AI is changing how humans get things done...including learning.

Industrial Revolution → Service Economy → Internet → "Augmented Intelligence Economy"

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What Does an Emerging Intelligence Augmentation Economy Mean for HF/E? Can Learning Engineering Help?

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The emergence of an intelligence augmentation economy will fundamentally change the nature of work and what people need to learn and do to be its contributors and beneficiaries. This paper explores what this means for the science and practice of human factors/ergonomics design and engineering as well as how we teach it. We summarize the augmented economy and HFES relevant examples of learning within it. We then point out some of the challenges to HFES within this setting. Finally, we propose the learning engineering process as one model that might help advance the field respond to the intelligence augmentation economy.

HUMAN FACTORS OF A NEW ECONOMY

The Intelligence Augmentation Economy

The nature of human endeavor and productivity is changing with the advancement of artificial intelligence, extended reality (XR – blending virtual and real environments), and Internet of Things (IoT – interconnection of computing devices embedded in everyday objects) technologies. Increasingly the work of humans will be shared with or the supervising of automated intelligent agents (Schreckenghost et al., 2022). An "intelligence augmentation economy" is replacing the knowledge economy. Just like the industrial economy and service economies before it, the IA economy will fundamentally change the nature of work and what people need to learn to be its contributors and beneficiaries. Just like with the previous economic shifts, it was technology which drove disruptive changes in how we lived and worked.

With the Industrial Revolution of the early 1800s to mid-1900s it was a shift from working in fields and cottages to working in factories (Allen, 2017). Public schools prepared people with basic literacy and factual knowledge to last their working life. With the service economy from the late 1960s to early 2020s people moved from factory jobs to jobs as hair stylists, waiters, lawyers, pharmacist, and yoga instructors as automation took over in the factories. In the service economy, more education meant more knowledge to start a career in a higher paying job. Schools didn't change much but more people attended college. Based on the high demand and value in the economy, people and governments were willing to pay for increasing costs of higher education during this economy.

Learning in the intelligence augmentation economy

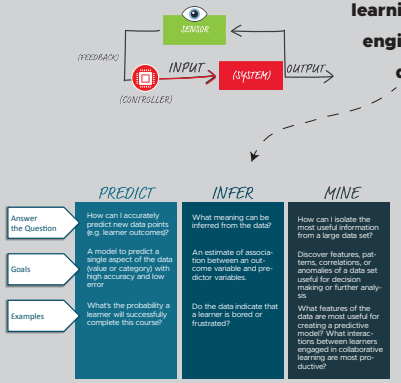
Now, as we enter the IA economy, knowledge is ubiquitous. The value that a person has in this emerging economy is based more on skills in continuous learning, collaboration, creativity, resilience, and a breadth of knowledge literacy (Toppe & Tracy, 2021), rather than depth of knowledge or ability to do repetitive physical or cognitive tasks. Knowledge work is replaced by human-machine collaboration. Likewise, there is a need to shift the predominant focus of education and training as the imparting of knowledge to the right mix of knowledge literacy and a new set of foundational skills for fluent collaboration with machines. There will be an increasing need to fill the gap for adults beyond the traditional education experience with just-in-time, highly contextualized and personalized, work-embedded learning experiences.

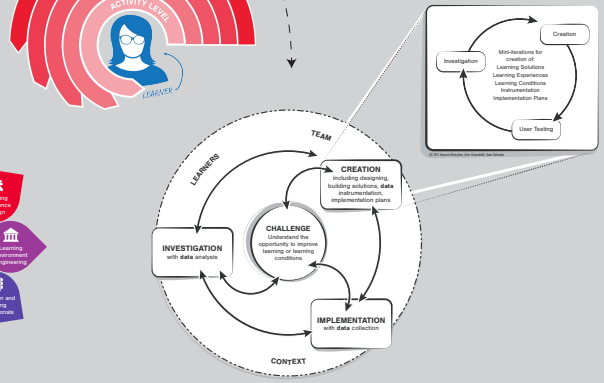
Filling the learning gap. One example of how this is being addressed is the PERSuasive Learning System (PERLS), a mobile microlearning platform, created by the Advanced Distributed Learning Initiative under the U.S. Department of Defense (Craig et al., 2022, Freed et al., 2017). The initiative is developing an open-source DoD-wide mobile microlearning platform for organizations to make the most of the "white space" outside of formal education activities by recommending content-on-demand to learners whenever and wherever they have available spare time.

Augmented reality for augmented intelligence. A next step in blurring the lines between working and learning are active intelligence augmentation, such as augmented reality overlays (Moghaddam et al., 2021; Quandt et al.,2018; Wild, 2016). For example, an aircraft mechanic

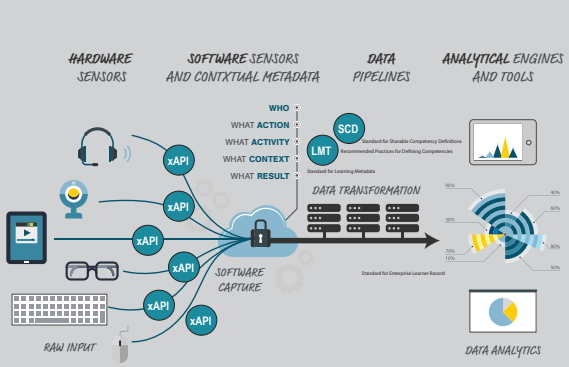
Learning Engineering & Learning Technology Standards

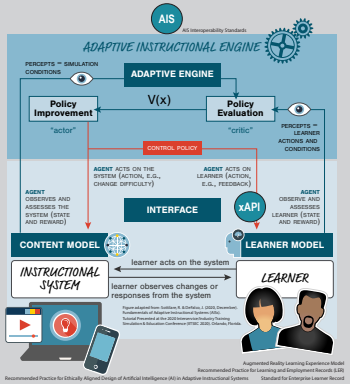
learning engineering ['lərniNG ˌenjə'niriNG] is an *iterative* **process** and *multi-disciplinary* practice that applies the **learning sciences** using **human-centered engineering** design methodologies and **data-informed** decision-making to support learners and their develoomment.





The LTSC **portfolio of standards** support the engineering of **interoperable** and **adaptive** distributed learning solutions.





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