Artificial Intelligence in education—imagining and building tomorrow's cyber learning platform today

April 13 2016

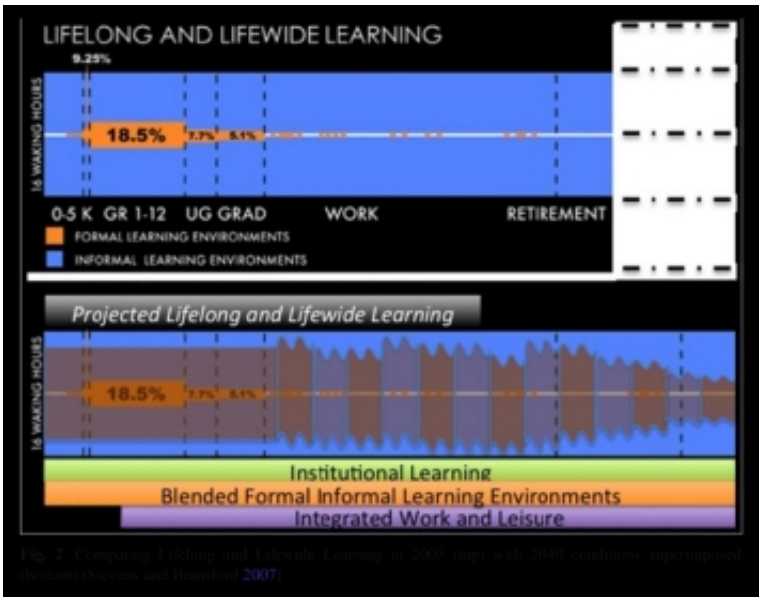
The NYU-X Holodeck, the first Experiential Super Computer effort, integrated virtual, acoustic, physical, robotic, physiological, co-located, and distributed individual and team experiences into an advanced education, research, and innovation instrument--concept drawing credit: the authors

In the late 1960s, urban planners Horst Rittel and Melvin Webber began formulating the concept of "wicked problems" or "wicked challenges" —problems so vexing in the realm of social and organizational planning that they could not be successfully ameliorated with traditional linear, analytical, systems-engineering types of approaches.

These "wicked challenges" are poorly defined, abstruse, and connected to strong moral, political and professional issues. Some examples might include: "How should we deal with crime and violence in our schools? "How should we wage the 'War on Terror'? or "What is good national immigration policy?"

"Wicked problems," by their very nature, are strongly stakeholder dependent; there is often little consensus even about what the problem is, let alone how to deal with it. And, the challenges themselves are ever shifting sets of inherently complex, interacting issues evolving in a dynamic social context. Often, new forms of "wicked challenges" emerge as a result of trying to understand and treat just one challenge in isolation.

Fast-forward forty-plus years to the present, 2016, and the entrenched and seemingly intractable societal problems, our "wicked challenges," whose solutions by their very nature continue to evade even the most capable experts, are still amongst us. Their "solving" takes more than just basic human will. It calls for a collaborative computer-assisted inter-connected framework of humans working together to begin to tackle the persistent problems of society.



Burleson and Lewis' concept of comparing Lifelong and Lifewide Learning in 2005 (top) with 2040 conditions superimposed (bottom) (from Stevens and Bransford 2007)

"Advanced cyberlearning environments that involve Virtual Reality and Artificial Intelligence innovations are becoming powerful tools that can facilitate the explorations and conversations needed to solve society's "wicked challenges," said Winslow Burleson, PhD, MSE, an engineer by training and currently associate professor, New York University Rory Meyers College of Nursing. "Cyberlearning is an essential tool for envisioning, refining, and creating a "utopian" world in which we are actively "learning to be" - deeply engaged in intrinsically motivating experiences that empower each of us to reach our full potential."

Burleson explores possibilities in his latest paper, "Optimists' Creed: Brave New Cyberlearning, Evolving Utopias (Circa 2041)," published in the Journal of Artificial Intelligence Education. Burleson imagines the future of Artificial Intelligence in Education (AIED) in 2041 as having transitioned from what was primarily a research endeavor, with

educational impact involving millions of users/learners (in 2015), to serving, now—in 2041—as a core contributor to democratizing learning and active citizenship for all (impacting billions of learners throughout their lives).

"Life-long learning is best achieved through iterative re-solving of life's questions, issues, and problems, both great and small," says co-author Armanda Lewis, PhD, and doctoral candidate in Steinhardt's educational technology program. "Human interaction coupled with real-time computer simulation will enable learners at all levels to participate and take ownership of their learning process, thus contributing to the collective resolution of wicked challenges."

The researchers posit that the use of technology, specifically a bundled and ever-evolving fluid set of integrated cyber tools, will connect disparate groups and individuals, converging them in both a real and an imagined cyber-social-physical environment, called the Holodeck, that Burleson's NYU-X Lab is currently advancing in prototype form, in close collaboration with colleagues at NYU Courant, Tandon, Steinhardt, and Tisch,

"The "Holodeck" will support a broad range of transdisciplinary collaborations, integrated education, research, and innovation by providing a networked software/hardware infrastructure that can synthesize visual, audio, physical, social, and societal components," said Burleson. "By 2041 we will have taken the individualness of AIED, and carried it across multiple learners, synchronizing inputs and outputs, so that the whole is far far greater than the sum of the individual parts."

When Rittel and Webber published their seminal paper, "Dilemmas in a General Theory of Planning," in 1973, the fastest supercomputer (a Control Data CDC 7600) had a clock rate of 36.4MHz. They could only have imagined smart phones, pocket-sized tools with clock rates

exceeding 1.5 GHz—some 400 times faster than the CDC7600. Their tools to model, simulate, and live in possible futures as they re-solved the wicked challenges of their day were, by today's standards, very limited. Their computational tools, for example, were largely inaccessible, taking up entire rooms, with only rudimentary graphic and network capabilities.

NYU-X Lab's Holodeck prototype harnesses the collective power of shared computation, integrated distributed data, immersive visualization, and social interaction to make possible large-scale synthesis of learning, research, and innovation, that will dramatically accelerate the Rittel and Webber iterative mode of problem solving.

"The idea," continued Lewis, "is to effectively create a global meritocratic network using advanced versions of the NYU-X Lab Holodeck to create scenarios and engage in real-world problem solving; teaching others what you have learned, and creating the potential to re-solve society's wicked challenges while empowering every citizen to realize her or his full potential."

Burleson and Lewis posit that the NYU-X Holodeck will be a foundational model for the future of cyberlearning experience, offering a software/hardware instrument that seamlessly integrates visual, audio, and physical (haptics, objects, real-time fabrication) components with novel emerging technologies.

"This system enhances social interactions (human-human, human- virtual agent, and human-robot) by creating a powerful, unified education and research environment and network," notes Burleson. "Capabilities support capture of comprehensive behavioral, physiological, affective, and cognitive data; visualization and real time data analysis; and sophisticated scenario modeling and user engagement.

Key aspects of the Holodeck are: personal stories and interactive

experiences that make it a rich environment; open streaming content that make it real and compelling; and contributions that personalize the learning experience. The goal is to create a networked infrastructure and communication environment where "wicked challenges" can be iteratively explored and re-solved, utilizing visual, acoustic, and physical sensory feedback, human dynamics with and social collaboration.

Burleson and Lewis envision in 2041 that learning is unlimited - each individual can create a teacher, team, community, world, galaxy or universe of their own. The NYU-X Holodeck will become an environment where possible worlds and experiences can be imagined to help re-solve "wicked challenges", creating ever-evolving solutions which shape humanity's continuing evolution.

"Cyberlearning strives to ensure that each stakeholder is empowered to reach her or his full potential," comments Burleson and Lewis, speaking from the future. "We are proud of what we have achieved, and are cautiously optimistic for what our future holds. The future belongs to us all and we are motivated by our responsibility to continue our evolution toward utopia."

Provided by New York University