The Khan Academy is most known for its collection of videos, so before I go any further,let me show you a little bit of a montage.

(Video) Salman Khan: So the hypotenuse is now going to be five. This animal's fossils are only found in this area of South America -- a nice clean band here -- and this part of Africa.We can integrate over the surface, and the notation usually is a capital sigma. National Assembly: They create the Committee of Public Safety, which sounds like a very nice committee. Notice, this is an aldehyde, and it's an alcohol. Start differentiating into effector and memory cells. A galaxy. Hey, there's another galaxy. Oh look, there's another galaxy.And for dollars, is their 30 million, plus the 20 million dollars from the American manufacturer. If this does not blow your mind, then you have no emotion.

(Laughter)

(Applause)

SK: We now have on the order of 2,200 videos covering everything from basic arithmetic all the way to vector calculus and some of the stuff you saw there. We have a million students a month using the site, watching on the order of 100 to 200,000 videos a day. But what we're going to talk about in this is how we're going to the next level. But before I do that, I want to talk a little bit about really just how I got started. And some of you all might know,about five years ago I was an analyst at a hedge fund, and I was in Boston, and I was tutoring my cousins in New Orleans, remotely. And I started putting the first YouTube videos up really just as a kind of nice-to-have, just a supplement for my cousins --something that might give them a refresher or something.

And as soon as I put those first YouTube videos up, something interesting happened --actually a bunch of interesting things happened. The first was the feedback from my cousins. They told me that they preferred me on YouTube than in person. (Laughter) And once you get over the backhanded nature of that, there was actually something very profound there. They were saying that they preferred the automated version of their cousinto their cousin. At first, it's very unintuitive, but when you actually think about it from their point of view, it makes a ton of sense. You have this situation where now they can pause and repeat their cousin, without feeling like they're wasting my time. If they have to review something that they should have learned a couple of weeks ago, or maybe a couple of years ago, they don't have to be embarrassed and ask their cousin. They can just watch those videos. If they're bored, they can go ahead. They can watch it at their own time, at their own pace. And probably the least appreciated aspect of this is the notion that the very first time, the very first time that you're trying to get your brain around a new concept, the very last thing you need is another human being saying, "Do you understand this?" And that's what was happening with the interaction with my cousins before, and now they can just do it in the intimacy of their own room.

The other thing that happened is -- I put them on YouTube just -- I saw no reason to make it private, so I let other people watch it, and then people started stumbling on it, and I started getting some comments and some letters and all sorts of feedback from random people from around the world. And these are just a few. This is actually from one of the original calculus videos. And someone wrote just on YouTube -- it was a YouTube comment: "First time I smiled doing a derivative." (Laughter) And let's pause here. This person did a derivative and then they smiled. And then in a response to that same comment -- this is on the thread. You can go on YouTube and look at these comments -- someone else wrote: "Same thing here. I actually got a natural high and a good mood for the entire day. Since I remember seeing all of this matrix text in class, and here I'm all like, 'I know kung fu.'"

(Laughter)

And we get a lot of feedback all along those lines. This clearly was helping people. But then, as the viewership kept growing and kept growing, I started getting letters from people,and it was starting to become clear that it was actually more than just a nice-to-have. This is just an excerpt from one of those letters. "My 12 year-old son has autism and has had a terrible time with math. We have tried everything, viewed everything, bought everything. We stumbled on your video on decimals and it got through. Then we went on to the dreaded fractions. Again, he got it. We could not believe it. He is so excited." And so you can imagine, here I was an analyst at a hedge fund. It was very strange for me to do something of social value.

(Laughter)

(Applause)

But I was excited, so I kept going. And then a few other things started to dawn on me.That, not only would it help my cousins right now, or these people who are sending letters,but that this content will never go old, that it could help their kids or their grandkids. If Isaac Newton had done YouTube videos on calculus, I wouldn't have to. (Laughter) Assuming he was good. We don't know.

(Laughter)

The other thing that happened -- and even at this point, I said, "Okay, maybe it's a good supplement. It's good for motivated students. It's good for maybe home schoolers." But I didn't think it would be something that would somehow penetrate the classroom. But then I started getting letters from teachers. And the teachers would write, saying, "We've used your videos to flip the classroom. You've given the lectures, so now what we do ... " -- and this could happen in every classroom in America tomorrow -- " ... what I do is I assign the lectures for homework, and what used to be homework, I now have the students doing in the classroom."

And I want to pause here for -- (Applause) I want to pause here for a second, because there's a couple of interesting things. One, when those teachers are doing that, there's the obvious benefit -- the benefit that now their students can enjoy the videos in the way that my cousins did. They can pause, repeat at their own pace, at their own time. But the more interesting thing is -- and this is the unintuitive thing when you talk about technology in the classroom -- by removing the one-size-fits-all lecture from the classroom and letting students have a self-paced lecture at home, and then when you go to the classroom, letting them do work, having the teacher walk around, having the peers actually be able to interact with each other, these teachers have used technology to humanize the classroom. They took a fundamentally dehumanizing experience -- 30 kids with their fingers on their lips, not allowed to interact with each other. A teacher, no matter how good, has to give this one-size-fits-all lecture to 30 students -- blank faces, slightly antagonistic -- and now it's a human experience. Now they're actually interacting with each other.

So once the Khan Academy -- I quit my job and we turned into a real organization -- we're a not-for-profit -- the question is, how do we take this to the next level? How do we take what those teachers are doing to their natural conclusion? And so what I'm showing you over here, these are actual exercises that I started writing for my cousins. The ones I started were much more primitive. This is a more competent version of it. But the paradigm here is, we'll generate as many questions as you need until you get that concept, until you get 10 in a row. And the Khan Academy videos are there. You get hints, the actual steps for that problem, if you don't know how to do it. But the paradigm here, it seems like a very simple thing: 10 in a row, you move on. But it's fundamentally different than what's happening in classrooms right now.

In a traditional classroom, you have a couple of homework, homework, lecture, homework, lecture, and then you have a snapshot exam. And that exam, whether you get a 70 percent, an 80 percent, a 90 percent or a 95 percent, the class moves on to the next topic. And even that 95 percent student, what was the five percent they didn't know? Maybe they didn't know what happens when you raise something to the zero power. And then you go build on that in the next concept. That's analogous to imagine learning to ride a bicycle, and maybe I give you a lecture ahead of time, and I give you that bicycle for two weeks. And then I come back after two weeks, and I say, "Well, let's see. You're having trouble taking left turns. You can't quite stop. You're an 80 percent bicyclist." So I put a big C stamp on your forehead and then I say, "Here's a unicycle." But as ridiculous as that sounds, that's exactly what's happening in our classrooms right now. And the idea is you fast forward and good students start failing algebra all of a sudden and start failing calculus all of a sudden,despite being smart, despite having good teachers, and it's usually because they have these Swiss cheese gaps that kept building throughout their foundation. So our model is learn math the way you'd learn anything, like the way you would learn a bicycle. Stay on that bicycle. Fall off that bicycle. Do it as long as necessary until you have mastery. The traditional model, it penalizes you for experimentation and failure, but it does not expect mastery. We encourage you to experiment. We encourage you to failure. But we do expect mastery.

This is just another one of the modules. This is trigonometry. This is shifting and reflecting functions. And they all fit together. We have about 90 of these right now. And you can go to the site right now. It's all free. Not trying to sell anything. But the general idea is that they all fit into this knowledge map. That top node right there, that's literally single digit addition.It's like one plus one is equal to two. And the paradigm is, once you get 10 in a row on that,it keeps forwarding you to more and more advanced modules. So if you keep further down the knowledge map, we're getting into more advanced arithmetic. Further down, you start getting into pre-algebra and early algebra. Further down, you start getting into algebra one, algebra two, a little bit of precalculus. And the idea is, from this we can actually teach everything -- well, everything that can be taught in this type of a framework. So you can imagine -- and this is what we are working on -- is from this knowledge map you have logic, you have computer programming, you have grammar, you have genetics, all based off of that core of, if you know this and that, now you're ready for this next concept. Now that can work well for an individual learner, and I encourage, one, for you to do it with your kids, but I also encourage everyone in the audience to do it yourself. It'll change what happens at the dinner table.

But what we want to do is to use the natural conclusion of the flipping of the classroom that those early teachers had emailed me about. And so what I'm showing you here, this is actually data from a pilot in the Los Altos school district, where they took two fifth grade classes and two seventh grade classes and completely gutted their old math curriculum.These kids aren't using textbooks, they're not getting one-size-fits-all lectures. They're doing Khan Academy, they're doing that software, for roughly half of their math class. And I want to make it clear, we don't view this as the complete math education. What it does is -- and this is what's happening in Los

Altos -- it frees up time. This is the blocking and tackling, making sure you know how to move through a system of equations, and it frees up time for the simulations, for the games, for the mechanics, for the robot building, for the estimating how high that hill is based on its shadow.

And so the paradigm is the teacher walks in every day, every kid works at their own pace --and this is actually a live dashboard from Los Altos school district -- and they look at this dashboard. Every row is a student. Every column is one of those concepts. Green means the student's already proficient. Blue means they're working on it -- no need to worry. Red means they're stuck. And what the teacher does is literally just say, "Let me intervene on the red kids." Or even better, "Let me get one of the green kids who are already proficient in that concept to be the first line of attack and actually tutor their peer."

(Applause)

Now I come from a very data-centric reality, so we don't want that teacher to even go and intervene and have to ask the kid awkward questions: "Oh, what do you not understand?" or "What do you do understand?" and all of the rest. So our paradigm is to really arm the teachers with as much data as possible -- really data that, in almost any other field, is expected, if you're in finance or marketing or manufacturing -- and so the teachers can actually diagnose what's wrong with the students so they can make their interaction as productive as possible. So now the teachers know exactly what the students have been up to, how long they have been spending every day, what videos have they been watching,when did they pause the videos, what did they stop watching, what exercises are they using, what have they been focused on? The outer circle shows what exercises they were focused on. The inner circle shows the videos they're focused on. And the data gets pretty granular so you can see the exact problems that the student got right or wrong. Red is wrong, blue is right. The leftmost question is the first question that the student attempted.They watched the video right over there. And then you can see, eventually, they were able to get 10 in a row. It's almost like you can see them learning over those last 10 problems.They also got faster. The height is how long it took them.

So when you talk about self-paced learning, it makes sense for everyone -- in education-speak, differentiated learning -- but it's kind of crazy when you see it in a classroom.Because every time we've done this, in every classroom we've done, over and over again, if you go five days into it, there's a group of kids who've raced ahead and there's a group of kids who are a little bit slower. And in a traditional model, if you did a snapshot assessment, you say, "These are the gifted kids, these are the slow kids. Maybe they should be tracked differently. Maybe we should put them in different classes." But when you let every student work at their own pace -- and we see it over and over and over again -- you see students who took a little bit [of] extra time on one concept or the other, but once they get through that concept, they just race ahead. And so the same kids that you thought were slow six weeks ago, you now would think are gifted. And we're seeing it over and over and over again. And it makes you really wonder how much all of the labels maybe a lot of us have benefited from were really just due to a coincidence of time.

Now as valuable as something like this is in a district like Los Altos, our goal is to use technology to humanize, not just in Los Altos, but on a global scale, what's happening in education. And actually, that kind of brings an interesting point. A lot of the effort in humanizing the classroom is focused on student-to-teacher ratios. In our mind, the relevant metric is student-to-valuable-human-time- with-the-teacher ratio. So in a traditional model, most of the teacher's time is spent doing lectures and grading and whatnot. Maybe five percent of their time is actually sitting next to students and actually working with them. Now 100 percent of their time is. So once again, using technology, not just flipping the classroom, you're humanizing the classroom, I'd argue, by a factor of five or 10.

And as valuable as that is in Los Altos, imagine what that does to the adult learner who's embarrassed to go back and learn stuff that they should have before, before going back to college. Imagine what it does to a street kid in Calcutta who has to help his family during the day, and that's the reason why he or she can't go to school. Now they can spend two hours a day and remediate, or get up to speed and not feel embarrassed about what they do or don't know. Now imagine what happens where -- we talked about the peers teaching each other inside of a classroom. But this is all one system. There's no reason why you can't have that peer-to-peer tutoring beyond that one classroom. Imagine what happens if that student in Calcutta all of a sudden can tutor your son, or your son can tutor that kid in Calcutta? And I think what you'll see emerging is this notion of a global one-world classroom. And that's essentially what we're trying to build.

Thank you.

(Applause)

Bill Gates: I've seen some things you're doing in the system that have to do with motivation and feedback -- energy points, merit badges. Tell me what you're thinking there.

SK: Oh yeah. No, we have an awesome team working on it. And I have to make it clear, it's not just me

anymore. I'm still doing all the videos, but we have a rockstar team doing the software. Yeah, we've put a bunch of game mechanics in there where you get these badges, we're going to start having leader boards by area, and you get points. It's actually been pretty interesting. Just the wording of the badging or how many points you get for doing something, we see on a system-wide basis, like tens of thousands of fifth graders or sixth graders going one direction or another, depending what badge you give them.

(Laughter)

BG: And the collaboration you're doing with Los Altos, how did that come about?

SK: Los Altos, it was kind of crazy. Once again, I didn't expect it to be used in classrooms.Someone from their board came and said, "What would you do if you had carte blanche in a classroom?" And I said, "Well, I would just, every student work at their own pace on something like this and we'd give a dashboard." And they said, "Oh, this is kind of radical. We have to think about it." And me and the rest of the team were like, "They're never going to want to do this." But literally the next day they were like, "Can you start in two weeks?"

(Laughter)

BG: So fifth grade math is where that's going on right now?

SK: It's two fifth grade classes and two seventh grade classes. And they're doing it at the district level. I think what they're excited about is they can now follow these kids. It's not an only-in-school thing. We've even, on Christmas, we saw some of the kids were doing it.And we can track everything. So they can actually track them as they go through the entire district. Through the summers, as they go from one teacher to the next, you have this continuity of data that even at the district level they can see.

BG: So some of those views we saw were for the teacher to go in and track actually what's going on with those kids. So you're getting feedback on those teacher views to see what they think they mean?

SK: Oh yeah. Most of those were specs by the teachers. We made some of those for students so they could see their data, but we have a very tight design loop with the teachers themselves. And they're literally saying, "Hey, this is nice, but ... " Like that focus graph, a lot of the teachers said, "I have a feeling that a lot of the kids are jumping aroundand not focusing on one topic." So we made that focus diagram. So it's all been teacher-driven. It's been pretty crazy.

BG: Is this ready for prime time? Do you think a lot of classes next school year should try this thing out?

SK: Yeah, it's ready. We've got a million people on the site already, so we can handle a few more. (Laughter) No, no reason why it really can't happen in every classroom in America tomorrow.

BG: And the vision of the tutoring thing. The idea there is, if I'm confused about a topic,somehow right in the user interface I'd find people who are volunteering, maybe see their reputation, and I could schedule and connect up with those people?

SK: Absolutely. And this is something that I recommend everyone in this audience to do.Those dashboards the teachers have, you can go log in right now and you can essentially become a coach for your kids, or nephews, or cousins, or maybe some kids at the Boys and Girls Club. And yeah, you can start becoming a mentor, a tutor, really immediately. But yeah, it's all there.

BG: Well, it's amazing. I think you just got a glimpse of the future of education. Thank you. (SK: Thank you.)

(Applause)