[SQUEAKING]

[RUSTLING]

[CLICKING]

PROFESSOR: We spent a lot of the last few lectures going through some substance, but also going through a lot of methodology. So I thought that today, we have underlined to go-- to be deep-- longer on substance and shorter on methodology. So what I'm going to do is a bit of an overview of what we have learned over the years and on-- in education systems and what is wrong with them.

If you remember, in our first lecture, I showed you some numbers on what kids knew, and basically that's kind of the central puzzle I'm going to study today. So there is a lot-- because I think for practical reasons, it turns out that it's relatively easy to experiment on kids because they are your captive audience in classrooms. So a lot of the movement of running randomized controlled trials started on school-- asking questions on school quality.

So this is really one area where you can go beyond a single well-identified study tells you a thing-- to step back and think, how does the whole picture look like? And where issues of external validity and this, that, and the other applies less because it's not that you're interested in each of the points specifically, but how the whole picture fits together.

And in some areas, we are not at this point yet. We have disparate sets of facts. I think the economics of family and gender is a little bit like that, where we are still trying to feel our way around by looking at various case studies in various things. But education one is one-- education supply-- the quality of education is really one place where we have more to say.

So I thought I would take advantage of that to do one more of these overview lectures instead of drilling down in details on what would have been for today, which was some Regression Discontinuity Design. So we'll have to find another time to-- for an example on RDD or maybe do it in recitation. So obviously, it's useful to put that in context of the COVID-19 pandemic, because it's a real-- a total tsunami on the education system in developing countries-- in developed countries as well.

Obviously, in the US, a lot of kids stayed out of school for more than a year. But worldwide, 300 million children have been affected by school closures. And in many countries, the schools are yet to reopen. In India, for example it's mostly not reopened.

So as of today, as most of the kids now in rich countries are back in schools, there are still 128 million kids who are still affected-- that should be the end of September of 2021-- who have not gone back to school. And they are now all in poor countries. So that's big.

And perhaps not surprisingly, but it's been actually measured, it has catastrophic impact on learning levels. Even in the short run, what you can see is that, for example-- so this is the data from Pratham that looks at the-- that uses the simple ASER test, the simple tool for measuring reading and mathematics ability looking at arithmetic-- and I'll show you the reading in the next time.

So in 2018 and into 2021, a sample of about 20,000 kids that they had done in 2018 and were able to follow in 2021. And what we have here is-- already in the best of times, it's not that good. If you take the kids in standard V for example, only 34% of them can do division-- just a division at the division level.

So another 20% are one level above. So about half of the kids can do-- so half of the kids-- a little more than half of the kids can do at least a subtraction in standard V. A little less than half of the kids could do at least a subtraction in standard 4. And it's an easy subtraction-- it's like a two digit minus two digit with carryover.

But then if we are looking at this one now, basically, the standard V kids are now below 50%. Understand that for kids, basically none of them are at division level almost. So about a quarter of the kids are subtraction or above. So we started from a low level, and with the pandemic we have a catastrophically low level.

And of course, we don't know how people will catch up. But it has been so slow-- any progress on quality of education over the years has been so slow that a decline like that is going to be a big thing to recover. Something in reading-- so if you're looking, for example, at the fraction of kids in standard V who are at standard II level, it was 46% before the pandemic and it's at 34% at the time they did the survey. And since then, these kids in Karnataka are still not back in school.

So this is still a snapshot. We don't know what's going to happen in the future as they go back to school, but there are two things that are probably going to happen. On the one hand, a lot of the kids-- the older kids are just not going to go back at all.

So the re-enrollment of teenagers presumably is going to be quite low. So it's a generation that is going to suffer an enormous amount. I was talking to David Atkin who pointed out maybe the other-- it will kind of even out. The other generation will be more educated, so it's just this one generation-- maybe it's not that bad on aggregate.

That's going back to this equilibrium impact. But for that generation, it's certainly a disaster. And then the other thing is that for the kids who will go back to school, they will go back to school with very different experiences with even more heterogeneity in levels than they started from. Because another thing of this that you see even from this simple test is not only the levels are low, but the kids are all over the place.

Some kids in standard I can read-- at standard II, not very many, and a lot can not even recognize the letters. That's in normal times. And then after the pandemic, there are even more that cannot recognize the letters, but there is still-- it's not neatly organized along the diagonal.

So kids of the same age are very different-- arrive at different level. And that's true in 2018. That's even more true in 2021. And so that's something the school system will have to grapple with.

But in some sense, although I think this is a catastrophe and something that probably you guys-- some of you guys will want to study-- Salum is already kind of working on it in Mexico and in the present, but in the future as the pandemic subsides, the question of how the re-entry will take place will be pretty central. But in some sense, it's not new. Like in the US, the-- very much like in the US, the racial discrepancy and the burden of disease kind of put a magnifier on existing racial discrimination across any number of dimensions that collapsed and coalesced to produce that outcome.

Similarly, this drop in the level combined with increasing heterogeneity of experiences exacerbates existing trends. And the trends are basically that you find very high enrollment rates, but a lot of absenteeism and very low learning levels. So this is for India, and then I'll show you the world in the next slide.

This is a picture from 2014, but it pushed-- until the pandemic, it was more or less correct. Most of the kids are enrolled. So 2014, you have 97% of kids enrolled in school. This was the sixth year in a row that enrollment had been at 96% or above, so that's great, but the attendance is not very good.

If you show up on any random day, you find 71% of the children actually present, and it's not always the same 71%. So it means that the kids get-- between their own absences and the absences of the teachers, they miss maybe about half of the school that they should have. And they go one day, they come back the next day, they go one day, they come back the next day.

So they are absent-- their presence pattern is extremely irregular. And then this is not equal across the country. So in the North in Uttar Pradesh, Bihar, West Bengal, the absence rates are even lower with about 50% presence, and it's better in the South like many of the social patterns.

If you're looking at the world as a whole, we don't have perfect data for the world as a whole, but this is enrollment with darker for the better. So basically, most countries-- and this is, again, pre-pandemic-- were at that-- where data was measured, we are above 90% with some exceptions-- basically, the only exception being the Sahel countries which have lower enrollment.

But other than this band where enrollment remained an issue, the question of annulment had somehow had been solved. By the way, during the pandemic, most of the kids stayed enrolled because nobody bothered to take them off the roll, but that doesn't mean they're really there. But the absence, of course, is even much less good.

So here, there are much fewer countries in dark blue. Quite a few country in solid blue. But we see countries appearing in light blue. So this is India between 70% and 80%-- happy to see that the two sources coincide.

And then we still have our Sahel countries where not only they are not enrolled, but in addition, they don't go. And other countries where it's in the-- Pakistan, et cetera-- where it goes into the red and yellow, so people don't show up that much. And then as we already saw, they don't learn that much. Again, that's data from India since-- until 1916, it's continued similarly.

The fraction of standard II kids who can read-- standard V kids who can read standard a II text-- so a paragraph basically-- and it's less than half not really going anywhere until it collapsed in 2021. If anything, in math, it's a bit worse.

So that's the type of problems that they solve, or that they are required to solve. And the way the test works is that they are first shown the two digit subtraction. If they can do it, they ask for a division.

If they cannot do it, they are asked to recognize the numbers-- two-digit number and then one-digit number. So that's how you have these levels. So who can do subtraction?

So we already saw these type of numbers, but in standard V, only half of the kids could do a subtraction in 2014. And in standard VIII, only 44% of the kids could do this division. So this, in a sense, was the well known problem. Maybe it was known to you-- maybe it was not known to you, but it was well known to, say, the general education establishment.

This is something that, again, is not specific to India. For a while, we've known it mostly for India because Pratham run every year this ASER self-survey where they went to every single district and surveyed a representative sample of kids regardless of their enrollment status. Since then, the World Bank has done-- and then after the pandemic, further expanded in other places.

And then we also have those big standardized tests, like the PISA, which are used mostly in the richer countries. And then different countries started running their Pratham-- their ASER-type tests. So there was a little bit of impressionistic data floating all over the place.

And Penny Goldberg when she was chief economist and with the Noam Angrist that would be Josh's son-- they made an effort to harmonize the learning levels across countries basically by linking them back to an ASER-like scale. So it's a [INAUDIBLE] but basically, using countries like India, for example, that have both the PISA-like test and a simple instrument, and then-- to create a crossover.

So every country that has the two tests can be used to create a crossover between the different tests. And in this way, you can move from-- to put on a common scale-- countries that don't have a tool, common test. So it's kind of a chain of things.

So it's a little bit impressionistic, but it's a nice database. It's publicly available. The published a small descriptive paper on it in *Nature* recently, and the data is available, so that's something interesting to play with.

And this is one of the descriptive things. So it's kind of hard to interpret the scale-- of course, the 600, whatever that means. But for example, you have Singapore here, the US here, and the worst country is like way below. So there are vast differences in what people learn-- in what people knew, let's say, from these learning tests.

And generally, it's pretty correlated with income levels, where poor countries-- this cluster of African countries here that does pretty badly. India-- just to tell you that India-- that we've talked a lot about India, and we are going to talk a fair amount about India. You might think, well, it's something specific about India.

It's not-- it's terrible, but India is actually not that-- it's sort of where it should be on the line. So it's relatively specific-- relatively representative of what's going on in the world. So that's the part that I would say is known-- was known.

And to start with, it's a big problem that kids-- everyone's going to school, they spend a lot of time in school, and then they learn very little. It seems to be a big waste of time for everyone involved and a problem, because it would be nice if people learned more. But in some sense, I've come to realize that that might not be the worst problem-- that schools are worse than that.

They are worse than not being a very effective production function. And that in our focus on production function, we are missing a couple of things. The first one, and perhaps the most important thing which I want to convey is that schools are-- not only are they unable to teach anything, but they are unable to leverage and to acknowledge the skills that are already there.

So in fact, they don't teach, but they also have a whole of certification and they also should leverage what's there and kind of transform it so that kids can learn more, and they are completely unable to do that. So not only they don't teach, but they also don't certify knowledge that's already there. So they are missing at their second task, which is pretty important because that's what people are able usually to take to the labor market is a diploma.

If the school's taught nothing, at least they should be able to administer the diploma-- that if you have the skills, you should be able to get the parchment paper that goes with it. So why do I think that schools are unable to both leverage and recognize the knowledge that's there? So I'll give you two examples where that's pretty egregious-- both I'm involved with.

One is a set of studies that I've done with a psychologist at Harvard, Liz Belke, who is a specialist of early childhood math education, and Justin who was then a student here-- is now at Chicago and a student of Liz who is now at NYU in the psychology department. So what we did is that-- so the objective of this work, and the reason why I came to see her and to ask her to work with me, is going to come back in towards the end of this lecture. Where I had been working with primary school and trying to improve the quality of primary school for a long time, and found it very difficult, because even though we have interventions that we know work, it's like pulling teeth to get them adopted.

So we'll go back. One of the things I want to discuss today is why that's the case. But for now, take that for a fact. We have ideas of what works, but nobody is interested in it.

So I felt-- but at the same time, more and more kids go to preschools. In there, nobody cares what they do in preschool. It could be singing, or mopping the floor, or whatever. It doesn't really matter.

It's childcare, so no one has much of a view. So I thought, well that's like a margin of action. We should try and act in preschool to make the poor kids ready for school rather than try to fix the problem once they are in school.

And since Liz was working on early childhood acquisition of math, I thought maybe she knows something about or can develop something about that we can implement in preschools to make the kids in preschool ahead of the game and able to understand better what's going on in school. So she was super interested in doing that. So we started with a small experiment-- about 1,500 kids in preschool classes operated by Pratham in Delhi.

So this is kind of a class which is on the porch-- and a few kids and a young woman. That's your class, and they are playing one of our games. So we had three conditions. One is math games where they play a curriculum for a few weeks-- a whole curriculum on building non-symbolic math skills.

I'll tell you what it is in a second-- how it works. Then, we add an active control condition, which is playing very similar games, but to teach social skills instead of math. The idea was not so much to teach social skills-- although why not-- it doesn't hurt-- but mainly to have-- because not much happens in those schools at all in general.

So we didn't want to say that, well, they're learning better because someone is finally talking to them. But they could be talking to them about something totally different, so that's our active control, and then the normal curriculum. So we did some pre-test in the games for three months, and then a first post-test, and then we continued tracking the kids after they've reached school, so a long time after we have anything to do with them. And in a sense, that's the key.

So that's the game. So this is based on this idea that these cognitive scientists developed that before humans-- or in fact, animals develop any notion of symbolic mathematics-- so understand numbers, for example-- we already have a sense of-- some basic sense of mathematics-- for example, what is bigger and what is smaller. And barring extreme disability, everyone has that, and it can be trained. We can become better at it.

And from a purely correlational point of view, kids who were better at this type of test when they were 5 are doing better at PISA mathematics at 15. Of course, what we don't know is that it means they have an underlying ability that makes them good at all sorts of math or whether this is that non-symbolic skills that they built on more effectively to learn math throughout their career. But what they certainly hoped is that that was the case.

And therefore, the idea of our curriculum was initially to train non-symbolic math skills only and to see whether there is a translation of these possible ways that it can be trained. And second of all was, if we manage to train them, whether there is a translation in symbolic math skills down the line. So that's an example of a game. You have a card. One has more dots than the other.

I think you can guess without counting. And so the kids moved the one that has more dots towards the red bar. This one is the hardest one because there are more points.

So young kids cannot do the many points, and then as you get older-- and you can practice with that, and then you become better as you practice. Then, when they turn the card, it actually gives them some more representation, including symbols, so that introduces a little bit of the translation. One thing kids are also surprisingly good at is visual form analysis. So here, it's like there's one card that's not the same as the other.

What's the card that's different? The one that had the floating point. So they choose [INAUDIBLE] they choose. Oh, that was the wrong one. That's the right one. And then we had very, very similar things for very structured-- same rules to learn emotion and gaze.

So for example, this is the odd one out. All of these are reasonably happy. This one is-- so that's the equivalent for social games. So we kind of constructed games that were precisely the same. But in that sense, working with psychologists is interesting because they really get into the details of things more than we do.

What do we find? So the first finding-- and I want you to keep that and hold that thought, because that's going to come handy in a little while-- is that the kids-- so this test-- these games were developed in Liz's lab at Harvard and tested in Cambridge with whoever is volunteer. If you have kids, you can go from infant to 10.

I've taken my own kids. It's quite fun. They make them play all sorts of experiments. And then in particular, they came and played our games. So we have observations from the kids mostly of postdoctoral students and assistant professors and that kind of thing in Cambridge.

And then we did the exact same-- we have the exact same measurement for these Indian kids who are living in slums in Delhi, and they are just as good at playing these games, and they learn the rules. They are able to learn quickly. They progress fast. They have just as much of-- these poor Indian kids have just as much an intuitive grasp and interest in number and geometry as the kids of the faculty brats in Cambridge.

So that's kind of descriptive. It's nothing to do with the intervention, but it's interesting. The second thing is that you can definitely try and do this non-symbolic math test. This bar is simply the difference between a treatment and the control control.

And then for the symbolic-- for the math games and then for the social games, you can see that even with the social games, they make progress. So that's the fact that someone is teaching them to play games and all that. That's probably not related to their ability to do the tests.

So these tests are now presented in a completely non-gamified way, but it's still the same type of things and they are much better at it-- much better even than the social games. So that's one. The second finding is that that's-- this impact-- in particular, the difference between math and social, which is the true effect of learning the math-- it's remarkably stable.

18 months later, they are still just as much better at it. So it's not just that temporarily, they got weakened. And that's striking because most educational intervention have impact that vanish over time.

So usually, you find an effect and then it goes away as life occurs. Interestingly, we are following these kids now. So this is like-- now, they are in middle school. So we are kind of interested to see whether it's still there. But 18 months later, it's still there.

Sad finding-- at end line one, they are still with us. They are still in the Pratham time preschool. And Pratham preschool does start introducing numbers and that type of thing.

And at this point, the effect is smaller. So we can also test them on whether they can recognize numbers, and shapes, and do you know that this is a circle, this is a rhombus, et cetera, all the numbers. And they are somewhat better at it in line 1. But then that difference entirely goes away as soon as they're in school.

So initially-- so they start with-- they arrive at school with a much greater sense of abstract mathematics. As long as they were in the Pratham environment, there was some translation of that sense of abstract mathematics to non-abstract mathematics. But as soon as they leave school, this is gone.

And so that's the result I want to dismiss this is a failure as an intervention for my objective. But it's still an important result, because what it's telling us is that the skills have-- these kids have acquired some skills that, in the proper environment, could be translated into learning to do numbers, but the schools are totally unable to use it.

And it's not entirely surprising because they go to school and they start learning multiplication tables, and singing songs. And so at a very early grade, mathematics in Indian primary school is more akin to poetry than to math. But this is-- so I'm not surprised by this result, although I'm a bit sad. But I think this kind of shows-- like, we handed you kids who were able to do math and you just erased that from them without, by the way, erasing their non-symbolic sense of math.

AUDIENCE: Professor?

PROFESSOR: Yeah?

AUDIENCE: How should we interpret the magnitude? Is that standard deviation?

PROFESSOR: It's standard deviation like in most things. So they were-- so there were points [INAUDIBLE] higher in the symbolic math, which they had not learned in the games in the first end line, and then 0.025, which means 0 basically down the line. So that means that schools are not able to leverage the increased mathematical ability.

So for us, what does this mean-- is we have to go back to the drawing board to do that ourselves. I'll go back to that in a bit, but for understanding schools, that's the first point I want to make is that they were-- grade 1 were unable to do that. Now, this-- maybe this is a bit special-- they are not set up to-- the curriculum is rigid-- their curriculum is based first on learning the multiplication table. They can't switch.

So here's another example of the fact that there is a lot of skill out there that the schools are not able to pick up. And the studies that we did with the same basically coup on-- which is purely an observational study-- descriptive study-- of kids who sell in markets. So I'm sure you've seen them in eight countries.

You grew up with these kids selling in markets, and they do a ton of math in their head, at least in Indian markets. They're just so fast. And this is something that has always struck [INAUDIBLE] and me as odd about the ASER test, which is how come the kids cannot do the ASER test when they are doing things that are so much harder on a routine basis in their shop?

What's that-- so that's the puzzle. And so you might think, well, one reason is that it's only the kids-- after all, there are not so many market children and it's only the kids who are super good at math who are selected to be market children. The other ones do do other kinds of things. Or it could be that the ASER is not incentivized-- no one cares, they don't do it, whatever.

Or it could be that they know how to do that in their head, but they can't write, and so they are completely baffled by the physical form of the test. So we kind of were interested in testing all these things. So what we did is that we ran two studies-- one in Calcutta and one in Delhi-- where we sent mystery shoppers to the shops to buy some fruits and vegetables from the kids.

The way they did it is that they bought at least two things-- eggplant and tomatoes. They bought a funny quantity. So not half kg. So when you buy-- when you go to the market, you can either say give me a 1/2 of tomatoes, or you can take the tomatoes in a basket and you get them weighed.

So then you get like 323 grams so it doesn't get rounded up necessarily. So they got tomatoes and eggplants, and then they handed a bill to the person-- to the kid who gave them change. So the operation involves a complicated multiplication, the addition, and then the subtraction.

And then they kind of challenged the kid on saying, are you sure this is the right amount you gave me? And the kid had to explain, yes, you take this, multiply it by this, this is this, so I'm right. So we did that in Calcutta and Delhi, and then we took the kids apart-- the last pair who went to do their shopping-- asked the parents if we could borrow the kids to do some math with them.

And they did. Usually, they agreed. They came and did some math with some math. And then there, we gave them problems of increasing level of abstraction. So it's like an increasing level of [INAUDIBLE]. So if the guy is selling tomatoes, we are like, suppose the price of tomatoes is now 23 rupies instead of 20-- how much would I pay you for half a kg of tomatoes? And then we replace the tomatoes with eggplants, and then the eggplant by pens-- we sell by units and not by kilo, so that changed the operation.

So increasing level of-- different from what you do in a normal-- on a day-to-day basis. And then abstraction-- what is 55 time 7, and basically the ASER test. And so that was-- and then in Delhi, we did the opposite, which is we went to schools in this very neighborhood.

By the way, a lot of the kids who are in markets are also in school, but not all of them. And so we went to schools where most kids are not working in markets, but they are very similar neighborhoods, social status, et cetera, and we had them do the same tests plus sell items.

So they set up a little market and they are selling the items. So that's the project. It was a descriptive-- a very fun study to do.

And here's what we found. So the first thing we found is that our impressionistic impression that-- impressionistic impression makes it a bit overdetermined. Our feeling-- observations that the kids are really good at doing this math seems to really hold true.

So in Calcutta, they are above-- they are around 90% right the first time. And then if they were wrong-- since they were challenged, they had a chance to correct. And then with correction, they are like 95-98% in these real transactions.

In Delhi, the first one was a little lower. I think that's because those were relatively unusual for market transection to ask two goods in unusual quantity. But then when the second time came around-- second person came around, their brains were awake and they also with 94-95% accuracy.

And then you compare the schoolchildren doing the same exercise, and they are much worse. So that's the first thing-- that they are very good at doing-- they are indeed very good at market arithmetic-- much better than schoolchildren. So you could think it's just selection. So it's the best kids at math are working in a market.

So we can look at-- or you could say, well, there might be other reasons. For example, they know everything by heart. They just have a table in the back of their mind that tells them how much things cost.

So here, we can look at people's ability to do other things. So in Calcutta, we just had one hypothetical transaction that was quite removed to what they were doing usually, and we saw that they were not doing that great on it. So now, in Delhi, what we did is we progressed, as I was saying, by level of how far it is.

And so the further it is, the more difficult it is. So if it's the same type of goods, it's better. If it's at least in the same unit, it's better, if it's-- and so there is some flexibility within market transaction. They can do other ones.

And then the more-- but there's a limit to this flexibility there. So they are not-- it's not by rote because you can change the number on them. But there is some limit to this-- how well they can adapt to other things. So they are not that spectacular at math once you remove them.

And where they really have a problem-- and again, this was-- confirmed our motivative observation-- is that they are really terrible at the Pratham type tests. Only 32% of them can do division in Calcutta, 15% in Delhi. Only about half can do a subtraction, so similar to the Karnataka level, for example.

And there, the Delhi schoolchildren are much better than they are. So it was not just selection-- the best mathematician end up in the class. The best mathematician can do market math not spectacularly, because they can't go away-- spectacularly for their own job, but they don't have the kind of mental gymnastics to go to other things.

But they really can't go to the ASER test, and they do worse than the Delhi kids. So the Delhi kids can do the ASER test quite well, in fact, when you compare to the rest of India, but they cannot do the hypothetical transaction. The market kids can do the market transaction. They cannot do the Delhi test.

And one of the things that really trips the market kids is-- where you really have a huge drop off is when things are presented in abstract terms as opposed to [INAUDIBLE] term. So the same kid can do-- can you give me the price of one pen if five pens cost $0.20, and cannot do 20 divided by 5. So basically, this is what this says. This is what this comparison here-- similarly for those kids.

So going to abstraction is what makes it-- even if it's the exact same problem, removing the anchoring to real items is very difficult for them with one exception. When it is possible to round things up-- for example, if the problem is 31 times 7, which you can do as 30 times 7 plus 7, they are good at that.

They are good at simplifying problems even when they are abstract. So when they are-- so this is a subtraction. We didn't do it for division. But for a non-writable abstract subtraction, even after correction, they finally get it 65% of the time.

If it's roundable, they get it 85% of the time in an abstract form. If it's anchored, they do better to start with. That's what we saw in the previous graph-- that the abstraction tripped them up. But on the [INAUDIBLE] they're as good as they are in a market. They reach to 90%.

So they are very good at rounding. And by comparison, the Delhi schoolchildren don't get as much as of a boost on rounding as the Delhi market children. And the reason is the Delhi schoolchildren don't use this strategy at all.

So they have-- this is what they write up-- how much do they write on a piece of paper to solve the problem. And so this is the number of tally marks that they are making. And so the kids in market basically do everything in their head.

The kids in Delhi do everything written up. They write a million numbers. And I realized that I'm not showing-- I'm showing you how they write a million numbers. And I realized that I didn't take the right graph, so let me-- they write just as many numbers if it's roundable or if it's non-roundable.

They don't use the fact that it is roundable. So the market kids have strategies that they can fall back to when the strategy is applicable. The only thing the Indian-- the school kids can't do is just write down a bunch of numbers and add them up.

And some of them might have figured out how to-- the algorithm. These guys actually wrote it up. This is written up properly. So these guys know how to do addition in a standard algorithmic way, although he hasn't figured out the multiplication yet, which finally trips him up because--

[CHUCKLING]

--so the problem is deeper than the school not teaching much. It's that they don't recognize that there is existing knowledge-- abstract and concrete. These kids in the market, they have knowledge. They know how to do mathematics.

The school is-- and in this instance, impersonated by the school-like presentation of the ASER problem-- is unable to leverage that. And basically, what happens is that they see the thing and they say, I'm not good at math. I'm not-- I don't know how to do these things.

And as soon as they see a written problem, or even if you tell them orally the written problem, because oral versus written doesn't make a difference there-- if they see an abstract problem, in their mind, what it evokes is that, oh, I better take out my toolbox of algorithms that I learned in school for how to teach these thing. But in fact, they misunderstood the algorithm. So for example, they do the subtraction in this algorithmic way, but from the wrong part of the end, or they do place value errors, et cetera that they never do in their real job because they don't go back to this kind of half baked algorithm that they have learned.

So the school is unable to see what's inside in front of it-- that these kids have the skills, and they just-- but they don't-- their skills are not sufficient, because they need to be able to go from this day-to-day manipulation of arithmetic to-- you do need to go-- you do need to be able to go to the abstraction if you're going to do something more than doing a market.

You cannot learn algebra without understanding abstraction, but the school is completely unable to do this transition. And then on the other side is whatever schools teaches is completely useless for life, because these poor kids who are-- school kids who are very good at doing-- or relatively good at doing the abstract math, one thing I didn't tell you is not only they get the market transaction, but it takes about 15 minutes for them to do the calculation because they have unlimited time.

So in 15 minutes, they would have been run out of the market. So they couldn't-- whatever they have learned is not useful. And in fact, pratham did an ASER survey for middle school students where they asked them things like you have a bag of fertilizer that is enough for a field of three acres-- your field is 1 and 1/2 acres-- how much of the bag of fertilizer should you use?

And the kids are terrible at doing that. And even when they-- even the ones who can do division can still not do that-- do this type of-- so this is kind of a parallel thing of whatever abstracts to-- the concrete knowledge is not translated by the schools to abstract knowledge that would enable you to go further. And the abstract knowledge that is imparted is not usable in a concrete way. Yeah?

AUDIENCE: [INAUDIBLE] if the-- [INAUDIBLE] outcomes when we market children [INAUDIBLE] but the outcomes that the market children have are-- I wonder if they're actually related tp [INAUDIBLE] or something that they have to [INAUDIBLE]?

PROFESSOR: That they have learned?

AUDIENCE: From the job [INAUDIBLE] since it's really not fair to correlate existing knowledge, but something that had knowledge.

PROFESSOR: Yeah, but it's existing now. About 2/3 of these kids are in school. The market kids are still in school.

So whatever maybe they took a long time to acquire it, but now they have it and they are still they still can't do the ASER test. They have it. They're in school. The school canot use it. Yep?

AUDIENCE: So do you think that this is a more of an issue with the pedagogy of what the teachers are doing, or do you think it's more of a measurement issue in that the ASER and things should be trying to measure different things or testing in different ways? Which of these two do you think it is, or which is more important?

PROFESSOR: Both in a way, which is-- on the one hand, I do think that it's useful to know both for the ASER testing, but also for employers, for example, that they could start testing people that they might want to hire with tests that are less dependent on understanding an ability to rehash the abstract way-- the way that mathematics is being taught in schools.

So that's true for ASER, and that's even more true for Infosys-- or they want a software engineer. They want smart people who do a lot of things. Clearly, mediating it by performance in school is-- or even by how you do well at school-type exams is a problem.

In fact, you see some of the software companies like Infosys run testing camps that are trying to capture another form of knowledge precisely to get around that. I don't know how successful they are. I haven't seen the test, but that's-- so that's a great point. However, the second point is, do I see this as a problem of pedagogy?

Yes, because the school is-- it is important for people to learn to solve abstract problems, because otherwise, your limited. Once Infosys has hired these people based on their non-school-like test, I assume they start to tell them some abstract skills, otherwise, they would never be able to code. So the schools also would need to be able to do that, and also to help people use the abstract knowledge-- to apply the abstract knowledge in concrete situation seems to be part of the-- so I would say that this is a problem for both things.

So that's the problem. So the problem is deeper than the test scores are low. That's kind of what I was trying to say. And so where does it come from? So let me start by what it's not and the general things that you hear.

If you have an Indian-- if you ask Indian teachers, they'll always blame the parents or the kids, saying basically some version of the kids don't want to learn, or they are lazy, or they are not too smart, or they can't learn. So that's, of course, very patronizing, but it's actually more frequent than you hear-- for example, Bill Gates had a whole thing on a nutrition program for young kids.

And basically, he explained that school performance is low because kids are undernourished and, therefore, they can't learn, which is basically the same-- a politically correct argument of the same version. So I don't think it's that. Why I don't think it's that? Because of my preschool mathematician.

I'm taking those kids, I'm learning them exactly-- I'm teaching them the same thing that the Cambridge kids teach, and they are just as good when they were four. So something has happened to them later. So I don't believe you cannot learn statistics.

That's one. Another thing you hear often, especially in the education world, is that it's all about resources. The systems are under-resourced, the teacher salary is too low, and also there are no textbooks, flip charts, computers, and so on and so forth in the school.

So we know a bunch about that, because these are precisely where you have this huge cluster of experiments that have been conducted over the years. And what do we know? Well, number one-- yeah?

AUDIENCE: Sorry-- just thinking also about the issue you brought up earlier in the lecture about attendance. Is there any argument or evidence in favor of attendance being a factor as well where maybe there's very complex terms that, if you go everyday, you learn a lot, but if you're always finding then--

PROFESSOR: There is. When kids [INAUDIBLE] to school is either because they are more present or their teachers are more present and they learn more. So there is something a-- little bit of something that happens in every day of school.

When kids are not in school, they also learn more, so something is happening. So there is some amount of learning that's happening. And you get fewer days of school, you get fewer days of that. And we saw it in-- it makes a big difference to have COVID and there is no school.

So something is happening in the school, not nothing, and then therefore, attendance matters. But maybe not as much as should be happening is what we are-- so the argument that teachers are poorly paid, it definitely holds for France where teachers are poorly paid as a function of their education. I think it holds in the US too. Someone would need to check that.

It does not hold in India where the salary of a teacher in the distribution is super high and conditional on their education-- even is super high. And after all, we saw in Ghana how everybody is desperate to be a teacher because it's such a rent seeking, rent paying occupation. Teacher salary in the public schools are so much higher than what they are paid in private school, which suggests that there is a huge wedge there.

So the-- it's very unlikely to be due to teacher salary. And in fact, there is an experiment by Karthik Muralidharan and others that demonstrated that in Indonesia-- super large scale experiment where the teacher salary was doubled, and the impact on test scores is nothing.

Nothing immediately, nothing as you select more teachers and better teachers into the job. So there's just no effect on teacher pay per se. Yeah?

AUDIENCE: It's not another-- [INAUDIBLE]. incentive problem, it seems to me.

PROFESSOR: Yeah, so I'll go to incentives in a moment. Before that-- in fact, I'll go to incentive right away. Before that, other resources.

So that's where this is like-- this line has about 20 years of research in education, trying everything from textbooks, to cutting class size in two, to anything you can think of-- any inputs except computers. And I'll go back to the computers in a minute. None of that makes any difference.

In fact, the famous Michael Kremer textbook paper that launched us all was an extremely surprising result even to him and to all of us, because it showed no impact of providing textbooks in Kenyan schools that didn't have textbooks. So it's not about stuff. It's not about teacher money, it's not about things in the classes.

Then, you have the economist knee jerk reaction. So in the first one, kids can't learn is the teacher's knee jerk reaction. The second one is the Oxfam teacher knee jerk reaction. The incentive is the economist's knee jerk reaction.

It's got to be incentive. And it's true that directive incentives to specific things has a small effect-- some effect. For example, going back to the attendance question you asked, we have a paper with Emma Hanna and Stephen Ryan looking at providing incentives to teachers to show up.

And then if you give them incentive to show up more, they show up more. And if they show more, the kids learn more. That makes sense. There are also a number of papers being based on providing incentive for test scores.

And down the literature, it's a bit murky. Some papers-- for example, Michael Kremer shows that if you give incentive based on test scores, you improve test scores that are targeted, but you don't improve-- you improve the performance on the exact test that is being targeted, but not on any other measures of learning. So-- and then Karthik has another paper where he argues that, no, there is some gain in actual learning coming from the incentives, so there is a bit of a dispute there.

It's a bit in the eyes of the beholder. But I'll grant you that if you give incentive on test scores, there's going to be some increase in test scores. Now, we can just put that aside and say, well, providing incentives to teachers in public schools who are otherwise not very well-incentivized is much less incentive than just the private schools.

You would think the private schools are the ones that are completely incentivized. And in fact, there is a literature in particular with [INAUDIBLE]-- by [INAUDIBLE] and [INAUDIBLE] that is all about the fact that parents are super demanding as customers. And if they see that the performance of the school is low in the sense that they see low test scores around them, they move the kids.

And so you would think that the private schools are where you would find that-- where the incentives are very steep. Yep?

AUDIENCE: Do we know anything about the supply of teachers in the sense that how they are educated to begin with?

PROFESSOR: How--

AUDIENCE: How the teachers are--

PROFESSOR: Educated themselves? So yeah, they go to college. So they are well-educated. They don't do much, but they are well-educated.

They are able to do that job. They're-- I think it's much it becomes much more of an issue in secondary school. If you remember, we discussed that for secondary school, you start to have a competition between the labor market and the schools.

And so the best-- the people who would be best at teaching are also very good in the rest of the economy. So in middle income growing country like Ghana or India, you start feeling that for secondary school. But in primary school, you have a vast supply of people who could do a perfectly good job educating kids. And I'll go back-- I'll show you why I think they can do that job if they want to in a minute. Yeah?

AUDIENCE: So how should we think-- this is maybe too big of a question for right now, but how should we think about all of this literature about teacher incentives, and school quality, and pedagogy, or attendance, or whatever-- comparing the things that happened in the developing world versus-- I know a lot of education literature exists for the United States, or Europe, or other such developed countries. And so how should we think about comparing the findings from those two different literatures?

PROFESSOR: It's a great question, and hold that thought. I'll go back to it. I think like in everything where we are wondering how to apply results from one context to another, we have to think whether the context changes the model of what is being delivered in schools. And in this particular instance, I'm pretty sure it does, and then I'll tell you exactly how in a moment.

AUDIENCE: Professor?

PROFESSOR: Yeah?

AUDIENCE: What about incentives for students themselves? This is-- we're talking about the teacher side.

PROFESSOR: Yes, incentives for students themselves are effective. They increase test scores. They increase-- so if you give, for example-- Michael Kremer also has a paper on girl scholarship that are conditional on performance, and you get an increase in performance.

And that relates to the point I'll-- again, hold this thought. That's going to become relevant. So let's go back to my private schools.

So the private school, you would think, is the most steep incentive you could get-- is to just to run a private school which is entirely funded by parents and where parents are always willing to walk away. So if incentive are powerful, then private schools should do much better than public schools. Make sense?

And in fact, if you compare just at the correlations, kids in private school do much better than kids in public schools. But of course, kids in private schools are selected. Their parents have the money and they also are interested enough to send them to private schools, so we can't do that.

So Karthik Muralidharan run an experiment on private school attendance. And here, I'm going to step back-- step aside one point that's going to be my one methodological point for the day, which is he was not just interested in the impact of private schools on kids who attend private school. But he was also interested-- which for us, for today for the argument is all I need.

But he was also interested in another question that people, for example, in the US-- also in the US literature on charter and voucher is continually asked, which is what's the impact of having more kids in private school on kids that are around them? Are the other kids in private schools-- that they are crowding out in their private school, or are the kids in public schools that are left in the public school-- which might be a good thing because there are fewer kids around to compete with them or bad things, because now they've lost their most motivated peers.

So this paper was really constructed to answer this question of the equilibrium effect of having more kids in private school-- in particular, the equilibrium effect of a voucher program. And it's the first paper that did that, I think, around the world. So what it did is that is key-- separated-- he first randomized at two levels.

He randomized at the level of the village and then he randomized at the individual level within the village. So in the villages-- basically, think of a village as a school market-- extended village enough to cover the whole school market. So you have the control villages, and you have your treatment villages.

And then the treatment villages, you further have-- the kids who are in public school were, in principle, eligible-- they are to apply-- there was a lottery, and some of them got it and some of them didn't get it. So now, we have randomization at two levels-- at the level of the market and at the level of the individual. So if we want to know the impact of going to private school in an environment where there are some private schools and some vouchers around, we can compare these two groups.

If we are interested in the impact of this voucher program on the kids left behind who were interested in also doing it, we can compare this group to this entire control group. Sorry-- no, this group-- the not awarded-- basically, the control to the super control. If we are interested in the impact on the private school kids who never wanted this in the first place, we can compare them to their counterparts in other-- in the control villages. And finally, for the public school kids who were not interested in the program, we can compare them here.

So that's the design. This kind of 2-step randomization to look at equilibrium is a design that I want to use to look-- in France to look at the spillover effect of an active labor market policy program. People are also to look at effects on allowing some people to migrate on other people, et cetera. But that's one of the first papers that did it. Yeah?

AUDIENCE: If you went to offer the voucher later on to the control group, if you do some matching between the people who later on decided to apply, or will you be concerned that something in that timespan will change, and you were not [INAUDIBLE]?

PROFESSOR: So what is the-- what's the design that you're proposing instead?

AUDIENCE: So I think I would just be concerned about, say, non-applicants or the people who were not so awarded the voucher in the control group. If you were later to consider carefully comparing the treatment you have right now to that control group, if you later give the voucher to the control group and then you just use the individuals who chose to apply the voucher--

PROFESSOR: Yeah. So you would be worried that the people who chose to apply the people who didn't are different in a way that are difficult to control. So a paper we didn't have time to cover, but I sometime cover is the warming paper where they were interested-- they tried to estimate the externalities without having such a design.

So you try to construct a group of kids that is comparable of a situation where they are-- it's not perfect. You don't have really perfectly comparable kids. So this design avoids that. You don't have to worry about, can I make the non-applicant similar [INAUDIBLE].

Basically, in your design, you would hope that the non-applicants, two years later, are comparable to the non-applicants you got-- that these ones two years later are comparable to them. And then you would look at the externality on them. But it's not clear that they are-- it's not clear that you can rely on that.

So that's why those designs are-- because it's two years later. Who knows? So that's why those designs are better to measure externality. So that was-- my kind of advertising pose is finished.

It's a great design, but it didn't come to be so useful in this particular instance, because in fact, the impact on the people-- so here, now we are comparing the treated-- the people offered the voucher to people who were not offered a voucher, and there is not much of an impact, if anything.

So this is in Andhra Pradesh, the medium of instruction is Telugu. Public schools do not teach English and they do not teach Hindi, or they might teach a tiny bit of English, but very little. So what do we find? By year two of the program, the kids offered a voucher actually do worst in Telugu, although that's not significant, but they don't do any better.

And so now there are such that we can rule out even a modest positive effect of this intervention on them. Similarly, on math, they do much better in English. And overall, it's a big fat 0.

You can now-- we saw [INAUDIBLE] last time. So if you want, you can instrument for actually going to school with receiving a voucher. I think this is a perfectly decent instrument, so I would not be too worried about the exclusion restriction. But of course, it's the same thing. It's just cosmetic.

Now, four years later, same thing-- negative-- insignificant impact on Telugu and on math. Positive in English. Now, he went and collected a bit more data on other things. So I think that's environmental and science, there is some positive impact-- insignificant impact there combined across tests excluding Hindi.

And then he went and collected Hindi, which is not taught in public school. And when you add the Hindi, you find a positive effect on the private school. Not to say he really wanted to have a positive headline number, but maybe because this is like-- this is an effort.

But this is very interesting, because what we have is that the private schools are not teaching better at what they teach. They also teach things, but they put more effort in different things. So it's not that they are-- and presumably, they are doing that because there is parental demand to do it.

And so that can-- is informative for us on what are parents demanding. And what parents are demanding is not good performance on mathematics and Telugu. What parents are demanding is English and Hindi.

And they-- surprisingly, there is no-- so now, you can do all your fancy contrast of spillover. It would have been nice if the impact had been positive. Of course, there is no spillover of something that doesn't have a direct impact, but it is what it is. So-- yeah?

AUDIENCE: [INAUDIBLE] spillover effects [INAUDIBLE]. You cannot ever rule out even large spillover effects.

PROFESSOR: Yeah, the spillover-- because the main effects are null, and the spillover becomes-- because the main effects are 0, the spillover becomes-- where are my spillovers-- become uninteresting and uninformative.

I don't know if you would call them large. This is 0.06, so that-- you can rule out 0.12 standard deviation. If it's like, you can rule out that 95%, then there's nothing to write home about.

And negatively, again, you can rule out minus 0.12. If it was a mean at 0.12, you could say, well, there is something there. It's not a huge effect, but it is an effect.

But if it's a 95% confidence interval that's at 0.12, I wouldn't-- so I don't think the standard is that huge. It's just that it's not-- there's no direct effect, so it would be surprising if there were a spillover effect. That's bad luck.

I mean-- it's bad luck-- it's not bad luck. It's interesting anyways, but the results would have been more interesting in a setup where you have large direct effect which are undone by spillover. In our paper on labor market policy in France, that's what we have. We have large labor effect when we compare treated and control in the same labor market, but it turns out they are all redistribution within the group, and there is no effect compared to the control group.

The French saying for that is taking the closer out of Peter's back to put them on Paul's back. So it's substantively more fun, but-- but going back to the results-- so it's not that the incentives don't work and that people are not responsive to the incentives.

It's that they are-- it's that the incentive themselves that are the parental preferences are not going in the direction of-- are going to-- are not targeting the fundamental learning. And that's consistent very much to what we saw in Kenya, where people don't see much value in primary education whatsoever. They see value in secondary education to the extent that it's a ticket into tertiary education, which is itself a ticket into the rent seeking paying job. Yeah?

AUDIENCE: Was this necessarily a thing, because it feels like he wishes-- he wanted more in the labor market [INAUDIBLE], at least for [INAUDIBLE]--

PROFESSOR: Yeah. So that's not irrational. I don't-- I think it's totally rational. So English, for example, makes sense to have a little bit of English.

And even if you didn't have English-- if what they cared about is doing great in-- and we'll see in a moment-- is doing at grade level-- being able to take exams, and not the learning. What parents seem to care about is what's going to be useful down the line. So a little bit of English they think is useful.

We just saw that the math is not-- that is taught in school is not of any use anyway, so why would they value it? So I'm not saying it's irrational, but that's the-- parents are interested not in fundamental learning, but in what's going to be helpful to the kids or to them. So on the one hand, there is English, and on the other hand, there is doing well as in passing exams.

And so there, what the parents are responding to is the structure of the school system and how it's organized, which is that-- and that's not just in India, but that's true in most developing countries-- in particular, all the former colonies-- is a curriculum that is extraordinarily demanding-- much more demanding than our primary school curriculum here in the US. That's kind of going back to your question of what's the difference.

So this is a snapshot of grade 4 curriculum in Haryana. So I hope that you guys are good about your table of multiplication up to 15, because otherwise you cannot-- if you don't know them like this, you cannot do-- you cannot pass your-- you are not at grade level in grade 4 in Haryana. So in October, they are recognizing shapes. By November, they are measuring the area.

I mean, this is a bit crazy. And the problem you're finding in a lot of former colonies-- and the reason is that the school system was created not for educating everyone to be able to learn basic-- to read, and to write, and operate in their life, but to educate a minority to become clerks for the colonial powers. And that's what the system was for.

At Independence, when it was open to everyone and scaled up, it was opened without a change in the curriculum, partly because it's very difficult to say that, oh, no, we are going to go back and teach something simpler, because that's sort of saying your kids are not at the level of-- so politically, it's very, very difficult to say that-- it was difficult to say at independence. It's still difficult to say today that the curriculum needs to be scaled back.

So you have this curriculum. In India, they passed the right to education in 2010, saying that every kid has a right to primary education. Great, but part of the right to education law was that the teachers have to complete the curriculum no matter what.

So they become legally liable if they don't complete this crazy curriculum that almost none of their kids can follow. So the result is a system where teachers are teaching to one or two people in a class at the very, very top of the class, which brings me to the US system.

The US system in primary school is not that. It's a system of No Child Left Behind, whether for good or for bad, the teaching standards are extremely low and you're trying to get everyone to minimum core. So you might imagine that starting from a system that have different objectives and different philosophies in mind, the effect of different interventions would also be quite different. So that's kind of the answer to your question.

So what's the possible answer to that is, basically, teaching is at the wrong level. So you could go back and try and teach at the right level. And so that's basically the flagship program of the Pratham-- the same people who do the ASER-- is this teacing at the right level approach, where they basically do regular testing of kids every month or so, put them in groups by level of competencies [INAUDIBLE] competencies, and then move them as they go along.

So it turns out that the kid who reached grade 4 without learning to write or read can learn very fast if someone told them then, because they are cognitively quite ready. So a kid can learn to-- but if no one is ever teaching them, then they won't learn. So they make-- so this was my-- so something like that-- the ancestor of this program was the first randomized evaluation I was involved with that was called the Balsakhi program in Baroda and Bombay.

And since then, we've been evaluating some version of this program in rural areas, in urban areas. At some point, we were ready to scale up. Pratham scaled up in Bihar. In the context of their scaling up, we were able to carve out a control group.

So that's the opposite of your standard. And then when you have a status quo and then you do a new intervention it's a small piece. Here, this new intervention was in a large place, so you have all of the problems that will potentially arrive when you do something on a large scale.

And we took out the control, and it didn't work at all. And until then, we had great results, and then it didn't work at all. So we had to go back to the drawing board.

We tried to understand why it wasn't working. And to get a long story short, it wasn't working because the tyranny of the curriculum was still there. So the teacher said I can't implement your program. You trained me to implement this program, but I can't because I don't have the time because I have to finish the curriculum.

So the program could not catch with teachers, even though-- and this goes back to your question you asked earlier-- would they be capable of teaching? Yes, because if you take the same teacher during summer, we use the same teacher Bihar-- [INAUDIBLE] Bihar recruited teachers to teach during summer, and we experimented that. And their kids during summer focusing on basic and [INAUDIBLE] approach did great progress.

So in one summer, they made more progress than in an entire school year with the same teacher. Because during the summer, it was very clear what they had to do and it was not the curriculum. And when you move them back to the normal classroom, they think I have to do my curriculum-- sorry, I don't have time for this teaching to learn to read and write thing.

So then what we did is that we went back-- or Pratham went back and thought, basically, it has to be-- then it becomes a political/economic problem, which is how to get it to take hold in the system. And so we thought that we needed one-- the teachers needed to know that this is the time to do teaching at the right level, and you cannot do anything else. So they basically-- the government added an hour in the school day, both in treatment and control.

But in control, they just added an hour. In treatment, they said this hour is for teaching at the right level activity-- classes have to be mixed, kids have to learn to go back to do the teaching at the right level activities. And they also enrolled the school inspectors to serve as supervisors of the program, and that worked nicely. The other way is to say, well, forget the teachers. Let's have it implemented by outsiders.

That was done in UP. That's a dysfunctional school system, and that also worked. So now, Pratham is being scaled up in India. The teaching at right level is being scaled up in Africa, and it's a model that can-- either of these two models is robust enough-- can be implemented in other countries, and is being implemented in those places.

So let me conclude rapidly. I've given everything I told you-- how do we go about fixing primary education. So some people say, well, give up on the schools. And in fact, the founder of Pratham, Madhav Chavan, that's kind of his view now.

It's like, the schools are just a big waste of time. And let's give tablets to the kids in villages, and then have them learn this way to-- materials you push to the tablets. It has potential, particularly with digital education, but it has a big problem, which is at least the schools, parents have bought it and they're sending the kids there, so the kids are captive.

Anything else, you have to convince the parents that it's worth their while, and it's very hard convincing the parents it's worth their while. So Karthik did an experiment where we found absolutely spectacular effects of software-based mathematical intervention on math and Hindi. 0.67 standard deviation is great, but the problem is that even though it was 0.67 standard deviation, when you ask the type of questions that are asked on exams that are the grade level questions, there is no impact on those, at least on math.

That's because the kids are so far behind that even though they progressed-- and all of them progressed-- they still haven't reached the point where the questions that are being asked at the exam are pertinent for them. Eventually, you would think they reached them. And therefore, the parents are totally not interested.

And what happened to this program is that-- and this is a long paragraph, but it's likely to say at the very end of this program that shows this great result-- is that the moment the experiment was over, the program was finished because the parents refused to spend a few cents to keep it going, because from their point of view, it wasn't reaching-- it wasn't useful because it wasn't bringing the kids where they wanted them to be. So something that's not happening in the school is hard, so I don't think we can give up on the schools.

Changing the curriculum would, of course, be the Holy Grail. It's a political-- I've been trying a good part of my professional life with very limited success. And then there is the final possibility, which is what we started to do in-- with Liz, which is to work anywhere where it's not yet in the margin.

So tutoring programs, preschools, the completely different schools like they have in Uttar Pradesh where there is no teaching happening anyway, which you can take over, that kind of thing. So I want to let you go, so I won't get into the details of what we did with Liz. But basically, experiment after experiment, we've developed an approach to teaching preschool mathematics that we think is good and can now be scaled up to now, more and more, and more, and more kids go to preschool so if at least they can be exposed to our program, nobody cares.

People seem to be very happy to let us operate in preschools, whereas anything like the teaching at the right level in primary school, you have to fight with this existing pressure. And one worry, though, is that-- this other detail doesn't matter. The one worry is that as this margin expands-- that's the trade-off-- this margin expands, more and more schools go to primary-- to preschool.

That's great. This gives us more space to do our stuff. But then as it expands, people start caring more about it. So there are calls to regulate the coaching centers and what is being done there.

And there are calls to regulate the preschool and have a curriculum for preschool. So it's kind of permanent cat and mouse problem. So the bottom line is that basically, you need to be pretty patient, which is I don't think there is going to be a silver bullet.

Even though we now understand the problem well, we can't fix it easily. All you can do is having these programs that push a little bit the margin. The gains are not enormous, but they are there.

And it's a lot of kids, so that's already something. And there is not going to be a big revolution where we suddenly are going to make it work so much better. And when I conclude like that-- if I give a seminar or a presentation in India, people are really upset.

And they come to me-- like, in particular, the tech people-- very well-intentioned. They say, how can you say that? We don't have the time-- we have to-- I think it's better to do that than to do nothing, which is the alternative.

We have to act-- this generation-- blah, blah, blah. So this is-- that's kind of the unpopular message of the whole, "the only thing you can do is push a little bit the envelope here and there, and you're not going to get a revolution." Yeah?

AUDIENCE: I'm sort of thinking about the dialogue between this teaching at the right level and the literature on tracking. Is there a sense within the teaching at the right level of how much of the effect of the program is due to peer effects of a new configuration of [INAUDIBLE] the children are learning versus changes to the curriculum itself?

PROFESSOR: To the activities? Yeah, so I think it's a lot the former, which is just a lot of being with a group of your same like-minded kids. And so we have a paper in Kenya with Michael Kremer and Pascali, where we kind of have both because we track.

And then we have either the regular teacher or a young enthusiastic teacher, and we do find the effect of tracking in both cases both for the-- both-- in the non-tracked school, we have huge effect of the young enthusiastic teacher. And in a tracked school, we still have an effect of the young enthusiastic teacher, but even in the regular school, the tracking really helps.

AUDIENCE: Even if the-- it's just a simple structure just to capture [INAUDIBLE] and then take both students teach math, science, scientific skills [INAUDIBLE]. And all the other interesting fact is that that student also has a higher probability of leaving the country once after going through that education system--

PROFESSOR: There is that-- yes.

AUDIENCE: Quite interesting [INAUDIBLE].

PROFESSOR: Yes. No, I think that you're absolutely right, which is the most brilliant-- the one kid who manages to make their way through the school system, and not being crushed by it, and go to University is probably somewhere here. So they're contributing to the world, but not necessarily to--

Great. Thank you. So We'll see you next week. Oh, it's a long weekend, so we'll see you on Wednesday.

[AUDIO OUT]