

## MIT CSAIL Alliances | Abelson\_Project\_9

Welcome to MIT's *ComputerScienceandArtificialIntelligenceLabsAlliancesPodcast*. I'm Kara Miller.

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On today's show, teaching everyone, young and old, about AI is critical. And it's extremely time sensitive.

You're not going to lose your job to the computer. You're going to lose your job to another person who's working with the computer

But working with the computer, well, that started to take on a whole new meaning.

It's going to change what we mean by highly technical. So it's not the details of Python or Java or something like that or how you do it. The thing you want people to learn is what's worth making.

Today, Hal Abelson, a leading voice in teaching people about AI and a professor of computer science and engineering at MIT, joins me to talk about his work and the enormous challenges that lie ahead.

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Of course, the learning curve on AI is steep, Abelson says, so steep it makes people uncomfortable, even people you might not expect.

I mean, gosh, it's making computer science professors uncomfortable in terms of, do I really need to teach what I've been doing all along?

And then consider middle school teachers.

If I can take standard exercise and one of my 13-year-olds can go type something into a computer and get a better essay than they would have expected to do, it's just disrupting everybody.

So it is hard to move fast enough to educate people, both younger and older, about advances in AI, which is where you encounter a dilemma. Businesses want people to move up that learning curve ASAP.

There's an enormous, enormous, enormous interest, certainly, in industry. Every day, you read something in industry that says, who do I need to hire as developers? Well, maybe I don't need the most sophisticated developers anymore. Maybe I can take somebody at a high school education level or below that.

So that's part of the real furor that's happening that has real, real, real economic consequences in terms of who could be on a development team. So, again, certainly within CSAIL, our alliances, there are tremendous numbers of our alliance partners who are thinking about that opportunity.

So when Abelson thinks about teaching both kids and adults about AI, he acknowledges the challenges. Those who are in school and those who are out of school need to understand how radically the world is shifting. But how can you get them actionable information in a timely way?

How do you ensure we don't have a gap of a few years during which tech has changed but very few people understand how to work with that new tech? How do you make people aware of how jobs are evolving, which jobs are worth training for, and which aren't?

Look at these companies that are advising people what to invest in the stock market. So these companies that are now saying, I'm using some of this technology, and I'm putting my analysts out of business because this technology is doing it better. And that's just one example of anything-- the stuff we're doing at MIT and even at CSAIL, we're doing a bacteria research, all sorts of biological design, all sorts of things, designing anything.

So I want to talk in a minute about kids and education, which is the main place where we think about education. But let's just for a minute talk about adults and education.

Absolutely.

How do you-- especially for people who, let's say, are not in school anymore. How do you feel like we plug the gap, I guess I would say, if things are changing in rapid pace? And it's really important to understand how the world is changing. And for your job, for the kinds of decisions you make, how do we bridge that gap?

Well, one thing to get across to everybody-- we can talk about kids more in the moment. But it's just that everybody should be able to use this stuff to feel empowered about the technology and to think about things that would change your life. And yet some sense of, gee, I could imagine some computational tool doing that.

And I know enough-- I know enough about the basis for the technology. It's not to say I could design it or make it or something. But I know enough to say what's appropriate and what's real. I know enough to recognize that there are problems with it. And I know enough to be optimistic about what would be possible. And I know enough to see myself as somebody who's in this.

So just as one example, our CSAIL project right now is working with residents at Maine State Prison.

Maine State Prison.

Yeah, Maine State Prison. It turns out Maine is very, very liberal about this. They allow residents to have laptops in their cells, things like that.

But that's just one example of people who are not trained in this, who want to say, gee, I can be-- I can feel empowered and know something about this technology. And maybe when I get out, that could help me-- that could help me with re-entry because I know that. So that's work we're doing right now. And that's not kids. That's certainly adults.

So let's talk about that question of-- you were saying before, I think that everybody should have access to these tools. I know at least in companies-- let's just start with companies. And let's go to schools.

I know in companies, there's a lot of bans on people using large language models to do things. People are worried about privacy and security. But it also means that people are not necessarily taking advantage of the kinds of tools you think like, oh, gee, this is something everybody should be able to do now.

Well, there's two aspects to it. First of all, it's a very powerful tool. And you've got to say from the point of view of a company, OK, why wouldn't I use it? Why wouldn't I use typewriters? Why would I do my calculations using an automatic calculator or a computer or something?

This is very much in the same line. These are really powerful tools. And in terms of-- there are all these studies that are happening right now where they're doing, what does this have to do with productivity?

And I think I even read in the last few days a study that actually documented that all sorts of jobs can be more productive if they use this thing. Of course, that's got to be sorted out. And of course, there are lots of problems with this that have to work on. Of course, everybody knows one main one that some of the material that comes out of these things is false.

So a major, major research-- major, major research area is how you cut down on what people call hallucinations. But there's a lot of optimism that that's going to be solved. But then what you're doing is you have a very, very productive tool that can do really, really good things. And why is a company not going to use it?

I mean, there are particular things that I can answer-- that I can answer for that, that companies need to worry about if this thing produces stuff and you publish it on the internet, depending on what it says for the company, there's issues of liability, if you say something about some particular person or you say something that's really, really damaging and false.

So there are really a lot of reasons to be very careful and think about what's going on. But in the longer run, you're just really increasing productivity.

Let's switch it to schools. As you said, there are a lot of high school English teachers, for example, high school history teachers who think, yeah, for a long time, I've been teaching kids how to write, how to put together this essay. Now kids can basically almost skirt that entire assignment and have a--

Oh, not only almost.

Completely skirt that entire assignment. When you talk to teachers, how do you think about that? I mean, do you have a complete mindset shift that has to happen?

Well, the mindset is, what's the goal? The goal is to have kids do better learning experiences and to make better things. And now what have available is a really powerful tool that makes them make better things.

And of course, if you don't think about as a teacher how you want to take advantage of that and how you want to think about it, then, of course, you're open to this thing. If you're just giving the same old assignment, OK, the machine can do that. But the question is, what can you do that you didn't do before?

So have an assignment that says write something about some topic that you like. Or better then, tell the machine to write it. And now say, how can you look at it and make it better? How would you change it? What's the machine doing? What does it make you think of?

So it gives the student an example to not only be always writing something but to be a critic of it and thinking about it and thinking about changing it. And that's a-- you've got to believe that's also a very powerful, better educational experience, then you couldn't have done without this.

So what we need certainly in terms of schools is a lot of teacher training because you need a lot of thought to come up with this. You need to see examples. So there's an enormous need for doing better teacher training and getting teachers to understand the opportunities that are set by these tools.

So that's a big policy area. It might be the major policy area to think about training teachers to use these tools.

It is certainly a real skill to be able to edit work like when you say, OK, have the computer write this essay. And then say, what would you change, what's not so good, whatever. But do you worry that we're missing something that kids are not going to come up with their own ways to articulate complex ideas?

Well, it's true, but it takes a lot of thought to think about what that is. So in general, this is an opportunity to think about the goals of education and what's really important. And that's not easy. And that's why I keep saying what's needed really is a lot of teacher training where teachers can think about what they're really, really trying to do and what this new tool makes possible.

And what's your sense on where things stand with that kind of teacher training? Because there's a lot of schools in this country. And there's a lot of teachers and all that.

No, just-- I mean, you got to remember, first of all, schools don't have a lot of money. And secondly, teachers are really, really, really busy. So if you say on top of everything else that you are doing in teaching, go rethink the goals of your education classes.

It's a small side project.

So it's happening.

I read statistics on it, but it's really slow. It's like in the maybe 10% where the teachers are really, really doing things. But again, MIT is supposed to be making policy recommendations about education. And one of the key ones is really investing in teacher training.

OK, do you worry-- again, I talked about this at the beginning. But do you worry that the gap between when education catches up to the way that technology is changing and right now is going to leave a lot of kids coming out of school into a completely different world, a world they haven't necessarily--

Oh, that--

--been fully prepared for?

I mean, absolutely. I mean, there's a whole history of putting technology into schools. And the big answer is that it's slow in general. There's a lot of resistance. It takes a long time before teachers can adapt.

I think one of the key technology instructors in schools was the blackboard.

Yeah, OK.

Because suddenly, there's a blackboard. And it's got to totally change the way that I'm teaching. It took a long time for that to get absorbed. So again, what's a little bit funny is we're used from the industry side to seeing this enormous rapid pace of change, mostly because there's incredible investment opportunities there. But the schools don't have that. And it's going to be slow.

I know that you've been working on an App Inventor that aims to let people with maybe not necessarily tech backgrounds create apps--

Oh, absolutely.

Do you want to talk about that? And it's in some ways, it's a little bit of a sign of what's coming down the road.

OK, well, I mean App Inventor is a platform and a service we run out of CCL. It's pretty large scale. We have a million active users a month.

Wow, OK.

And we started in about 12 years ago. And since then, we've had, oh, gosh, 20 million users. So it's a very CCL active thing. It might be the-- it might be the largest impact educational project coming out of MIT, not to mention CCL.

But its goal is that anyone should be able to make a mobile app. Mobile app because in lots of places, that is the device that students have. Again, I said a million active users a month. About half of our users are from developing countries.

Oh, for example, you know the European country of Moldova, right, which has a lot of problems with Russia right now? They've got another problem which is a lot of hepatitis B. And it's a challenge to find sources of pure drinking water.

So there's a group of, I think, four or five high school girls in Moldova who built an app that you take your mobile phone. You're at the source of water. You take a picture of the water source.

You fill out a little questionnaire that says, is this good to drink, how does it taste, what is it done, special things. Oh, the pump handle at the well here is broken, so you can't really use it. And they make this little database. So you put this on a database.

So that's a-- again, it's a mobile app that pretty much kids can make. This used to be very hard to do. But these days, it's really pretty easy.

And are people using this in Moldova to--

People using it. But not only that is you can take this database. And the girls have put it on a Google map. So you're driving around in the country. And you can see on the map where the sources of water are.

And again, that's remarkable when you think about it. What this girls have made is a national resource and now say where are the place-- where are the times when you see young kids building something that could be a national resource? And why is that? That's because of the internet infrastructure that we've put in.

What level of technical knowledge-- I think people want to know. Do these girls know how to code, these girls in high school who created the water rating system in Moldova?

Well, that's what our App Inventor platform does. The whole idea is that you don't type in text or code in a particular language. What we have is you assemble programs by sort of like Tinkertoy pieces that you drive around on your phone or your browser or something. And that makes the program.

And our vision is that pretty much anyone could do that. We are right now saying, well, that's too hard. We want to do something that makes it even easier. There's a research project we're working on. We haven't quite distributed out of CSAIL yet. But it's coming pretty soon, probably about two months. And the way that works is that you create your program by speaking-- by speaking in natural language.

So I could say-- and now I'm going to try and be literal. I can say to the system, build me an app that has a few buttons corresponding to different languages. And when I press the button, translate what I speak into the language for that button and speak the translation to me. Say literally that. And if you say literally that, it will produce you-- it will produce you a mobile app that does that.

What does that say to you about the future of technology and, to what we were talking about before, the need to have people who are highly technical versus not on teams?

Well, again, it's going to change what we mean by highly technical. So one of the phrases we like in terms of education, what's the most important idea to get across if you're doing computing, in teaching computing? So it's not the details of Python or Java or something like that or how you do it.

The thing you want people to learn is what's worth making. So that involves some technical knowledge about what's possible to make, not details of the same thing, but just really getting appreciation for the entire infrastructure.

So when I think about what's important-- and this is not just kids-- you say to people, what's worth it to be using this technology for? And that can happen at any level. And it needs some sophistication. It needs some sense of what's possible. But the real thing that you need-- you were talking before about democratizing the technology.

The thing you want to democratize is the sense of how everybody can be empowered to do stuff that really matter to them. We have a phrase that we use in our research project called computational action. And computational action, we say is how do you make things-- how can you make things that can improve your life and your life of your family and the life of your community or in the Moldova as an extreme example is a national resource.

So we think of ourselves as promoting this thing called computational action. And it goes all the way down to, I mean, even primary school. What does a primary school kid think would be useful to them?

It also seems like a-- we are heading towards this potentially huge surge in productivity if the middle steps of between I want this or I know it's good for the society around me-- I think one of the things people have done with App Inventor is help people they knew who are blind. It's one thing to say, this is what I want I wish I had. And it's a very different thing to say, but this is what I actually do have or to go out and create it. But you're making that gap much, much smaller--

That's exact--

--between I want and I have.

That's exactly right But it's also a complete reflection of what's saying in industry. In industry, what's the buzzword? The no-code movement. So think about the no-code movement for 14-year-olds and what that really could mean.

So we don't have to guess, or we don't have to extrapolate what the excitement-- what the excitement would be. That's really, really happening.

I wonder too about-- I mean, there's always a gap in education at least in the US, but this may be true across the world too, between wealthier and poorer kids.

Oh, absolutely. Absolutely.

And I wonder, in some ways, AI offers the opportunity to close that. But I always worry that new technologies end up exacerbating it because you have people in wealthier communities maybe can put together the money to hire somebody to teach computer science in high school. Or they can do stuff like enrichment stuff on the weekends. Advantages always come to--

Oh, I think that's absolutely certainly true. I mean, that's one of the real frustrations. You do something where you're saying you really care about working with underrepresented schools and marginalized communities and all that. And then what you find are the wealthier places, the ones that really, really, really, really take advantage of it.

So that's a hard thing to-- again, as I said, in App Inventor, we're trying to do things that are accessible because you design things so it can be done on mobile phones. And as I said, half of our users come from developing countries.

But again, it's just this terrible unfairness that the wealthier places can somehow move faster in taking advantage of that. And again, you have to put tremendous, tremendous effort on that. It's another recommendation-- I said MIT is making educational recommendations of which a major, major one is teacher training. But another major, major one is to try and get more equity in how these things go out.

So what's your fear then? If we have technology-- and we've been having conversation about technology that's totally upending things. And it's moving really fast. And it's changing jobs. What's your fear if students across the board are not exposed to that technology in an equal way?

What's the phrase by someone in Harvard Business School? You're not going to lose your job to the computer. You're going to lose your job to another person who's working with the computer.

And I think that really capitalize it in terms of getting not just kids but everybody prepared for the way those environments are going to be. You're going to need some appreciation. You're going to need some kind of sophistication. And again, you're going to need the opportunity to apply that.

So a lot of the fear that's happening is really well founded. But it requires a response.

It seems like there's-- on a more positive note, potentially, it seems like there's an opportunity here because technology is changing so rapidly to get out of some of the traditional structures that we've had, where maybe you don't need a college degree to do certain kinds of things. I mean, Sal Khan, who founded Khan Academy, has talked for a long time about the idea of micro-credentials. And--

Oh, yeah.

--in many ways, that didn't really ever take off. But I wonder could-- I mean, you talked about working with prisoners. Is there an opportunity here because AI is so different and so disruptive for maybe groups of people who have been on the sidelines to get in if things are done right?

Well, again, if things are done right. That's a big, big phrase you just said.

[INAUDIBLE]

There's certainly enormous opportunity and enormous ground for optimism. But you've got to remember that schools have hundreds of year track record in resisting improvements in doing things. There's a whole, I want to say, entrenched bureaucracy, which isn't quite the right word. But there's a whole sense of how this whole system works to resist exactly making those kinds of changes.

So that's on the education side. And again, on the industry side, I think you can be a little bit more optimistic because the financial rewards for an industry can do something. But still, there's a lot of-- there's just a lot of ways of doing things and prejudice that stop all of this.

So I think the answer to your question is, yes, there's grounds for optimism. But we have to be really, really realistic about how hard it is to make changes like that.

Well, a final question then, when you talk to people in industry, do you feel like they will put pressure? We have seen alliances in some places between, let's say, high schools like technical high schools and industry because industry felt like, well, gee, people aren't coming out with the kind of technical knowledge that's needed to work in X, Y, or Z factory. I can't find these people.

And so they partner with schools to produce the people that then can get, hopefully, really decent jobs. Do you think industry will-- I don't know-- pressure education to some degree to try to shape people to enter the positions that they know are being created?

Well, I think a little bit and in the longer run. But those changes are hard to make. I mean, imagine that you're in an industry. You're trying to-- imagine what that means. You're in an industry. And you're trying to attract schools and stuff.

Certainly in the US, the issue with schools is that it is so distributed. Every district has different rules and different kinds of incentives and things. So when you-- especially coming from the outside from industry, well, sure, you can do a little bit. But making wholesale changes, again, going to be tough.

There are a couple of programs that train kids to do various technical things and then give them a pathway into getting an internship or a job or something like that. And those are very, very promising. But they're tiny and on the small scale.

Right, and I have to say, I have a friend who teaches computer science in high school. And one of the things that is certainly true is that it's hard to even find educators because those people are snapped up by industry, leaving not that many people who know a lot about computer science available--

Aboslutely. There's just not.

--to teach at the high school level. Even the college level struggles to find people.

Oh, yeah, they're completely snapped up. And the ones who aren't snapped up are insanely busy. We always talk about at MIT how busy we are doing things. But, man, teachers are really busy.

Yeah, yeah, yeah. Hal Abelson is a professor of computer science and engineering at MIT. Thank you so much.

OK, I've enjoyed it a lot. And I think-- again, MIT is just a fun place to be doing this stuff from.

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And if you're interested in learning more about the CSAIL Alliance's program and CSAIL's latest research visit our website, [cap.mit.edu](http://cap.mit.edu). Plus, if you want to learn about our new digital course coming this spring, it's called Driving Innovation With Generative AI, you can find details on our website.

I'm Kara Miller. Our show is produced by Matt Purdy and Nate Caldwell with help from Audrey Woods. Tune in next month for a brand new edition of the *CSAIL Alliance's Podcast* and stay ahead of the curve.

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