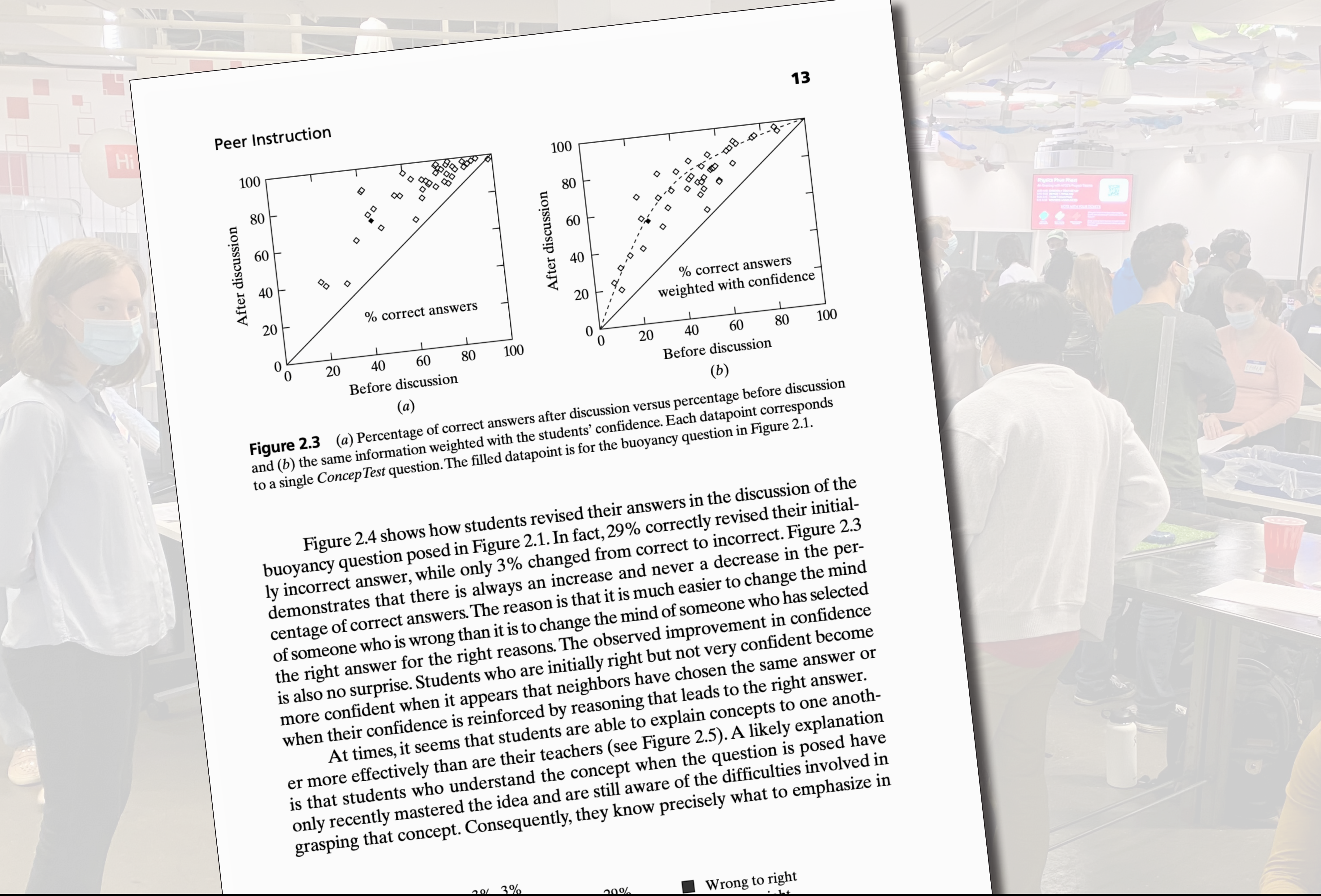


Figure 2.3 (*a*) Percentage of correct answers after discussion versus percentage before discussion and (*b*) the same information weighted with the students' confidence. Each datapoint corresponds to a single *ConcepTest* question. The filled datapoint is for the buoyancy question in Figure 2.1.

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.

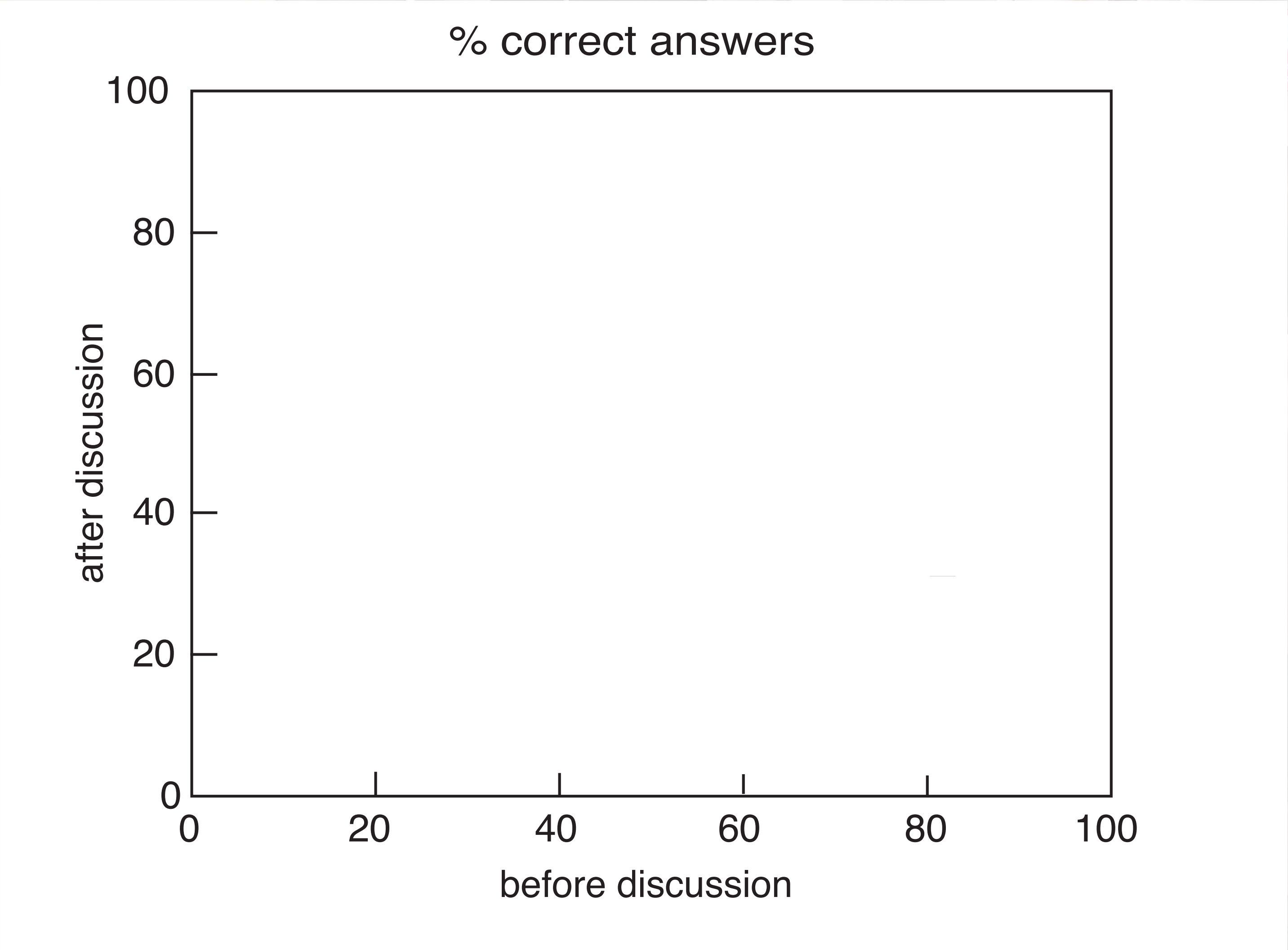
At times, it seems that students are able to explain concepts to one another more effectively than are their teachers (see Figure 2.5). A likely explanation is that students who understand the concept when the question is posed have only recently mastered the idea and are still aware of the difficulties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

1 pandemic lessons

2 new normal

3 self-paced PI

in-class PI



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

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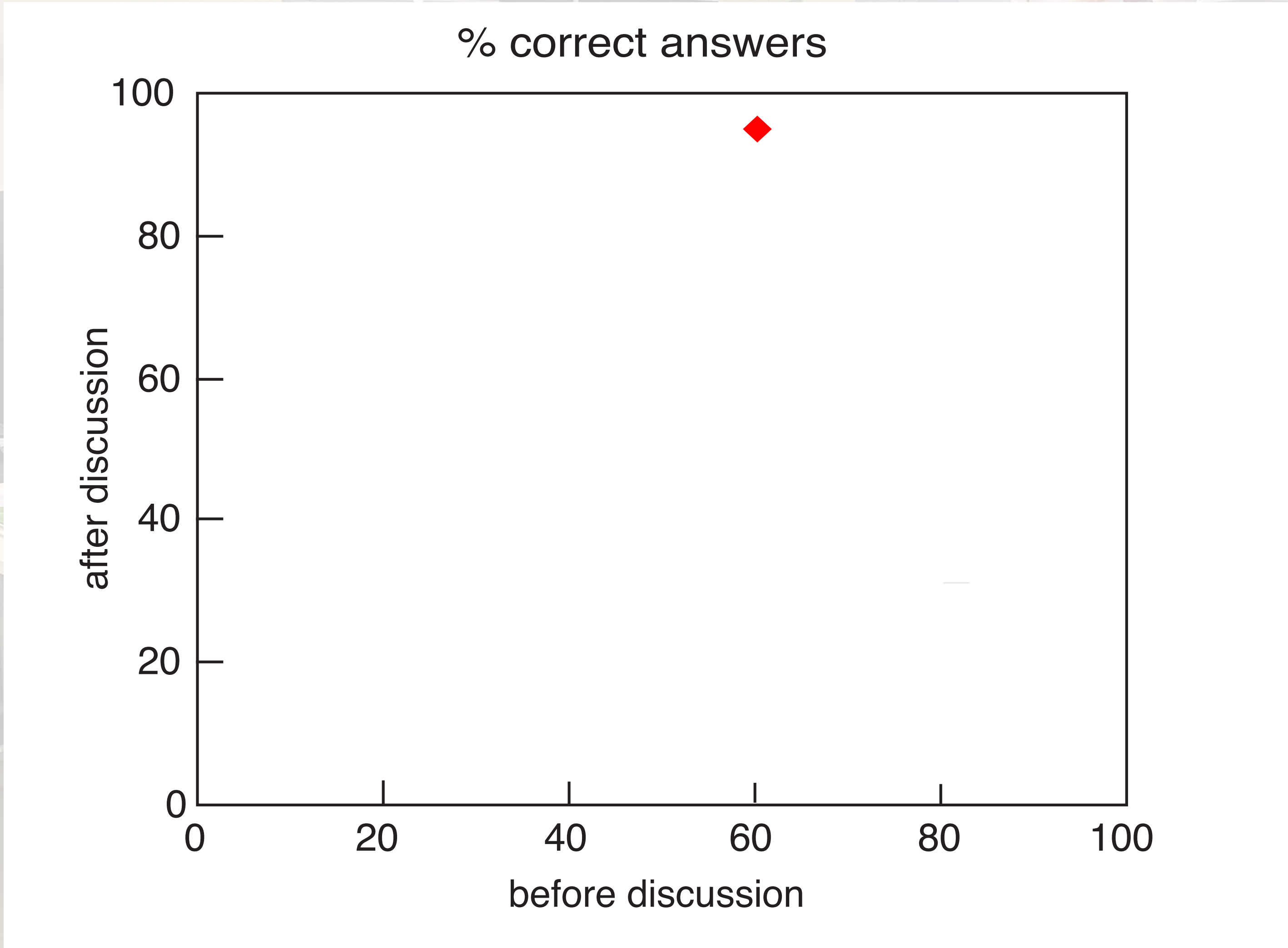
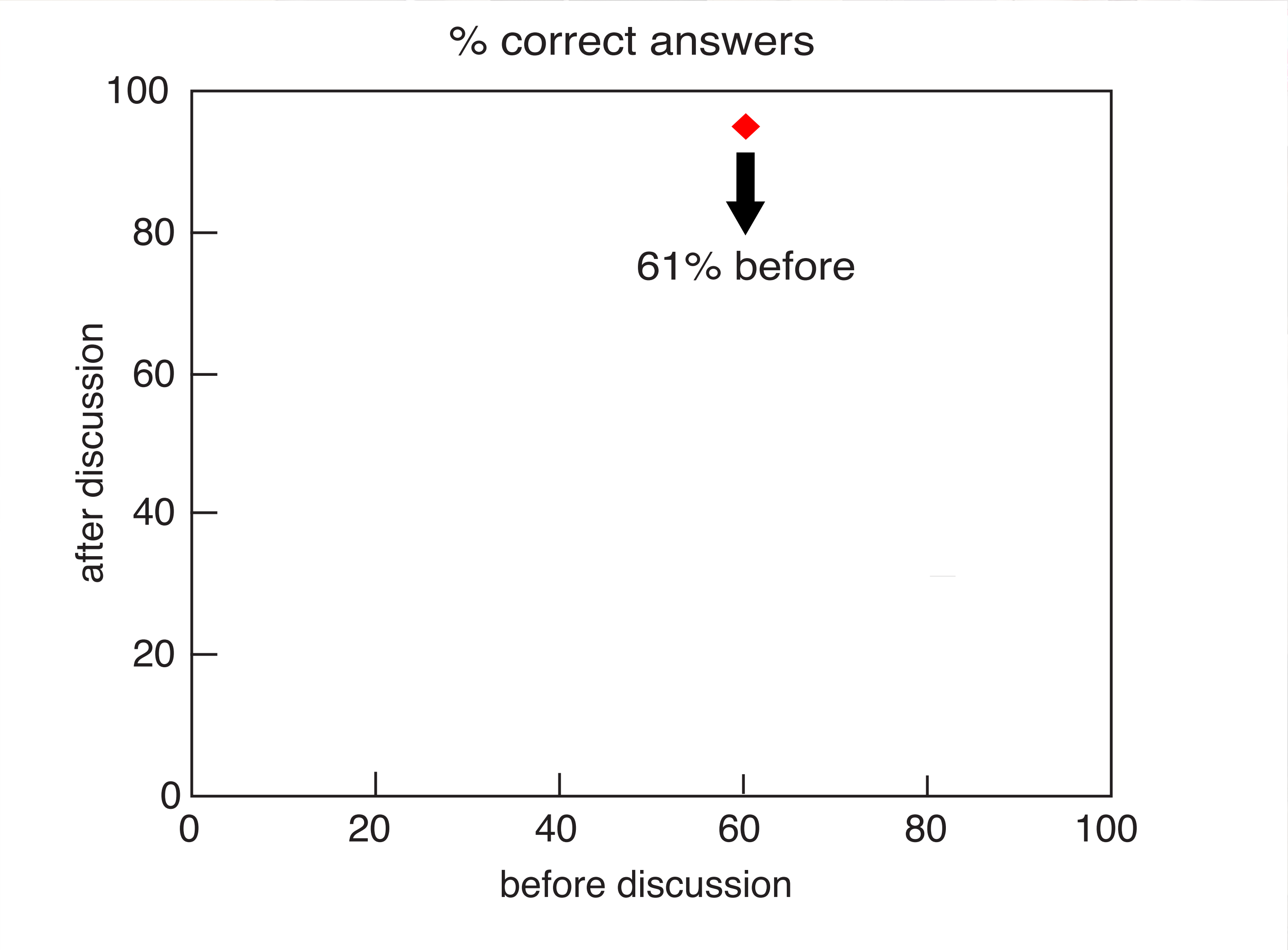


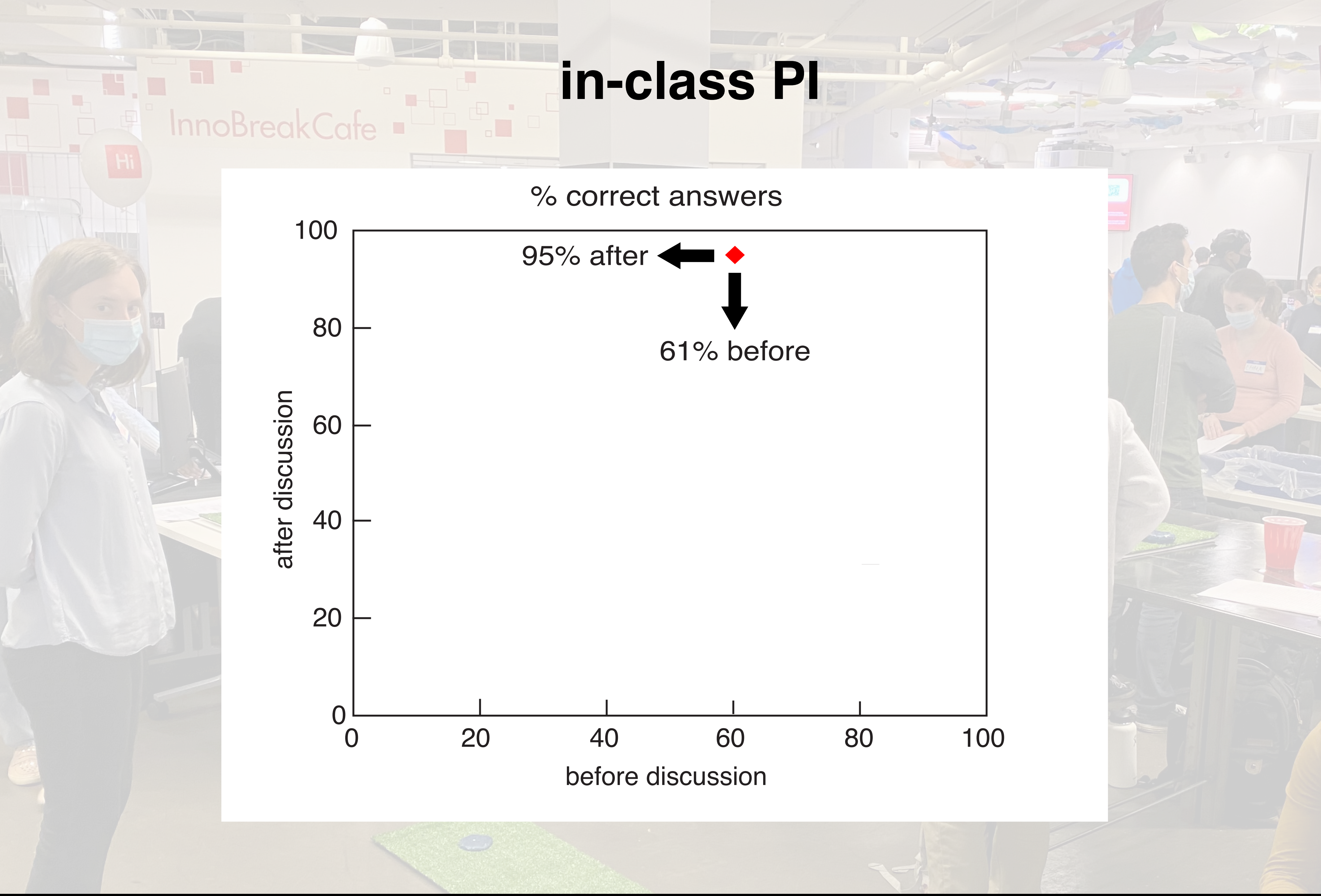
1 **pandemic lessons** 2 **new normal** 3 **self-paced PI**

in-class PI



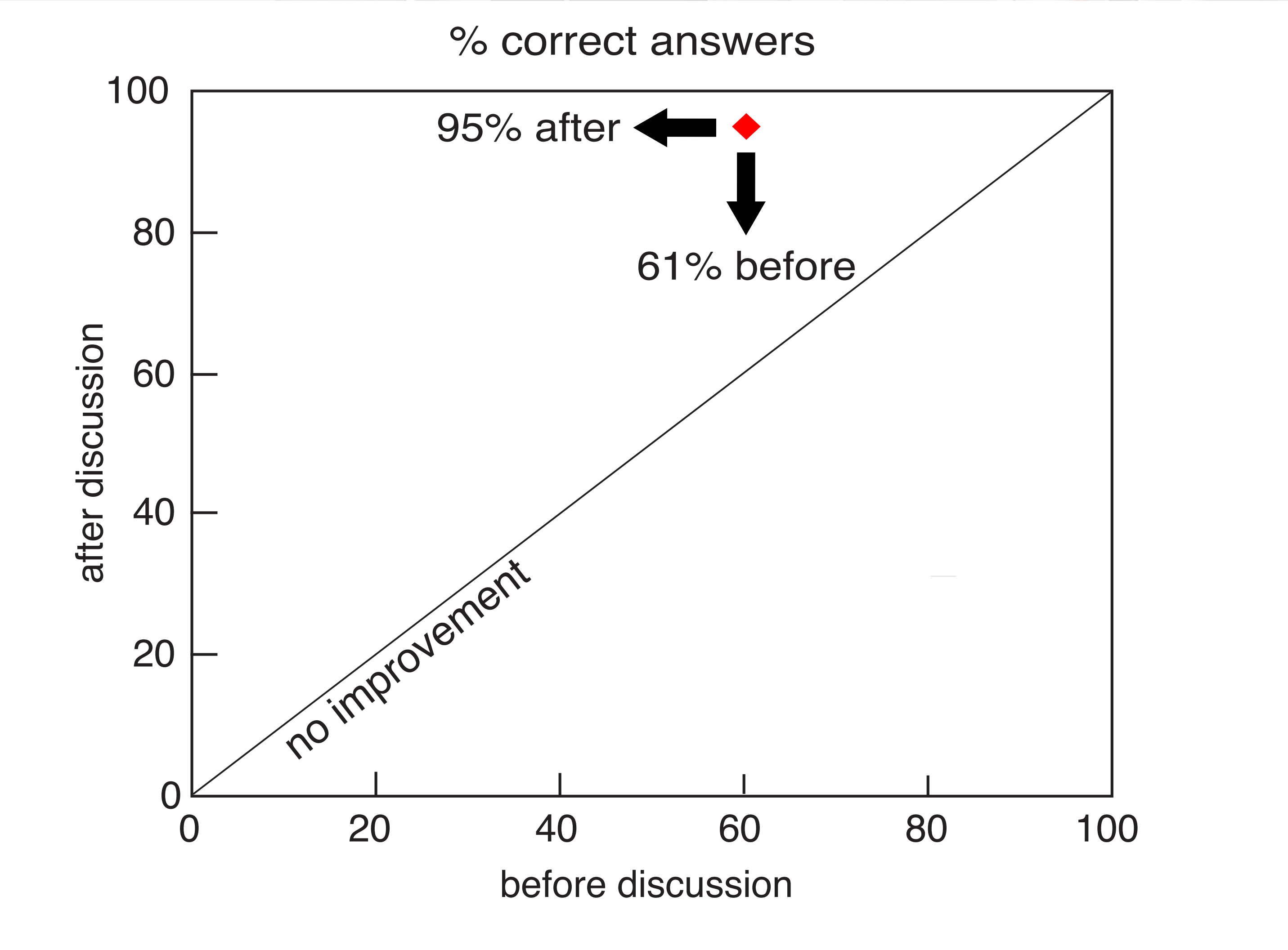
❶ pandemic lessons ❷ new normal ❸ self-paced PI

in-class PI



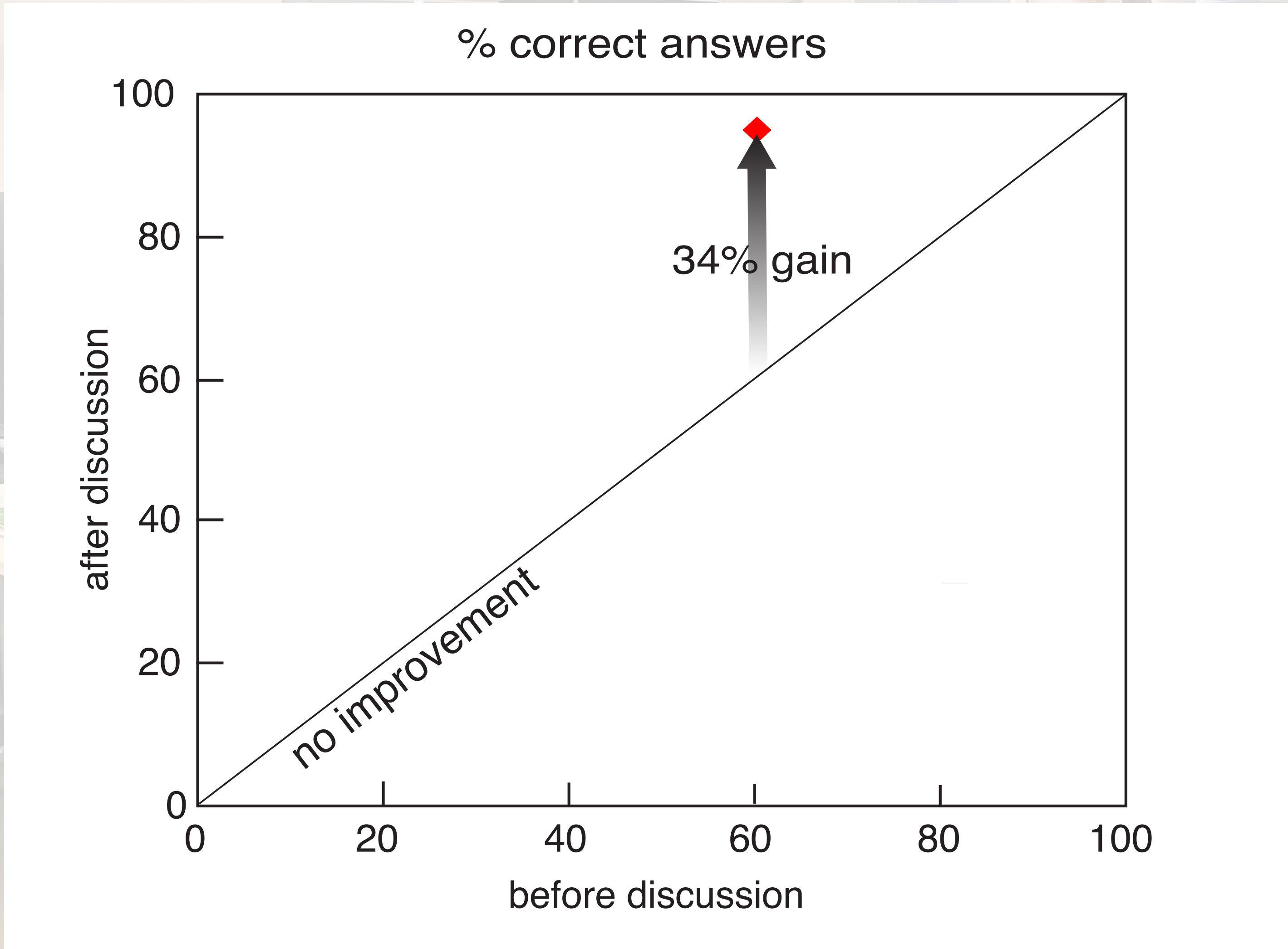
% correct answers
95% after
61% before
after discussion
before discussion
0
20
40
60
80
100

in-class PI



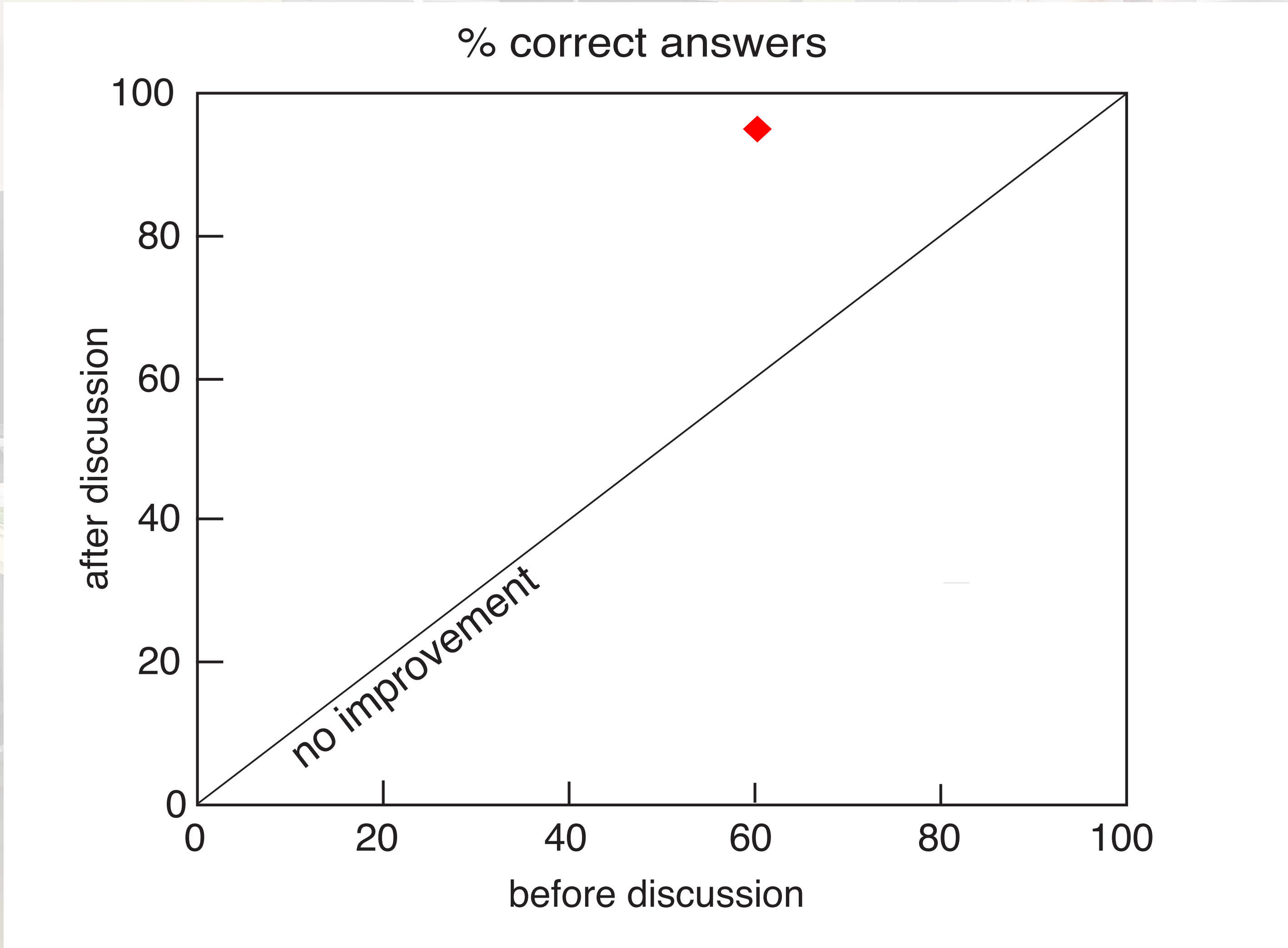
❶ **pandemic lessons** ❷ **new normal** ❸ **self-paced PI**

in-class PI



1 pandemic lessons 2 new normal 3 self-paced PI

in-class PI



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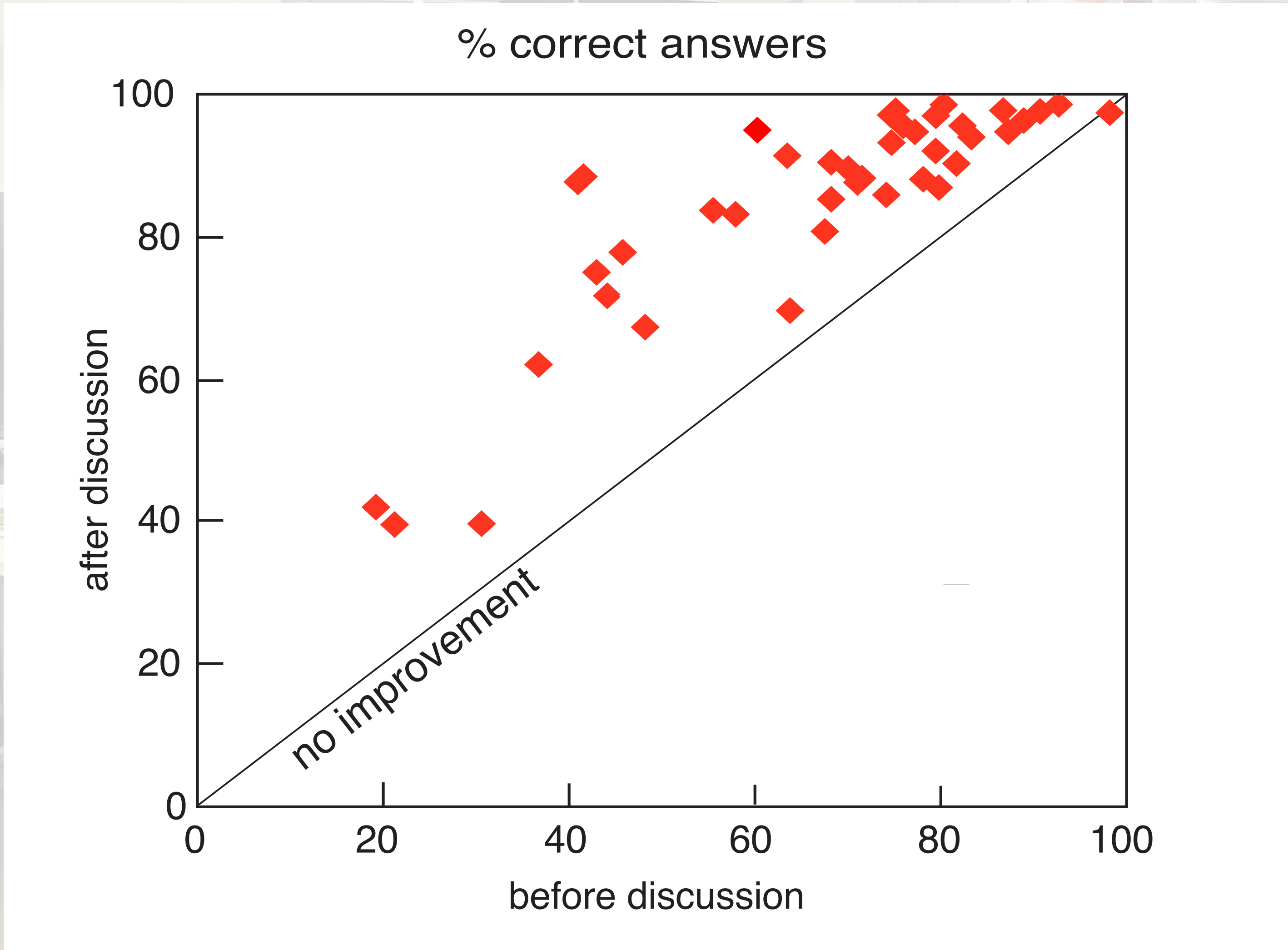
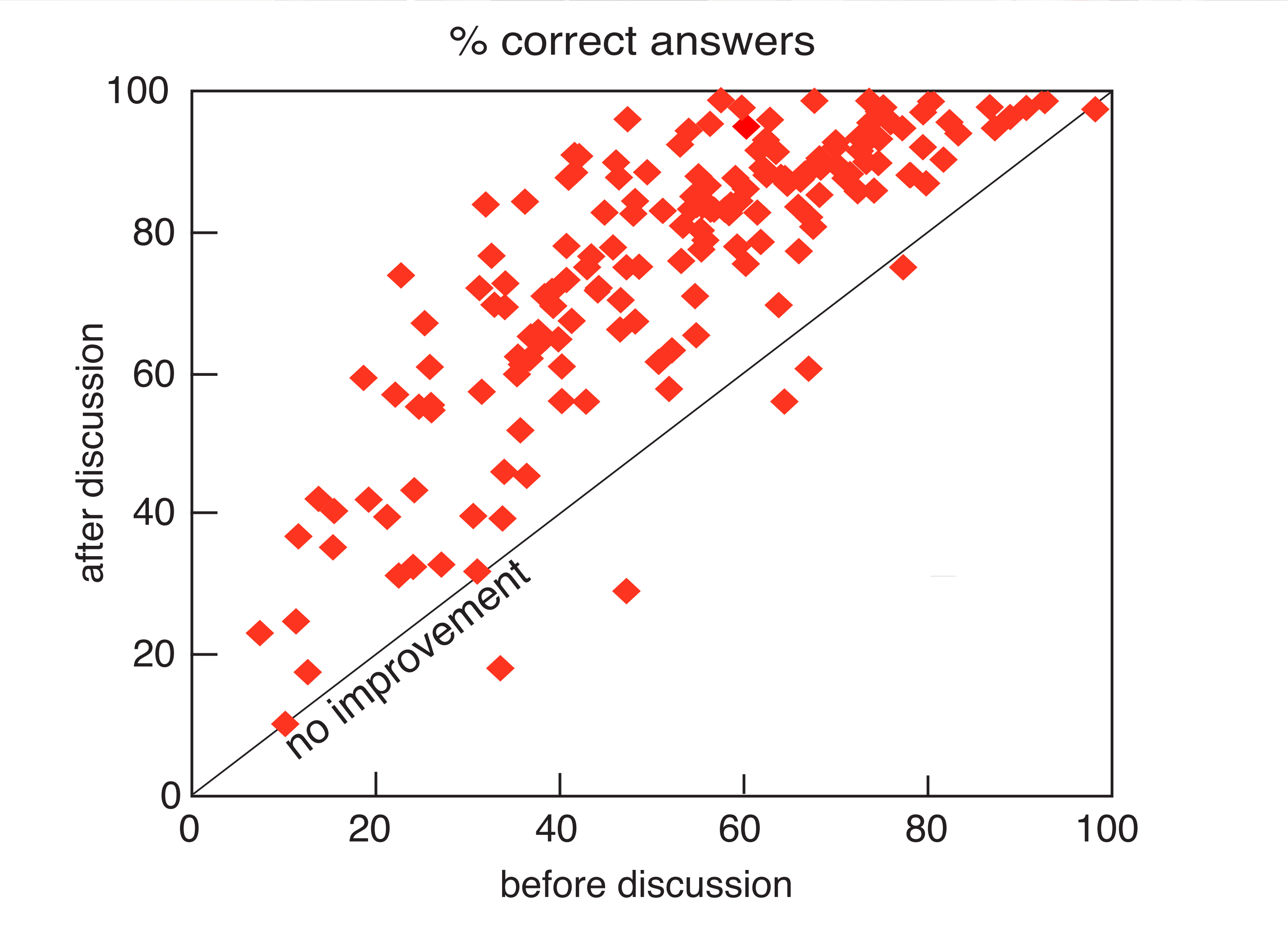
in-class PI



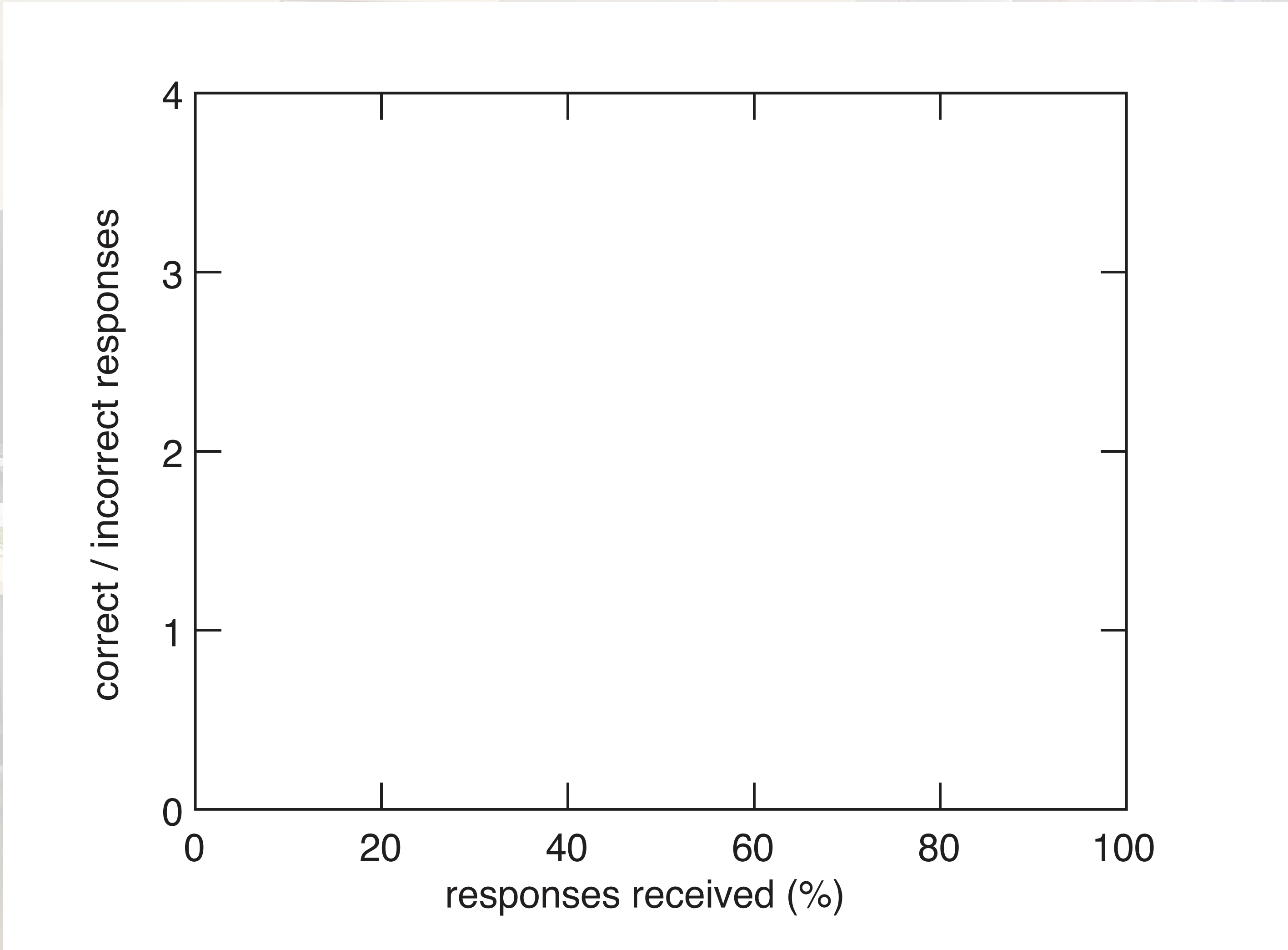
❶ **pandemic lessons** ❷ **new normal** ❸ **self-paced PI**

in-class PI



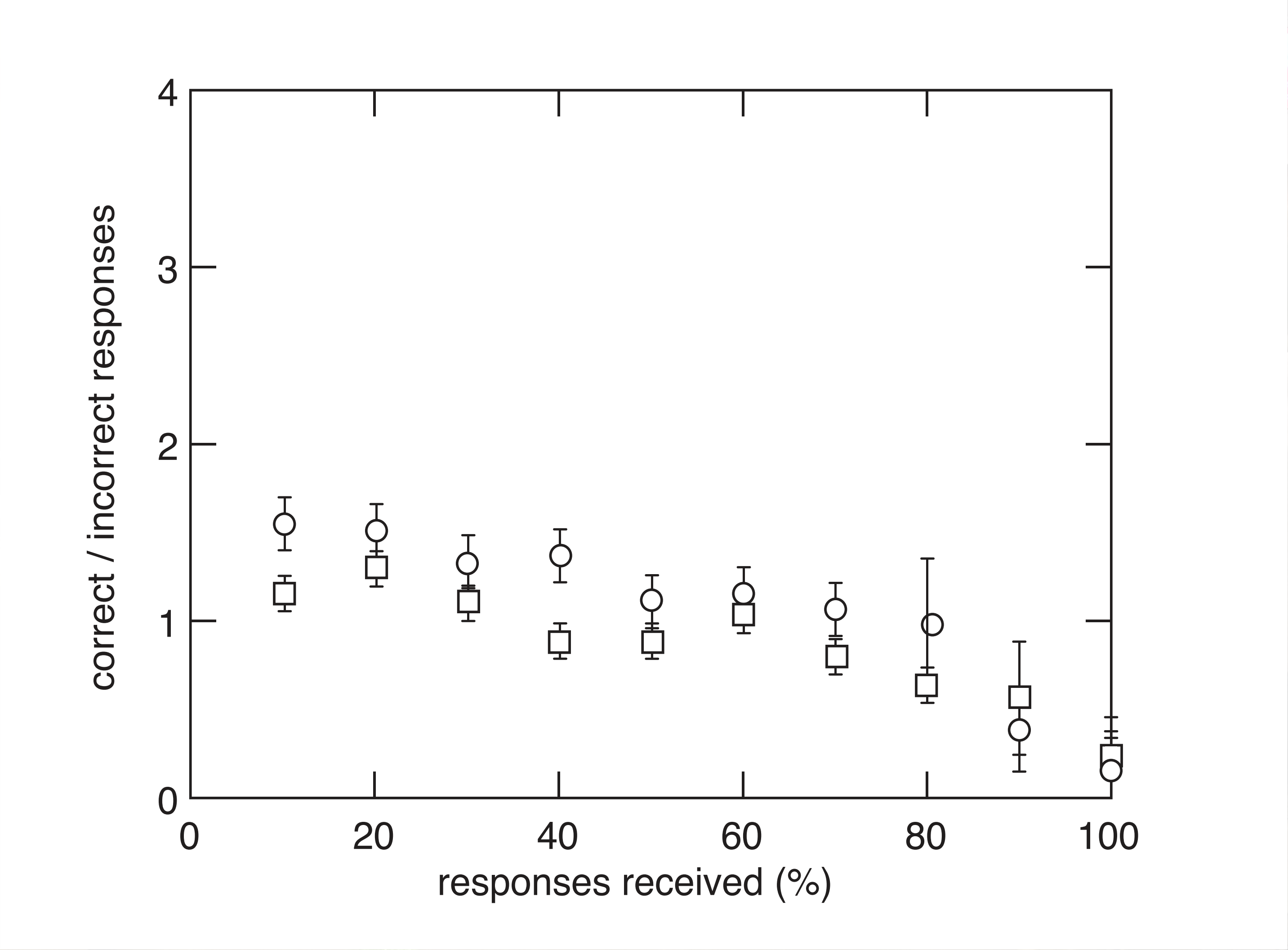
1 pandemic lessons **2** new normal **3** self-paced PI

in-class PI: response time analysis



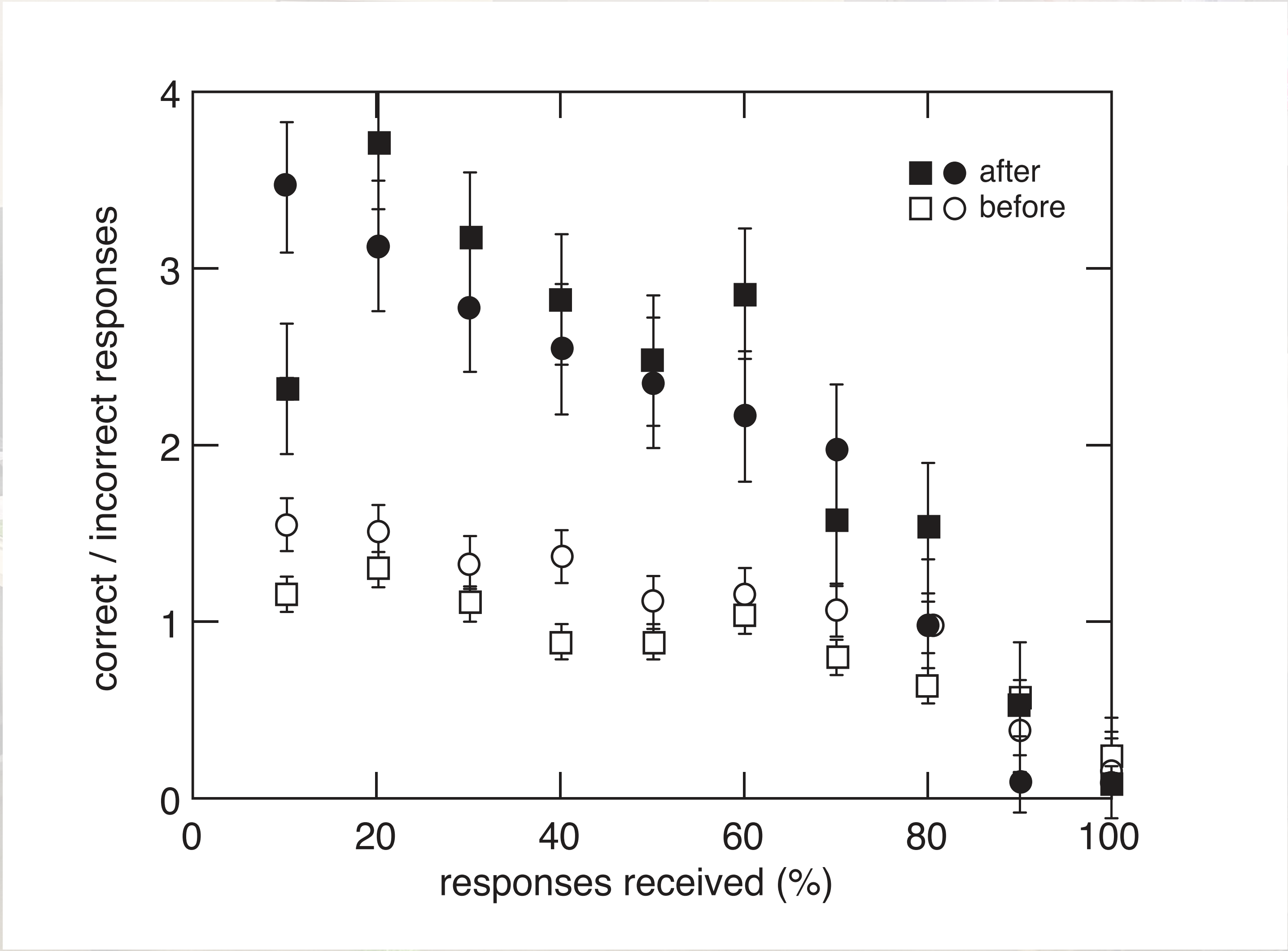
❶ **pandemic lessons** ❷ **new normal** ❸ **self-paced PI**

in-class PI: response time analysis



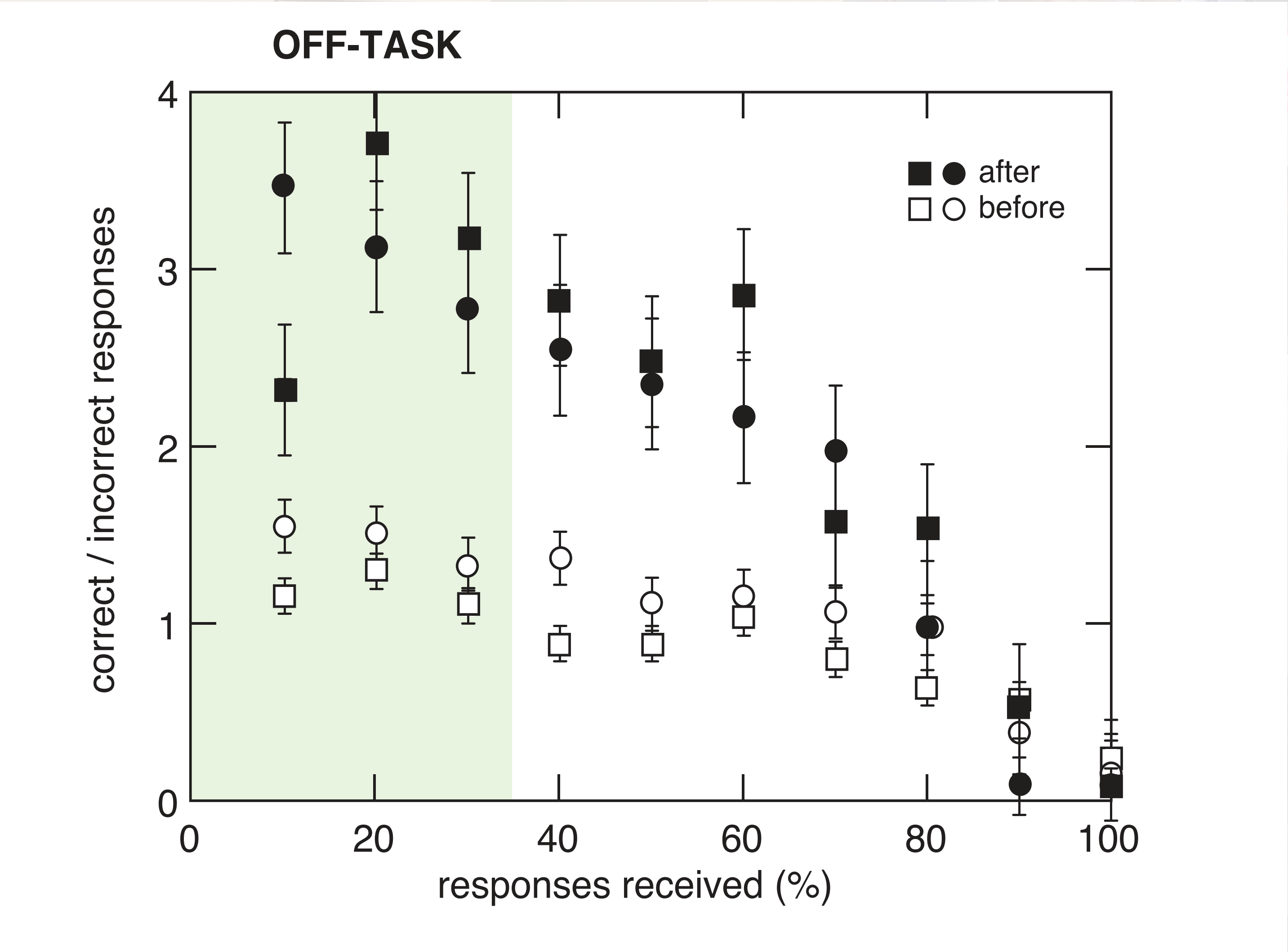
1 pandemic lessons **2** new normal **3** self-paced PI

in-class PI: response time analysis

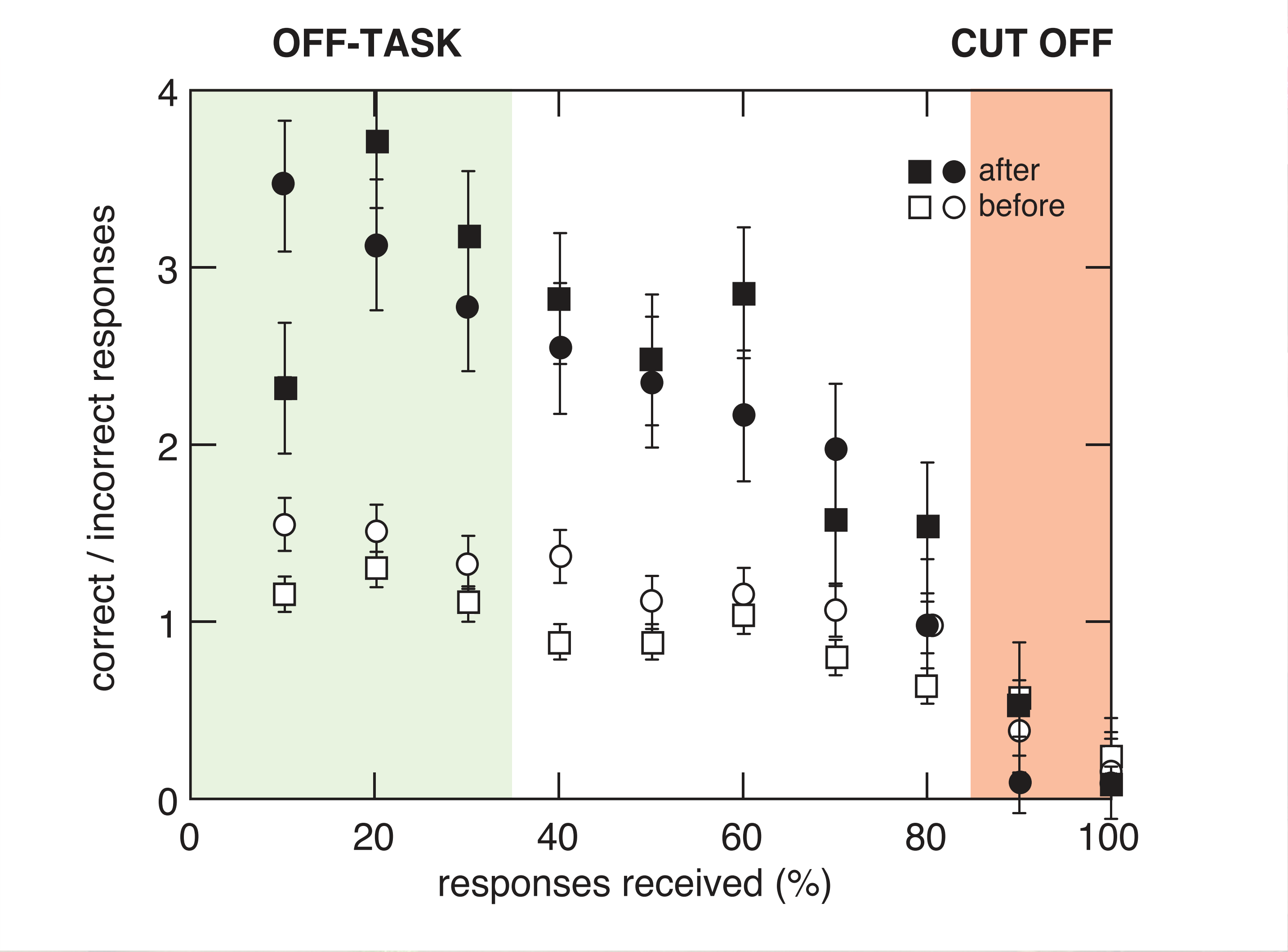


1 **pandemic lessons** 2 **new normal** 3 **self-paced PI**

in-class PI: response time analysis

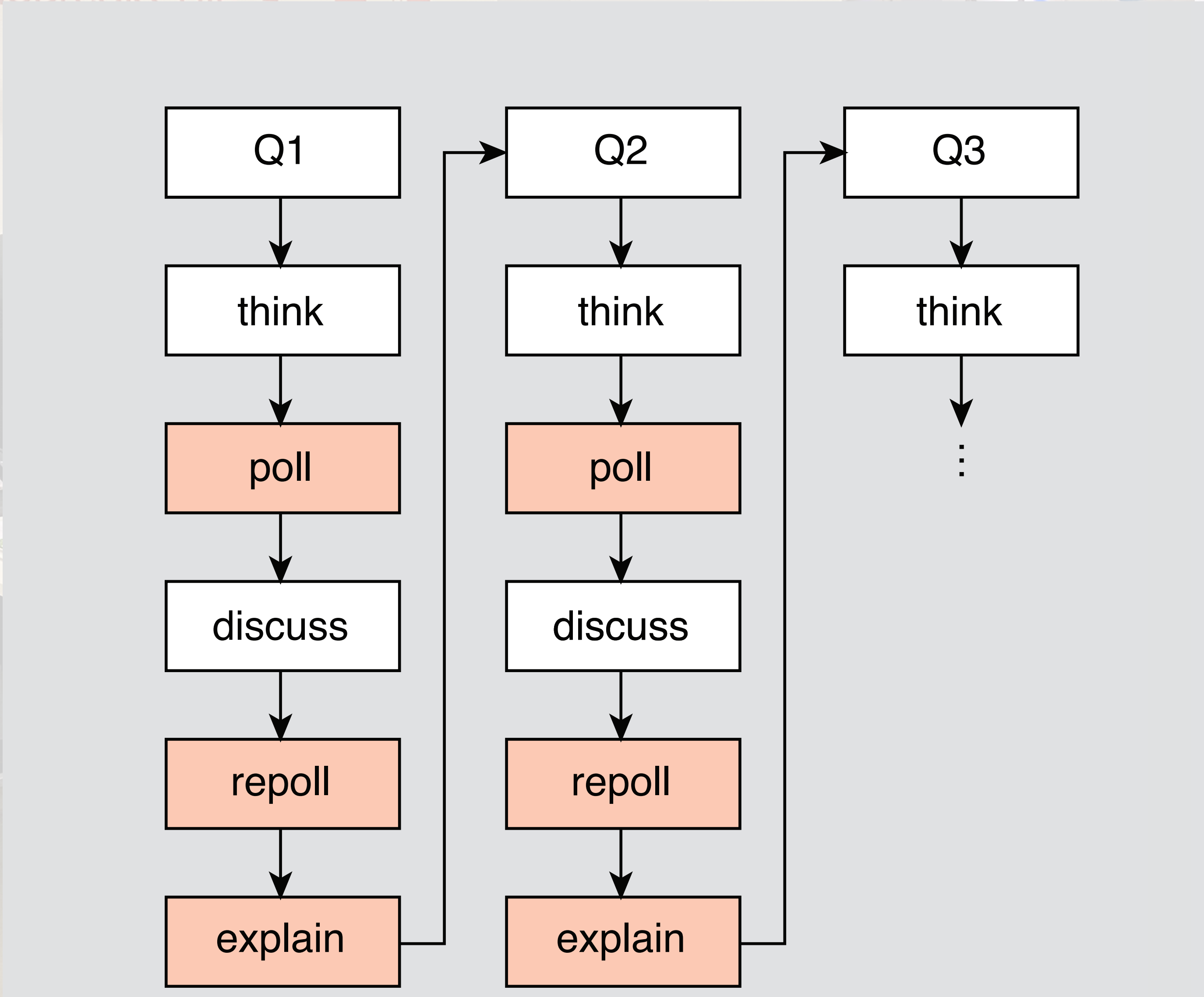


in-class PI: response time analysis



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

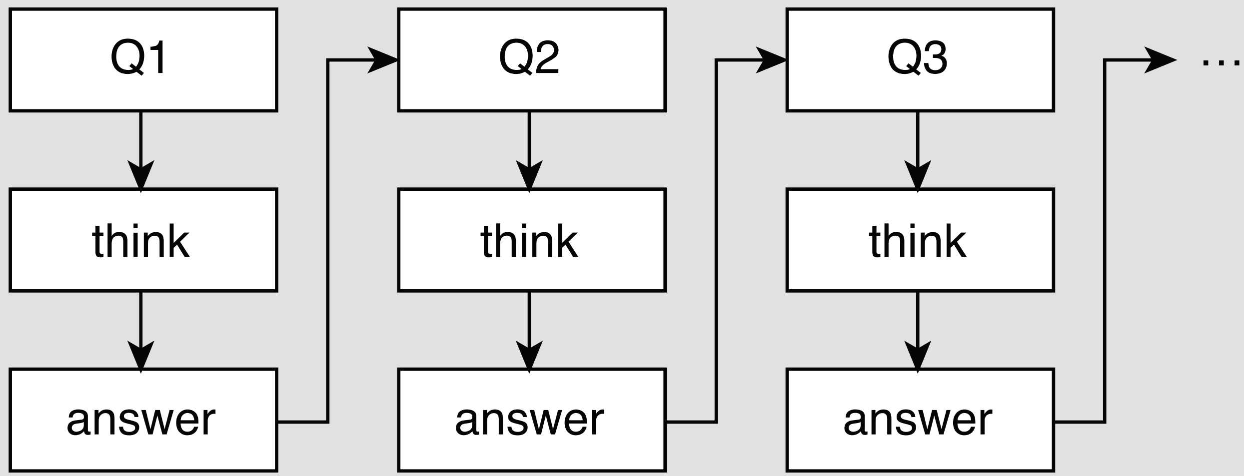
in-class PI: class sequence



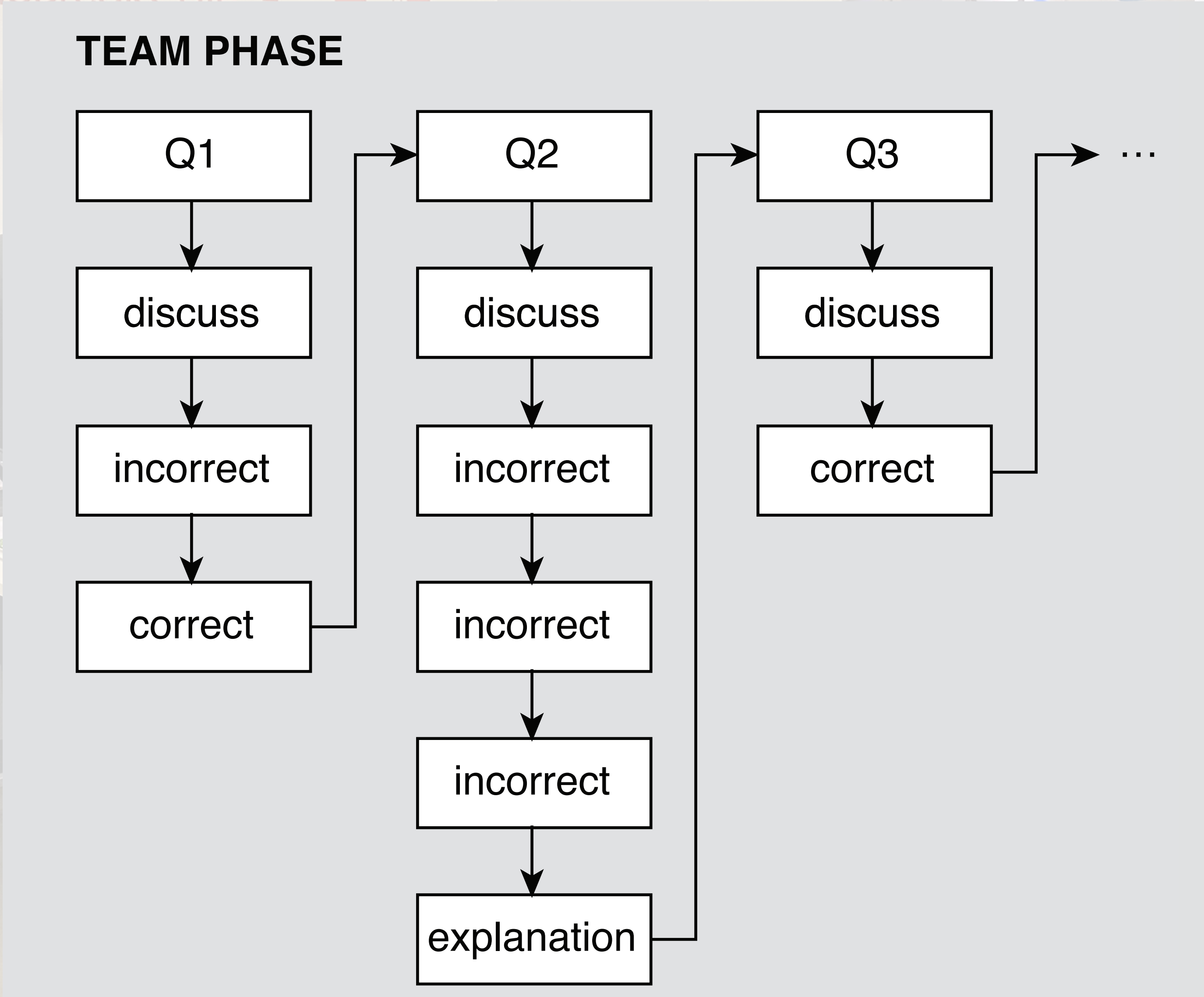
1 pandemic lessons 2 new normal 3 self-paced PI

self-paced PI: two phases

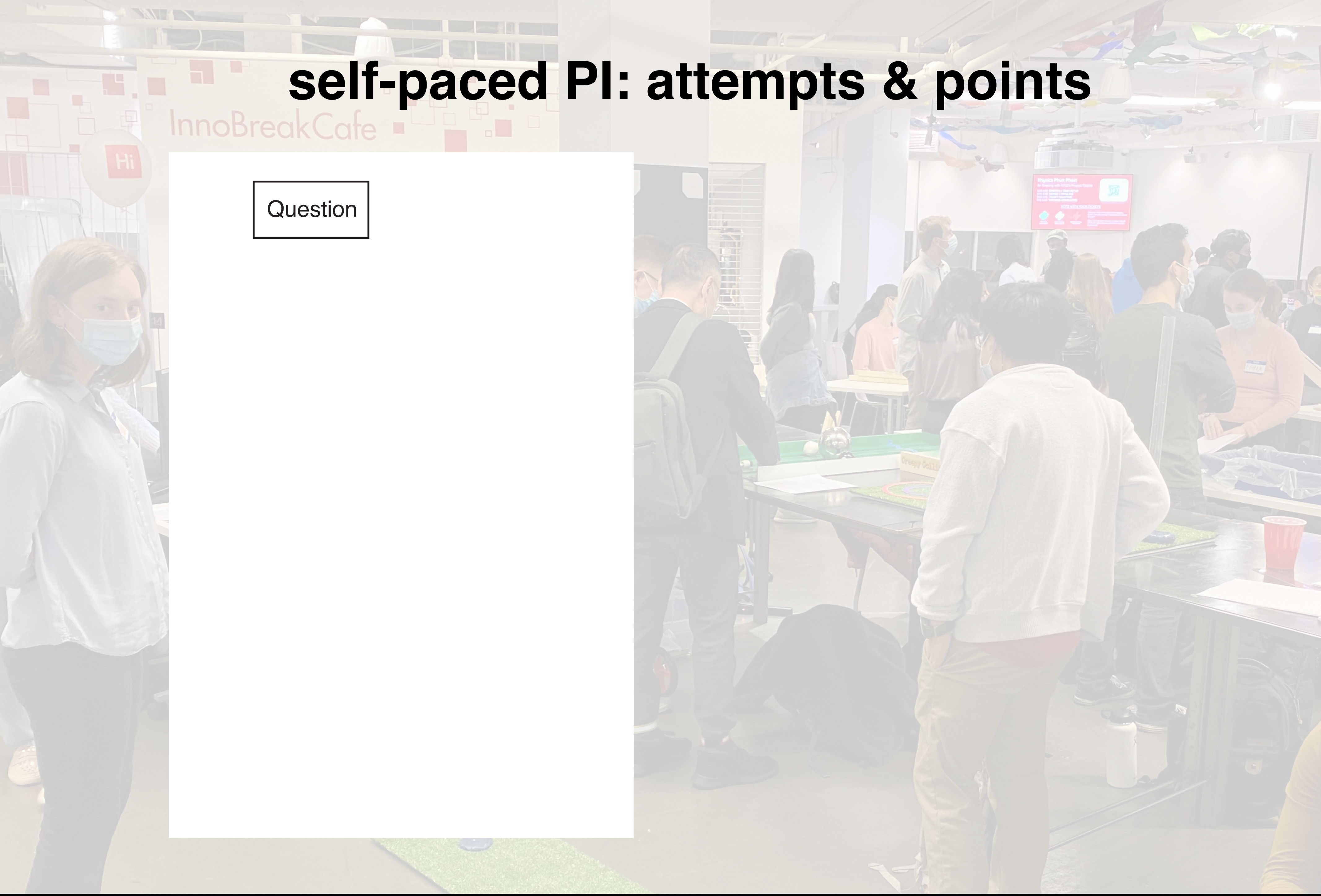
INDIVIDUAL PHASE



self-paced PI: two phases

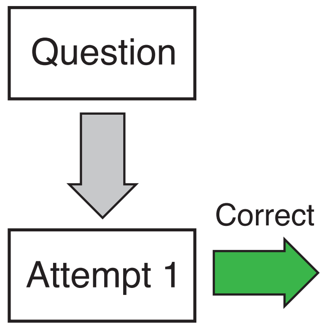


self-paced PI: attempts & points

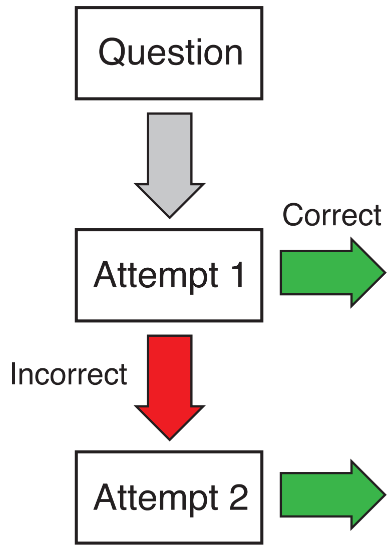


Question

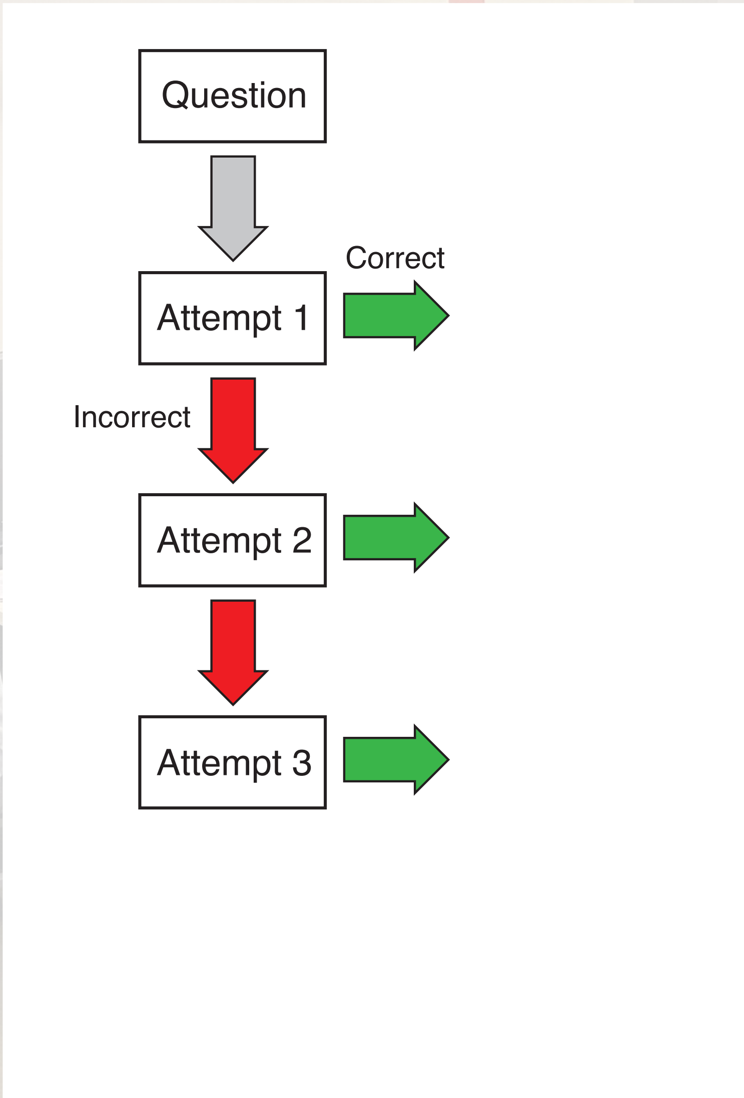
self-paced PI: attempts & points



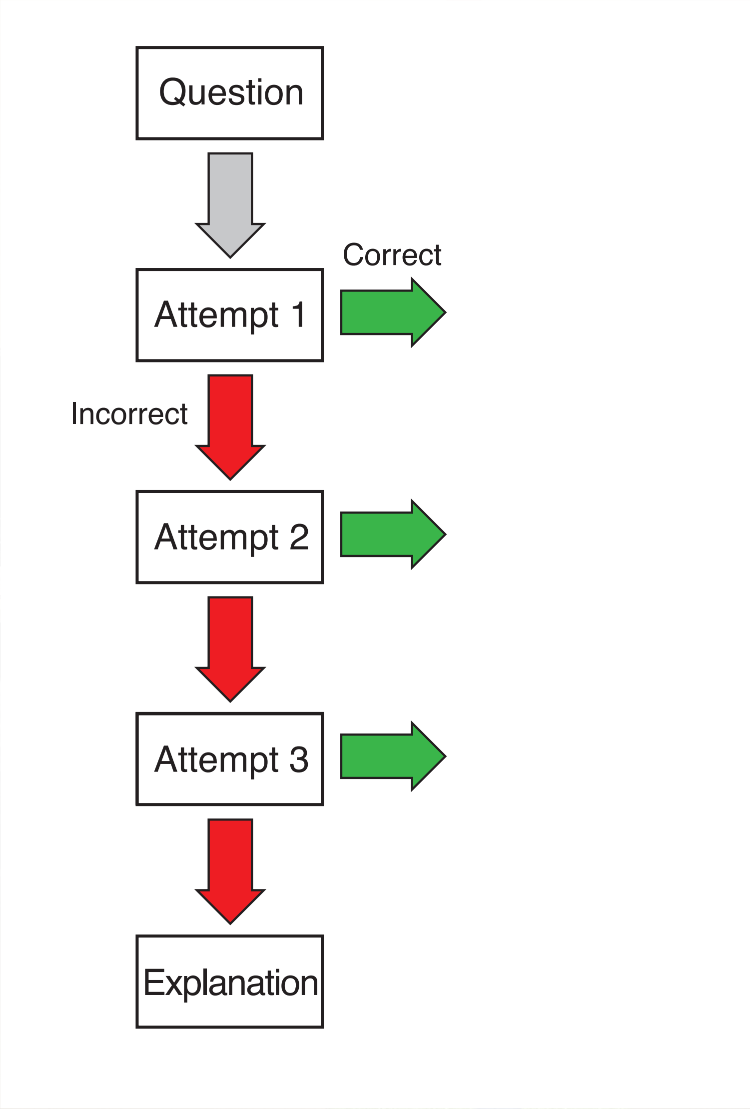
self-paced PI: attempts & points



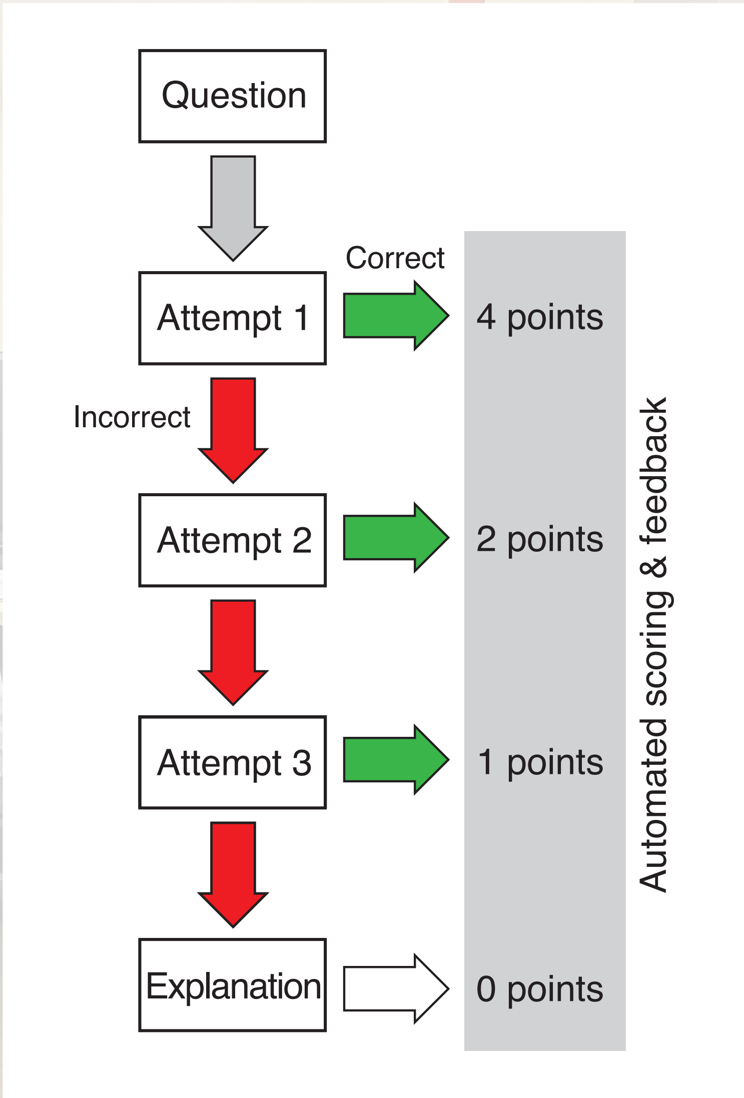
self-paced PI: attempts & points



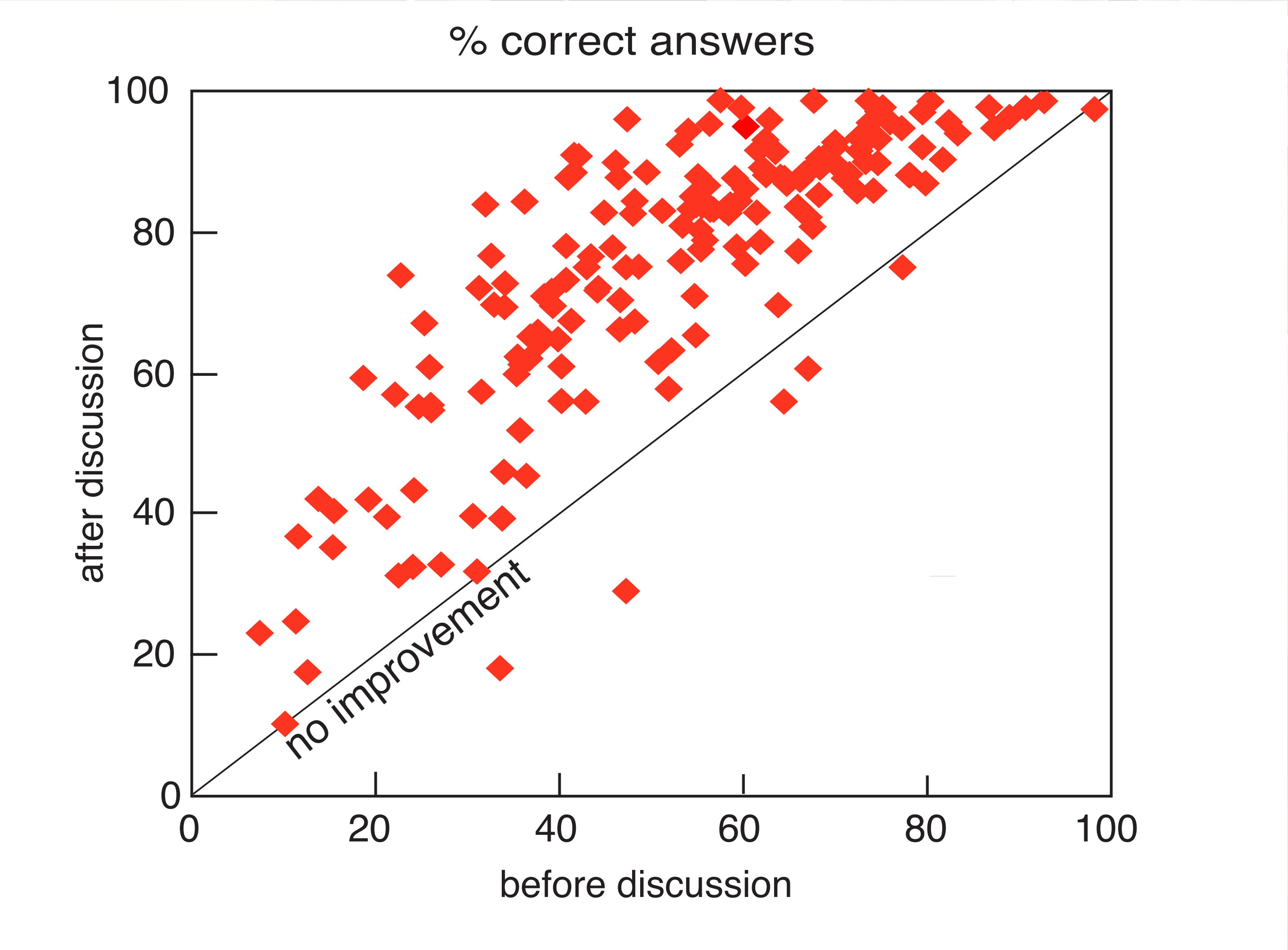
self-paced PI: attempts & points



self-paced PI: attempts & points

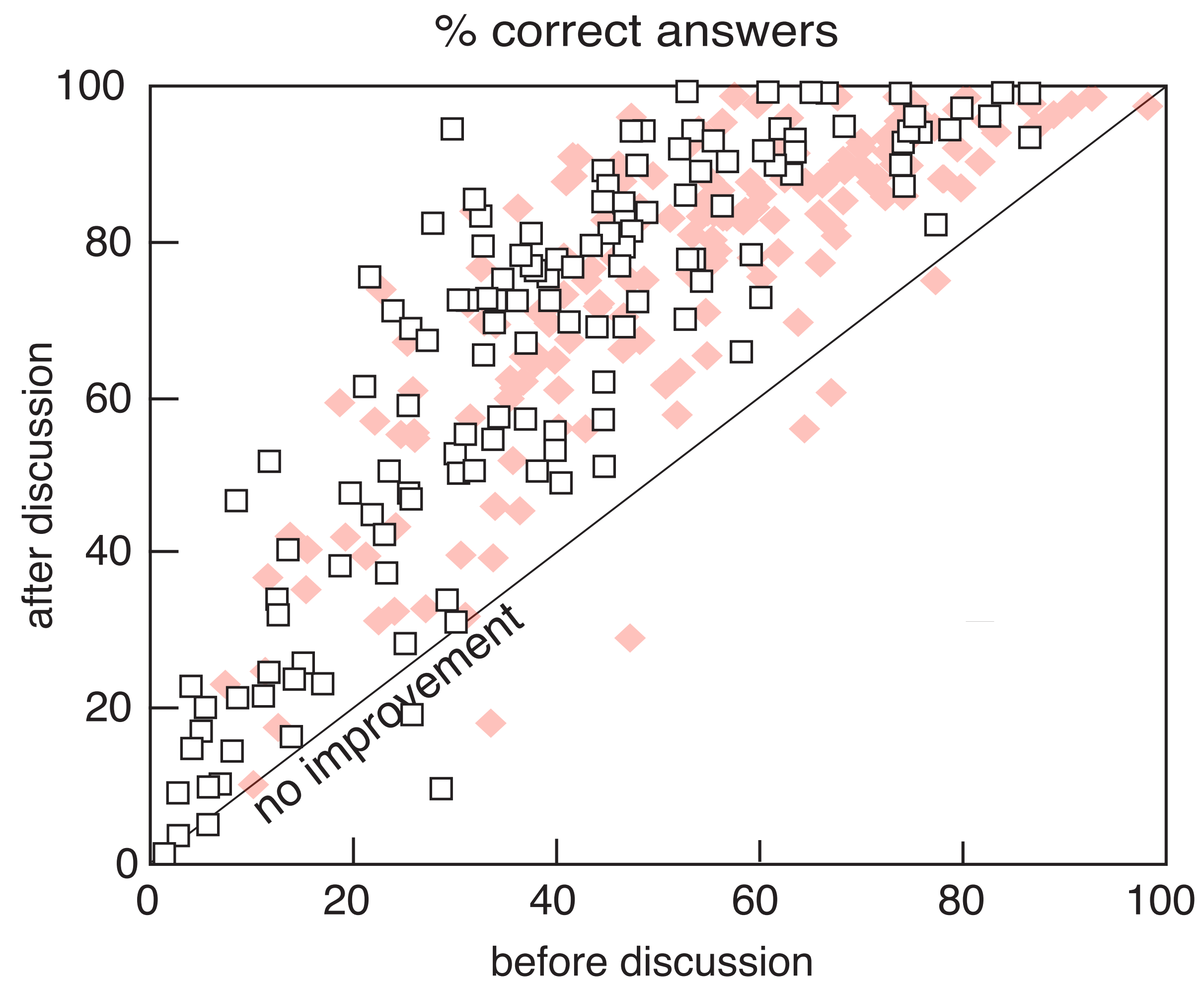


self-paced vs. in-class PI

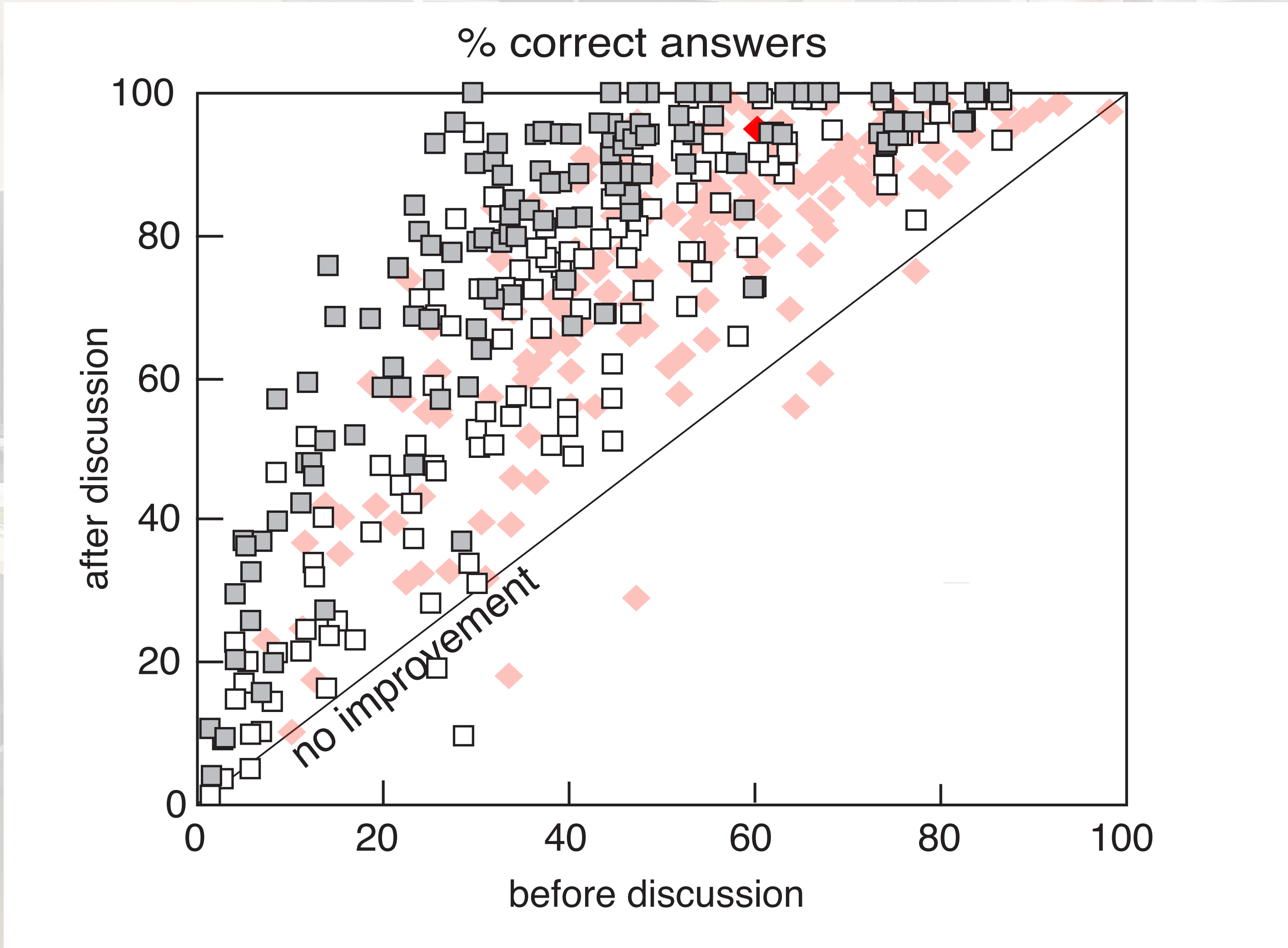


1 pandemic lessons **2** new normal **3** self-paced PI

self-paced vs. in-class PI

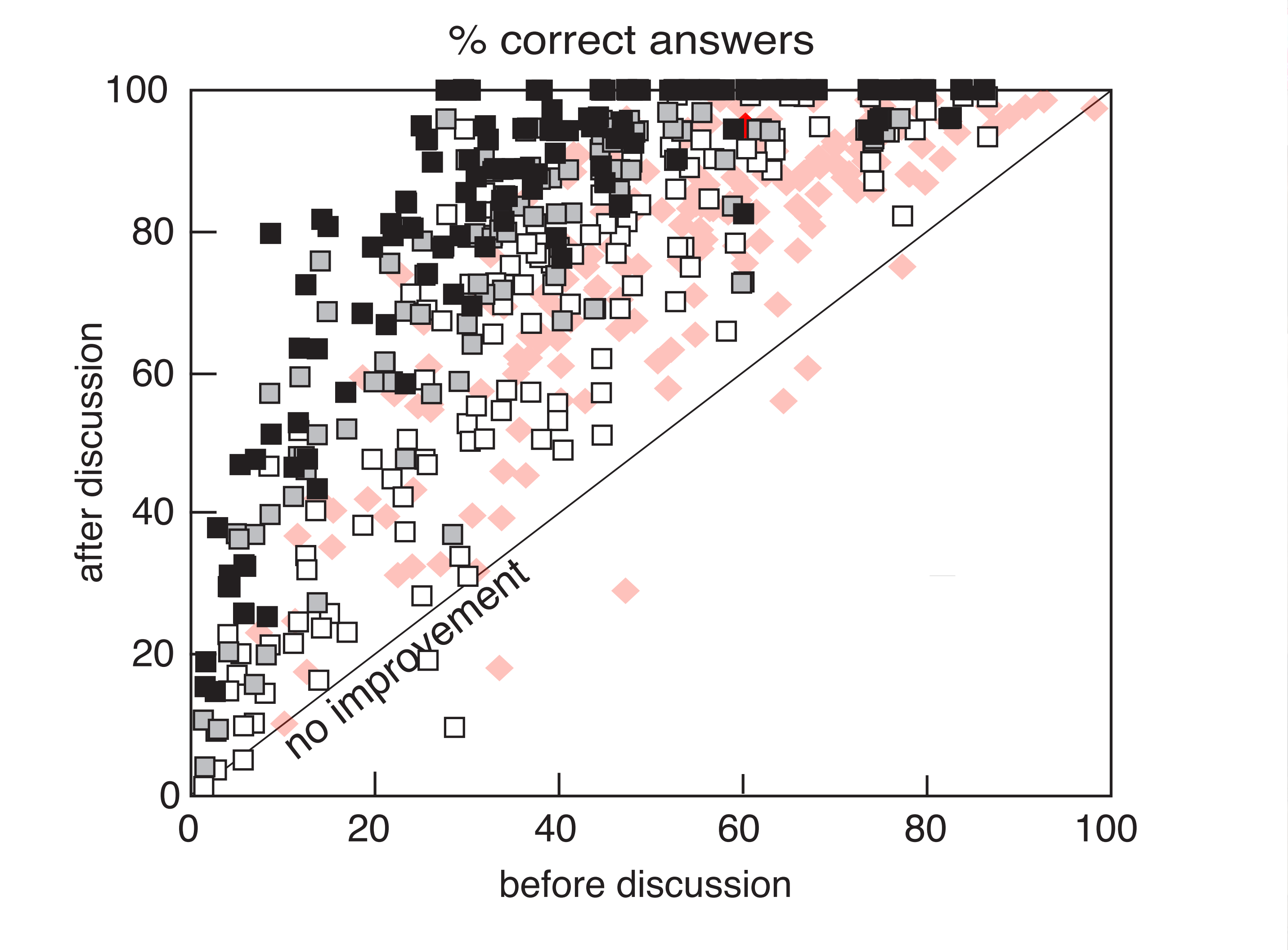


self-paced vs. in-class PI



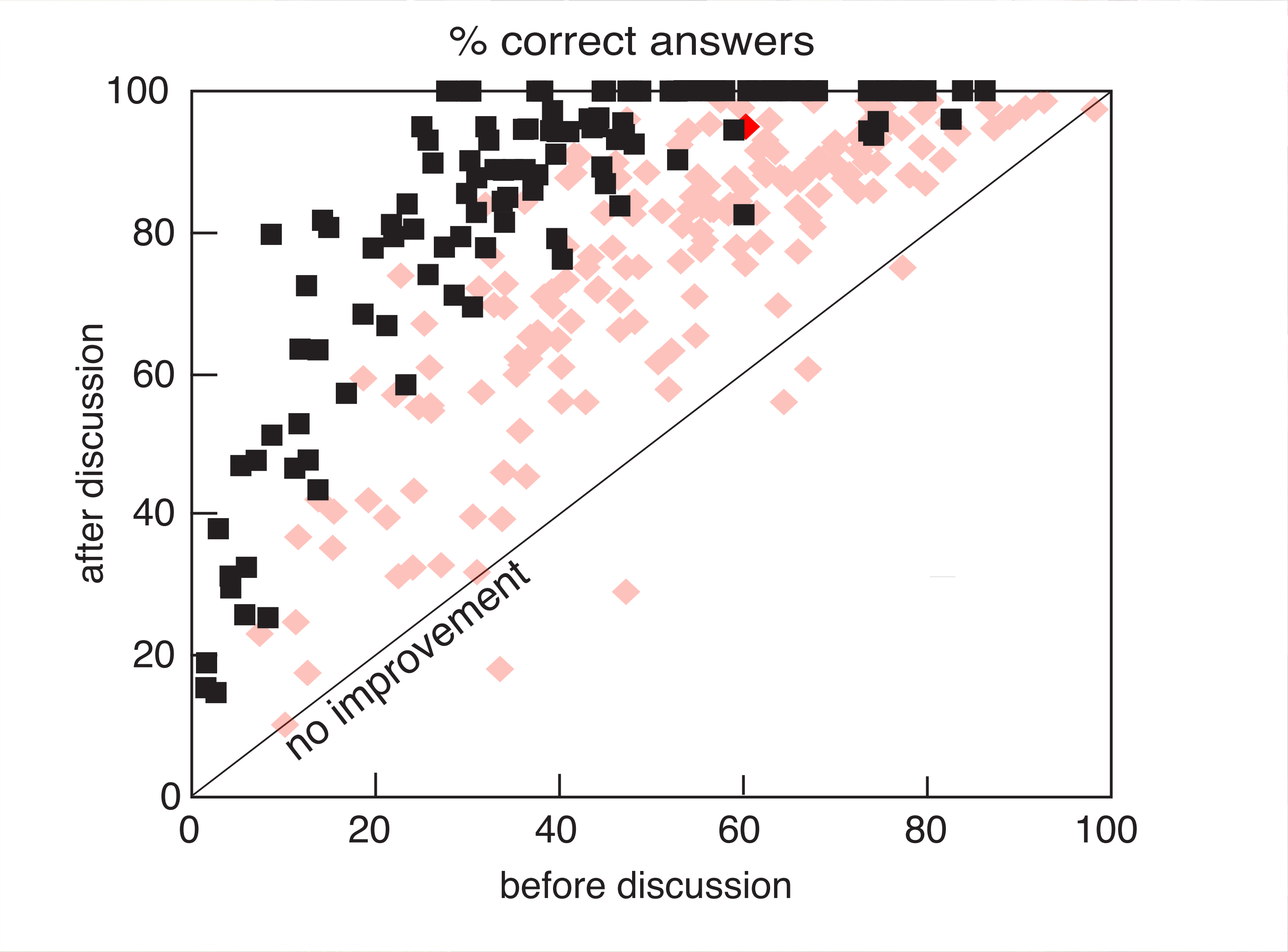
❶ **pandemic lessons** ❷ **new normal** ❸ **self-paced PI**

self-paced vs. in-class PI



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

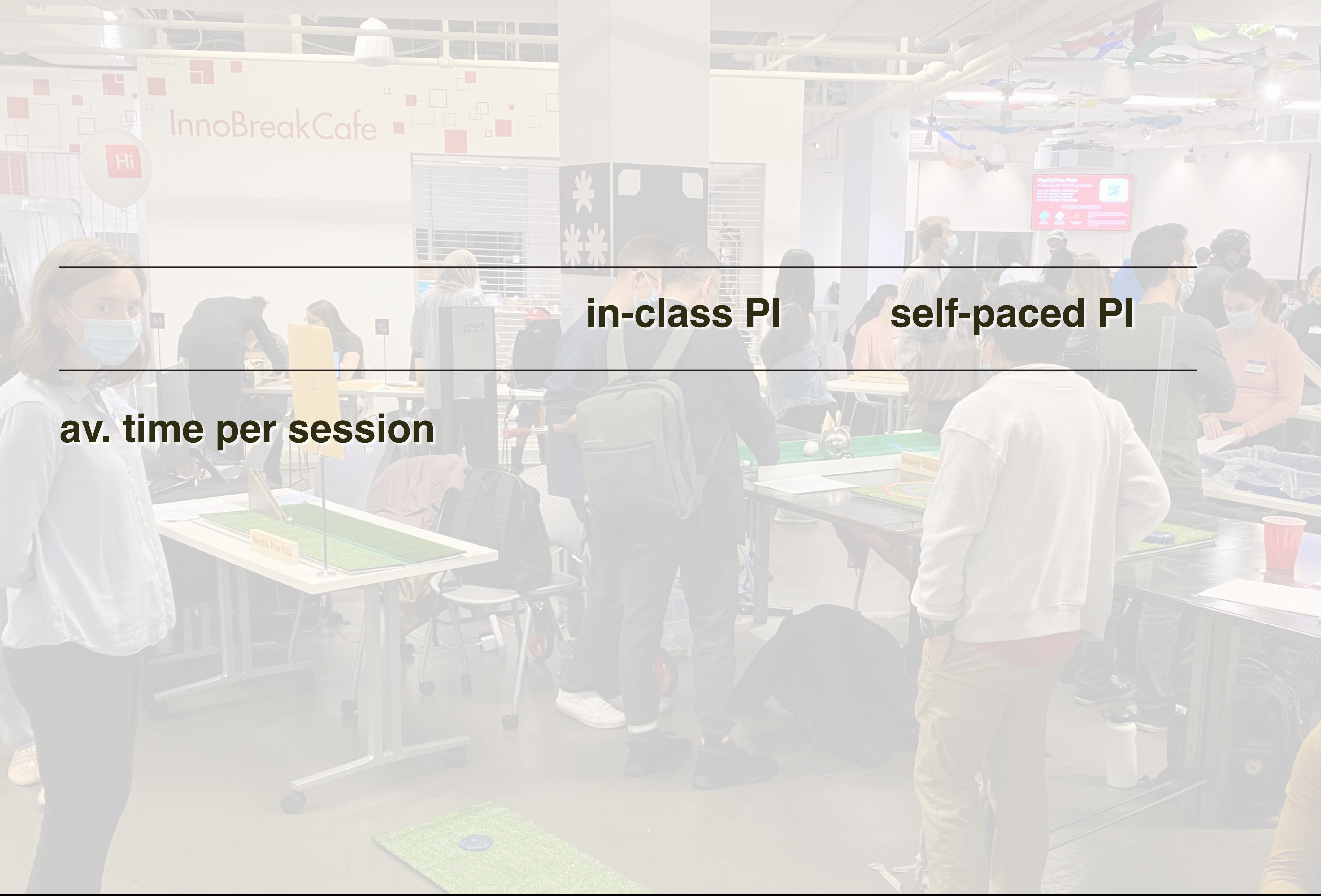
self-paced vs. in-class PI



❶ **pandemic lessons** ❷ **new normal** ❸ **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		

	in-class PI	self-paced PI
av. time per session	92 min	

	in-class PI	self-paced PI
av. time per session	92 min	71 min

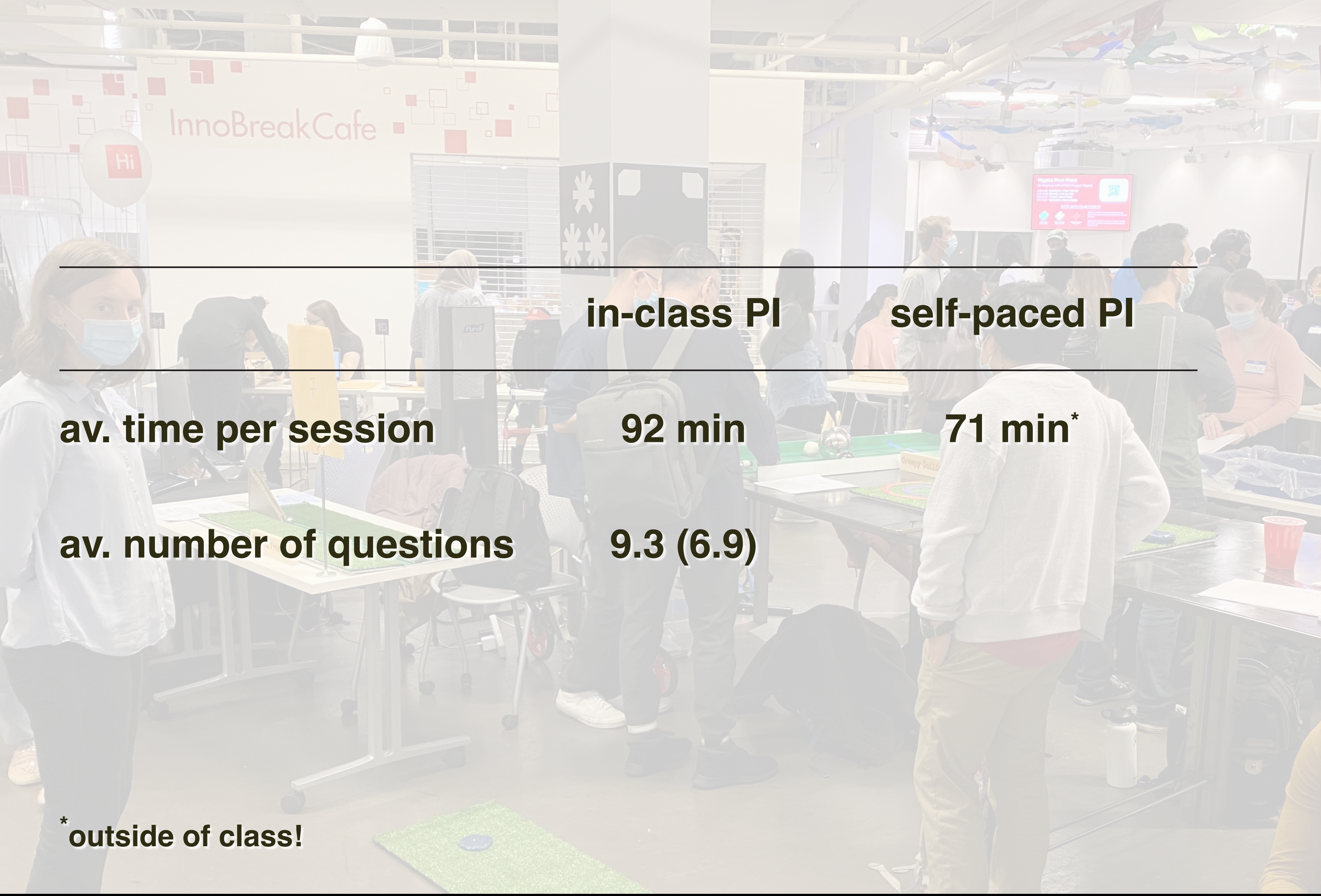
	in-class PI	self-paced PI
av. time per session	92 min	71 min*

*outside of class!

	in-class PI	self-paced PI
av. time per session	92 min	71 min*
av. number of questions	9.3	

*outside of class!

❶ pandemic lessons ❷ new normal ❸ 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)	

*outside of class!

	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!

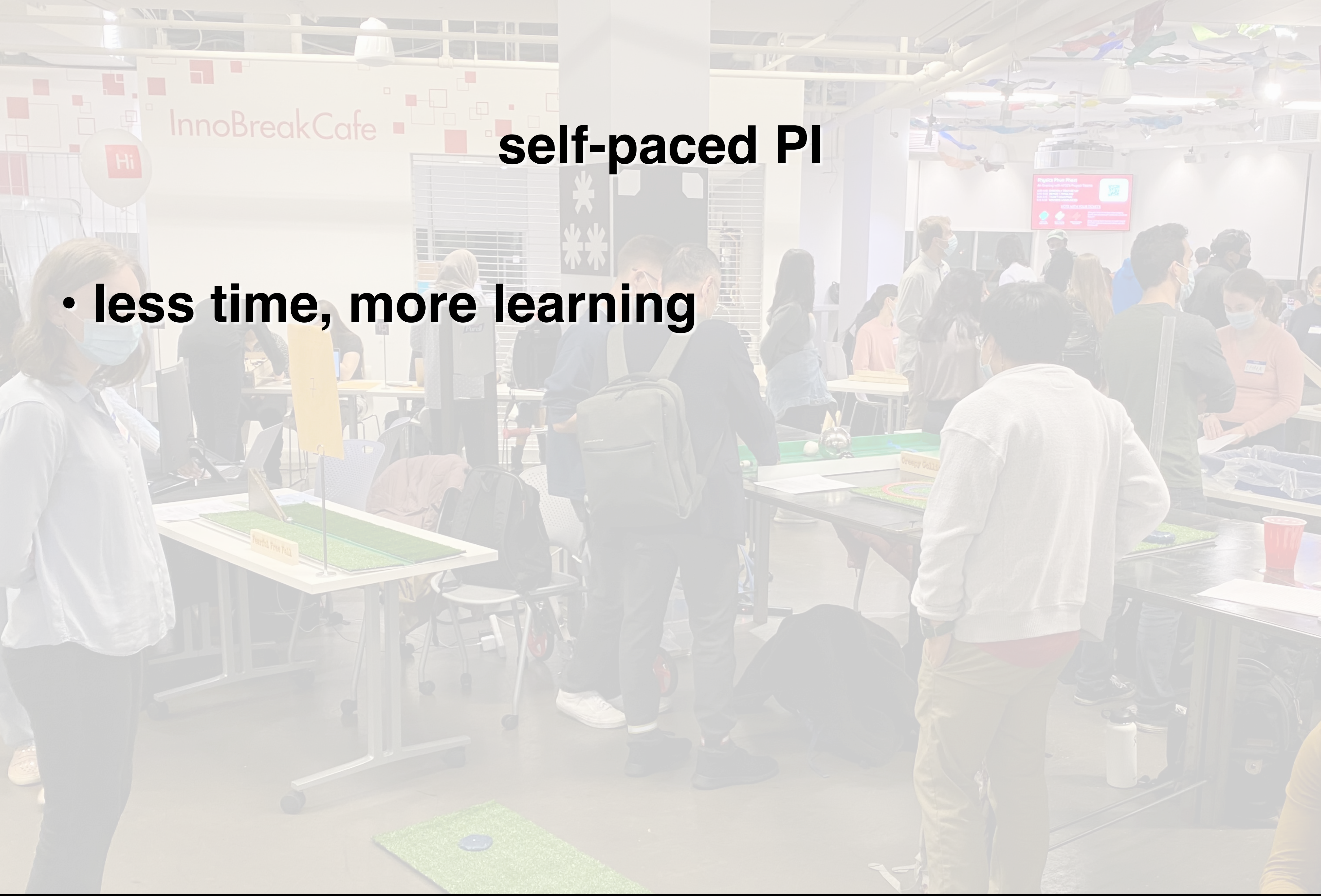
	in-class PI	self-paced PI
av. time per session	92 min	71 min*
av. number of questions	9.3 (6.9)	11

increased gains in content learning & self efficacy!

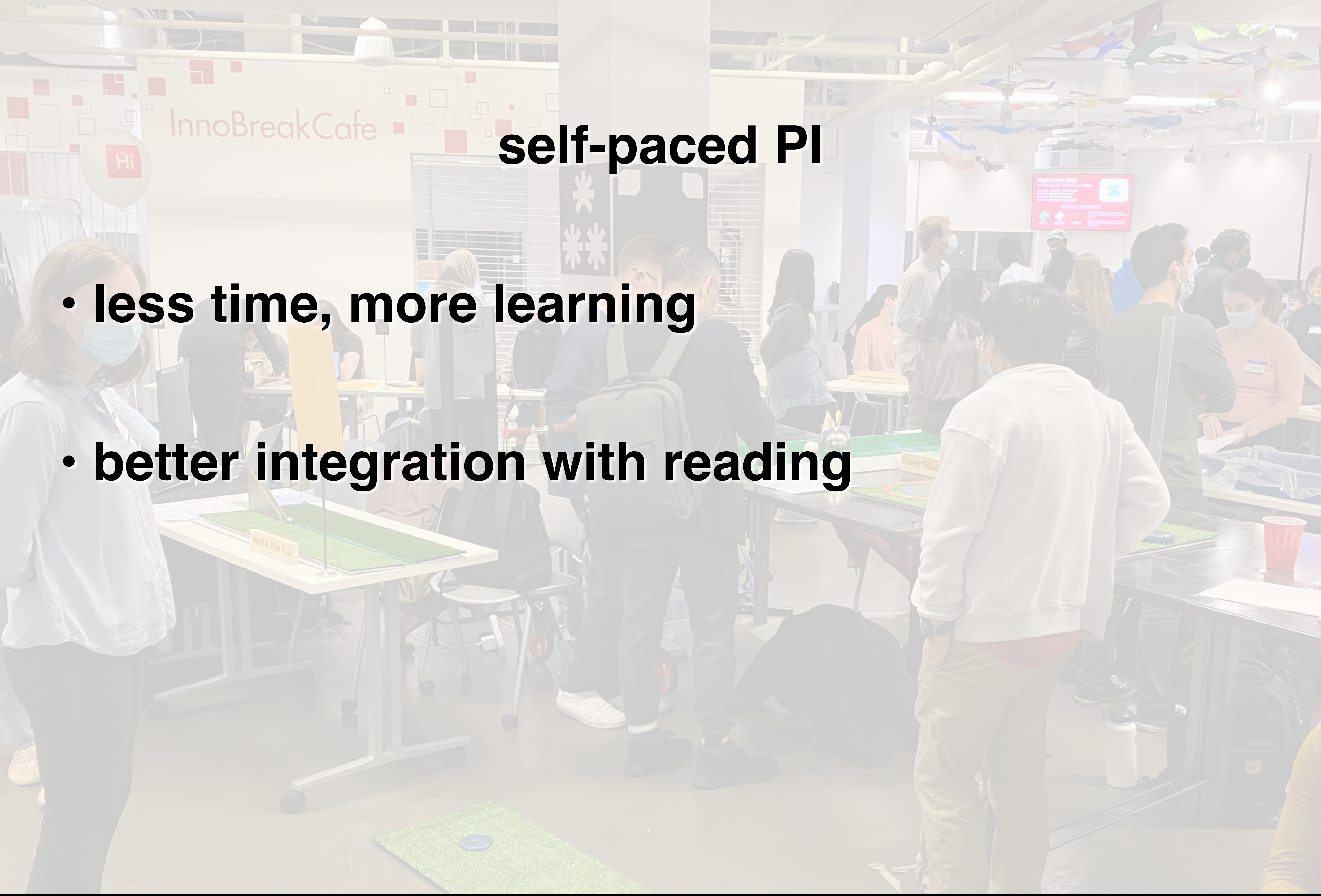
*outside of class!

self-paced PI

- less time, more learning

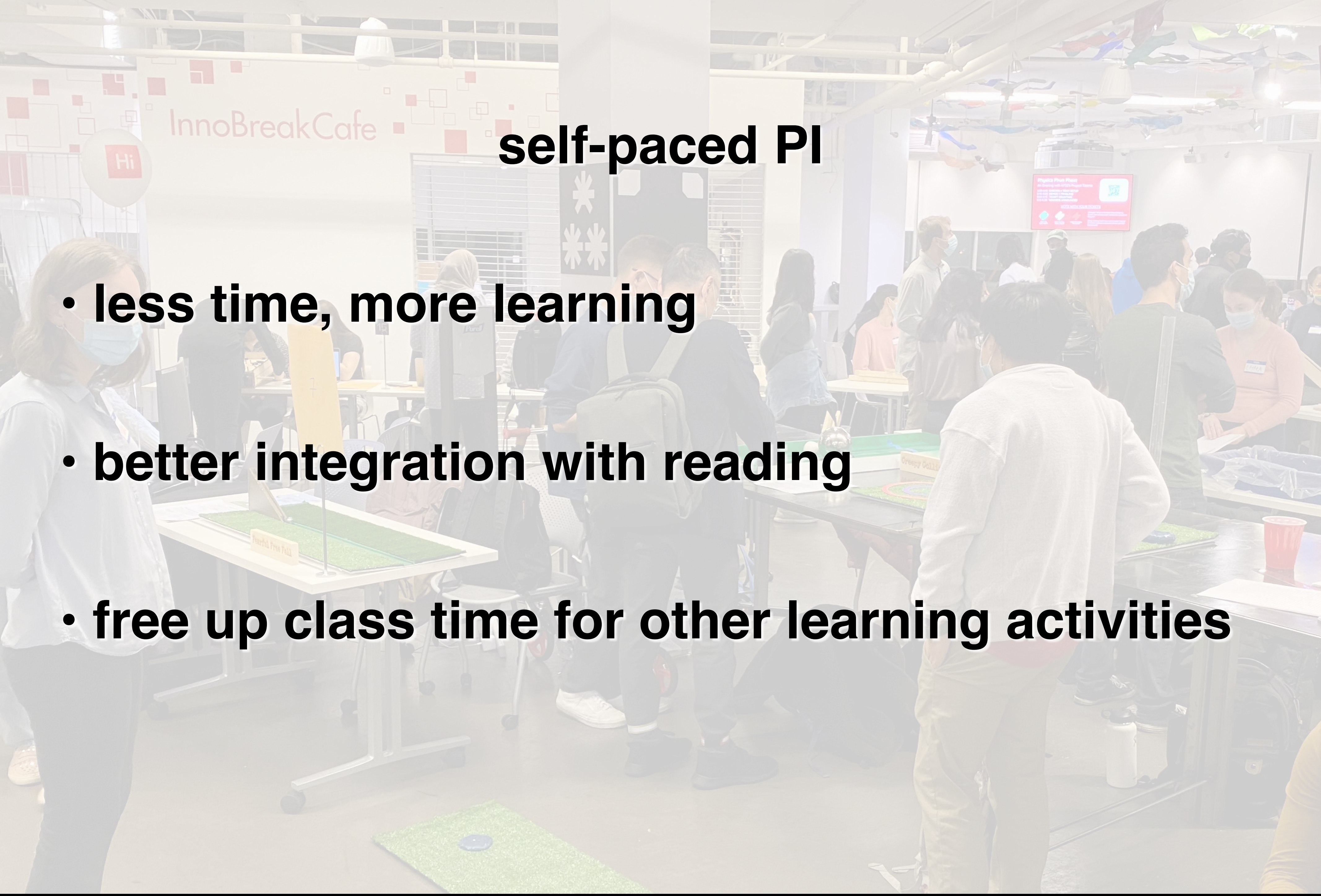


1 pandemic lessons **2 new normal** **3 self-paced PI**



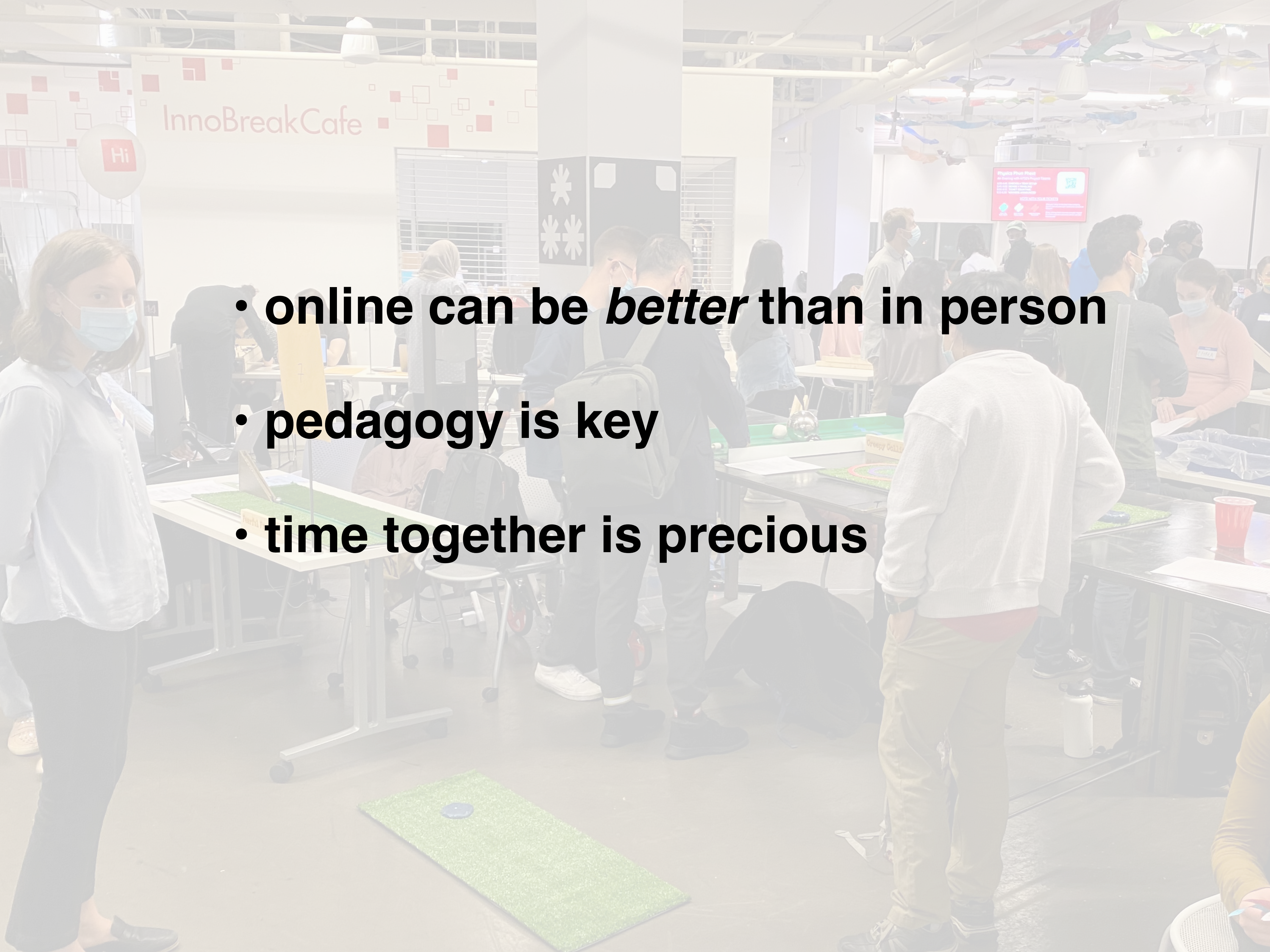
self-paced PI

- less time, more learning
- better integration with reading

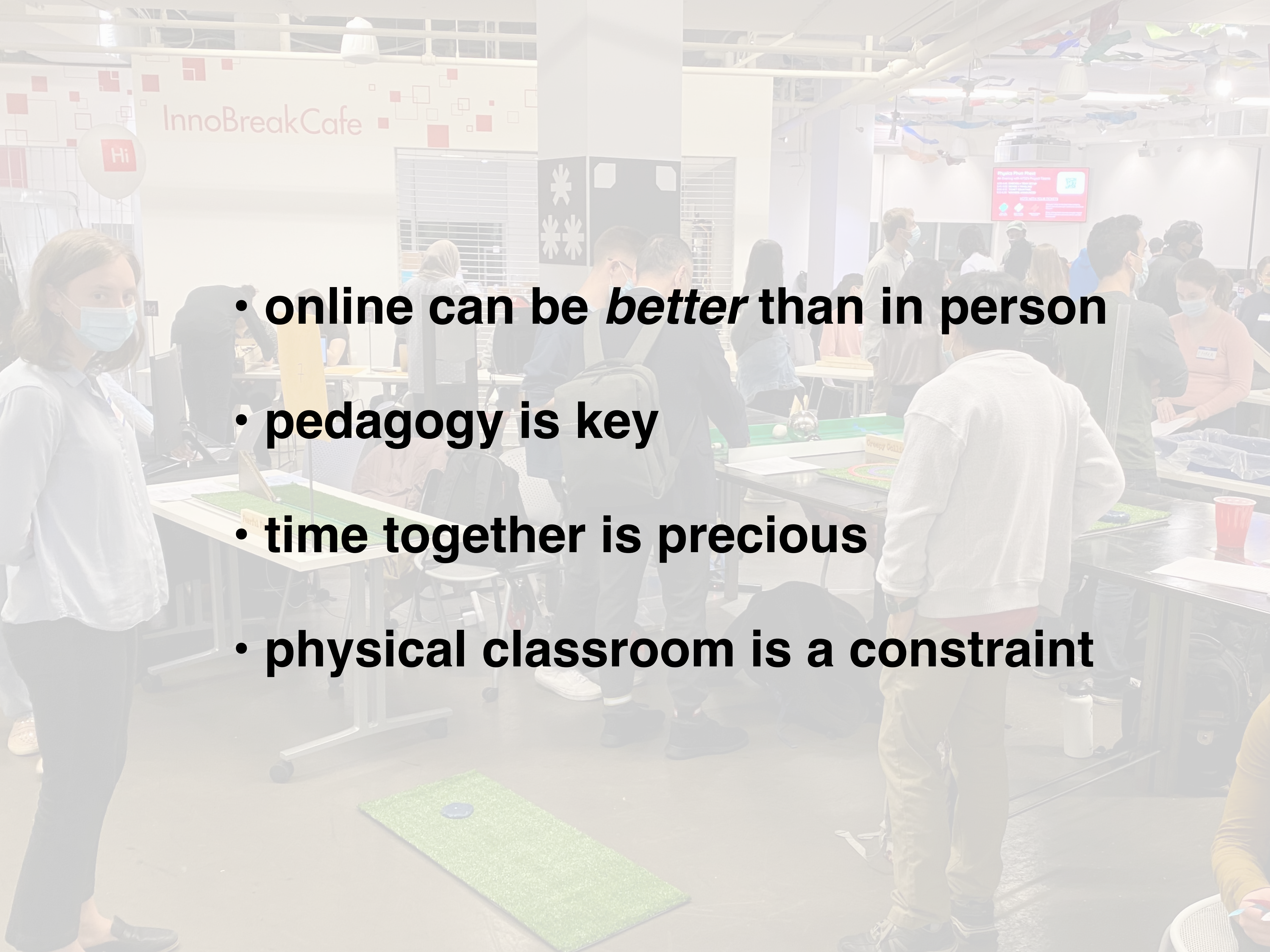


self-paced PI

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



- online can be *better* than in person
- pedagogy is key
- time together is precious



- online can be *better* than in person
- pedagogy is key
- time together is precious
- physical classroom is a constraint

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