

AP50: Lessons from pandemic teaching



Learning Incubator Lunch Discussion
Cambridge, MA, 13 September 2023

AP50: Lessons from pandemic teaching



@eric_mazur

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Cambridge, MA, 13 September 2023





Weekend long reads



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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

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-
-
-

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 years to come. They will shape not just our lives but the world we live in. 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.



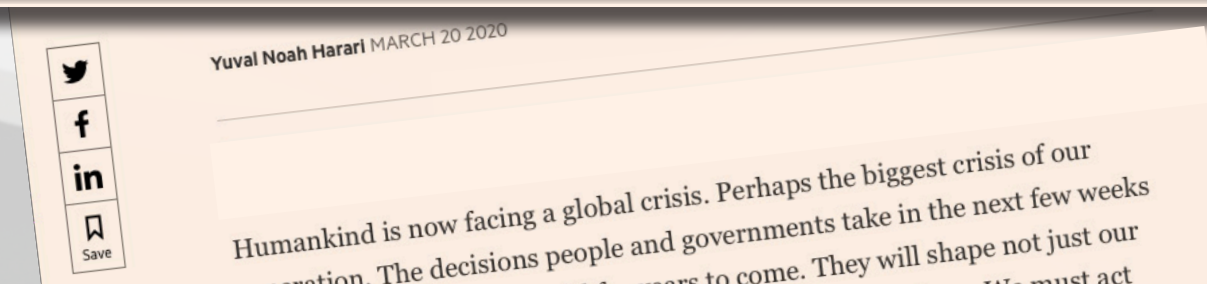


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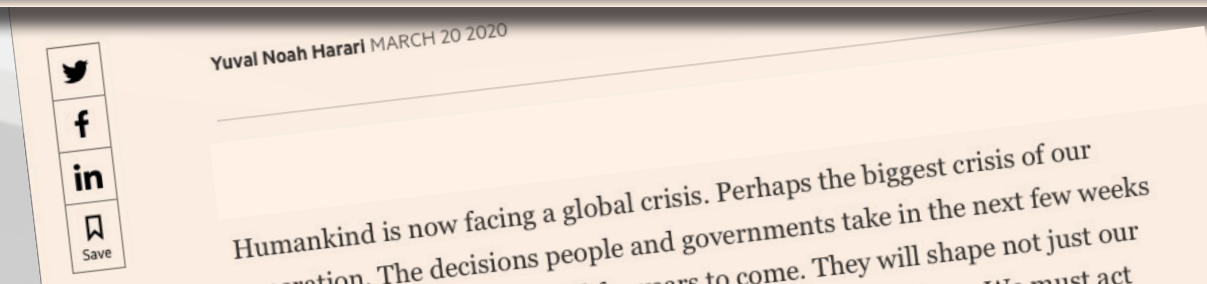


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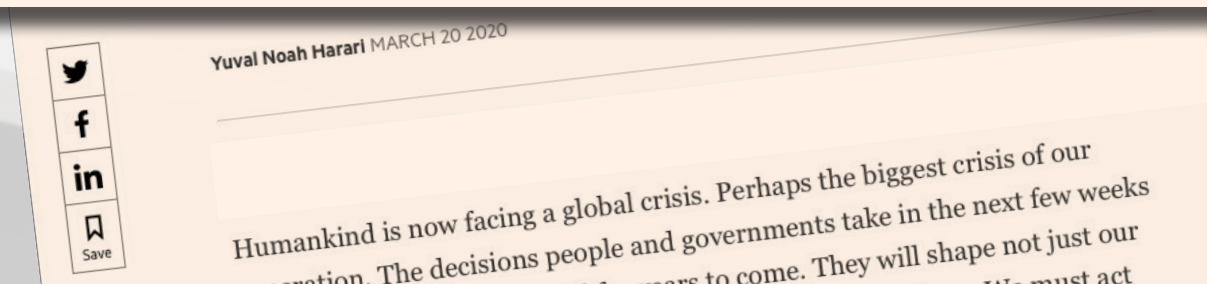




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Will online teaching become a fixture of life?

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.





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

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

A group of students is gathered around a white circular table in a classroom or computer lab. Several laptops are open on the table, and students are looking at the screens. In the background, other students are working at desks. The scene is brightly lit with natural light from windows. A large, bold, black text overlay is centered over the image.

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

class

**information
transfer**



home

sense-making

instructor-paced
synchronous
lecture

self-paced
asynchronous
homework/study

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

self-paced
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 students in a classroom or computer lab, with the text "Small wonder!" overlaid. The scene shows several students sitting at desks with laptops, engaged in various activities. In the foreground, a student is looking at a laptop screen displaying a website. Other students are visible in the background, some working on laptops and others talking. The overall atmosphere is one of active learning and collaboration.

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

home

**information
transfer**

self-paced
asynchronous
& **interactive**

class

sense-making

instructor-led
synchronous
& **interactive**



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

home

information
transfer

self-paced
asynchronous
& interactive

home

sense-making

instructor-led
synchronous
& interactive

class

sense-making

instructor-led
synchronous
& interactive

**fully
interactive**



1 pandemic lessons



1 pandemic lessons

2 new normal

Optimize instructional face-to-face time

A group of students in a classroom setting, focused on their laptops and engaged in discussion. The students are seated at a round table, with several laptops open in front of them. One student in the foreground is pointing at a laptop screen, while others look on attentively. The background shows more students working at desks, creating a busy, collaborative learning environment.

Optimize instructional face-to-face time

home

information
transfer

self-paced
asynchronous
& interactive

home

sense-making

instructor-led
synchronous
& interactive

class

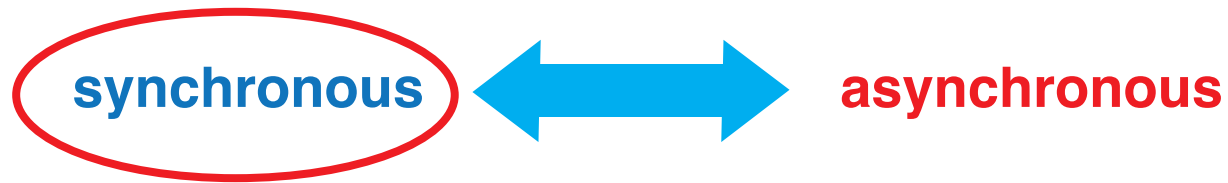
sense-making

instructor-led
synchronous
& interactive

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

synchronous



asynchronous

instructor-paced



self-paced

Optimize instructional face-to-face time

synchronous



asynchronous

instructor-paced



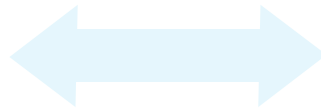
self-paced

everybody together
at the same *pace*

Optimize instructional face-to-face time

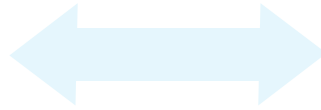
lecture

synchronous



asynchronous

instructor-paced

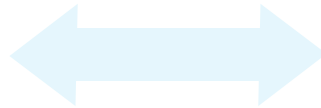


self-paced

Optimize instructional face-to-face time

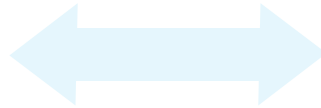
recorded lecture

synchronous



asynchronous

instructor-paced

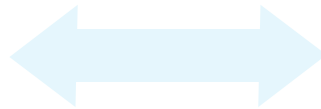


self-paced

Optimize instructional face-to-face time

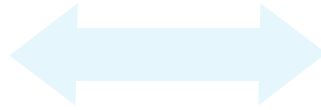
recorded lecture

synchronous



asynchronous

instructor-paced



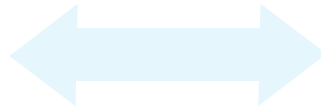
self-paced

1.5x!

Optimize instructional face-to-face time

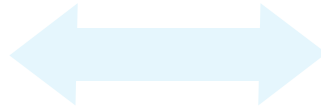
lab

synchronous



asynchronous

instructor-paced

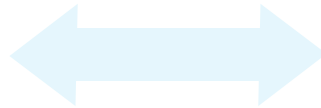


self-paced

Optimize instructional face-to-face time

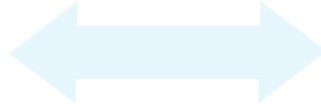
homework/study

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!**

A group of people are gathered around a table in a meeting room, working on laptops and looking at documents. The scene is brightly lit with large windows in the background. The text "Try this exercise!" is overlaid in the center of the image.

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



**team
work**

efficient team



**team
check**

quality control

synchronous

Establish continuous accountability

A group of people in a meeting room, some sitting at a table with laptops, others standing, engaged in a discussion. The scene is brightly lit, suggesting a modern office or classroom environment. The people are dressed in business casual attire. In the foreground, a woman is gesturing with her hand while talking to another woman. Several laptops are open on the table, and there are some papers and a small plant. The background shows other people working at desks.

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

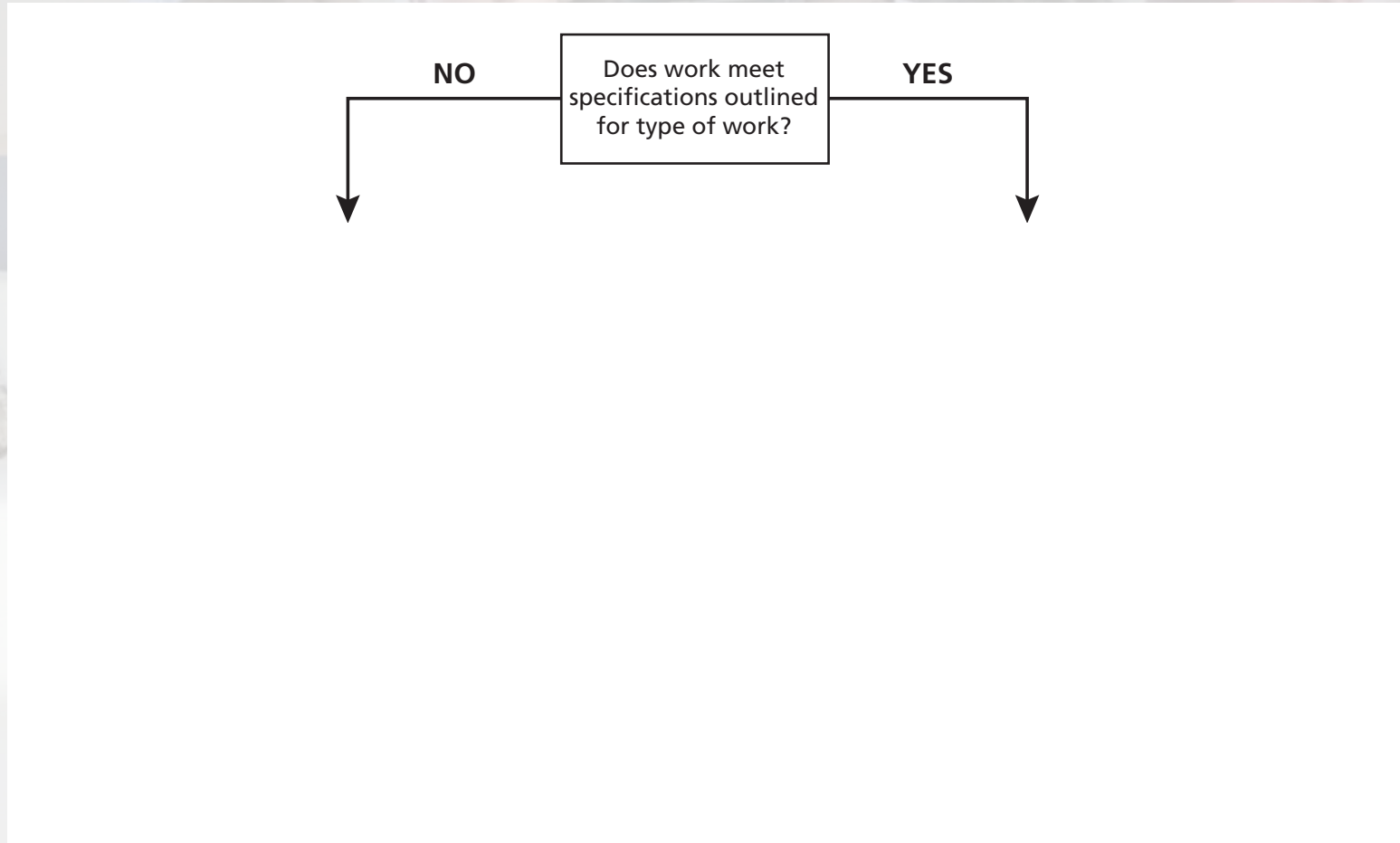


Establish continuous accountability

Specifications grading

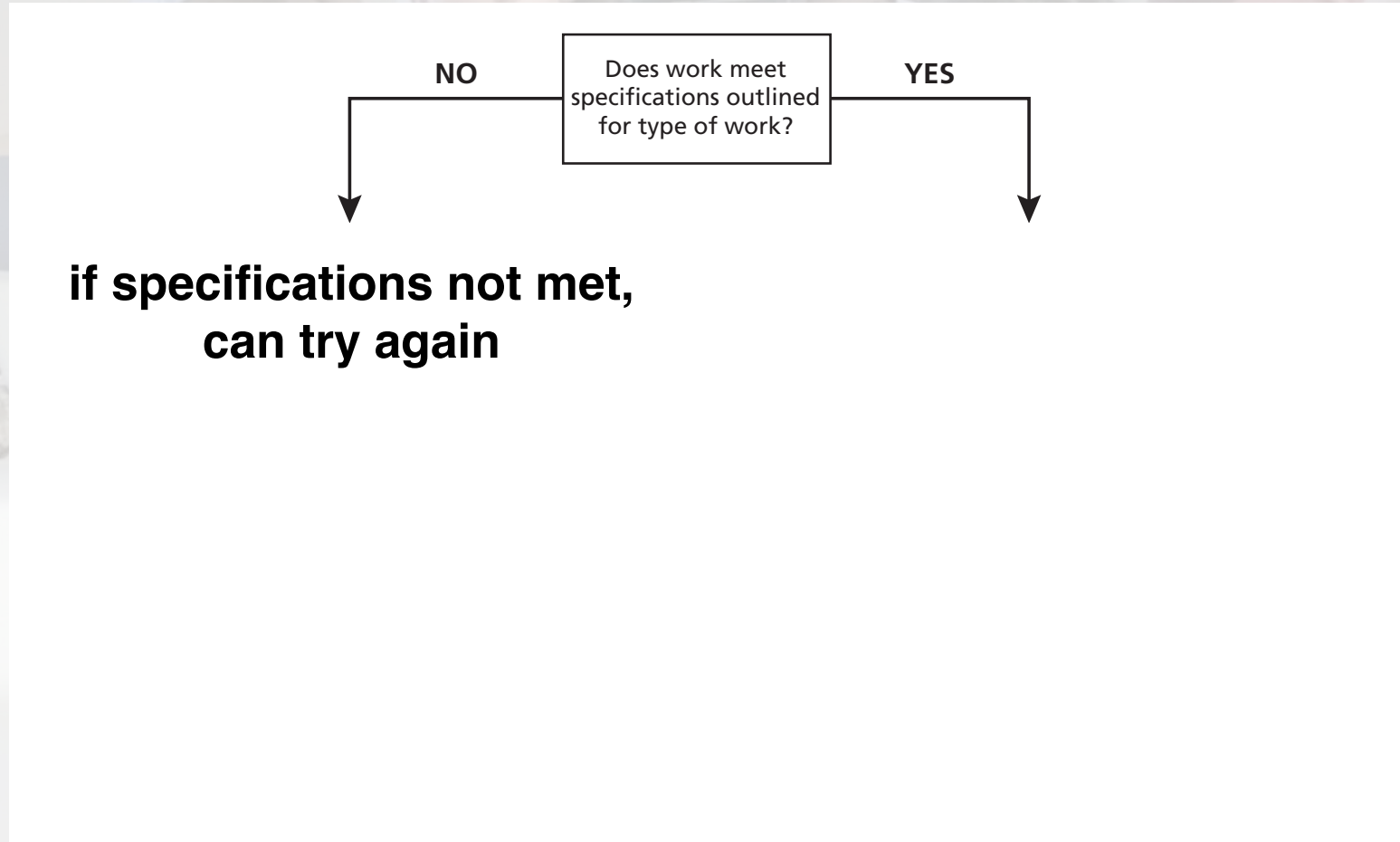
Inside Higher Ed, *Yes, Virginia, there is a better way to grade*

Establish continuous accountability



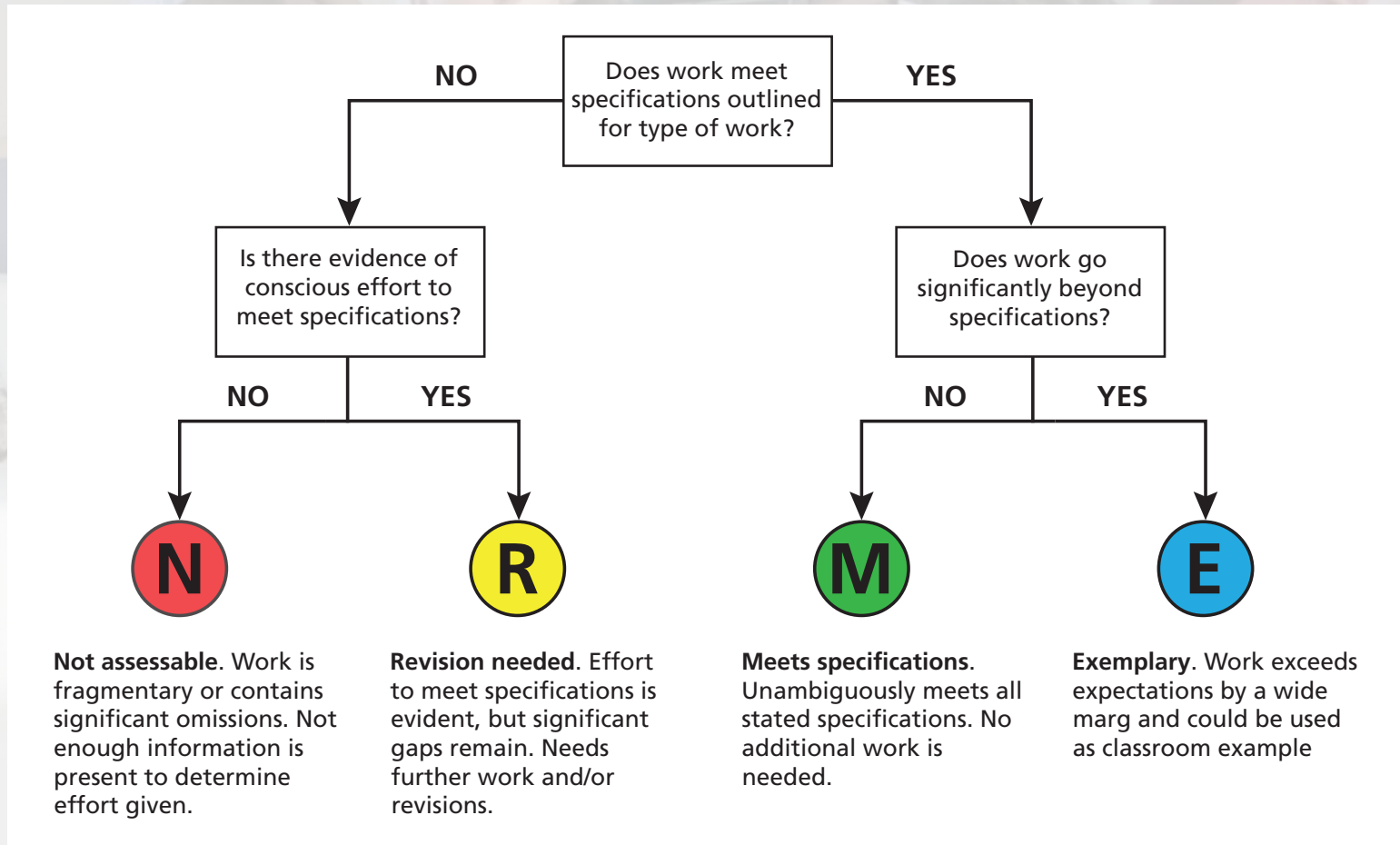
Inside Higher Ed, *Yes, Virginia, there is a better way to grade*

Establish continuous accountability



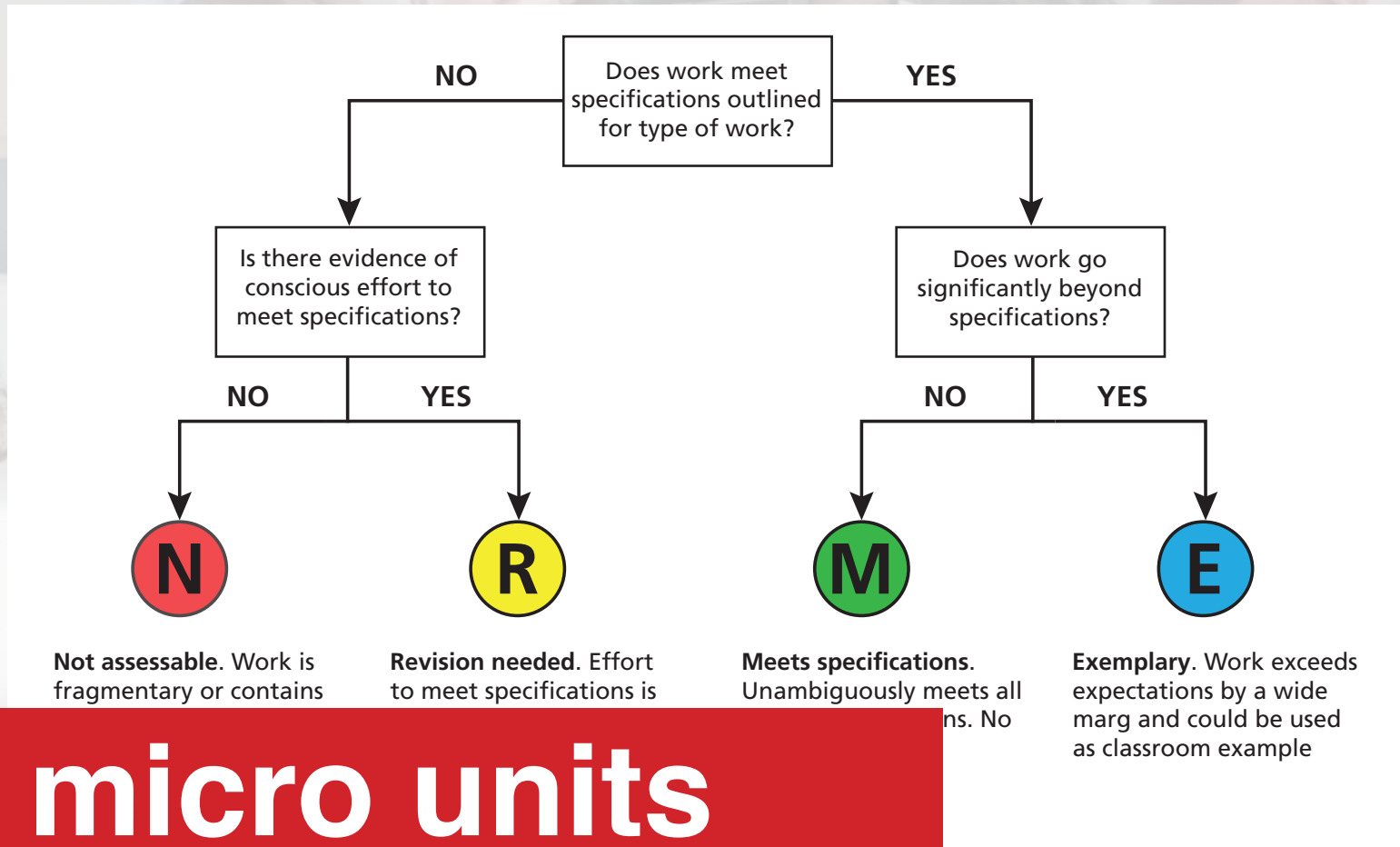
Inside Higher Ed, *Yes, Virginia, there is a better way to grade*

Establish continuous accountability



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

Establish continuous accountability

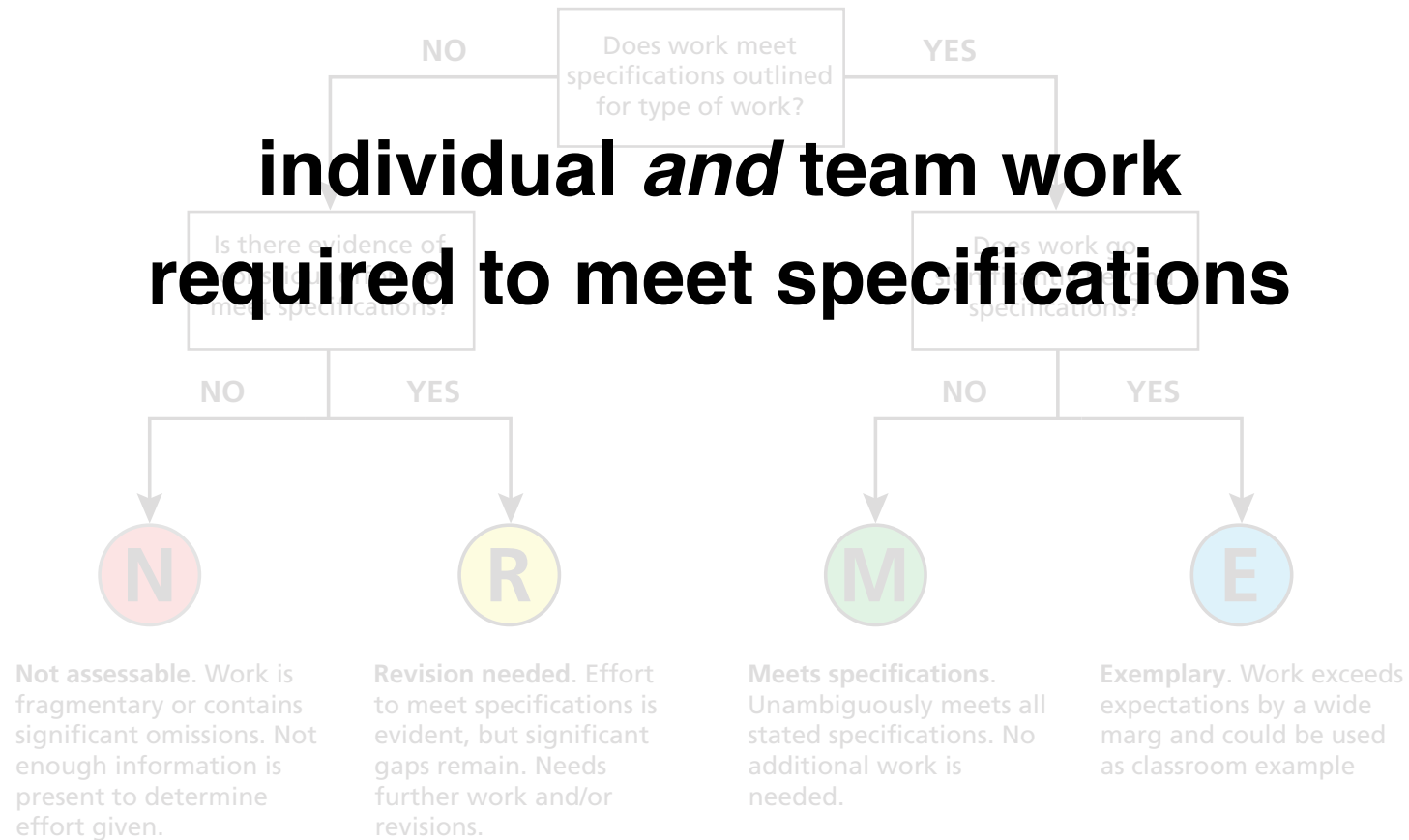


70 micro units

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 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...

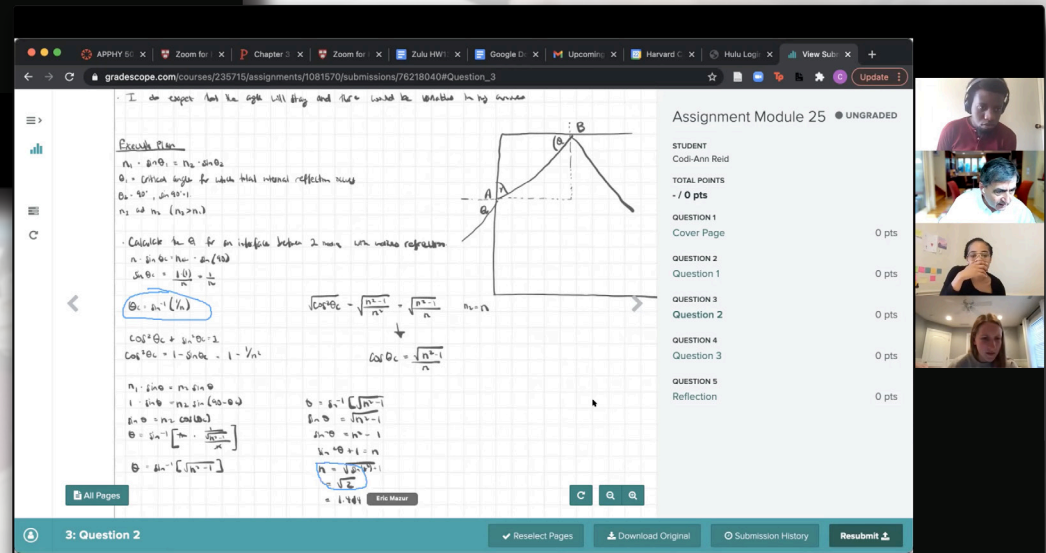
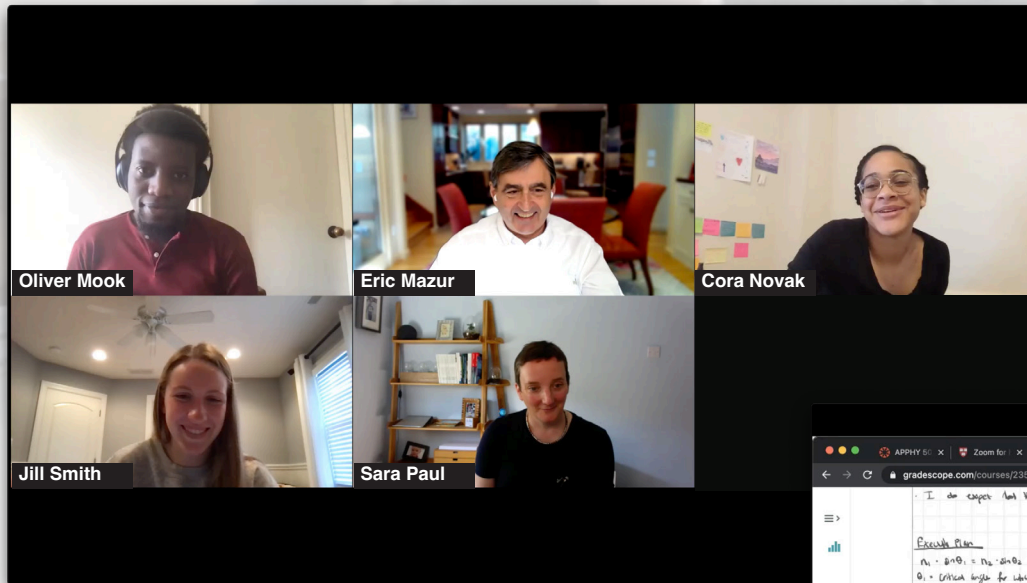
Shift ownership of learning space

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

A screenshot of a Gradescope assignment page. The page title is 'Assignment Module 25 • UNGRADED'. The student is 'Codi-Ann Reid'. The page shows handwritten mathematical work on a grid background. The work includes a diagram of a right-angled triangle with vertices A, B, and C, and a dashed line representing a reflection. The text includes: 'I do expect that the angle will flip and that could be useful to try mirror', 'Example 1: n1 = 2, n2 = 1, theta = 90 degrees', 'theta = critical angle for which total internal reflection occurs', 'n1 sin theta = n2 sin theta', 'n1 sin theta = n2 sin(90 degrees)', 'n1 sin theta = n2', 'sin theta = n2/n1 = 1/2', 'theta = arcsin(1/2) = 30 degrees', 'theta_c = arcsin(n2/n1) = arcsin(1/2) = 30 degrees', 'cos theta_c = sqrt(1 - sin^2 theta_c) = sqrt(1 - 1/4) = sqrt(3/4) = sqrt(3)/2', 'n1 sin theta = n2 sin theta', '1 sin theta = 2 sin(90 degrees)', 'sin theta = 2 sin(90 degrees)', 'theta = arcsin(2) = arcsin(2/1) = arcsin(2) = 90 degrees', 'theta = arcsin(2/1) = arcsin(2) = 90 degrees', 'theta = arcsin(2/1) = arcsin(2) = 90 degrees'. The page also shows a sidebar with a list of questions and their scores: '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'. The bottom of the page has a teal bar with '3: Question 2', 'Reselect Pages', 'Download Original', 'Submission History', and 'Resubmit'.

Shift ownership of learning space

every student on front row & address each by their name

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

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$
$$n_1 \sin 45^\circ = n_2 \sin \theta_2$$
$$n_2 \sin \theta_2 = n_1 \sin 45^\circ$$
$$\theta_2 = \sin^{-1} \left(\frac{n_1 \sin 45^\circ}{n_2} \right)$$
$$\theta_2 = \sin^{-1} \left(\frac{1.0 \sin 45^\circ}{1.5} \right)$$
$$\theta_2 = \sin^{-1} \left(\frac{0.707}{1.5} \right)$$
$$\theta_2 = \sin^{-1} (0.471)$$
$$\theta_2 = 28.1^\circ$$

$$\cos^2 \theta_2 + \sin^2 \theta_2 = 1$$
$$\cos^2 \theta_2 = 1 - \sin^2 \theta_2 = 1 - \left(\frac{1}{\sqrt{2}} \right)^2$$
$$\cos^2 \theta_2 = 1 - \frac{1}{2} = \frac{1}{2}$$
$$\cos \theta_2 = \frac{1}{\sqrt{2}}$$
$$\theta_2 = \cos^{-1} \left(\frac{1}{\sqrt{2}} \right) = 45^\circ$$

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$
$$1 \sin \theta_1 = 1.5 \sin (45^\circ - \theta_1)$$
$$\sin \theta_1 = 1.5 \sin (45^\circ - \theta_1)$$
$$\sin \theta_1 = 1.5 \left[\sin 45^\circ \cos \theta_1 - \cos 45^\circ \sin \theta_1 \right]$$
$$\sin \theta_1 = 1.5 \left[\frac{\sqrt{2}}{2} \cos \theta_1 - \frac{\sqrt{2}}{2} \sin \theta_1 \right]$$
$$\sin \theta_1 = \frac{3\sqrt{2}}{2} \cos \theta_1 - \frac{3\sqrt{2}}{2} \sin \theta_1$$
$$\sin \theta_1 + \frac{3\sqrt{2}}{2} \sin \theta_1 = \frac{3\sqrt{2}}{2} \cos \theta_1$$
$$\sin \theta_1 \left(1 + \frac{3\sqrt{2}}{2} \right) = \frac{3\sqrt{2}}{2} \cos \theta_1$$
$$\tan \theta_1 = \frac{3\sqrt{2}}{2 + \sqrt{2}}$$
$$\theta_1 = \tan^{-1} \left(\frac{3\sqrt{2}}{2 + \sqrt{2}} \right)$$
$$\theta_1 = \tan^{-1} (3.464)$$
$$\theta_1 = 73.9^\circ$$



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

1 pandemic lessons

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

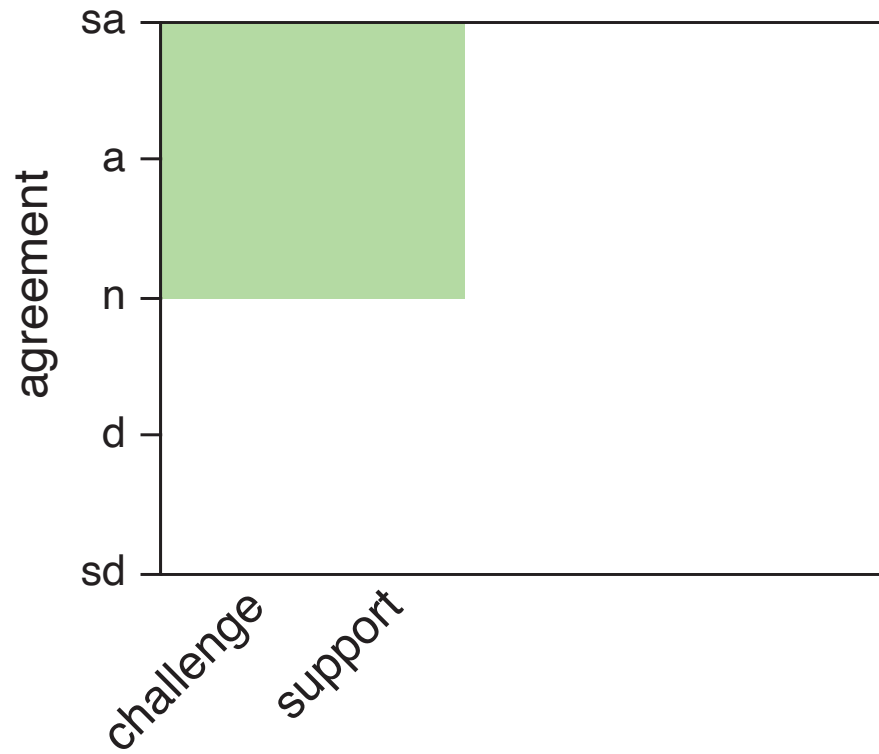
2. I had plenty of support

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

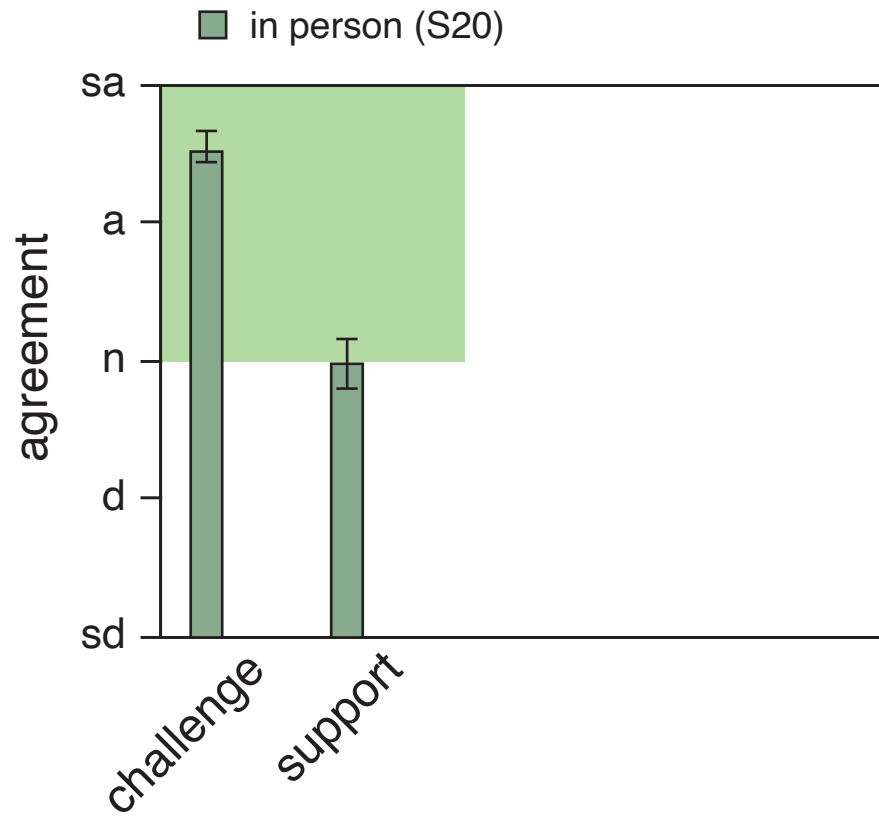
4. I made progress because of my own efforts and choices

5. I felt I was part of a community of learners

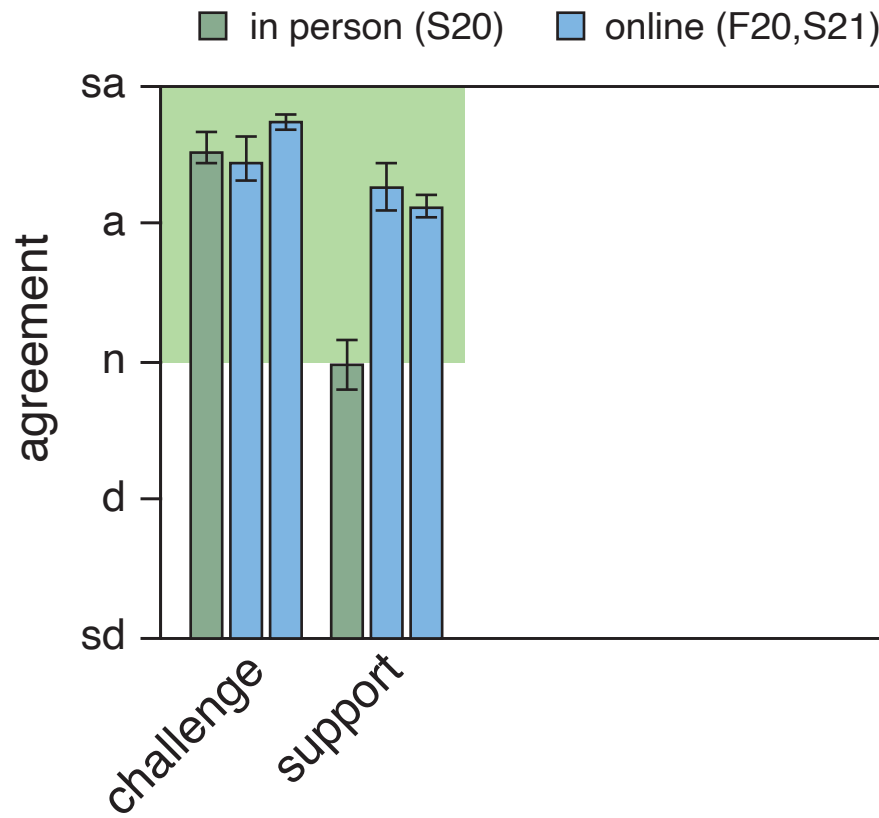
challenge vs. support



challenge vs. support



challenge vs. support





self-determination

1. I was challenged intellectually (challenge)

2. I had plenty of support (support)

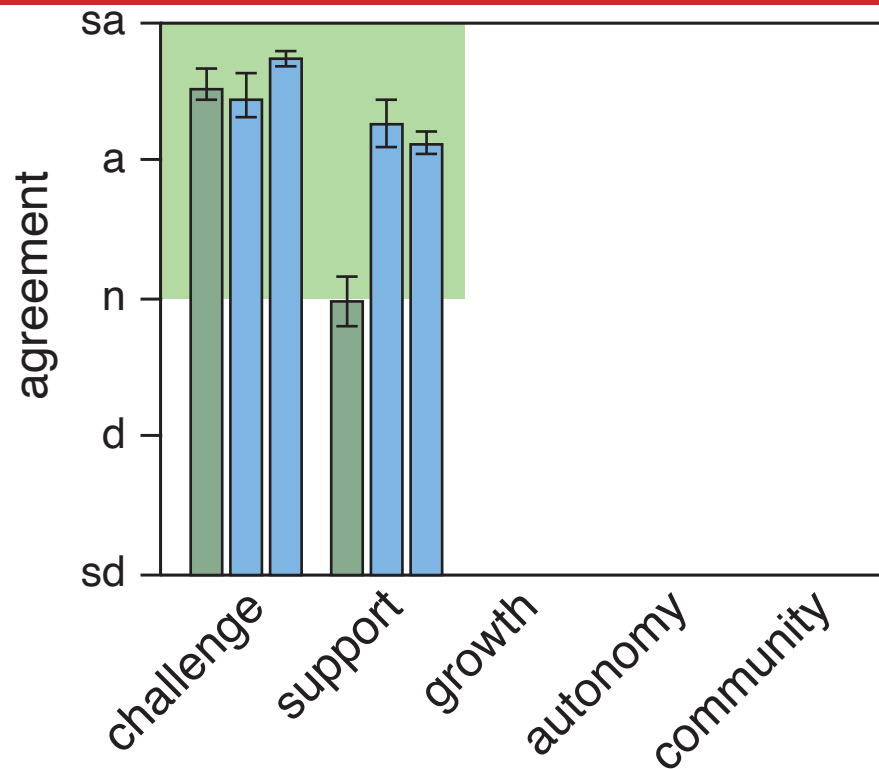
3. I am closer to mastering the ideas of the course now (growth)

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

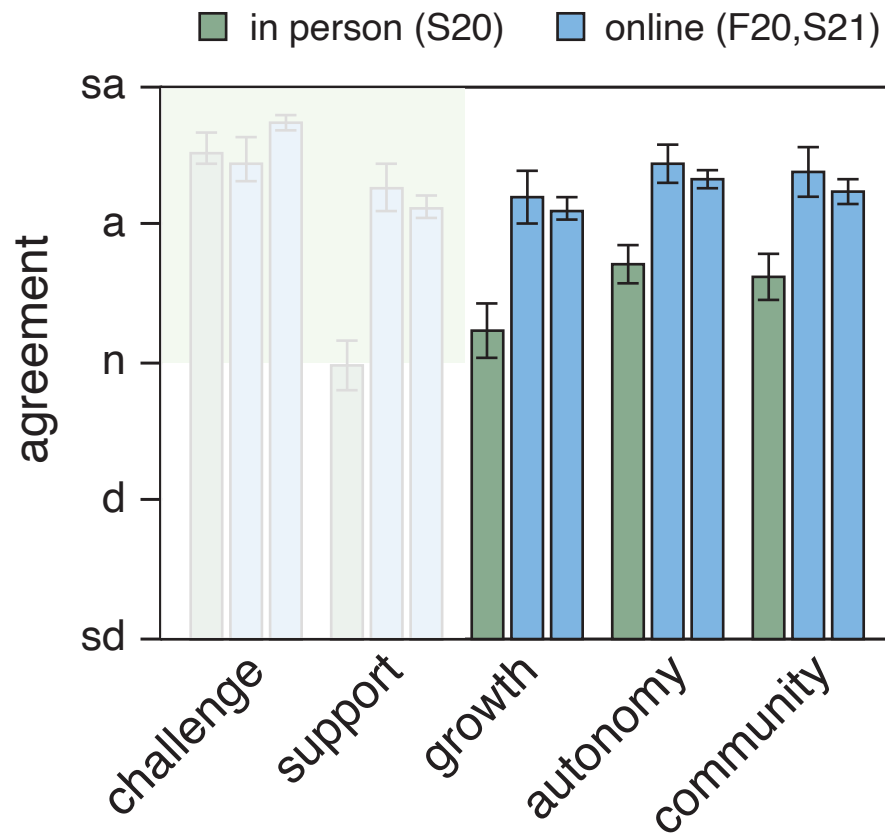
5. I felt I was part of a community of learners (relatedness)

self-determination

What do you predict?



self-determination





I did my best teaching *ever* online!

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



1 pandemic lessons

2 new normal

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

practical work

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

tutorial

challenge

practical work

skills session

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

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

tutorial

challenge

practical work

skills session

project work

replaces lectures

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

replaces lectures

tutorial

using a social learning platform

practical work

skillsession

project work

1 pandemic lessons

2 new normal

weekly workflow

content module

practical work

reading

skillsession

readiness assurance

replaces lectures

tutorial

project work

using a social learning platform

Perusall

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

strengthen basic knowledge

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

tutorial

challenge

practical work

skillsession

project work

**strengthen basic knowledge
through self-paced Peer Instruction**

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

resolve common misconceptions

1 pandemic lessons

2 new normal

weekly workflow

content module

reading

readiness assurance

tutorial

challenge

practical work

skills session

project work

1 pandemic lessons

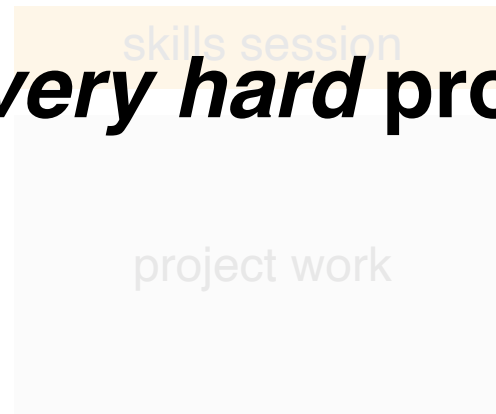
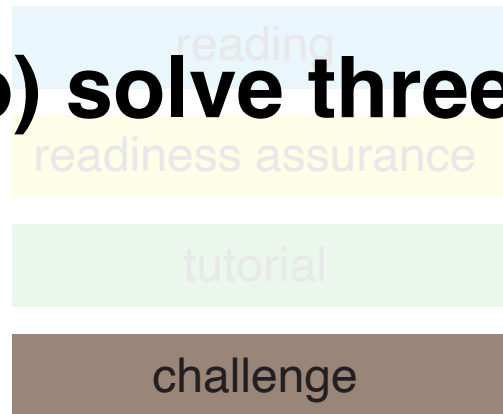
2 new normal

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)

challenge

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

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

practical work

reading

ONLINE

readiness assurance

tutorial

challenge

FLEX SPACE

skills session

project work

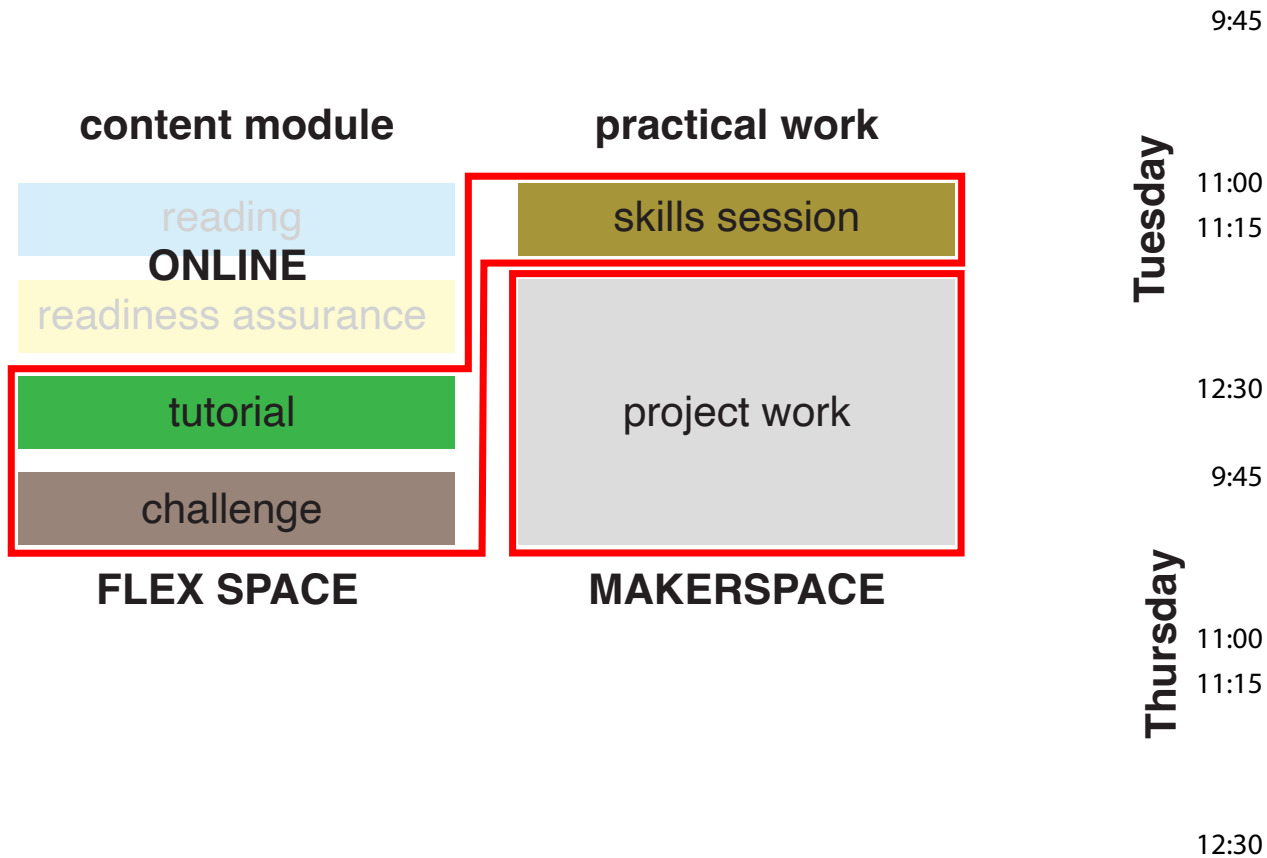
MAKERSPACE

1 pandemic lessons

2 new normal

InnoBreakCafe

learning space

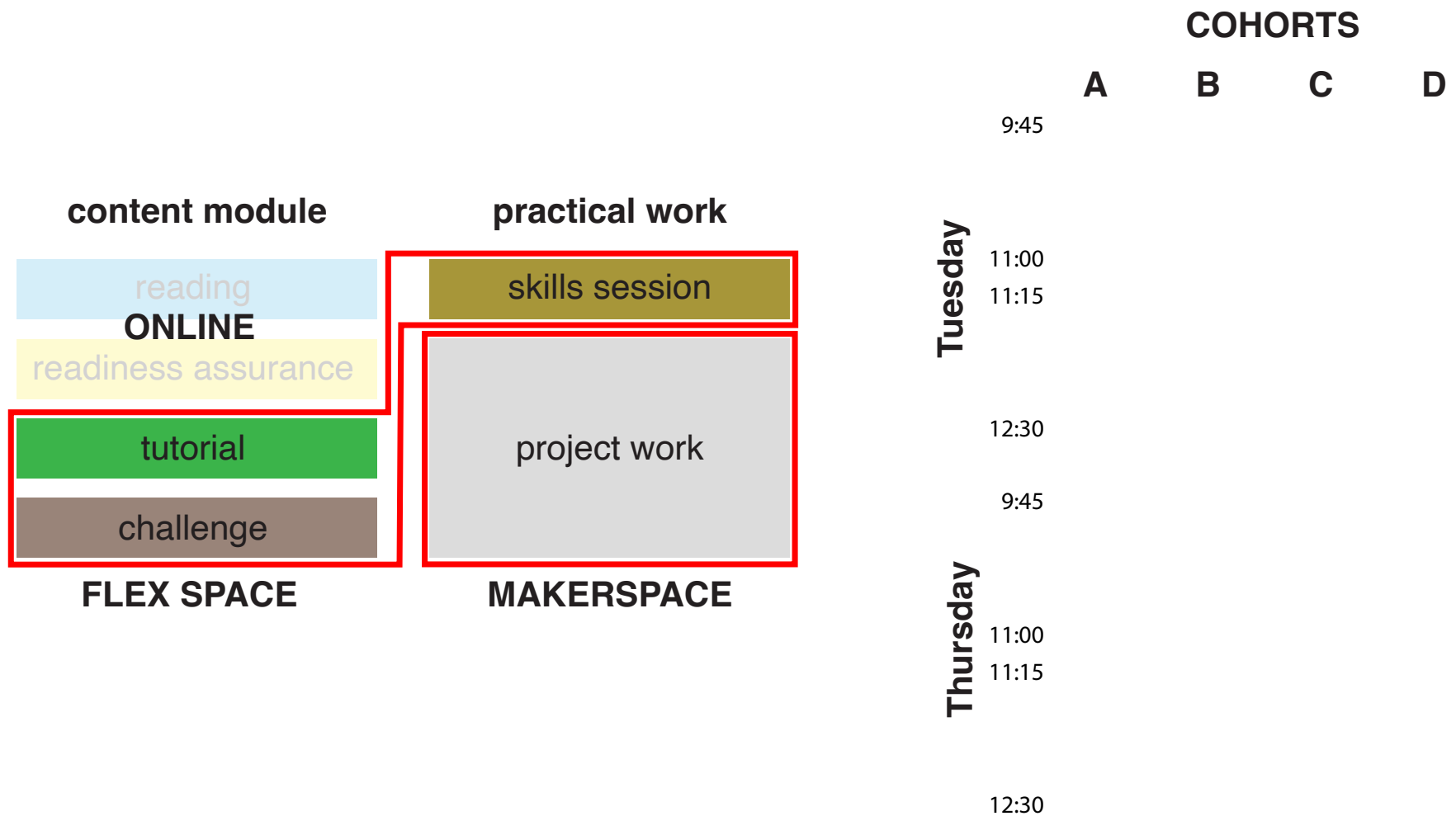


1 pandemic lessons

2 new normal

InnoBreakCafe

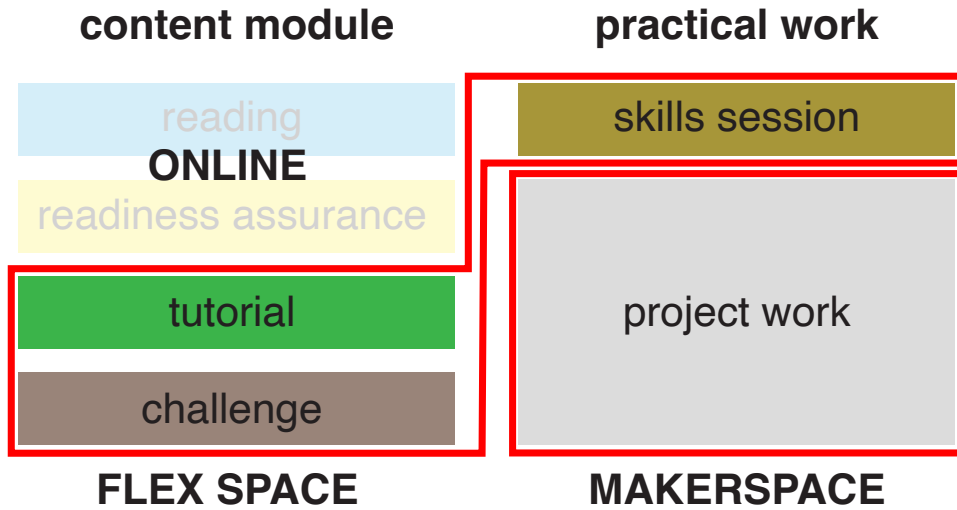
learning space



1 pandemic lessons

2 new normal

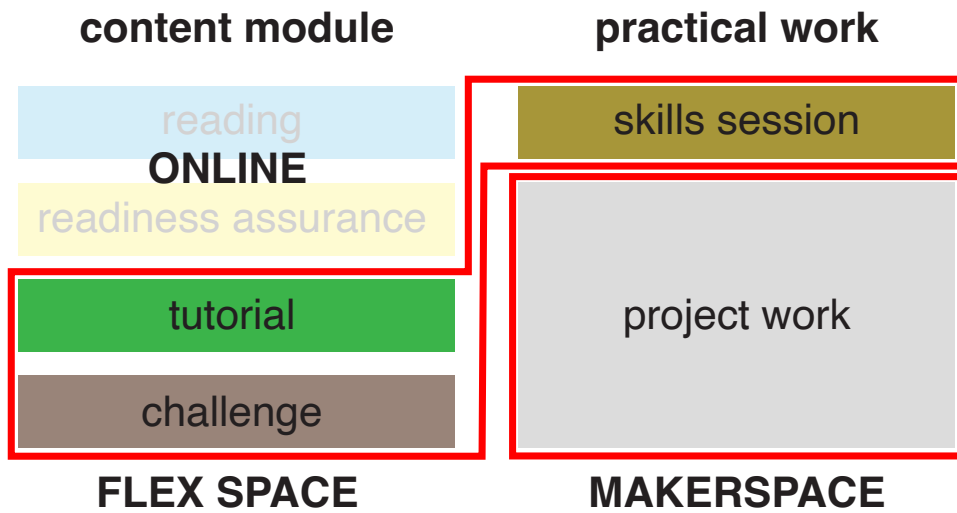
learning space



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
Thursday	12:30			
	9:45			
	11:00			
	11:15			
12:30				

learning space



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



“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

InnoBreakCafe

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course Canvas page: bit.ly/erics_course

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