

# TOWARD AN AI-READY WORKFORCE

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## HEARING

BEFORE THE  
SUBCOMMITTEE ON CYBERSECURITY, INFORMATION  
TECHNOLOGY, AND GOVERNMENT INNOVATION

OF THE

COMMITTEE ON OVERSIGHT  
AND ACCOUNTABILITY

U.S. HOUSE OF REPRESENTATIVES

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*Documents are available at: docs.house.gov.*



# TOWARD AN AI-READY WORKFORCE

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Wednesday, January 17, 2024

U.S. HOUSE OF REPRESENTATIVES  
COMMITTEE ON OVERSIGHT AND ACCOUNTABILITY  
SUBCOMMITTEE ON CYBERSECURITY, INFORMATION TECHNOLOGY,  
AND GOVERNMENT INNOVATION  
*Washington, D.C.*

The Subcommittee met, pursuant to notice, at 2:16 p.m., in room 2154, Rayburn House Office Building, Hon. Nancy Mace [Chairwoman of the Subcommittee] presiding.

Present: Representatives Mace, Timmons, Langworthy, Burlison, Connolly, Khanna, and Lynch.

Also present: Representatives Krishnamoorthi and Beyer.

Ms. MACE. Good afternoon. The Subcommittee on Cybersecurity, Information Technology, and Government Innovation will now come to order. Good afternoon and welcome, everyone.

Without objection, the Chair may declare a recess at any time.

And I will now recognize myself for the purpose of making an opening statement.

Good afternoon, and welcome to this hearing of the Subcommittee on Cybersecurity, Information Technology, and Government Innovation. Today, America is indisputably the global leader in artificial intelligence, which is why you all are here today. This Nation has led the way on AI. During its liftoff stage, American companies and institutions have developed the most sophisticated AI models, like ChatGPT we hear so much about. American companies, universities, and research institutes are producing the bulk of the cutting-edge research that is pushing forward the frontiers of knowledge in the field.

Going forward, maintaining America's edge in AI will be key to our continued national security and economic prosperity, but we cannot take that lead for granted. We are now entering a stage of widespread AI adoption. According to business leaders, AI technologies will be integrated broadly into the economy, both here and abroad. A large global survey of employers said they are highly likely to adopt AI over the next 5 years. They expect AI to create a lot of job churn but to ultimately lead to a 25 percent net increase in jobs. That is why they also identified AI and Big Data as among their top priorities for workforce upskilling. That means, going forward, keeping our global edge in AI will increasingly depend on the global competitiveness of a broader American AI workforce.

We will still need to have the best computer scientists and software engineers. That report found AI and machine learning experts are projected to be among the fastest-growing jobs in the country. But we will also need to fill a much broader pool of AI-related work roles requiring various skill sets. There will be opportunities for both new workforce entrants and employees looking to retool and upskill.

But this transition will also test our training pipeline, and America's pipeline in the STEM fields is a concern. Take cybersecurity, which is also critical to our national and economic security. We have a shortage of 700,000 cybersecurity workers across the private and public sector, and why is that? We know that our traditional education system does not produce nearly enough degreed grads in the field to fill the need. We also know that that shortfall would be much worse if not for the appearance of nimble educational alternatives that include short-term boot camp programs that issue non-degree credentials, like certifications and badges.

Our witnesses today will testify about how these sorts of flexible, targeted programs that reduce borrowing needs are now being used to train young people for AI-related roles and to upskill older workers. We know that China is making a multipronged push to lead in AI talent. They have been trying, largely without success, to lure back home Chinese nationals graduating from top U.S. computer science programs, but they domestically produce many more STEM grads than we do, and the Chinese Ministry of Education has approved in recent years hundreds of new university AI programs, according to Georgetown University's Center for Security and Emerging Tech, which also found that AI is the most popular new major in China.

Before I yield, I want to speak to the Federal workforce. It is critical the Federal Government has an appropriate AI workforce. We have a bill on the Committee reported last year that requires Federal managers to be trained on AI so the government can deploy it wisely. We had the Defense Department's chief AI officer testify before this Subcommittee, and it is clear DOD is at least making progress in this space, but the Office of Personnel Management is another story. It was tasked 3 years ago by Congress with identifying AI talent gaps across the Federal civilian AI workforce and with creating a new AI job series for Federal workers. It has done neither of these things, so we are still waiting.

And then with that, are we going to waive on two Members?

I am going to ask unanimous consent for Representative Krishnamoorthi from Illinois and Representative Beyer from Virginia to be waived onto the Subcommittee for today's hearing for the purposes of asking questions.

And without objection, so ordered.

And with that, I will yield to the Ranking Member for his introductory remarks.

Mr. CONNOLLY. I thank the Chair. A 2020 World Economic Forum study found that AI-generated machines could disrupt an estimated 85 million jobs globally by next year. Though that sounds scary, and is, the study also suggested that AI adoption could, on the other hand, create as many as 97 million new jobs. AI has to be a tool used to enhance the job, not replace the worker.

If done correctly, we can create a new job sector that equitably spreads the benefits of AI to all parts of society while remaining a global technological leader.

One requirement necessary for the U.S. to remain a global leader in AI is to build and invest in a robust workforce and talent pipeline that draws from every corner of the American educational system. We must prepare future technologists from the moment they enter elementary school and attract talent from all places, including community colleges, 4-year colleges, and trade schools. That is why I co-led the Chance to Compete Act with Virginia Foxx of North Carolina, which would allow agencies to hire based on one's ability to do the job. We believe the Federal Government should reward those based on merit rather than affiliation. Giving people the opportunity to retrain and reskill into new fields and professions based on achievement and ability will help unlock massive amounts of unrealized talent.

To remain competitive with the private sector, the Federal Government must nurture its own talent pipeline. One way we can do that is to provide students with the opportunity to participate in meaningful paid internships. Much of the private sector, including large firms like IBM, Microsoft, Google, Nvidia, are already excelling in this process. The Federal Government must model internship programs and find ways to get great talent into agencies, whether it is for a quick stint or a lifelong career. Even a short time in government can be valuable and provides an opportunity to share knowledge between both the public and private sectors.

The legislation I have introduced, the Building the Next Generation of Federal Employees Act, would do just that by increasing the availability and quality of paid internships across the entire enterprise of the Federal Government. I hope this is a source of bipartisan interest on the Committee as we work to reintroduce in the coming weeks. We also cannot forget about our current Federal employees and must provide them with technical and conceptual AI training resources. The President's executive order, which we had a hearing about a few weeks ago, makes it clear knowing how to use technology can be great, but knowing how to use technology responsibly is paramount.

I have co-led the AI Training Expansion Act with Chairwoman Mace, which would expand the access and curriculum of these educational programs to employees up and down the organizational chart. We must make this training more than just an AI awareness exercise and ensure that such training enables employees to harness the power of AI in order to do their jobs smarter, faster, and to greater effect.

Another way that government could benefit from AI is through joint ventures between the public and private sectors that drive toward collaborative solutions. Many have likened the AI revolution to the next space race, which is why Congress created the National Artificial Intelligence Resource Task Force in 2020 to explore ways to effectively foster AI research and application. Among the findings of the task force's January 2023 final report was the need to increase the diversity of talent in AI by "supporting the needs of researchers and students from diverse backgrounds who are pursuing foundational, use-inspired, and translational AI research.

The report recommended that we look for this talent in academic institutions, nonprofits, startups, and small businesses.

President Biden's Fiscal Year 2023 budget requested \$1.8 billion in non-defense R&D related to AI, including successful public/private partnerships. The budget also sought funding for critical resources for NIST, the National AI Research Institutes, and Federal agencies as they implement the Administration's recent groundbreaking AI directives. Those bodies are responsible for developing guidelines for evaluating and red teaming, promoting ethical and trustworthy systems and technologies, and contributing to innovative solutions. We must invest in educational resources and teachers who can help students prepare for the future and help employers identify those who will lead the AI workforce and AI innovation. We need a workforce that will use AI ethically and equitably, ensuring AI is used to benefit American families, communities, and businesses across the country.

I look forward to a productive discussion today with our witnesses, specifically, how we can better prepare, not replace, our current workforce for the possibilities of AI. Thank you.

Ms. MACE. Thank you. I am pleased to now introduce our witnesses for today's hearing. Our first witness is Dr. William Scherlis, Professor of Computer Science at Carnegie Mellon University. Our second witness is Ms. Timi Hadra, Client Partner, and Senior Executive for West Virginia at IBM, and our third witness is Dr. Costis Torgas, Director of the Cybersecurity and Privacy Research Institute at the George Washington University. We were also going to be joined today by Dr. Richard Levin, a former president of Yale University and Senior Advisor at Coursera. Unfortunately, Dr. Levin fell ill over the weekend and could not be here in person today. We want to wish him well and hope for a speedy recovery. In lieu of his attendance, I ask unanimous consent to enter his testimony into the record.

So, without objection, so ordered.

Welcome, everyone. We are pleased to have you this afternoon.

Pursuant to Committee Rule 9(g), the witnesses will please stand and raise their right hands.

Do you solemnly swear or affirm that the testimony that you are about to give is the whole truth and nothing but the truth, so help you God?

[A chorus of ayes.]

Ms. MACE. Let the record show that the witnesses all answered in the affirmative. We appreciate all of you being here today and look forward to your testimony. We will remind the witnesses that we have read your written statements, and they will appear in full in the hearing record. Please limit your oral statements to 5 minutes. As a reminder, please press the button on the microphone in front of you so that it is on, and the Members up here can hear you. When you begin to speak, the light in front of you will turn green. After 4 minutes, it turns yellow, and when the red light comes on, your 5 minutes has expired, and I will ask you to wrap it up very politely.

So today, I will now recognize Dr. Scherlis to please begin his opening statement.



**STATEMENT OF DR. WILLIAM L. SCHERLIS  
PROFESSOR OF COMPUTER SCIENCE  
CARNEGIE MELLON UNIVERSITY**

Dr. SCHERLIS. Chairwoman Mace, Ranking Member Connolly, Members of the Subcommittee, thank you for the opportunity to participate in this important hearing. I am William Scherlis, a professor of computer science at Carnegie Mellon, but I should also mention that I have government experience, the honor of serving two tours at DARPA, the Defense Advanced Research Projects Agency, with a mission to advance innovations in information technology for national security, including AI and cybersecurity.

We are at a critical time with modern AI, neural networks for machine learning, large language models, LLMs, ML. This places, as you note, extraordinary demands on our workforce. How do we harness the power of AI while avoiding the pitfalls? How do we stay current with the exceedingly rapid pace of innovation? How do we stay ahead of competitors? That is why H.R. 4503, that you together have introduced, is so vital for the Nation.

Many have spoken about the potential for modern AI, and I am very excited about this, so many applications, but for our conversation today, we need to understand the whole picture, and this includes some not so obvious weaknesses and vulnerabilities, the pitfalls, and you have mentioned some of those as well. We hear about issues of bias and fairness and accuracy. Even with fully correct training data, we can get wrong answers—machine learning, miscategorizing LLMs, hallucinating—and we struggle to explain.

We also have cyber adversaries. AI turns out to be an easy target. Undergraduates learn to spoof neural nets for face recognition. It is unclear whether this spoofing is fully preventable. LLM providers provide guardrails, so systems do not do bad stuff—inventing new kinds of fraud, for example, but researchers know how to bypass those guardrails.

So, there are four ways that we address these challenges. First is what we call AI engineering. AI is actually generally a capability within a system, and systems operate within operational workflows. AI engineering is about designing and testing the systems, the workflows, and the AI inside. Our engineering college at Carnegie Mellon has master's degree programs for AI engineering, each for a specific engineering discipline. The Software Engineering Institute, a CMU FFRDC for the Defense Department, develops AI engineering practices for the DOD and others. So, that is the first.

The second is we need to continuously make improvements to the machine learning and LLM algorithms. The third is, in addition to that, we have to aggressively develop new kinds of AI technologies that will take us beyond the purely statistical neural nets. Remember, we are just getting started with AI, but the fourth point, and most important, is awareness, what the AI workforce needs to understand. Now, AI researchers have many opinions on this, but that is the way it should be, and my point is that there is a wide range of AI-related skills and expertise, data wranglers, LLM prompt writers, interaction designers, systems engineers.

The executive order that was mentioned, 14110, on trustworthy AI highlights the role of AI red teams to mitigate weaknesses and avoid hazards. They are like cyber red teams but with sophisti-

cated AI skills. Everybody at all levels needs to understand the pitfalls as well as the benefits, and when we put this together, the roles and skills that they need, we see a very broad range of needs for the AI workforce.

At Carnegie Mellon, we help the AI workforce in many ways. Degree programs, we have AI Ph.D.s, and I am going to say this, that go back to the 1950's. We have the Nation's first undergraduate degree in AI. We have about 2 dozen master programs. The curricula draw from computer science, statistics, data science, math, but also ethics, psychology, humanities, and the arts. Nondegree programs are essential to broaden access and to scale up. We partner with the Army Futures Command and the Army AI Integration Center on offerings that are tailored to the huge diversity of Army AI developers and users.

At the other extreme, for K through 12, we have CS Academy, now used for free by 7,000 teachers in all 50 states. Pittsburgh Public Schools asked for this kind of capability. We developed it, and it took off. We also engage the workforce directly. Hotel and transit workers, for example, directly participate in our programs to ensure that the AI that they use aligns with their experience with benefits both to the employees and the employers, and we have government-focused executive education. With Learning by Doing, students gain hands-on AI experience tailored to their mission.

So, to summarize, AI offers tremendous opportunity and tremendous challenges, many of which are non-obvious. Success with AI depends on unique skills and expertise. There are many kinds of AI roles and applications, which means many kinds of workforce needs. Our CMU experience illustrates a few ways to meet many of those needs, but we need to keep pace because it is a very fast-moving environment. The proposed legislation to expand AI training—

Ms. MACE. We are over time. Thank you.

Dr. SCHERLIS [continuing]. Vital for the Nation.

Ms. MACE. Thank you, and then, Ms. Hadra, you are recognized for 5 minutes.

**STATEMENT OF MS. TIMI HADRA  
CLIENT PARTNER AND SENIOR EXECUTIVE  
FOR WEST VIRGINIA  
IBM**

Ms. HADRA. Good afternoon, Chairwoman Mace, Ranking Member Connolly, and distinguished Members of the Subcommittee. Thank you for the opportunity to testify today. My name is Timi Hadra, and I am a client partner at IBM and have been supporting Federal agencies for over 20 years. I also serve as IBM's Senior Executive for West Virginia, where I lead our Regional Innovation Center, driving innovation and promoting a skills-first talent perspective.

IBM has been a proud partner to the U.S. Federal Government for decades, helping agencies use technology to accomplish their missions, meet new challenges, and drive innovation. Today, we have over 4,300 IBMers working alongside Federal workers. IBM has been at the forefront of innovations, such as AI, for decades.

You may recall in 2011, IBM's Watson won Jeopardy and ushered AI and machine learning into the living rooms of America. And now, in an era of accelerated, generative AI adoption, IBM's AI platform for enterprise, Watson X, is helping business and governments manage their data with trusted governance and innovative, open-source solutions.

Today, I will share how IBM has helped prepare people to work alongside AI, created new pathways for technology jobs, and re-skilled our own workforce to maximize opportunities created by technologies. And last, I will share our recommendations on how the Federal workforce can be AI ready.

First, let me underscore IBM's commitment to responsible development and deployment of AI. When harnessed and deployed responsibly with ethics at its core, AI can enrich and advance human ingenuity in ways that could solve the most pressing problems of our time. We are also mindful of the impacts new innovations have on society and what skills people will need to work with emerging technologies, and here are three examples.

In 2021, IBM unveiled a global commitment to help skill 30 million people by 2030, and most recently, we pledged to train 2 million people in AI by 2026. This will be accomplished through IBM's SkillsBuild, our online platform with free coursework for teachers, students, and adult learners. It offers free coursework in AI fundamentals, chatbots, AI ethics, and generative AI. We are collaborating with universities and leveraging our network of experts to build faculty and student AI capacity. I encourage you to share with your constituents the free AI courses that they can start taking today.

Ten years ago, IBM embarked on a skills first journey, creating opportunities for well-paid jobs for those without college degrees, including apprenticeships for technology jobs. Today, more than 50 percent of our U.S. job postings no longer require a 4-year degree, and almost 20 percent of our U.S.-based hires do not have college degrees. As generative AI begins to transform industries, skills play an even more crucial role in meeting the talent need of employers. That is why IBM places skills at the center of our people strategy. IBM requires employees to complete at least 40 hours of learning annually and provides the tools for that learning. IBMers with the highest learning hours are 20 percent more likely to move to a new role and 44 percent more likely to get a promotion.

As AI adoption accelerates, we believe Congress must double down on actionable ways to ensure the Federal workforce is ready to safely procure, govern, and work alongside AI. It is time to put implementation into high gear. Specifically, we believe there are two key ways Congress can help advance an AI ready workforce. First, foster a culture of upskilling and lifelong learning. The Federal Government must place skills at the center of the people strategy and invest in quality, relevant, and accessible tools for the span of each worker's career. Second, scale skills first hiring in the Federal Government and on Federal contracts.

AI is here. It is redefining work, and it will require more people to work with technology. IBM looks forward to continuing to work with Congress to advance a risk-based approach to regulating AI while ensuring Americans, including the Federal workforce, have

access to skills training in the era of AI adoption. Thank you for the opportunity to testify today.

Ms. MACE. Thank you. I now recognize Dr. Toregas to please begin your opening statement.

**STATEMENT OF DR. COSTIS TOREGAS  
DIRECTOR  
CYBER SECURITY, AND PRIVACY RESEARCH INSTITUTE  
GEORGE WASHINGTON UNIVERSITY**

Dr. TOREGAS. Chairwoman Mace, Ranking Member Connolly, and Members of the Subcommittee, I appreciate the opportunity to testify today. I am Dr. Costis Toregas, Director of the Cybersecurity and Privacy Research Institute of the George Washington University, and a fellow of the National Academy of Public Administration, chartered by Congress in 1984 to help address critical societal challenges.

I applaud your efforts to focus attention on the critical workforce shortages looming ahead in the artificial intelligence field and the impact such shortages may have on American strength and prosperity. The truth is that while AI has been around for many years, as we heard, from the 50's, interest and concern peaked only recently as its use has become easy for the general public, and they know. Rather than talking about what is AI or how can we develop or regulate AI, I am going to focus my remarks on how can we develop a workforce pipeline that can use AI to strengthen the U.S. economy.

We have very few markers to help us answer this third question. We know that we do not yet have adequate numbers of teachers and faculty to teach AI. We are not sure how we can test students and workers for AI readiness. AI courses in high schools, community colleges, and universities are not organized around national best practice, so we are at the beginning of the adoption curve for this powerful technology, and things are kind of messy. So, how should we proceed?

I suggest that we look at another critical workforce pipeline, that of cybersecurity that you are very familiar with, and learn from the 10-plus years of investments we have been making and focusing on developing larger numbers of cyber-ready workers. The systems, the networks, the incentives, the educational strategies we created can help us develop AI counterparts and perhaps even use the same performers, the same strategies to good effect.

In my written testimony, I have identified several cybersecurity experiences to consider: the importance of diversity in the workforce, the challenge of organizing educational programs across disciplines, the rapid change of the underlying technology itself, and, most importantly, the difficulty of confronting 50 diverse educational programs at the state level that may approach the workforce issue and the educational streams supporting it differently. These all contribute to a difficult learning curve for cybersecurity workforce, and yet, we learned a lot, and I want to encourage you to look at the strong lessons learned in the cybersecurity world and support their transfer in the AI domain rather than spend valuable time and resources building AI responses from scratch.

Let me now offer five action suggestions for your subcommittee. One, develop a statistical capacity at national level to track current numbers of students and teachers in AI by region, as well as estimated AI workforce needs of government and industry in the future. We will not know if we are succeeding if we cannot measure our outcomes. Two, encourage states to harmonize AI programs for K through 12 through national conversations of experts and discussions of circular frameworks and rubric, and promote the broad notion of a digital citizenship program for all students that will include not just AI, but digital literacy, cybersecurity, privacy, and civics in the digital era.

Three, support the development and maintenance of curricula focused not only on the “what is AI?” or “how can AI be improved?” but, rather, how can AI be used in this space. Good candidates for execution are the more than 1,000 locally based and supported public, independent, and tribal community colleges, and they can be strong performers in the new field of AI workforce development. They are able to change courses quickly and adopt AI-focused curriculum, degrees, or certificates far faster than other types of educational institutions.

Four, focus on the need for additional AI educators

—we need teachers, which we do not have now—and establish support programs that incentivize their attraction and retention at high school, community college, and university level. My good friend Janelle Strzok, who is the Chairwoman of Women in Cybersecurity, has three words to describe how you can support a network of individuals. She says, connect, inspire, and guide. We need to do that for our faculty, for our teachers.

And then finally, help launch a tripartite partnership between private sector, education, community, and government around workforce development issues in AI. We currently speak in isolation, and we need to come together and create viable solutions with all stakeholders at the table. The mandate could include establishing a long-term vision and the steps necessary to align academic performance to industry needs. Industry and academia must come together. You can help do that. Thank you very much.

Ms. MACE. Thank you so much, and I will now recognize myself for 5 minutes.

My first question goes to Ms. Hadra. Thank you for being here today. Your testimony states that robust implementation of the AI and Government Act by the executive branch would be a key first step in preparing the Federal workforce for a new way to work using AI. In that law Congress adopted 3 years ago, Congress told the Office of Personnel Management to find out how many employees at each Federal agency have AI skills and how many more we need. It also recommended OPM create an AI job series. OPM has done none of that. How can Congress ensure the Federal workforce is AI ready if we do not know the current skill level in agencies or their future needs?

Ms. HADRA. Thank you for that question, and a good place to start, I mentioned in my written testimony and in my oral testimony about IBM SkillsBuild. This is a free online platform for students, teachers, and adult learners, so it applies to our Federal workforce. It is a place that we can get started quickly to start hav-

ing our Federal workforce learn the AI skills that they need, while each agency works to employ the requirements in the OMB memo.

Ms. MACE. Has IBM attempted to determine how many of its employees are AI qualified company-wide?

Ms. HADRA. I do not have the specific numbers, and I can get those for you on our company-wide numbers.

Ms. HADRA. But we have a curriculum that we implemented in the summer of 2023 that all IBMers were required to complete. I think it was about 12 hours of curriculum, and the thing that we did on top of—

Ms. MACE. So, you have a metric that you are tracking, at least with your employees' qualifications.

Ms. HADRA. Right.

Ms. MACE. Mm-hmm.

Ms. HADRA. And then have them put that to use. I mentioned in my written testimony about our Watson X challenge, which was in August 2023, where after they took the curriculum, we had teams come together and solve a business problem using our Watson X platform, so that they were not only taking courses on learning the AI technology but also how to put it to work.

Ms. MACE. Right. Why do you think it is so hard for the Federal Government or certain agencies to adopt this kind of nimble attitude toward AI?

Ms. HADRA. That is a great—

Ms. MACE. Smart and nimble, right.

Ms. HADRA. It is a great question, and it is a challenging topic, but I think sometimes, as some of my fellow panelists mentioned, we are not talking across agencies. Maybe we are not talking across industry. I think it is important for the Federal Government to look at what industry has done and try to implement and use the tools that are out there, like our SkillsBuild, like the other platforms that are widely available, and start getting those in use sooner.

Ms. MACE. We need a Khan Academy of AI is what we need. You also mentioned in your testimony that Federal contractors are rarely able to place an individual without a 4-year degree on a technology services contract, regardless of their qualifications. Are you saying that the terms of the Federal contracts IBM is asked to sign prohibit the work be done by those without college degrees? Does that inhibit your ability to fill those roles?

Ms. HADRA. Yes, it is an issue, and let me explain. In my experience with Federal contracts, a lot of times you have labor category descriptions and requirements that say, if you have a cybersecurity analyst, these are the minimum qualifications that they must meet. In some cases, we have seen change, so it is not that the regulations are not being implemented, but it is just not enough. So, as an example, that cybersecurity analyst, it may say as an entry level, you need a bachelor's degree plus 1 year of experience, or it might say bachelor's degree, or you can substitute 4 years of experience. But our cybersecurity apprenticeship program is a 6-month curriculum. Those people do not have 4 years of experience, but they are immersed in 6 months, and they are ready to hit the ground running on those programs. And because they do not meet

that minimum qualification, we are not able to put them on that contract.

Ms. MACE. They might even be more qualified than someone with a 4-year degree because they put that skill set into practice. I am going to move on as I am running out of time, and I apologize. Dr. Scherlis, my last question today is Carnegie Mellon and other leading universities now offer a variety of AI-related education options, including traditional degrees, boot camps, certifications, et cetera. Are there effective alternatives to traditional undergraduate and graduate degrees that will be instrumental in preparing the American workforce to be AI ready? What do you advise?

Dr. SCHERLIS. Thank you for that question. I mentioned one example, which is working directly with the workforce. In this case, it was related to hotels and transit workers, right, and working directly with the workers and their employers so that when the employers are building AI systems, they can craft those systems in a way that aligns well with the workers' experience and knowledge and how the workers can evolve in those roles. So, that is one example of direct outreach.

Ms. MACE. Thank you. Thank you so much, and I have run out of time, so I will hand the microphone over to recognize my colleague from Virginia for his 5 minutes.

Mr. CONNOLLY. Thank you, and before the clock starts, can I ask unanimous consent to enter a statement from Johns Hopkins University and the Center for AI and Digital Policy into the record?

Ms. MACE. Without objection.

Mr. CONNOLLY. I thank the Chair.

Mr. CONNOLLY. Dr. Toregas, you stated in your testimony that standard terminology for AI skills is still under development. Why is it still under development, and why is it even important?

Dr. TOREGAS. Thanks for that question. It is important because, otherwise, we cannot classify and promote specific skills for specific jobs, and we met the same circumstance in cybersecurity. It has taken them at least 8 years to develop a typology for cybersecurity skills development. We also have several agencies, each of which promote their own typology. As a consequence, I think it is vital with AI, since we are still in the beginning, to jump first and to insist that there be some kind of a mechanism that defines what are the skills, how do you prove that you have those skills, and how do they mesh to job requirement.

That is the last thing I said when I talked about industry. It is very difficult sometimes for an academic institution to hear what industry needs.

Mr. CONNOLLY. Yes.

Dr. TOREGAS. So, sometimes it gets lost in translation, so, therefore, surrogates come in. Do you have a bachelor's degree? OK, good. You are good to go. That should not be the case.

Mr. CONNOLLY. Yes.

Dr. TOREGAS. It should be the case that we align to specific skills and specific preparations. That is what is needed in standardization. Thank you.

Mr. CONNOLLY. Yes. Yes. That is actually something that has always fascinated me, that gap between lab bench research, science, academia, and what IBM needs, and trying to translate that is not

always easy. We certainly saw that in the commercialization of technology once the cold war was over. DARPA, where you were, Dr. Scherlis, you know, had lots of technology that was classified. For example, one no longer classified is sound cancellation technology, you know, used for submarines. Well, we are using it all the time now in the commercial sector, but it took somebody to understand the application, and who are those people. And they may not need a degree. They may have common sense and private sector experience, knowing what the environment demands.

Dr. Scherlis, you were at DARPA. You have sort of been at the beginning of this, well, beginning of this explosion of this fascination with AI. What keeps you up at night? What worries you about where we could go with AI?

Dr. SCHERLIS. So, I have a concern regarding the various pitfalls that I mentioned in my statement and elaborated in some detail in the written statement. My concern is not about those pitfalls, but my concern is, rather, that those who are—because the AI applications are so compelling and so transformative, not just enhancing productivity but creating new ways of doing business, that we get so enamored of those that we do not have that awareness of what the pitfalls are, and we get stuck, and we get surprised. And that is one of the characteristics, in fact, of the world of cybersecurity, is that we build systems. We can measure what the system does and how long it takes to build that system and how much it costs. We cannot easily measure how secure it is, and so we let security attributes kind of evolve and unfold over time, so that is a significant challenge.

And I think that part of this AI education and training process is to help people be aware of the various pitfalls, the weaknesses and vulnerabilities, and also the mitigations, the various techniques that we can use as we engineer systems and as we place systems into workplace contexts to use those systems safely.

Mr. CONNOLLY. Yes. Sometimes, though, I have seen it in cyber. I have looked at cyber protection programs, but they also train people in cyber techniques we would prefer they not be trained in, but to protect, you have to, but it can be used for good and bad once you have trained somebody.

Dr. SCHERLIS. Right. Actually, I just want to make one more point, which is the point about measurement of cybersecurity risk, the point about measurement of similarly AI risk educational outcomes. These are all hugely challenging research questions. As we think about putting programs in place, I think it is important to think also about what kind of research we can do to measure and assess outcomes, both for the systems and also for the people who are entangled with those systems, recognizing how fast the technology is evolving.

Mr. CONNOLLY. I was going to ask Dr. Toregas the same question. Real quickly, what keeps you up at night?

Dr. TOREGAS. Three things. Equity, the fact that in many cases, human beings are not before AI impacts operations, and then the replicability. You cannot force a scientist who is into AI to replicate an experiment because AI works in mysterious ways, so, therefore, we cannot be sure of how exactly is it working. Those are the three things.



Mr. CONNOLLY. Thank you.

Dr. TOREGAS. Thank you.

Ms. MACE. Thank you. I will now recognize Mr. Timmons for 5 minutes.

Mr. TIMMONS. Thank you, Madam Chair. I think the challenge we are facing is bifurcated in two areas. One is the existing workforce. How do we elevate the capacity of our existing workforce to maximize the benefits that AI offers our economy, our businesses? And I think that is separated into two areas. One is government because government generally does not adopt best practices as fast as the private sector. I think that is an understatement. The other is, how do we develop undergrad and graduate degree programs that will increase our capacity to further develop AI and advance the potential positive impacts that it has? And I think that part is relative to our competitiveness in the international community, and the first part is making sure the U.S. economy is continuing to be competitive in the global economy.

Dr. Scherlis, would you agree that that is a good way of looking at it? How do we increase our capacity of our workforce and separate that between the government and the private sector, and then how do you develop our capacity long term to be a leader in this in the global community.

Dr. SCHERLIS. So, thank you for that question. So, I will agree that there is some separation, but I think the separation is largely, arguably, a cultural outcome that in government, it is really important for us to have strong programs of professional development and advancement for our technology workforce. Otherwise, people do not stay current. And I think that it may be that in many firms in the private sector, certainly in the tech sector, that is an active element of the employer handshake.

But I think, you know, when I look at what is going on, for example, in the Defense Department, for example, our conversations with the Army, the role of leadership and the ability of leadership to think in imaginative ways, to think about what kinds of risks can we safely take, that can bubble down through an organization and affect, for example, who is involved with acquisition, with engineering, with developing strategy, with planning. All those kinds of positions are going to be affected by AI, so if we create an environment where we are receptive to change, we are receptive to education and learning, I think that would make a significant difference.

Mr. TIMMONS. Would you agree that human nature generally is going to facilitate increased usage of AI? I mean, if it can make it easier for you, might as well try to use it. A lot of people out there have tasks that they do not want to do in their job and in their lives, and if you can press the easy button, you are likely going to do it. So, a lot of it is awareness in that respect. Is that fair?

Dr. SCHERLIS. Well, that is why awareness of the AI pitfalls is so important because if we make it very easy to adopt AI for purposes for which it may not be well matched, then all of those problems of bias and fairness and vulnerability to adversarial attacks, all of those bubble up. So, the adoption process, on the one hand, should be attentive to the potential to not just improve productivity but to create new capabilities on the one hand, but on the other

hand, to do that in a way where we are attentive and alert to the risks and safety issues—

Mr. TIMMONS. And I guess I want to talk about those risks. Dr. Torgas, you mentioned this. If you use ChatGPT and you ask a question, and then you say, answer that question if you are in Saudi Arabia or if you are in Yemen, it is actually quite different. Certain words are entirely gone. The word that they use as “ethics” instead of “equity,” instead of “DEI,” it actually is culturally different. So, I mean, how do we have this conversation in a productive way without kind of imposing our cultural values on the planet? Does that question make sense? If your biggest concern is equity and your view of equity and your values are very dissimilar from other cultures that are also going to be using AI, how do you reconcile that? How do you deal with that?

Dr. TOREGAS. Thank you for that question. It has no simple answer, alas. I would say that the very technology of AI includes a session where AI learns—you kind of stuff the machine with things—before you even use it. What you stuff the machine with is vital, and many different countries are beginning to use AI by including and incorporating training regimens that reflect their own values, so their AI is different from our AI. There is no independent AI. So, as a consequence, I think, ultimately, as a society, we are going to have to learn to reflect in what we expect of AI our own values.

Mr. TIMMONS. Thank you for that. I yield back, Madam Chair.

Ms. MACE. Thank you. I now recognize Mr. Lynch for 5 minutes.

Mr. LYNCH. Thank you, Madam Chair. Initially, I would like to ask unanimous consent to enter into the record a statement from the Partnership for Public Service, a nonpartisan, nonprofit organization dedicated to better government and stronger democracy. I assume that is OK. I was looking for unanimous consent on this, yes.

Ms. MACE. Yes.

Mr. LYNCH. OK. Great. Thank you.

Mr. LYNCH. I assume that, but lately you do not want to, you know, leap to conclusions. First of all, I want to thank the witnesses for your good work in helping the Committee with its task.

So last year, the Biden Administration launched a National Cybersecurity Workforce and Education Strategy, and then recently, as recent as last month, the National Science Foundation launched a new initiative called the Education AI Initiative. So, we have seen some work within our university systems across the country. I know that in my own district, UMass Boston University of Massachusetts, Boston, which is home to the Paul English Applied Artificial Intelligence Institute, has begun their work with a goal of, you know, attracting students for that specific discipline. In Bridgewater State University, also on the edge of my district, they have created a first-of-its-kind cybersecurity program with the help of Federal grants to try to inculcate students in that curriculum, and as well, Northeastern University in my district has the Institute for Experiential AI, which helps actually solve AI research problems.

So, we are beginning to see energy and resources being put into this effort, but one of the gaps is the availability of teachers in this

discipline. I mean, I founded a charter school in Massachusetts, and while we might have 90 applicants for a teaching position in English, we might have 11 applicants for a similar position in math and science. And so, what is happening is, especially in the Boston area, and it is happening everywhere, I am sure, is private industry is scooping up anybody with a certain talent or skill set. How do we get at that problem where we actually create the teachers who will be able to sort of multiply the effort and help us either catch up to some of the countries that seem to have taken a lead in this or actually maintain our edge? Dr. Toregas?

Dr. TOREGAS. Thanks again for that question. I think experimentation and boldness are the keys. In my own University of George Washington, the National Science Foundation and NIST, the National Institute of Science and Technology, has provided a grant to develop a comprehensive way to look at law and society. It is called Trustworthy AI in Law and Society. The key there is the combination of different disciplines which can inspire teachers to want to become involved in it.

A second simple example is the networking of professionals together. National Science Foundation

—again, bravo to the National Science Foundation—has funded something called the National Center for Training and Education in Cybersecurity. They assemble more than 300 universities and community colleges, they develop common curricula, and they help faculty careers. The same model can be used in the AI field. There is no reason why we cannot begin to develop multiple solutions as opposed to one good program here, one good program there. We can develop a network of programs.

Mr. LYNCH. That is great. Ms. Hadra, your thoughts?

Ms. HADRA. Thank you for that question, and we do agree that there is an urgent need to train the student and faculty capacity in AI, and that is why IBM continues to invest as an industry partner in programs that are free, such as the IBM SkillsBuild platform. And that is for teachers, that is for students, that is for adult learners, so that we can provide that fast start to help build that capacity that we need now.

Mr. LYNCH. That is great. Dr. Scherlis?

Dr. SCHERLIS. So, I mentioned in my remarks the CS Academy, which was in response to exactly this challenge that you just identified, and it came to us from teachers in our public school system. And it is basically an upskilling program intended to help teachers develop skills in computer science, and because it is free, it has been adopted extremely widely. And it is not just 7,000 teachers, but it is more than 380,000 students that have benefited from this. But we also have an, since you mentioned the NSF, an NSF-funded program focused specifically on AI for K through 12, and that is a program where we have been developing curriculum. We were a co-lead in the creation of that curriculum, and it is now being piloted in schools in Georgia. So, this is a really important topic.

I will just mention when computer science itself burst onto the scene in the 1980's, we had similar programs to upskill college professors to help them understand the basic features of computer science. These are traditionally teachers of mathematics and physics.

Mr. LYNCH. Great. Madam Chair, I yield back.

Ms. MACE. Thank you. I will now turn to Mr. Burlison to be recognized for 5 minutes.

Mr. BURLISON. Thank you, Madam Chair. You know, having come from the IT industry, there is a very broad array of jobs and roles and responsibilities. I recall oftentimes, though, people lumped them all in the same thing. They think that everybody in IT can fix their computer. You get where I am going. So, with that being said, it has already been alluded to that there is a varying scope that is broad in the different fields that are going to be within this industry, and I will give opportunity for each of you to elaborate on what careers or jobs that are going to be. What is the range that you see happening, and what is the one that is most in demand?

Dr. TOREGAS. Thanks for the question. Again, this is why I emphasize the importance of typology. How do we describe jobs in the AI field? We have already heard that there are jobs, like, how do you shape a question? That has become a job now. How do you shape a question for ChatGPT? There is also the computer science behind it. How do you make better AI machinery?

My kind of North Star would be to make sure that we develop our faculty because the key area is faculty. If we do not have faculty at the high school level, on the community college and university level, we will lose the battle 10 years from now because they are being diverted in other fields. And we desperately need educators, so that is where the focus has to be.

Ms. HADRA. Thank you for the question. In addition to the roles that he just mentioned, I think it is really important to think about AI is going to change 90 percent of jobs, right? So, we need to think about how, one of the Members mentioned, around freeing people up from redundant tasks that you may not want, that is not the most exciting part of our work. We have done this at the VBA, the Veterans Benefits Administration. I mentioned in my written testimony that we used AI and automation to help them process a lot of the information that comes in, increasing that process time and freeing those overworked VBA employees up to do more higher value work for the veteran.

So, I think it is really important that as we are considering the era of AI adoption, how we help each employee, each Federal worker, think about how their job can change, maybe what they can free up to do, and then if their job is—

Mr. BURLISON. Without feeling that their job is threatened.

Ms. HADRA. Yes. I absolutely acknowledge the uncertainty, but if we have transparency about more jobs that are being created, jobs are being elevated in our H.R. function. As an example, in IBM, when we have done a lot of this reskilling already, most of the people in our H.R. job function are now one job band higher because we have used AI to—

Mr. BURLISON. Yes.

Ms. HADRA [continuing]. Automate some of the work that—

Mr. BURLISON. To magnify productivity.

Ms. HADRA. Exactly.

Dr. SCHERLIS. So, I will mention a few elements of this. One is, of course, enhancing productivity. Another is providing good over-

the-shoulder advice. That is the sweet spot for both machine learning and large language models, but also, of course, developing new kinds of capabilities, but in addition, let us think about the network of various roles in an organization. Think of that as kind of a workforce supply chain, so to speak, and we can take a holistic view of those supply chains and think, OK, with the advent of AI, maybe we can reconfigure roles that maybe have a traditional configuration that could be improved because of the benefits of AI.

And so, we have a program at the Block Center at Carnegie Mellon that is doing exactly this. It is a supply chain-focused initiative. So, instead of taking existing job roles within existing structures, we are looking at the structures themselves to see maybe there are ways that we can reconfigure how we do the overall body of work within an organization, rather than just trying to optimize the individual elements of an existing organizational structure. Thank you.

Mr. BURLISON. Quickly, Dr. Scherlis, regarding China, where would you place America in its competitive stance when it comes to AI with China?

Dr. SCHERLIS. I do not have a strong judgment on that point because I do not have particular visibility. Everything I read tells me that China is definitely investing very heavily. They have close connections between universities and government and industry that allows them to move very quickly, and I think we need to learn how to move very quickly within the structures of our democracy.

Mr. BURLISON. Thank you. I yield back.

Ms. MACE. Thank you. I will now yield to Mr. Khanna for 5 minutes.

Mr. KHANNA. Thank you, Madam Chair. Thank you for convening us.

Paul Krugman writes about the power loom, that initially, obviously, it had high compensation remuneration for those who knew how to use it, and then eventually, the technology became sufficiently deployed and that the skills required for it were not as much, and so you saw a leveling of the income disparity as the access to new technology became easier. One of our big challenges in the digital revolution, combined with the AI revolution, is how we avoid the growing disparity in income that we have seen so far and disparity of opportunity. I often say, you know, my district, I represent a \$10 trillion market cap with Apple, Google, Intel, Yahoo, and Tesla, and many other parts of the country do not have that economic opportunity.

Dr. Scherlis, what are a few major initiatives we can undertake to create more equality of opportunity when it comes to digital wealth generation?

Dr. SCHERLIS. I think that starting early is essential, and that is one of the reasons why at Carnegie Mellon, we focus so closely on K through 12 programs, outreach programs. One, we get to people early so they can become kind of acculturated with the new technologies, first computer science and now AI, and then that also puts them into a state of improved readiness so that they can participate, for example, in our degree programs with strong backgrounds. In the early days of computer science undergraduate degrees, we reached out to K through 12 for exactly this purpose, to improve the applicant pool for our programs so that we could oper-

ate those programs at a high level. So, I think starting early is the most important lever we can push.

Mr. KHANNA. I agree with a far more need for technology education starting very, very early on. That does not mean that people have to go become computer scientists or programmers, but they need to have the facility and understanding, as all of you have testified, because these are going to be every job in this country. Whether it is manufacturing, retail, or services, it is going to require technology proficiency, and I think our schools are woefully behind in creating the technology proficiency that is going to be required of every individual.

When we go beyond that and think of the 60 percent who may not have college degrees, how do we bridge that divide in what I think will be a lot of digital trades jobs, jobs that may require 9-month, 12-month, 18-month credentialing and be able to pay a lot, but we are not preparing them. I mean, one of the programs I have done with Google and HBCUs, community colleges, and HSIs is, actually, Google, with other technology companies have come, and Carnegie Mellon, I think, is actually involved in it, in providing some of the curriculum and then creating a pathway for these folks after 18 months to get a job. And candidly, some of the community colleges I went to, they could have all the education in the world. They would be woefully unprepared to actually get a job and no pathway to a job.

So, how do we get private industry and the right folks who understand the curriculum that is going to be needed for hiring involved in this kind of partnership? Maybe I will ask everyone on the panel. Dr. Scherlis, we can start with you, and then Ms. Hadra and Dr. Toregas.

Dr. SCHERLIS. So, I will just mention one example. We have a program at Carnegie Mellon called Social and Interactive Learning—SAIL—which is a platform that is directly targeted to community colleges. We have about 40 community college systems across the country that make use of this platform to help provide certificates for IT career growth, and so in a lot of cases, we collaborate with industry so that these certificate programs can be tailored to local needs of local employers.

Ms. HADRA. A quality of opportunity was really the foundation of our Skills First talent perspective. One of the tools that we use to put this in action is our apprenticeship program. You mentioned trades. The apprenticeship programs that we have, there are 35 roles registered with the Department of Labor, recognized by industry. They get a completion certificate when they graduate. And for the workforce that you mentioned that might not have the skills to even begin in an apprenticeship program, we have also published free pre-apprenticeship program course work that people can take to prepare themselves to become an apprentice.

But it should be mentioned that our IBM apprenticeship program is a full-time paid learn-while-you-earn full benefits program, and we have successfully hired over a thousand apprentices just in the U.S. since we deployed it, 50 in my state of West Virginia.

Mr. KHANNA. My time has expired.

Ms. MACE. Apologies. You had great questions, by the way. They were good. All right. Mr. Langworthy, you are recognized for 5 minutes.

Mr. LANGWORTHY. Thank you, Madam Chair. I would like to thank all of our witnesses for being here with us today to discuss America's path to an AI-ready workforce, and it seems like each passing day is bringing AI more incorporated into everyday Americans' lives. Leading experts believe AI will completely change the workplace and significantly increase all of our productivity, but the bottom line is this: the American people need to be prepared for a future where AI technology plays an even greater role than it does today. Additionally, we need to ensure that AI is harnessed as a job creator and that, as this technology is more widely used, effective guardrails and training are in place to ensure that it is ethical, and it is responsible in its use.

Ms. Hadra, I would like to start with you and talk about our population who is already in the workforce and may not have the skill set necessary to be prepared for an AI-integrated work product. Many Americans are still new to AI and may only see its uses in mainstream models like ChatGPT. How does IBM approach the process of retraining and upskilling existing employees?

Ms. HADRA. Thank you for that question. Investing in upskilling, reskilling, and lifelong learning is just in IBM's DNA. And as we usher in new technologies like AI, we must ensure that both our employees and our society more broadly have opportunities to gain these skills, and we do this in real time. We want our employees to remain valuable to our clients, so we employ reskilling and upskilling programs annually. I mentioned in my testimony that we require a minimum of 40 hours of education learning annually for every employee.

An example of where we see employees' jobs that are being affected by AI, we are reskilling and being transparent about what their next path could be. All of our job roles in IBM have an associated learning path that shows you what continuous learning you need to do to stay on your current role and progress in your current role or progress out of your role, so we have a multipronged approach to making sure that people have transparency. We use a co-creation strategy, so they are part of the solution and really have them help buy in to wanting to learn the skills because they see the opportunity to grow their careers.

Mr. LANGWORTHY. Thank you, and turning toward college-age students and recent graduates, Dr. Scherlis, from a long-term perspective, what are the benefits of a traditional 4-year AI degree?

Dr. SCHERLIS. So, the 4-year AI degree is closely aligned with our 4-year computer science degree. It is very intensely focused on the mathematics of computer science, on the development of software code, on algorithms, on all of the technical foundations that are necessary for a full career in computer science. Given that the field of computer science is moving so quickly, we want to provide our students with a foundation that will endure. And so similarly with AI, we are focused on that foundation in statistics and data science, in computer science, in the design of the computing hardware and the computing software so they have a very full background in all those capabilities, and then they will be ready to be involved in the

creation of new kinds of AI capabilities, as well as in the application of AI capabilities in ways that are safe, that avoid the pitfalls, and that also push the envelope in terms of the kinds of things that we can do with AI.

Mr. LANGWORTHY. OK. You know, my district is a rural district, New York's 23d congressional District, where many of our high school students, they would choose a career in the trades or vocational skills over maybe a 4-year degree. Are there opportunities for high school graduates and college-age Americans who do not want to go down a traditional 4-year degree route to learn the same AI skills?

Dr. SCHERLIS. So, that is one of the reasons why I mentioned the work that we are doing with community colleges but also directly with employers and employees and the program that is looking at these so-called supply chains, the structure of organizations, because we have to look at the influence of AI on everybody, not just the leaders in the technology field.

Mr. LANGWORTHY. Great. Want to open up this question to all of our witnesses because I feel like there are several approaches. In terms of school-age children, what programs are in place to begin teaching our youngest generations how to be proficient with AI, and is there anything that the educational system should be doing better to prepare this and for subsequent generations? Quickly. Oh, I did not realize. My time has expired, so anything that you have to offer in writing, we would certainly appreciate that, and I yield back.

Ms. MACE. Thank you so much. I will now recognize Mr. Krishnamoorthi for 5 minutes, sir. Thank you for your presence today.

Mr. KRISHNAMOORTHY. Hey. Thank you, Madam Chair, thank you to our Ranking Member for this excellent hearing. Thank you to the witnesses.

[Chart.]

Mr. KRISHNAMOORTHY. I have this visual here. I did not come up with this. I thought it was a really neat visual created by Opportunity at Work, and it talks about something called the paper ceiling, and it is defined as the invisible barrier that comes at every turn for the 70 million workers who are STARs. Now, you might be wondering what is a STAR? They define a STAR as a person skilled through alternative routes other than college, 4-year college. And so, maybe I will start with Ms. Hadra.

Ms. HADRA, I assume that the people that are in your earn-and-learn program are precisely these types of people, these STARs, correct?

Ms. HADRA. Thank you for that question, and I am so glad you brought that up, because, actually, one of our apprentices at my center, in Rocket Center, and I mentioned her in my written testimony, Cindy, was featured on a STARs campaign ad, so yes. Yes.

Mr. KRISHNAMOORTHY. Oh, great. So, the answer is yes.

Ms. HADRA. Exactly. Yes, hundred percent.

Mr. KRISHNAMOORTHY. And so, you know, one of the big concerns that I have is that, are you familiar with these automated hiring systems that a lot of employers use?

Ms. HADRA. Not as much, no.



Mr. KRISHNAMOORTHY. OK. Dr. Scherlis, I think I saw you nodding your head. These automated hiring systems basically screen resumes to look for certain indicia of whether the applicant can do the job that is being posted, but oftentimes, what they do is they screen out people without a 4-year college degree. Dr. Scherlis, have you seen this automated hiring system at work?

Dr. SCHERLIS. I have not seen it up close, but when I talk with young students who are entering the workforce, this is one of the topics of their conversation is what are the magic keywords to include—

Mr. KRISHNAMOORTHY. Right.

Dr. SCHERLIS [continuing]. In my resume that will allow me to get caught in the net. But I just want to mention that outreach to nongraduates is an essential piece of the story. We have an outreach program called CMU Computer Science Pathways, that works with community organizations to engage with people who are traditionally maybe not entering the high-tech workforce because they are under resourced, or we could say underestimated.

Mr. KRISHNAMOORTHY. I am glad you have that. I want to focus for a moment on these automated hiring systems because they are ubiquitous. Most large employers use them, and apparently, according to 90 percent of employers in a recent study, they felt that because of those automated hiring systems, they are screening out precisely those STARS who could otherwise do the job. And so, because of that, we have introduced legislation called the Opportunity to Compete Act, H.R. 5960, to “tear the paper ceiling and prevent automated discrimination against applicants without bachelor’s degrees so that these STARS could flourish.” What is your opinion of that, Ms. Hadra?

Ms. HADRA. Well, as I mentioned in my written and oral testimony, 50 percent of our job postings at IBM in the U.S. do not require a college degree anymore. So, we are definitely moving to a skills first perspective, and we encourage that adoption in the Federal Government as well.

Mr. KRISHNAMOORTHY. And what is the barrier to adopting that skills first mindset among your peers?

Ms. HADRA. I think it is really getting the demands of the learning institutions and industry together to help identify which roles can be more apprenticed. Like, we are saying AI, cybersecurity. There is a shortcoming in the workforce system around these requirements, so I think a lot of it is, you know, dialog, and I think we would be happy to have a follow-on conversation with you because we are very passionate about the success of our skills-based hiring program.

Mr. KRISHNAMOORTHY. Well, we would love to see more people talk about this legislation and the need to allow people who can do the job to be able to prove they can without presenting a diploma to prove they can. And so, what do you do, for instance, to allow STARS to be able to prove that they have those qualifications to meet the skills of the job?

Ms. HADRA. So, our apprenticeship program, which, again, registered with the Department of Labor, 35 different job roles, there is a clear curriculum and a clear completion criteria. So, our Application Developer Apprenticeship Program, as an example, has

around 500 hours of specific learning that we provide, and then there is also some specific performance objectives. Have you been able to develop in this code? Do you get a good performance review, you know, the whole learn-as-you earn, and then they have a graduation because they have completed all of the criteria.

And it is important to note that we registered our apprenticeship programs with the Department of Labor, so they were portable, so they were recognized, and they were not just this is what we are saying is important. It is an industry standard.

Mr. KRISHNAMOORTHI. Great. Thank you so much.

Ms. MACE. Do you have any more questions that you want to ask? We have, like, 30 seconds to a minute. We are waiting on Mr. Beyer to get here.

Mr. KRISHNAMOORTHI. Can I—

Ms. MACE. Yes.

Mr. KRISHNAMOORTHI. OK. OK.

Ms. MACE. Please do, 30 seconds. He is running as fast as he can, but you got it.

Mr. KRISHNAMOORTHI. OK. Well, in that case, let me ask you this. How do we in Congress use artificial intelligence to do our jobs? Have any of you thought about that because, you know, I do not see automatons taking our jobs because we are going to make that illegal probably, but I could see AI someday being used to perform certain functions in our office. And I would just be curious if you have ever thought about that or what your thoughts are on that.

Mr. KHANNA. We have AI ask a question, and we can filibuster it.

Mr. KRISHNAMOORTHI. That is right. ChatGPT, please filibuster here.

Dr. TOREGAS. If I can take that quick question, I am sure that your staff uses AI today. Well, they use it to get background information, they use it to shape arguments, and then they perform a very important function. They use human intelligence after AI to give you the advice that you need. So, that would be my guess, that you are already in it.

Ms. MACE. Thank you, and we properly filibustered for you, Mr. Beyer, this afternoon, and Mr. Krishnamoorthi, we use AI in our office, just quick write-up stuff, so I think we should not ban it. Helps our comms teams. Mr. Beyer, you are now recognized, if you are ready, for 5 minutes.

Mr. BEYER. Madam Chairman, thank you so much for filibustering for me. I do not want to make it a habit on this side of the Capitol, though, but thank you.

Dr. Scherlis, in your testimony, you spoke about explainability, transparency, bias, fairness, accuracy, and reliability of the AI models. Just last month, we introduced a bill called the AI Foundation Model Transparency Act to try to address the issue and shed some light into the black box of AI foundation models. My bill would call for the model deployer to make certain information about the training data, how the model is trained, publicly available. The hope is that users should know why the model is giving certain results, so it is not used in a discriminatory way.

So, the question, Dr. Scherlis, is, do you think this type of transparency effort would support the Federal Government's existing workforce with evaluating AI models?

Dr. SCHERLIS. Thank you for that question. I think there are tremendous challenges with the AI foundation models, and, in fact, some of the inventors of those models have stated openly that they themselves do not fully understand how those models come to certain conclusions and outputs. There is a challenge because within a large language model, you can have hundreds of billions of parameters that are all adjusted as it goes through its learning process. So, to understand what goes on inside of one of those models is like doing brain surgery on a person as a way to undercover what their opinions might be on various issues. It is a frighteningly difficult challenge. And so, from a research perspective, explainable AI is a very significant problem, and there are many possible solutions and a lot of discussion and disagreements within the AI research community.

There is another pitfall, which is because these models are fundamentally statistical in nature—they are like predictive statistics—even if I train it on a hundred percent correct training cases, I can still get hallucinations coming out, certainly with the current systems, and so that is because the statistical nature kind of lumps similar things into buckets. The distinctions go away in that learning process.

So, there are lots of actions that AI people are taking to mitigate this problem, to make the outputs a little bit more accurate, but to get to a hundred-percent pure accuracy with full explanations, that is, I think, still in the future.

Mr. BEYER. Yes. We participated in a red teaming exercise late last week that Congressman Jay Obernolti put together, and they told me that they could get up to an 80 percent on AP calculus test, and I found a couple of people there that had got a hundred percent without using AI, so.

Ms. HADRA, you know, one of the things we pulled out of the President's executive order is the notion of mandating the NIST AI framework for Federal Government agencies using it, bill last week, bipartisan—Zach Nunn, Marcus Molinaro, Ted Lieu, and I—the Federal Artificial Intelligence Risk Management Act. Can you comment on both the notion of can we begin to move to the private sector by first working on the NIST framework within government contracting?

Ms. HADRA. Thank you for that question, and IBM is urging governments to focus on three priorities as we have been advocating for a risk-based approach to regulating AI. We have been advocating for that since 2019. Our three priorities are regulation of the specific application of AI, not the underlying algorithm; prioritizing liability over licensing; and supporting open-source AI innovation. So, specifically to your question, I think we could offer a follow-on AI focused briefing, but it is important to mention our three priorities as it relates to the risk that my fellow panelist is mentioning.

Mr. BEYER. Thank you very much. Dr. Toregas, the biggest thing that has come out of our AI Caucus so far is the Create AI Act, you know, creating a massive data set, not the 6 trillion words that Sam Altman scrubbed off the internet, but, rather, a curated data

set for researchers and the like. Are we on the right track? Will this help us overcome some of the biases, the hallucinations, the incorrect information, or is it hopelessly naive?

Dr. TOREGAS. Thank you for your question. I think anything is good as long as it feeds the workforce question. We are here discussing workforce development, and workforce development cannot happen unless we understand the technology underlying AI. So, your efforts and the efforts, by the way, of other nations in this same sphere are helpful in that regard, yes.

Mr. BEYER. Thank you. Madam Chair, I yield back.

Ms. MACE. Great questions. Thank you. In closing today, I want to thank our panelists once again for their testimony, and do you have any closing remarks, Mr. Ranking Member?

Mr. LYNCH. No.

Ms. MACE. OK. Mr. Lynch does not, and with that, without objection, all Members will have 5 legislative days within which to submit materials and to submit additional written questions for the witnesses, which will be forwarded to the witnesses for their response.

Ms. MACE. If there is no further business, without objection, the Subcommittee stands adjourned.

[Whereupon, at 3:33 p.m., the Subcommittee was adjourned.]

