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Priority theme 2 on Building digital competencies to benefit from existing and emerging technologies with a special focus on gender and youth dimensions.

Statement submitted by

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I commend the Commission on the themes for the 21st session of CSTD as well as for the attention to gender which has been present throughout the discussions.

On yesterday we heard an excellent panel discussion on "Impact of rapid technological change on the achievement of the SDGs. One of the overarching questions that emerges from such discussions relates to *building digital competencies to benefit from existing and emerging technologies,* the theme of this session and **with a special focus on gender and youth dimensions.**

For many of us digital technologies have transformed our personal lives and hold the potential to transform economies and greatly improve the lives of all people. But this is so only if we can take charge of this potential. Yesterday and this morning we heard presentations about availability and gaps of digital technology, and how it affects all of the aspects addressed under the SDGs.

Addressing the demand for digitally competent workforce and citizenry. Many of the speakers have pointed to the lower participation of women in ICT. This is not the case in all parts of the world, nor is it the case historically. The history is computing is replete with women. From Ada, Lady Lovelace, who programmed Babbage's machine, to the women (referred to as computers) who programmed the ENIAC, to Admiral Grace Hopper who led the team that developed COBOL an early high level programming language oriented to business use. In the US women were over 35% of those receiving degrees in computer science in 1984-84. From that high level, there was a precipitous drop; today women receive around 18% of computer science degrees. The root causes of this under participation are complex—from the introduction of personal computing, and the choices made within families to provide access to sons rather than to daughters, to the development of content that appealed to boys rather than to girls, all leading, if you will, to an androgenization of computing. We know that some universities have worked to understand and reverse that trend.

Carnegie-Mellon is one such university. Efforts to understand the structures are chronicled in *Unlocking the Clubhouse: Women in Computing,* by Jane Margolis and Allan Fisher. Unpacking and addressing the root causes at CMU allowed the university to move from 7% women's enrollment in 1995 to near equal enrollment of women and men in computer science today. What was needed was a change in culture. Removing the barriers to women's participation is critical to giving us access to women as a pool of available talent—within the workforce, yes, but also as decisionmakers, as inventors and innovators.

It is important to ensure diversity of all kinds among the inventors and innovators who will create the next generation of digital tools. We need the different perspectives that they bring and the different priorities they might express.

We need diversity among the leadership who will shape the future of these technologies (including corporate, financial, thought leadership and policymakers) and drive the direction we will take, including the uses to which technologies will be put and the ethical considerations of differential impact. Who will have input into technological choices that are to be made?

While the net impact of a introduction of a technology may be positive, immediate effect will likely be disruptive. If history is a teacher the jobs that are likely to emerge from workforce disruption will require higher level skills than those that were replaced. Attention will be needed to re-skilling for the new technologies. And it is important to see who will likely be affected.

Education will be critical to keep pace in providing the needed skills. It is important to provide opportunities to those who may have been left out, so that all can benefit. The report notes that women are more likely to lack digital skills. Partly this is due to lack of access to the technologies or of opportunities to benefit from the technologies. An irony here is that technologies are not ubiquitous in education to support innovation in learning. Young people may have a greater comfort with the technologies and better digital skills than their teachers!

What digital skills and competencies? Speakers noted the need to start early. I doubt that is a problem. Design of much of the user focused technology is intuitive. I watched my great-niece, who was not yet walking, swipe a smartphone so that she could access her app! But while useability is enabled through design, much of newer uses such as in big data, are non-intuitive... while they have the potential to aid in decisionmaking, opaque algorithms have the potential to "bake in bias and inequality."

The skills needed to advance technologies can be obtained by education, training and providing experiences. The challenges there relate to access, to opportunity and to the availability of infrastructure. For women, there is often the added issue of "time." The MOOC may be available; the time to access it likely is not.

At the end of the day, technologies are tools, just tools, created and available to solve problems. Competencies are needed to identify problems and to determine which tools are needed are which point, or even which technologies may need to be invented at which point in order to address them. The SDGs point us toward important problems which deserve our attention.

Massive amounts of information led us to valuing the development of search engines to access data in a meaningful way. Education must focus on the problem solving and how to teach that. The AAAS-Lemelson Invention Ambassadors program highlights the role of invention and innovation in problem solving, including many of the problems related to the SDGs. Huda Elsasaad and Diana Yousef are using their backgrounds in STEM (Huda in engineering,

specifically in industrial and environmental chemical contamination and control, and Diana in protein biochemistry and in business) to develop clean tech and social ventures, including change: WATER Labs to provide expanded access to clean water and sanitation in developing countries. Their invention: a low-cost, portable, flushless toilet. The impact: improved public health, fewer barriers to education, decline in sanitation related violence against women, positive impact on environment and more.

Sorin Grama, trained as an engineer, is the principal inventor of a thermal energy storage system used in refrigeration applications. Its first commercial application is for chilling milk in rural India where frequent power outages require back-up diesel generators. Sorin's thermal energy battery eliminated the diesel generator while preventing milk spoilage. In India, more than $10 billion worth of fresh produce and dairy goes to waste due to the lack of refrigeration and poor grid infrastructure. To date, Promethean has installed over hundreds of commercial milk chilling systems...

What competencies are needed? Their backgrounds in engineering were starting points, but they had to be willing to move into many different areas that they has not trained for.

What education, training or experiences are required to develop those competencies? Problem identification and problem solving. Critical thinking. Invention education. How provided? What role for teachers and what role for the technology itself? Using the technology in teaching and learning.

What are the considerations beyond knowledge and skills? A major one must be tools for sense making and for choice making.... Discernment. Ethics. And teaching that must come early as well.

How deployed/used? We need to bring persons from different conditions involved in the technology

Diverse perspectives essential in design, development of content, determining use, choosing problems to be addressed.

Public trust— communication is essential to build this.

We must usually employ interventions to address the needs of youth or of women. A fundamental question is, "What about the current structure requires us to intervene? How can we transform the system to one which can work for all?" I believe that is the real challenge.