

From: Jo Boaler joboaler@stanford.edu
Subject: FW: a letter regarding the Proposed Framework
Date: October 1, 2021 at 6:10 AM
To: Gould, Robert rgould@stat.ucla.edu

JB

Dear Rob,

I got a call from Linda D-H last night who told me she has received the attached letter from Stanford mathematicians, and Patrick Callaghan (which surprised me). Would you have any time to look at it? I think it is a push back on the UC/CSU decision that students can take data science instead of algebra 2....

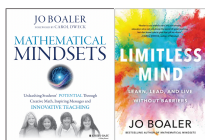
They argue that students taking data science in college need to take calculus, and other things,

Thanks, Jo

** My working day is probably different from yours. Please don't feel obliged to reply to this e-mail outside of your working hours**

Jo Boaler she/her
The Nominelli-Olivier Professor of Education (Mathematics)
Stanford Graduate School of Education,
CERAS
520 Galvez Mall
Stanford University, CA 94305-3009

joboaler@stanford
[@joboaler](#)



From: Linda Darling-Hammond <ldh@learningpolicyinstitute.org>
Date: Thursday, September 30, 2021 at 6:37 PM
To: Jo Boaler <joboaler@stanford.edu>
Subject: FW: a letter regarding the Proposed Framework

Here is the letter from Rafe and colleagues. I think the most useful part is the list of topics (some of which are actually mathematical dispositions or practices), which are needed for students pursuing a quantitative major in college. Apparently they talked to a variety of folks in these majors at Stanford to come up with the list and felt it would add to the specificity that could be offered for the top of the sequence in the data science pathway. I think it probably is relevant across pathways. I think perhaps augmenting this with the rest of a topics list (including what you had started to outline for high school math in the big topics discussion) might be a way to say a) what everyone should experience in high school math in some fashion and b) what those who are pursuing quantitative careers should include. It might avoid having to play out the content of every course in every

should include. It might avoid having to play out the content of every course in every pathway. What do you think?

Great to talk to you. I will keep your niece and family in my thoughts and prayers.

Best, Linda



CAMF topic
guidance.docx

From: (null)
Subject: Re: FW: a letter regarding the Proposed Framework
Date: October 1, 2021 at 8:48 AM
To: Jo Boaler joboaler@stanford.edu

Well, this is more measured than I feared!

Initial thoughts:

- 1) This might be a good time to bring in Uri Treisman. the Dana Center has done much more diligent work on this topic than the letter-writers. (And Roxy, Jessica Utts and I co-authored a paper on the math the students need to student college-level introductory stats
- 2) It would be a more meaningful statement if their list included practicing data scientists (not researchers). The initial descriptions I all agree with..if you intend to major in data science and be prepared to go to grad school for research. Evan might be helpful here.
- 3) The Park City Math Institute did a Data Science year a few years back and we co-wrote a paper that includes what math is needed for a DS college career (ttached).
- 4) They're right to some extent. We call DS an "intro" course because there's LOTS you can do without the math they mention, and that stuff is more important (in my humble opinion) than the math. In addition, that stuff is difficult, challenging, and subtle and takes practice and time to be learned. One course isn't enough. And so I hope our IDS students go to college and take another intro course, which will go a bit deeper, but also strengthen what they know. Then they're ready for "citizenship" (or at least tentatively ready). those who wish to major in that or a related field will need more math.
- 5) This paper downplays the significance of linear algebra. Really, there should be a "pathway to linear algebra", and calculus can be a nice theory-based class to show how some computations are performed. Calculus methods are important for understanding the theory behind data science, but only those who will have careers in data analysis need this theory, and most of them dont' need it at the level of a mathematician or data scientist.

Thanks for shouldering this burden! This is a cantankerous group, fighting for relevance.

One of my concerns with nestling data science in the math curriculum is that it forces a false choice between data science and calculus. I think we need to repeat again and again : All students need data science; some need calculus.

Rob

Vice-chair, Undergraduate Studies, Dept. of Statistics
Vice-president, International Association of Statistics Education, <http://iase-web.org/>
Founder, ASA DataFest

On October 1, 2021 at 6:10:3

9 AM, Jo Boaler (joboaler@stanford.edu) wrote:

Dear Rob,

I got a call from Linda D-H last night who told me she has received the attached letter from Stanford mathematicians, and Patrick Callaghan (which surprised me). Would you have any time to look at it? I think it is a push back on the UC/CSU decision that students can take data science instead of algebra 2....

They argue that students taking data science in college need to take calculus, and other things,

From: Gould, Robert rgould@stat.ucla.edu

Subject: Re: Area C

Date: October 5, 2020 at 9:21 AM

To: Pamela Burdman pamelaj@justequations.org, Gould, Robert rgould@stat.ucla.edu

Cc: Brown, Kyndall kbrown@gseis.ucla.edu, Chad Dorsey cdorsey@concord.org, Jo Boaler joboaler@stanford.edu, Suyen Machado suyen@mobilizingcs.org, Zarek Drozda zarekd20@uchicago.edu, Francois, Annamarie francois@gseis.ucla.edu, Priselac, Jody Z. priselac@gseis.ucla.edu

RG

Thanks!

Robert Gould
Vice-chair, Undergraduate Studies, Dept. of Statistics
Founder, DataFest

On October 5, 2020 at 9:19:45 AM, Pamela Burdman (pamela@justequations.org) wrote:

From Monica:

“Not quite ready for public announcement, as I need to meet with staff to address short- and long-term plans for addressing these changes.”

Pam

Sent from my iPhone

On Oct 4, 2020, at 9:28 AM, Gould, Robert <rgould@stat.ucla.edu> wrote:

My apologies. Hopefully it came through this time.

And please don't disseminate until I hear word.

Best,
Rob

Robert Gould
Vice-chair, Undergraduate Studies, Dept. of Statistics
Founder, DataFest

On October 4, 2020 at 5:01:33 AM, Chad Dorsey (cdorsey@concord.org) wrote:

Rob,

This is wonderful news indeed! For interest's sake, could you attach the policy you referred to? I think it got left off the original message.

--Chad

On Sat, Oct 3, 2020 at 1:47 PM Gould, Robert <rgould@stat.ucla.edu> wrote:

Dear Friends and Colleagues,

I received good news this morning. BOARS, the committee that sets UC-wide policy for determining which high school math courses "validate" others, has approved a revision that will make it very clear that data science courses validate algebra II. This will be binding for the Cal State system as well. I've attached the policy.

Our recent discussions have been laced with some irony, if that's the right word, since, as we're

Our recent discussions have been laced with some irony, if that's the right word, since, as we're moving full-steam ahead towards a data-science-rich future in California, there was a real possibility that IDS and other stats courses would be stripped of their ability to "validate" algebra II. As a consequence, these courses would be relegated to non-college pathways. Monica Lin put together an ad-hoc committee that included near-equal proportions of statisticians (me, Jessica Utts, and Deb Nolan) and rightminded mathematicians (to be a bit editorial), and we drafted a new policy. There was a very real chance it would not be approved and, I venture, had this been proposed 5 years ago it would not have. But in fact, apparently members thanked the proposal for helping address problematic issues with the "calculus pathway".

I should caution, though, that when our ad-hoc committee met, there was some confusion as to whether BOARS could revise the policy or whether it would require subsequent approval from the statewide academic senate. I believe that the plan is to move ahead as if BOARS has the right, and see if it is challenged, since the attempts at researching this were ambiguous. But that's my understanding only, and Monica Lin has a stronger understanding. I'll seek clarification.

Here's a bit of history, as I recall it...

The "old" policy was established so that if an advanced student passed calculus but skipped Algebra II, she would be required to take Algebra II since she had established that she knew the material well enough to take the next course.

Later, statistics courses were established that "required" algebra II. Under the old policy, if a student passed that course, they would "validate" algebra II since the stats course required algebra II. But, in fact, few, if any, of those courses actually relied on material in algebra II. Somehow, the existence of these courses created a revision that included "statistics" as courses that validated algebra II, but it did not mention whether or not such courses needed to list algebra II as a requisite.

IDS (and I believe a couple of other courses) received validation under the "statistics policy". But this was challenged by several cal state campuses who, in fact, tried actively to undermine it. Their claim was that the strict interpretation of the policy meant that to validate algebra II your course either had to teach the content of algebra II or require the content of algebra II. There are enough old guards out there in the UC math system that a serious challenge to revising the policy was a real possibility. In fact, in our ad-hoc committee, some of the mathematicians expressed concerns that some colleague would not be happy with the change. So it is particularly gratifying, and a great relief, to think we can proceed knowing that the data-pathway is secure. I'm also impressed it happened so soon, since we were expecting this discussion to stretch beyond the first meeting. So BOARS must have had strongly positive feelings!

Best,
Rob

From: Gould, Robert rgould@stat.ucla.edu
Subject: Re: *Urgent* – Data science education suggestions for the Biden administration – can we add your name?
Date: December 1, 2020 at 8:18 AM

To: Ji Yun Son [REDACTED], Suyen Machado suyen@mobilizingcs.org, Michelle Mann michelle.mann@netapp.com, Kumar Garg kgarg@schmidtfutures.com, Melodie Baker melodie@justequations.org, Evan Shieh e [REDACTED], THOMPSON Tom - ODE tom.thompson@state.or.us, Jo Boaler joboaler@stanford.edu, Rebekah Elliott elliottr@science.oregonstate.edu, Anne Stanton astanton@linkedlearning.org, Inbaucom@uncg.edu, cathyw11@stanford.edu, Monica Lin monica.lin@ucop.edu, Michelle Hoda Wilkerson mwilkers@berkeley.edu, Zarek Drozda zarekd20@uchicago.edu, Francesca Denise Henderson fdh@umd.edu, Monica Casillas monica@idsucla.org, Pamela Burdman pamela@justequations.org, Chad Dorsey cdorsey@concord.org, Callahan, Patrick J [REDACTED], Sharon Hessney [REDACTED], Harshil Parikh hsparikh@tuvalabs.com, Deborah NOLAN deborah_nolan@berkeley.edu, Madeline Ahearn mahearn@lesd.k12.or.us, Recio, Josh josh.recio@austin.utexas.edu, Erica Heinzman eheinzman@ucsd.edu, Gould, Robert rgould@stat.ucla.edu, Rachel Levy [REDACTED], Matthew Spengler mspengler@blueprintschools.org, Jason Zimba jzimba@studentsachieve.net, Anne Gallagher [REDACTED], Martinez Alexandra amartinez9@sandi.net
Cc: Sarah Curtis scurtis@concord.org, Ulrich Boser ulrich@the-learning-agency.com, Chad Dorsey cdorsey@concord.org

Thanks, Zarek,
I responded 'yes' to Chad already.
Rob

Robert Gould
Vice-chair, Undergraduate Studies, Dept. of Statistics
Founder, DataFest

On November 30, 2020 at 8:44:14 PM, Zarek Drozda (zarekd20@uchicago.edu) wrote:

To clarify, requesting you **CC everyone listed in the CC field (Chad, Sarah, Ulrich) when replying to this email**—sorry for any confusion.

Thanks everyone,

Zarek

--

Zarek Drozda

Center for RISC

The University of Chicago

Cell: (612) 325-1460

From: Zarek Drozda <zarekd20@uchicago.edu>
Date: Monday, November 30, 2020 at 12:02 PM
To: Martinez Alexandra <amartinez9@sandi.net>, THOMPSON Tom - ODE <tom.thompson@state.or.us>, Madeline Ahearn <mahearn@lesd.k12.or.us>, "Recio, Josh" <josh.recio@austin.utexas.edu>, Erica Heinzman <eheinzman@ucsd.edu>, Matthew Spengler <mspengler@blueprintschools.org>,

Monica Lin <Monica.Lin@ucop.edu>, Suyen Machado <suyen@mobilizingcs.org>, Harshil Parikh <hsparikh@tuvalabs.com>, Chad Dorsey <cdorsey@concord.org>, Rachel Levy [REDACTED], Pamela Burdman <pamela@justequations.org>, Jo Boaler <joboaler@stanford.edu>, Jason Zimba <jzimba@studentsachieve.net>, Ji Yun Son [REDACTED], [REDACTED], Francesca Denise Henderson <fdh@umd.edu>, Melodie Baker <melodie@justequations.org>, "cathyw11@stanford.edu" <cathyw11@stanford.edu>, Monica Casillas <monica@idsucla.org>, "Gould, Robert" <rgould@stat.ucla.edu>, Anne Gallagher [REDACTED], Evan Shieh [REDACTED], Deborah NOLAN <deborah_nolan@berkeley.edu>, Rebekah Elliott <Elliotttr@science.oregonstate.edu>, Michelle Hoda Wilkerson <mwilkers@berkeley.edu>, Anne Stanton <astanton@linkedlearning.org>, "Inbaucom@uncg.edu" <Inbaucom@uncg.edu>, Kumar Garg <kgarg@schmidtfutures.com>, Michelle Mann <Michelle.Mann@netapp.com>, Sharon Hessney [REDACTED]

Cc: Chad Dorsey <cdorsey@concord.org>, Sarah Curtis <scurtis@concord.org>, Ulrich Boser <ulrich@the-learning-agency.com>

Subject: *Urgent* – Data science education suggestions for the Biden administration – can we add your name?

Hi all,

Folks at Schmidt Futures and the Learning Agency have drafted some policy recommendations for the next administration. Later this week, a letter will be sent to the incoming Biden administration recommending actions that would promote K-12 data science education. We're forwarding this in hopes of gaining as many significant signatures as possible before it gets passed on to the administration later this week, and this group of course represents some of the lead crusaders.

The letter is attached for you to review. All that's needed is to **reply to this message by this Wednesday, Dec. 2** confirming that we should list your signature.

Signatures will be added as individual signatures with affiliations (e.g., John Smith – Foundation for a Better World) unless you specify otherwise that we should add your name only and no affiliation.

Please make sure to **CC everyone in this email when you reply** so that we can ensure that your signature gets added.

All the best,

Zarek

From: Jo Boaler joboaler@stanford.edu
Subject: Re: webpage
Date: September 19, 2021 at 9:24 AM
To: Gould, Robert rgould@stat.ucla.edu

JB

Hi Rob,

I hope the procedure goes well, I can empathize ...

Here is the article back to you, with a reference added and a couple of word changes, I think it is looking good.

If you are OK with this, I will send it to EdSurge when we have the link to the new webpage. One thing I paused on was the use of the word “standards” throughout, and in the title, but I think it is good – we have produced “big ideas” but they are a kind of standards – just not in the minutia that is usually produced.

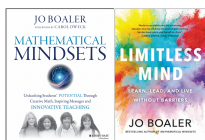
I am excited for all of this to release. We can change anything – in the ideas or the attached tasks etc – any time after it releases, so it is not static.

Best, Jo

** My working day is probably different from yours. Please don't feel obliged to reply to this e-mail outside of your working hours**

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From: Gould, Robert <rgould@stat.ucla.edu>
Date: Friday, September 17, 2021 at 1:00 PM
To: Jo Boaler <joboaler@stanford.edu>
Subject: Re: webpage

The next few days are pretty crazy, so it doesn't really matter when you get back. [REDACTED]

[REDACTED]

From: Jo Boaler joboaler@stanford.edu
Subject: Re: a new idea
Date: February 18, 2021 at 1:17 PM
To: Gould, Robert rgould@stat.ucla.edu

JB

That is wonderful, thank you so much Rob,

Best, Jo

Jo Boaler she/her
The Nominelli-Olivier Professor of Education (Mathematics)
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[joboaler@stanford](mailto:joboaler@stanford.edu)
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From: Gould, Robert <rgould@stat.ucla.edu>
Date: Thursday, February 18, 2021 at 12:34 PM
To: Jo Boaler <joboaler@stanford.edu>
Subject: Re: a new idea

Dear Jo,
I'd be honored, and I'd enjoy working with you, too.

I really appreciated the work you did on revising the no-longer infamous Chapter 5! I felt it was a fair compromise, given time and political constraints, and finessed the tricky points just right.

Best,
Rob

From: Jo Boaler <joboaler@stanford.edu>
Date: February 18, 2021 at 10:55:08 AM
To: Gould, Robert <rgould@stat.ucla.edu>
Subject: a new idea

Dear Rob,

I hope you are doing well, in this strange time. I am hoping there is light on the horizon...

My team of doctoral students has identified something we could write about to help with the spread of data science across the country, and I was wondering if you would be willing to work on it with us? I know that you are incredibly busy though and totally understand if you are not able to do this. Even if you are not, I would love to get your feedback on our idea?

We are thinking we could set out what we think should be in data science standards K-12, as many states are now developing data science and the current standards in the common core are woefully inadequate, as you know.

We are thinking that a good news-ey piece could share what is in the common core for data now, with what could and should be there.

We know you have amazing expertise on this, and you are our first choice to work with on it. I was thinking when we have a draft we could get feedback from the group that meets monthly? Would you be at all interested in this?

Warmly, Jo

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From: Jo Boaler joboaler@stanford.edu
Subject: Brian
Date: July 15, 2021 at 3:41 PM
To: Gould, Robert rgould@stat.ucla.edu



Ugh – Brian Conrad –

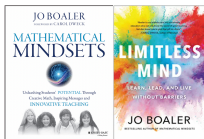
https://www.thecentersquare.com/california/op-ed-research-used-to-justify-californias-equity-math-doesnt-add-up/article_9c0ddb74-e4bb-11eb-85c1-e76a4749a8d9.html

best, Jo

** My working day is probably different from yours. Please don't feel obliged to reply to this e-mail outside of your working hours**

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@joboaler



From: Jo Boaler joboaler@stanford.edu
Subject: Re: FW: Data science
Date: July 10, 2021 at 8:47 AM
To: Gould, Robert rgould@stat.ucla.edu, Cathy Ann Williams cathyw11@stanford.edu

JB

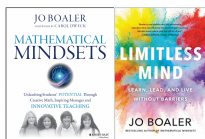
Many thanks Rob, that is really helpful to know,

Warmly, Jo

**** My working day is probably different from yours. Please don't feel obliged to reply to this e-mail outside of your working hours****

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joboaler@stanford
@joboaler



From: Gould, Robert <rgould@stat.ucla.edu>
Date: Friday, July 9, 2021 at 12:36 PM
To: Jo Boaler <joboaler@stanford.edu>
Subject: Re: FW: Data science

Hi Jo,

First, I reached out to Mike Hill, the undergrd vice chair of Math at UCLA, and he tells me that he's aware of some mathematicians putting together a rebuttal to the letter you shared. (You're probably already aware of this). But he also said that he thinks most in the department are on "our" side, for what that's worth.

Brian's points are good. I have two responses, and both are aspirational. I agree that, at this point in time, if you want to major in the math sciences, you need to get on the calculus pathway. But that said :

- 1) We need 'on ramps' for students who step off the calculus pathway, get inspired by a DS or CS course, and need to ramp back on.
- 2) We need to make sure students can take more than the 4 math classes so that they can take IDS (for example) & Algebra II, maybe during the same year. This is one serious drawback of situating stats and DS in the math curriculum; it forces a false choice. But where else can they be situated?
- 3) Universities need to build on-ramps for students who have CS/DS backgrounds to get them on board with math. The life sciences here at UCLA provide a model, Cal State East Bay is working on another. At first blush, I would think that a first-year college course in linear algebra would be a good starting place .

Brian gave good examples of Algebra II topics that could be taught within a stats course. But none of the stats topics he relates these two are covered in IDS, in large part because they're just not that

useful anymore in modern data analysis practice. And in cases where they are (for example, confidence intervals—which he says can be used to help motivate the quadratic equation), that mathematical approach is not useful for understanding the statistical concept and often interferes with understanding. So the issue is really problematic.

My primary concern about students who step off the calculus pathway and then want back on is that they will be missing in basic mathematical literacy: how to read notation, how to think about a math variable “x” (which is different from a stats variable), how to “read” an equation. There are opportunities to do this in stats, and I think it’s important to do so.

Robert Gould
Vice-chair, Undergraduate Studies, Dept. of Statistics
Founder, DataFest

On July 9, 2021 at 10:47:23 AM, Jo Boaler (joboaler@stanford.edu) wrote:

Hi Rob,

I connected with Brian Conrad, as we had worked together on something before, he is among the better ones in the dept I believe.... He explained his concern in this way to me:

Since data science majors at institutions as varied as Chico State, UC Irvine, Cal Poly, and so on all require calculus (because calculus underlies probability as well as the multivariable optimization that lies at the heart of data science) as well as high-dimensional linear algebra that builds on traditional algebra skills, the aim of incorporating algebra skills into a data science course is very much worth doing — it gives students readiness to pursue such options in college, and provides numerous contemporary ways to convey the continued relevance of topics such as logarithms, exponentials, the quadratic formula, and so on.

I do get his concern — if a student chooses data science over algebra 2, and then goes to a college that requires calculus, they will have some catching up to do. And if colleges require calculus to do data science, as he says, that seems harder. I do not see the solution as forcing algebra into DS or having students take algebra 2 (an awful course!). I would prefer colleges become more flexible, and do they really need to require calculus for a data science major?

I am going to reply to Brian, but wondered what you thought on all this?

Best, Jo

** My working day is probably different from yours. Please don't feel obliged to reply to this e-mail outside of your working hours**

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Robert Gould
Vice-chair, Undergraduate Studies, Dept. of Statistics
Founder, DataFest

On March 3, 2021 at 12:25:44 PM, Jo Boaler (joboaler@stanford.edu) wrote:

Thanks Rob – and in the midst of our standards work we are wondering if “inequalities” are at all relevant in data science. Can I ask you? If you have a quick reaction?

Best, Jo

Jo Boaler she/her
The Nominelli-Olivier Professor of Education (Mathematics)
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520 Galvez Mall
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[joboaler@stanford](mailto:joboaler@stanford.edu)
[@joboaler](https://twitter.com/joboaler)

From: Gould, Robert <rgould@stat.ucla.edu>
Date: Wednesday, March 3, 2021 at 12:07 PM
To: Suyen Machado <smachado@idsucla.org>, Jo Boaler <joboaler@stanford.edu>
Subject: Re: A-G

congrats!

Robert Gould
Vice-chair, Undergraduate Studies, Dept. of Statistics
Founder, DataFest

On March 3, 2021 at 11:24:15 AM, Suyen Machado (smachado@idsucla.org) wrote:

Hi Jo,

Congratulations! This is very exciting news.

Yes, each school/district will need to submit your course for approval. There is a question that asks if they are using a course that has been approved for another school/district. They would answer "yes" to this question. You will need to forward your copy of what you submitted to each of the schools/districts to copy it on their submission form. Hope that makes sense.

Suyen

On Wed, Mar 3, 2021 at 7:49 AM Jo Boaler
<joboaler@stanford.edu> wrote:

Hi Suyen,

I hope all is well with you, and you are able to get vaccinated,

And I hope you don't mind another question from me 😊

We have now got A-G approval for our new high school course, by getting one school to apply for it. What does this mean for other schools? Do they also need to apply, or does it somehow carry over for them?

Many thanks for your help,

Jo

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joboaler@stanford
@joboaler

From: Jo Boaler joboaler@stanford.edu

Subject: Re: next data literacy meeting

Date: December 16, 2021 at 1:29 PM

To: Pamela Burdman pamela@justequations.org, April Feng aprillfeng@uchicago.edu

Cc: Gould, Robert rgould@stat.ucla.edu, Sarah Curtis scurtis@concord.org, Chad Dorsey cdorsey@concord.org, Suyen Machado smachado@idsucla.org, Kristyn Manoukian kristyn@the-learning-agency.com, Jeffrey Severts jseverts@uchicago.edu

JB

I am Ok with that – and the latest intel I have is we really need any industry leaders, tech people, so if we know of any we could include that would be good too,

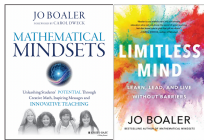
Apparently the governor is hearing from them now and he is more impacted by them being unhappy than mathematicians.

Best, Jo

** My working day is probably different from yours. Please don't feel obliged to reply to this e-mail outside of your working hours**

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From: Pamela Burdman <pamela@justequations.org>

Date: Thursday, December 16, 2021 at 1:27 PM

To: April Feng <aprillfeng@uchicago.edu>

Cc: Gould, Robert <rgould@stat.ucla.edu>, Jo Boaler <joboaler@stanford.edu>, Sarah Curtis <scurtis@concord.org>, Chad Dorsey <cdorsey@concord.org>, Suyen Machado <smachado@idsucla.org>, Kristyn Manoukian <kristyn@the-learning-agency.com>, Jeffrey Severts <jseverts@uchicago.edu>

Subject: Re: next data literacy meeting

Hi there,
Erica Heinzman has emailed me about this issue. Wonder if we should add her to this meeting? Or the CourseKata folks?

Pam