CRITICAL CONVERSATIONS

Event transcript featuring **Dr. Vivienne Ming**

UNPACKING AI & THE FUTURE OF HUMAN POTENTIAL

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CRITICAL CONVERSATIONS

Event hosted by **New Roads School**

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Critical Conversations Speaker Series
Featuring Dr. Vivienne Ming

TRANSCRIPT

Guest
Dr. Vivienne Ming

Moderator
Mario Johonson
Director of Student Wellness and Human Development
New Roads School

Moderator
Mark Vickers-Willis
Director of External Community Engagement
New Roads School

MARIO JOHONSON:

Good evening, friends. Welcome to the Critical Conversations Speaker Series. My name is Mario Johonson and I will serve as this evening's event moderator. I'd like to welcome our esteemed featured guest Dr. Vivienne Ming, New Roads School Director of Community Engagement, and Critical Conversations co-founder Mark Vickers-Willis and our expansive national network of partner schools.

We are also pleased to welcome Graphic Recorder, Jessamy Gee from Think in Colour (Australia), who's here to help capture our thinking. Jessamy will be creating a live visual representation of the output from our session today that will be made available to our partners

Dr. Vivienne Ming explores maximizing human potential as a theoretical neuroscientist, serial inventor and entrepreneur, author, and AI humanist. Over her career she's founded eight startups, been chief scientist at two others, and launched what she calls the "mad science incubator" at Socos Labs, where she explores seemingly intractable problems—from a lone child's disability to global economic inclusion—for free. As the co-founder and Chief Scientist of Dionysus Health she applies machine learning to lessen the corrosive health effects of chronic stress in communities, where she is one of two transgender women pioneering diagnostics and therapeutics for some of the most challenging issues in women's health. She also develops tools for learning at home, in school and in the workplace, models of bias in hiring and promotion, and neurotechnologies to treat dementia, an outgrowth of her research at UC Berkeley's Redwood Center for Theoretical Neuroscience. In her free time, Vivienne has worked on designing AI systems to treat her son's diabetes, predict manic episodes in bipolar sufferers, and reunite orphan refugees with extended family members. She sits on boards of numerous companies and nonprofits including RFK Human Rights, The GenderCool Project, Optoceutics, Dionysus, and Crisis Venture Studios, among others. Vivienne also speaks frequently on her

AI-driven research into gender and inclusion in business. It is our immense pleasure to welcome the illustrious Dr. Vivienne Ming as our guest this evening.

In recognition of our time limitation, I'm going to jump right into the heart of things. This conversation will be centered around four segments. Segment one, deep processing, feeling the burn, and the emergence of authenticity. Segment two, unleashing the mad scientists. I'm really excited for segment two. Segment three, paradox, possibility, and navigating tensions.

And finally, segment four, nurturing creativity, adaptation, and exploration over capitulation to algorithms. When it's time to transition to another segment, I'll deliver a gentle tap of this chime to indicate that we're moving to a... we're closing one segment and moving to another segment. Let us begin with the first segment, deep processing, feeling the burn, and the emergence of authenticity. Dr. Ming, we'd like to begin our discussion by learning more about your own individual journey as a human being. Can you provide a brief personal biography that includes all the basics where you were born, grew up, and the essential dynamics of your family, please? And welcome.

DR. VIVIENNE MING:

Sure. Although my bio seems to be getting longer and longer. I think we've already eaten up half of our hour just with the ludicrousness that you read out for everybody. Having said that... Well, let's scare everyone and think that this is going to go on for the next eight hours by saying I was born in a little valley. I am here in the Bay Area. At the very least, New Roads is down in LA, Santa Monica. I was born in between. Well, I was actually born in Pasadena, but I grew up in this little valley that John Steinbeck wrote an entire novel about called the Pastures of Heaven, which not coincidentally is west of East of Eden. So I grew up in the Pastures of Heaven in the Monterey Peninsula. My dad was a doctor, my mom was a teacher, and when I was a little kid, everyone kind of assumed I'd win a Nobel Prize.

And I don't mean to say that, as can happen, everyone was harsh, or my parents were... had these untenable expectations. It was just this weird understanding that I picked up from everyone else that I would do amazing things. My best friend was supposed to write the Great American novel, and we just lived these lives. And the thing is, it became clear really soon, I mean elementary school, that maybe I wasn't the person they thought I was. And the more clear it got, the more clear it was that I wasn't perfect, the more I gave up. And unfortunately, what that meant by the time I got through high school and, thanks to standardized test scores, got into university is that I pretty quickly flunked out and ended up homeless.

In some ways, I wish I had fun stories about being homeless, but there are no fun stories despite what some movies might suggest. I can remember a year in the mid-90s where I don't think I met a single person. I did not have a meaningful conversation with a single person an entire year. And wow, it is brutal. I wouldn't wish it on my worst enemy. So clearly, my story doesn't end there, though it could. Without getting too detailed. Sometime in 1995, I had a night where I had to make a hard choice about whether my life would end at that point or if it was going to move forward, and skipping over a lot of very complex feelings that, at this point, are so hard to remember. It was so long

ago. It's very disappointing to me that '95 is so long ago. But I made a decision. Maybe I would never be happy, but that didn't have to be how I judged my life.

I could live a life that made other people's lives better. And when you're homeless, even if you still have family to fall back on, that doesn't magically change everything. It took a solid five years for me to climb out of that hole. I mean, at that point, I dreamed... my dream was getting a job as a clerk at a bookstore, and then I could pay my own rent and read science fiction and fantasy novels for the rest of my life. That was what I dreamed about. Somehow, I found my way back to the UC system, and I can't tell you why, but I figured out which degrees I could finish in a single year, flipped a coin between cognitive neuroscience and economics. It came up heads. So I studied brains, and I finished that degree in 1999. My honors thesis was a computer system funded by the CIA that could tell if someone smiled by analyzing their face was a real smile or a fake smile, which was ethically very complicated.

But at the moment, given everything my life had been to at that point, was the coolest thing my sci-fi brain could have imagined. And now, I'm really going to pull this story together. After completely failing and pretty solidly ruining my life, I came back. I got perfect grades in every class, finished my undergrad in a single year. I got to choose where I went to grad school. I studied psychology and computational neuroscience at Carnegie Mellon. Then, I had an appointment... a joint appointment at Stanford and Berkeley at the Redwood Center for Theoretical Neuroscience. And then this new life started over again because there's a part of this story that I hadn't shared. And maybe I'll hold with this sharing because obviously I've got a lot more life to talk about, but we might have a chance to cover it in the other sections.

So, as I said, probably sometime around October of 1995, I had this brutally hard night where I need to figure out why I should be alive. On my birthday, probably 10 years to the day 2005, I was a hotshot grad student at Carnegie Mellon with a paper just published in Nature on my way to doing big things and I was engaged to this amazing woman who had demonstrably terrible taste in a spouse. And I turned to her for no reason whatsoever and said, "If you want to know my deep, dark secret, it says, I wish I was a woman." That began in another journey and another transition for me. Here's the one thing that will complete this part of the story. I was wrong. I do get to be happy. But I think what's important about my personal life story, at least the part of it I've shared, is the time that I spent doing kind of hard things, 10 years, from deciding to continue my life and keep trying until it paid off. 10 years where things were still pretty hard.

Even though everything about my life was getting better, I still kind of hated myself. But the payoff, I have the best job in the whole world. I run a philanthropy. People bring me hard problems. "Dr. Ming, my daughter has 500 seizures a day. Dr. Ming, our country does everything the World Bank says, and yet nobody hires our citizens. Please help." And I get to help them for free. I have a family that's amazing, and I get to be a person I actually like. So that's a journey. It's a big one. And I guess I will close on this one statement about this one aspect of myself. Transition, in my case, gender transition, wasn't some magical thing that took my life from the street into what it is now, but it was a big part of that journey. And right now, particularly when this is apparently a thing I thought was done with but has become a hard conversation again, if anyone you know is going through a transition of any kind, there's only one thing that should matter to you.

Will you be a better person? Is the only way I judge myself and the changes in my life. And in this sense, with one exception, possibly pushups, maybe pull-ups, we'll throw in as well. I used to do P90X for the fitness nerds in the world, but for those things, I invent technologies that save people's lives. I founded companies, created jobs. I've built education companies. I want to genuinely believe the world's a better place because I was here, but in particular, because this version of me was here, not some idealized one my parents had when I was a little kid that I didn't... couldn't live up to or anyone else's idea of me. I love being a mom. I love being a scientist. But in the end, it's how many other people my work has touched that really matters to me, which is still tied to what I believed that realization in 1995, which is live a life that makes other people's lives better.

MARK VICKERS-WILLIS:

Wow, what an incredible answer. There was just so... I think we could spend the next eight hours unpacking that.

MARIO JOHONSON:

Yeah, I was just thinking that. I was literally just thinking it. Thank you so much. That was really, really very well-contained. You gave us a very clear picture to start us out with.

MARK VICKERS-WILLIS:

And can I just... Mario, there's so many questions I'd like to ask, but what I'm intrigued by, and having learned a little bit about you prior to obviously this evening, is this journey that idealized sort of as a child in where you were living and the romantic sort of notions of that childhood. And then, obviously, when you talk about the extraordinary purpose and impact you are now having with your work is quite extraordinary.

But, obviously, there is... it is marred with this passage of time in between where there was so much negative self-talk, destructive views of self-suicidal ideation, obviously, as you were saying, homeless [inaudible 00:13:41] time. You're now a world expert on unlocking human potential among many other things. Considering tonight we have many parents and educators that are here viewing and will view this, what could you offer now, both as a parent and as a neuroscience, but also just as a human being who's gone through this journey? How do you think we can more effectively support our young people when they're going through these sorts of challenging times?

DR. VIVIENNE MING:

Yeah. I mean, you could imagine how many times I've been asked, "If you could go back in time, what would you have told your parents?" And the thing is, I know where a lot of this came from. My father, as I knew him, was this charismatic, the smartest person you've ever met, a doctor living in coastal California.

We had so much, but I didn't actually fully understand. He grew up a sharecropper in nowhere Kansas. Dorothy have never heard of where my dad is from. Genuinely, if there's a Kansan on the line, he's from Hardner. And if you've ever heard of Hardner, wow, you've really gotten around.

MARK VICKERS-WILLIS:

My wife's from Kansas. I'll be asking her.

DR. VIVIENNE MING:

The next biggest city is [inaudible 00:15:06] and then Medicine Lodge and Alva, Oklahoma. He also had this amazing potential. Graduated in three years from high school, top of his class for the entire state, full scholarships everywhere. But he didn't go because what's the point if you're just going to end up back on the farm? He did go to KU, tutored Wilt Chamberlain in chemistry. You know, the famous chemist. And Vietnam sort of changed the course of his life because he got... ended up getting drafted to be a fight medic and ended up a doctor. But as he said himself, it transformed everything about who he is, and he would never wish it on his children. These sorts of experiences, understanding that homelessness or a war, yeah, they are transformative.

But what my parents actually gave me without realizing it, when I went back years later to university, I went back after 10 years of nothing, 10 years of knowing exactly how many coins I had to find on the side of the street to buy a box of Rice-A-Roni because that would be my meal for the week. If you've ever... If there're parents watching, and there, surely, are some who are sending their kids to test prep, and you're thinking about everything that has to go on their college transcript and thinking about the next stage I walked in, it was UC San Diego, I returned to UC San Diego as unprepared as you could imagine after 10 years of being completely out of it and I did as well as anyone's ever done that.

What I had was not that I had everything at my fingertips, all of the skills, how to factorize a polynomial, and every fact and every detail. A lot of those is I kind of lost. What I had were the fundamentals that my parents put in me. And I admit, in that sense, I won the life lottery. I had these two amazing people that whether they realized it or not, they were role modeling for me what truly mattered. My dad was a doctor who made house calls until he was 73. Like the day he died, he was going into the office to go see patients. That sort of thing. I had a very good life as a kid, but that sort of thing really resonated. That idea, "Live a life that makes other people's lives better," that was an echo of things he told me my whole life, and it's part of what brought me back.

I'm sure that both of my parents felt that they, in some way, had failed me, but they had put so much in. So here's the thing. I admit it may not feel that helpful, but it is truly the most honest answer I could give you is stop obsessing over the transcripts and the test prep. Do whatever there feels good to you, but you can't have ruined your life much worse than I, without actually pulling the trigger, and I came back from it. Be the person you want your kids to be. There is no impact you will have on their lives than what you role model for them. And the great thing is you get to be that person.

That's the... What a wonderful side effect of following my absurd advice is you get to be the person that you want your child to become.

And I know that sounds intangible, but there's concrete aspects of that about being resilient, about being able to take the perspectives of others, about having a sense of purpose in your life, whether that's spiritual or very grounded. It turns out my research has shown, and I get crazy data sets, like 122 million people, and I get to look and see what predicts their long-term life outcomes. And it turns out those seemingly intangible things I just mentioned, that's what predicts it. It's not the university you go to. It's not the skills that end up on your resume or on your transcript.

It is those things that are so fundamentally human that we think of them as being soft, or we think of them as being intangible, but in fact are incredibly real and largely the product of the people that are around us in our lives that we pick up from them and we learn these things from them. And so I don't want to keep rambling on the subject unless we want to get nerdy, and then I can get into the hard research about it. But this is the one thing I'd pay out back to my parents is you actually did all the right things. We just didn't realize how long it was going to take. And yet, it would've been great if I and you and everyone else had been able to give me more time and recognize it was going to come.

MARIO JOHONSON:

It was actually a brilliant ramble because it leads really a great segue into the next segment, actually, Vivienne. Let's move on to that segment at this time. Unleashing the Mad Scientists. So, Vivienne, your entire professional career is way too extensive, of course, for us to cover in a single discussion, even though we've covered a lot already.

However, there are a few punctuation points that are extremely relevant to the discussion. Let's start with your role as a researcher and neuroscientist. What attracted you to this field of study, and how did it factor into your own personal story? Again, you've already started covering a little bit of that already. If you could maybe pick up on that just a little bit more, that would be terrific.

DR. VIVIENNE MING:

No, I'm genuinely happy to, and as I alluded to, some of this was dumb luck. When I say I flipped a coin to decide between economics and cognitive neuroscience, I am not joking at all. I literally flipped a coin. I could also have done math, and I thought, at the time, "Math, what am I ever going to do with that?" Little did I know where my career would go because almost immediately after entering the world of neuroscience and thinking I'd stick wires into cats and use rabies retrovirus to trait axonal trajectories, I got introduced to computational neuroscience. The field that arguably has given rise to modern deep neural networks and modern artificial intelligence, or at least certainly played a big role in it. And I got hooked immediately, not the least of which is it's a lot... It's much more fun to build Skynet than it is to run rats through mazes.

So it was just cool. I could build this thing that could understand a human smile and something that felt fundamentally human, and I really got into that. But I was still... to me it's a tool. I can geek out about algorithms and data, but none

of that really gets me. What gets me is, what can I do with this? And in that sense, when I went to grad school, and we developed one of the first systems [inaudible 00:22:43] literally just learned to hear. We walked around parks in Pittsburgh, Pennsylvania, with a microphone, and our system learned to hear by listening. But then we realized not only is there some really neat purely theoretical science to be done here, but we thought, "What if we could take this algorithm and put it into a cochlear implant or hearing aid and allow people to hear with a system that could adapt in real-time to the sounds that were around them."

And we did an experiment, and sure enough, people's ability to hear speech and noise increased by 50% when we were able to bring the best of what machine intelligence and human intelligence could bring it together in one case. And then, boy, I love being a scientist. My whole job as an entrepreneur is to trick venture capitalists into funding my experiments. And it turns out, as long as you pay them back, they never catch on. They're such fools, but I get to go do this now on a regular basis. So all I thought, even back in San Diego as an undergrad, I sat up front in every class, and I thought, "How can I use this? How can I use it? How can I use it?" The crazy thing is, after being a student that had flunked out of classes, suddenly, it seemed just so easy to get perfect scores, but I wasn't trying to. I was trying to think, "How can I use this?"

And so, that really got me deep into understanding people and what does it take to... a line of mind from a long time ago to maximize human potential or human capacity or everything that is us. Part of it is obviously inspired by my own journey and thinking, "How is a kid like that even allowed to fail?" But the realization of my life is every kid is amazing, every single one. And if you believe that and you own it, then you have a responsibility to make a difference in every single kid's life. It's a delusion to think that you can, but you can try. And so that drove my work in neuroscience and when I started my first EdTech company with my wife bringing AI into education, and then we did another one and then one of the first companies using... looking at AI to take bias out of hiring.

And then the work I get to do nowadays, both philanthropically and in postpartum depression and Alzheimer's, the whole theme just comes back to I love nerding out about the brain about machine learning. I love reading economics papers. I mean, what sort of truly distorted mind enjoys an economics paper? But what I love about them is I can see in them the potential to change someone else's life. And it's not just motivating. It's me, the science fiction fan thinking, "Maybe I could build that." Not the truly science fictional version, but a real-world version that might actually mean something to someone. And so yeah, if we want to get deep into brains, boy, we can really geek out right now. But my dirty secret is everything's just a tool to understand people.

MARK VICKERS-WILLIS:

Well, I think... Thank you, Dr. Ming, with that. Again, there's so much I want to unpack again. One of the things that I know we talk about as a school is how do we leverage diversity. When we think about innovation and creativity, and we're a school that's sort of founded with racially, culturally, socioeconomic, and neurodiverse students, and it's often a very messy process too.

It's not always neat and tidy, but we're always trying to create environments where you can actually leverage a variety of perspectives. Because the research certainly shows that the outcomes all improve mental flexibility, collaboration, critical thinking, all the things that really matter when you think about the type of optimized environments when you want to maximize human potential. One of the things, though, is a previous guest of ours, Dr. Dan Siegel, [inaudible 00:27:26] looking at the biology of belonging, and he was talking about the neurobiological impulses that you have with inside outside grouping where we've got these neurobiological impulses where we're constantly trying to discern threats and who's with me, who's not.

And one of the biggest challenges with this is we turn off empathy with outside groups, particularly when we're under stress, which then obviously can impact that environment considerably. And when I think about the atrocious things that have been happening in the last few days in the world in Israel and with Gaza, this is a phenomena that's obviously just erupting in all sorts of ways. Can you provide, I suppose, any guidance in terms of how we might hack some of these process... these neurobiological processes that are part of who we are or provide any sort of... shed any light on that?

DR. VIVIENNE MING:

How to give a quick and actionable answer to one of the most profound questions of the human experience? A funny thing, for maybe 15 years now, I get invited to come in and make the business case for diversity. So some very big companies have had me come in, and it turns out it's a super easy case to make. The research is pretty unequivocal. You can... From boards to c-suites to individual teams, from innovation to the general workforce, from experiments to the real world, the finding again and again is all things being equal diverse teams outperform. So that should be the end, right. We're all perfectly rational, and we all make perfectly rational choices. So knowing the truth that it helps, that's the end.

At the beginning of lockdown, I got a request to come in and give one of those talks, and I'm always happy to, but I just felt like, "15 years later, and I'm still giving the same talk?" Well, I'm not because I never give a talk. I ramble manically until a clown with a broom comes out and sweeps me off the stage. But I love being extemporaneous because the research and the details change all the time, but the underlying story was still true. And while the world certainly has changed over 50 years and 15 years, I still thought, "This is... It is amazing that we still have to talk about this." So I thought, "Why don't I put my neuroscientist hat on?" And instead of looking at the data on diverse versus non-diverse teams, what if we look at the brains of people making these decisions?

And if we win in detail, I could give a whole other giant talk. So I'll simply say, unshockingly, our brains respond dramatically different to two strangers. One is very similar to us, and one is very different. Now, even within that, people themselves are different. We're highly heterogeneous. What makes an ingroup and an outgroup is highly variable across people as individuals, as cultures, and beyond. So but the general story is when we look at the neuroscience of trust in an idealized context where we're thinking of ourselves without pressures. We don't have to deliver a project. We're not making a decision about who to hire or what student to admit or anything like that. There's no social pressures, then we can genuinely share trust across divides. But even then, there's a big difference.

When you look at the brain of someone who's every... while meeting someone who's very similar to you, what we see is a lot of what we call automaticity. There's not a lot of recruitment of prefrontal circuits that would indicate a lot of effort being used in the sharing of trust. And in fact, what we do see is dopaminergic rewards and endogenous opioids. By trusting this person is similar to you, your brain is saying, "Hey, good job." We expect there to be a tangible reward later, but we're not even going to wait. We're just going to go all in and say you made the right choice. Yet when that person's very different than you, we see all sorts of effort for frontal recruitment. It clearly is not something that's coming naturally, and there's no upfront rewards. Rewards only come when the trust pays off.

The problem then is when we live our actual lives, all that frontal system that we are using for sharing trust with someone who's different than us is now competing for managing our own emotions, for planning the work that we're doing without even realizing it. Suddenly, in a [inaudible 00:32:51] real sense, we become a different person. And so we ran an experiment in which there was a game, and the people playing the game before the experiment even started could clearly see, "I'll make the most money, and they got real dollars, if I collaborate with the person who's most different from me." Almost everybody got it without being told, and they could articulate it right up front.

And then you start the game with the real dollars on the line, and almost everybody immediately finds the most similar person to them and collaborates with them. And maybe... therefore, of course, under earns, despite our supposed rationality. And the most amazing part is, at the end, they had explanations, clear, rational reasons why it was the right thing to do and why they were wrong at the beginning, but they weren't wrong at the beginning. They were 100% right. If they collaborated with someone who was most different from them, that would've actually gotten them the most points in the most dollars. But when the stakes were there, it changed how they made their decisions. So how do we go beyond that?

Well, again, this could be a very long story. I will keep it short. There's one genuinely proven way to work across boundaries to make a difference and transform not just a diverse workforce but an inclusive workforce and community as a whole. And it is a very wonky title, Counterstereotypical Exemplars, but actually it's really straightforward. You need to spend time with people that violate your stereotypes. It is the single most effective, most reliable way to change a person. And then specifically for me in this neuroscience of trust research to shift that boundary of what's an ingroup, what's an outgroup? And be able to pull people into that space where, in essence, you get trust for free because, at a certain point, that's where trust becomes sustainable.

Rather than this rare resource that takes sometimes superhuman effort to share, being able to move that barrier, and it truly takes working with people. And I'll add this one extra note in. At the same time we're doing this research, we're looking at innovation. And there's this paradox, a well-known paradox in the field of innovation research, which is called the diversity innovation paradox. People that are an outlier within a field are much more likely to produce novel, impactful, insightful, new research, and yet are much less likely to get cited to be recognized for their work and be promoted up towards professorships. It's a known phenomenon. And a friend of mine, who's a computational linguist, actually created an AI that read every single Ph.D. dissertation published since 1973, 1.8 million papers that read all of them.

It's the only thing in the universe that read my dissertation. I know that for a fact because I did not. And I sure as hell know my dissertation committee didn't. They just begged me to leave. So it read all of these, and it showed, yeah, absolutely. People that were gender or racial layers in their field, as a matter of probability, were more likely to have a truly innovative idea, but, unfortunately, [inaudible 00:36:40] less, much less likely to be recognized for it. So we then experimented with ways of bringing that out, ways of understanding how communities could actually evoke a focus on what interesting enough ended up getting called Minority Opinion. But this is minority in the sense of my sci-fi nerdity. This is like minority report. How do we get people to pay attention to that unique idea regardless of who came up with it?

Maybe even orient to those very people that are outliers because they're more likely to have those unique ideas. And so the research was amazing, but it doesn't end with our brains and the neuroscience of trust saying, "This is just who we are." We can completely change those boundaries, but it is effortful, and it takes time. And counter stereotypical exemplars. You have to go spend time with people that violate your stereotypes. And I will admit, if you are unwilling to engage with that, it can be really hard. Possibly you can't overcome these differences. But the amazing thing is you look across diverse societies around the world. The most successful multicultural, pluralistic societies around the world and across time are the ones where people regularly interacted across the divide in productive ways, and we should just engineer that into our lives.

MARIO JOHONSON:

Incredible, incredible. Again, many, many deep philosophical issues that are brought up there, which is, again, perfect transition for the next segment, which is kind of picking up some of the philosophical pieces, paradox, possibility, and navigating tensions. The philosophical implications of your work around AI, complex problem solving, human potential, and our neurobiological [inaudible 00:38:38], as Mark was just speaking to earlier, right.

Let's start with AI. Right now, there is a lot of fear surrounding AI, and you often talk about its paradox to providing answers yet engendering little to no active reflection on the part of consumers. What view can you offer to redirect the fear-based expectations around AI to a more affirmative vision of its generative possibilities?

DR. VIVIENNE MING:

Yeah. One thing about education is, in some ways, I think we can all acknowledge, sometimes education gets a bad rap as sort of an industry and a field, but actually AI is one of those areas where education has been a real front-runner. And so research on AI tutors, for example, has been going on four decades. And one of the most consistent findings is if you turn a student loose with a sophisticated AI tutor, and we can imagine an LLM like GPT today. But it could be something like the Algebra Tutor that was developed at Carnegie Mellon while I was a student there, or you just imagine Google and being able to look things up online.

If you make it easy to get the answer, then it turns out people stop exploring. They attribute those answers to their own knowledge base. And one of the best studies of this, they built an AI tutor, and they allowed students to interact with

it in three conditions. Obviously there was also a control group that had nothing. And in the first condition, the student would interact with the AI pre-test. There was a pre-test, the interact with the AI, and post-test, and the AI will give them answers. It will give them context and explanation. Again, imagine GPT. You ask it a question. It gives you the full answer. Turns out these students were genuinely better when they were using the AI, but at the post-test, they'd effectively learned nothing.

They'd looked like they hadn't gone through the class at all. So okay, we won't give you the answer upfront. We're going to pre-train or, as it's called, fine-tune GPT so that it only gives you answers once the student has already generated them themselves. Prior to that, it'll only give you context. Great. Again, the students are better when they're using the AI than they were without. But pretest-posttest, it's like they haven't learned anything. So, in the final condition, the AI never gave them answers. It only gave them context. How interesting that you are bringing up this issue. You may find this reading really informative about that. And now, again, if we were perfectly rational, that should be the worst condition.

The students are being given less information. How could they be learning more with less information? But sure enough, because surely everyone is ahead of me for the punchline of this study. Not only were the students better when they were using the AI tutor, they were better at post-tests. They had actually learned and learned more than the control group that didn't have any AIs. And if you think this is only about students, PWC, the big consulting firm, just released a report of a trial with GPT done with their own consultants. And they found that when they used GPT to analyze data and create reports and create slides to present arguments, they were genuinely better than the consultants at GPT that weren't using the system.

But then they were asked to decide what to do about their findings. And then it swapped. The people that didn't use the AI, and, again, highly trained elite university graduates, the ones that didn't use the AI were more accurate in determining the actual, interesting, complex question, "What do we do next?" Human beings have this amazing thing that modern AI doesn't, even the most sophisticated versions of it, we can explore the unknown. But when we thoughtlessly just roll AI into everything we do, we train ourselves to become no better than it is. I wouldn't spend all my time building AI systems if I didn't believe that they could do good in the world.

But where we see it doing good, I will tell you I use Bard just because I have a sweet spot in my heart for Google, and I use it a lot, but I treat it like one of my grad students. But not just like one of my grad students because this grad student doesn't just know about neuroscience or about machine learning or economics. It knows about everything, but it understands nothing. And my job is understanding I'm the creative potential. I'm the explorer. And when I say explorer and creative, I'm creating new equations. I'm creating legal plans for creating companies. I am, at times, creating artwork.

I write fiction. Creativity, all I mean is when there's no roadmap, when there's nothing to tell you what to do next, that is the space that is fundamentally human. And I think it's scary when people think about AI is taking everyone's jobs, and it's worth talking about that and a more nuanced idea of deprofessionalization. But what actually, when I look at this, I look at what AI is truly great at, which is the routine, and I'm willing to bet many of us have careers, very well-

paying careers, that historically... being a radiologist, reviewing contracts, writing boilerplate code that historically has been highly trained elite degrees. But still, on some level, someone with a very similar background to you could do it too.

MARK VICKERS-WILLIS:

Yeah.

DR. VIVIENNE MING:

And those kinds of jobs might genuinely transform dramatically. But here's what's amazing. What we already know in the routine is a finite space. The unknown is infinite. There are an infinite set of new voices and new perspectives on the world, and that's our unique human value. The value of you, your kids going forward isn't the same old thing everyone else knows because I have that for free in my pocket. It is truly what is your unique voice that you're bringing into this.

MARK VICKERS-WILLIS:

Can I just... And I just want to sort of expand off that. I know one of our other previous guests, Mary Helen Immordino-Yang, who's an amazing applied neuroscientist and all sorts of other things that she does. I mean, a lot of what she works or thinks deeply about and says is, "We only think deeply about those things we care about." So the connection between cognition and emotion and they're actually part of an interdependent same process. And it's interesting because I think about your work, and a lot of what you've talked about is that it's really about how do we foster this personal motivation or internal motivation.

And what I'm hearing here is, in some ways, AI can be set up to keep expanding and opening a deepening of inquiry about things you care about and can just... and let... With a 360-degree sort of movement, that sounds so exciting for young people to do it. [inaudible 00:47:04] the answer is not being given because it sounds as if that will totally remove that internal motivation on some level. So it's sort of weighing that up. So it's... Yeah. So do you want to expand on that?

DR. VIVIENNE MING:

If you... I'm going to take this, and it will feel for a moment like a completely different direction. One of the best studies, I think, on the negative effects of social media on adolescents was a natural experiment in Canada that involved a pseudo-randomized rollout of Broadband. And I will keep this quick. The mainline finding of the story probably isn't going to shock everyone. Social media access for adolescent girls in particular had big negative socio-emotional effects and academic effects interestingly mediated through reduced time spent with parents. But what I think is an even more

interesting part of the story, if you actually go into the paper and have the privilege to go actually look at the original data sets, there are other groups of kids in this study, that's the average.

But the dirty secret of science is those core headline stories that you read about science papers are never what the paper actually finds. Those are, "Well, the largest group kind of looked like that," but there were always other groups. Again, heterogeneity. So two of the other groups, the one was a group of teenage girls who just weren't on social media even when they had full access to it. And we tend to think of it as an inevitable thing, but clearly it's not. Some kids simply choose not to use it, and that is interesting, understanding why. But another group of girls were on it just as much as anyone else, and they looked great. And if you look behaviorally about what's different between them and the girls that were really suffering was a seemingly subtle point, which is every now and then they stopped and thought about it.

A picture on Instagram, a video on TikTok, they reflected on why do I like this or why do I not? And interesting, when we look at senior citizens, there was a very similar finding. Reduction in mobility is a big predictor. If you are well into your life, and suddenly, you are not able to get around much more, that's a really negative factor in predicting near-term mortality and morbidity. So a study was done looking at people that had reduced mobility but were spending time online. And what they found was people that were passively taking in streaming videos versus these senior citizens that were going out and exploring online, I bet you can already know what I'm going to say. The ones that were passive was a very strong negative predictor of near-term life outcomes. And the ones we were exploring literally lived longer and had greater cognitive acuity.

Interesting. This story, as you sort of identified it, I'm going to call it deep processing, that we occasionally take the time and think deeply about what we're doing. Again, what a wonderful thing to role model for your kids. Whether you're a professional peer, a teacher, a parent, is that has such profound value and a value that stretches from seven to 70 across these two studies. And I think is a big part of this here is people finding within themselves maybe something different, and especially in an educational context, not whether you know how to factor as a polynomial, not whether you know what was in the Treaty of Versailles, but again, something that feels a little slippery, which is do you believe your hard work is going to pay off.

Whether we're adults or we're student learners, we're kids, in the end, some of what we're talking about, whether I'm willing to go deep, whether I'm willing to really engage with a problem, for me, as a nerdy cognitive neuroscience... neuroscientist, I'm thinking, "Do I think that this effort is actually going to pay off? Do I think applying for a scholarship is going to change my life? Did my father think that going to MIT was going to change everything, or his parents think that?" If you can, in a sense, build into a kid a belief that their hard work will pay off, in some sense, you could get them to do anything. And if there was anything that you truly... I get asked, "What skills should my child know 30 years from now?" And to me, that's like saying, "What stock should I put all of my money into and never change for 30 years?"

How could anyone possibly know what the world... The world has never been as fast as it is today, and it will never be this slow again. So there's no answer to that question other than build for the unknown. And there is no better strategy

in building for the unknown than, if you will forgive the metaphor, building a kid that believes their hard work will pay off. So 30 years from now, they learn what... they figure out for themselves what it is they need to know. And the set of qualities and factors that really produce that kid are complex. I've written papers about them. We call it meta-learning, learning how to learn. But that's what really predicts long-term life outcomes and it's what, boy, we should be focusing in. Yes, no concrete skills. I'm absolutely not saying they don't matter, but fundamentally they matter.

It's a craftsman in their tools. We focus so much on our education and our workforce on the tools, and a craftsman without their tools is hobbled. It's an absolutely true statement. But tools without a craftsman is pointless. And yet we so neglect that side of it, except again, the very good fortunate few of us who get born into circumstances that allow us to get it kind of for free. We could be so much more intentional about all of this.

MARK VICKERS-WILLIS:

And I think that the point of your own life, what I found really interesting, is when you actually shifted your focus from happiness to purpose and thinking about that. And I think this whole idea that hard work will pay off and that hard work payoff isn't happiness necessarily. Could be an experience, could be an emotion, could be a feeling. But it's not where you're going to find the magic, I think, it seems to me in what you're saying.

DR. VIVIENNE MING:

One of the more interesting constructs that we looked at is purpose.

MARK VICKERS-WILLIS:

Yeah.

DR. VIVIENNE MING:

And you probably don't think of purpose as a scientific construct, but for a psychologist, it has a definition. It's something that's bigger than you, something it takes more than a lifetime to complete. And the really cool thing about purpose is people that rate higher on it live longer. They have more friends. They go further in their education, mortality, and morbidity all causes down, central body mass, insulin sensitivity, everything is better. They also earn more money and accumulate more wealth in their lifetime. But think about those last two. They are what is purpose? In my own research... And I realize we're running short on time here. My research shows the strongest behavioral correlative purpose is that you're willing to make sacrifices.

Sacrifices for that thing that's bigger than you. And that's a bit of a paradox because a lot of liberal economic theories says, "Be rationally self-interested, and all the rest of it will work out." And yet I've got data on hundreds of thousands of people showing, paradoxically, that if life is a big race, it's the people that stop and help the other racers that are most likely to win. And it doesn't make sense if we think of life as a race, but it does make sense maybe if you look at

something like the scope of my life or all of our lives, that there's something incredibly powerful in our willingness to make, let's call them small sacrifices, for other people. It shows the rest of the world what you truly care about, and it helps to engender a lot of trust. And in a complex society like ours or anywhere in the world, that trust is invaluable.

And so, in that sense, I think it's not a shock that people that have a greater sense of purpose tend to have better lives. I don't think it's a mystical reward, but then again, I'm not a super spiritual person. I think it's a bit of a tangible moment in which, yeah, if you live a life with the goal of being happy, you can chase it forever and never get there. But if you live a life of substance, it becomes just one of those gifts you get along the way. At least that was what I experienced, and it's been pretty amazing because now I get to nerd out with machine learning and study brains and occasionally invent something that saves people's lives.

MARK VICKERS-WILLIS:

I was just going to say, what a gift from your dad. I believe he was the one that said that to you to live a life of substance. That must be really how powerful is a legacy piece from him and your demonstration of it.

DR. VIVIENNE MING:

It was a great... I truly treasure the time I had with him. He had his first heart attack when he was 40, and he lived to be 73. And every one of those years was a gift to all of his patients and everyone around him.

MARIO JOHONSON:

Fascinating. Absolutely fascinating. Thank you so much, Dr. Vivienne Ming and Mark Vickers-Willis. This has been an incredibly informative, meaningful, engaging discussion. Wow, I just... my head is very full. Thank you again so much. Our next Critical Conversations event will be taking place on January 18th, featuring Zaretta Hammond, centered around culturally responsive teaching in the brain. A final point. If you're connected with the private or public school community that would like to partner and join with us, please reach out via our website to criticalconversations.com.

We'd like to thank again Dr. Vivienne Ming for such an insightful, deeply meaningful, and packed discussion. I'm so glad that we recorded that because it's the kind of discussion that you're going to have to go back several times to really get a sense of the deep meaning and impact of all that you all covered this evening. Again, thank you all so much for being with us this evening. Have a wonderful evening, and we look forward to seeing you in our next discussion. Thank you again, Dr. Ming.

MARK VICKERS-WILLIS:

Thank you Dr. Ming.

DR. VIVIENNE MING:

It was a pleasure. It'll be nothing but algorithms and equations next time.

MARIO JOHONSON:

We prefer you.

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