CAN TECHNOLOGY AND ARTIFICIAL INTELLIGENCE (AI) ENHANCE STUDENT KNOWLEDGE RETENTION

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ABSTRACT

Current approaches to teaching and learning assessment frequently create knowledge silos that reduce cross-disciplinary learning and knowledge retention. While technology has created more efficient delivery of content and data collection it has not addressed the unique learning conditions that individual students have in comprehending and most importantly retaining knowledge. Recent discoveries in the neurological sciences has enhanced teaching pedagogies. Advances in artificial intelligence (AI) can now customize learning experiences in a way to not only enhance knowledge comprehension but also knowledge retention. Together a new age of additive learning is beginning to enhance traditional approaches to teaching and comprehension.

Keywords: Knowledge retention, AI, additive learning

Since the 1990's education has been under increasing pressure to provide quantitative assurances that students were learning what was being taught (1). Post-secondary institutions became immersed in the challenges of providing a verifiable assurance of learning (2). AACSB, the premier accreditation organization for business schools around the world, provided substantial guidance on approaches to assurance of learning that would allow for quantifiable data to be acquired on student learning without being an excessive burden on faculty (3). The traditional approach has been assessments that are embedded in some instrument, usually a test, that can be easily graded. The need for generalizable results required that these assessments, while specific to a course, were generic enough to be equivalently applied to every student. The typical student response was to cram for the test with little concern as to whether the material would be retained or forgotten.

Recent research into how the brain learns information and retains knowledge indicates that these processes are not the same, one being a short-term neurological process while the other taking many days, and nights, to develop the necessary pathways to consolidate the learning into knowledge that is retained indefinitely (4). Today, we know that this process of knowledge retention is not driven by the memorization of facts but rather the merging of facts into a neurological framework that addresses broad areas of interest, some addressing long-standing questions that the individual has while others addressing knowledge that has been identified by the individual as having future value (5).

The recognition of what is being retained has put into question current approaches to teaching, learning and learning assessment. These questions include whether the current general approach

to assessment is aligned to knowledge retention (6), whether qualitative measures that stress experience and cross-disciplinary learning need to be more actively integrated into curricula (7), and finally, how these experiences and cross-disciplinary can be assessed at the individual level and more generally across a class or curriculum (8). Technology is a tool that can help in the collecting and collating of data as well as a vehicle for delivery of general instruction both in the classroom, as well as in distance learning (9).

As technology continues to evolve the potential uses for it grow exponentially. Strategies that allow students to self-manage their learning has shifted teaching from a push process driven by the instructor to a pull process driven by the student (10). From a neurological perspective, this change of process shifts learning from a short-term executive function as students prepare and take a test of facts pushed to them by the instructor to a long-term deep learning function as students target and tag information that they have identified as necessary for their future success. That cognitive act of students tagging information begins the neurological process of it being retained long after a test. Yet current technology still is a data repository of information that applies generally to all but specifically to none. The developing role of artificial intelligence (AI) could change how information is developed and delivered and in doing so add a level of customization to learning we are now starting to see in manufacturing with the advent of the 3D printer.

3D printing has changed manufacturing from a reduction process producing goods and services that are appropriate for a general population of customers to an additive manufacturing process specific to the individual (11). While adding a multitude of possible features to a manufactured product, 3D printing still utilizes a limited number of choices and iterations. Learning is as dynamic as the individual being taught and therefore requires practically an infinite array of iterations to suit the individual learner, especially if the goal is the retention of knowledge far beyond one's school years.

AI can provide the link between general factual data and knowledge the individual wants to know and will retain. This can be done by the traditional tracking of individual success or failure during a course of study but also by adding data gained from previous courses that have been taken as well as individual interest. AI and technology can chart an educational trajectory that crosses course disciplines and makes the necessary connection between what must be known and what an individual wants to know. It is this transition that changes where that information is housed in the brain and what ultimately happens to that information after it has been tested (12).

Education that is developed by the instructor but driven by technology and AI can ultimately have the same effect on individual learning as technology and the 3D printer has had on manufacturing. Customizing at the individual level a portfolio of knowledge that the individual sees as relevant. In doing so the chances of most, if not all, of that information being retained beyond the test is greatly enhanced. This change to education can be as potentially dramatic as the advent of 3D printing is starting to have on manufacturing.

Manufacturing is no longer looked upon as a wasteful process of removing what you don't need but rather an additive process of using only what is needed to build the item. It is not beyond the realm of possibility to assume that someday AI driven technology can also change education from a process where students are asked to determine what they feel is needed from a collection of

information, with the rest discarded, to an education process based upon additive learning, where relevant knowledge is provided in a comprehensive way building upon what is previously learned and what is currently needed to be learned. Driven by the student not provided by the instructor. A way that is more efficient for the student to learn and the instructor to provide, as well as a way that closely supports the neurological processes needed for that information to be retained by the individual long after she/he graduates from school.

References available upon request from the authors