The Potential of Blockchain in Education and Health Care

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In our nursing program, we require a transcript for every course taken at any university or college, and it is always frustrating when we have to wait for copies to arrive before making our decisions. To be honest, if a candidate took Religion 101 at a community college and later transferred to the BSN program, I would be willing to pass on the community college transcript, but the admissions office is less flexible. And, although we used to be able to ask the student to have another copy sent if we did not have a transcript in the file, we now must wait for the student to have the college upload the transcript into an admissions system and wait for verification. I can assure you, most nurses, like other students today, take a lot of courses across many colleges without getting a degree. I sometimes have as many as 10 transcripts to review.

When I saw an article titled "Blockchain: Letting Students Own Their Credentials" (Schaffnauser, 2017), I was therefore intrigued. I had already heard of blockchain as a tool to take the middleman out of the loop when doing financial transactions with Bitcoin. Now the thought of students owning their own credentials got me thinking about the movement toward new forms of credentialing from professional organizations (e.g., badges, certification documents). Hence, my decision to explore blockchain and its potential.

Let's start with some definitions. Simply put, blockchain is a distributed digital ledger. Technically speaking, it is "a peer-to-peer (P2P) distributed ledger technology for a new generation of transactional applications that establishes transparency and trust" (Linn & Koo, n.d.). Watter (2016) noted that "the blockchain is a distributed database that provides an unalterable, (semi-) public record of digital transactions. Each block aggregates a timestamped batch of transactions to be included in the ledger — or rather, in the blockchain. Each block is identified by a cryptographic signature. The blockchain contains an un-editable record of all the transactions made."

If we take this apart, here is what we have: a database that is distributed to computers associated with members of the network. Thus, rather than trying to access one central database, all members have copies of the database. Each time a transaction occurs, it is placed in a block that is given a time stamp and is "digitally signed using public key cryptography — which uses both a public and private key" (Watter, 2016). Locks are then connected so there is a historical record and they cannot be altered. According to Lin and Koo

(n.d.), "to add transactions, members in the network run algorithms to evaluate and verify the proposed transaction. If a majority of the members in the network agree that the transaction is valid, the new transaction is added to the shared ledger." Essentially, the middleman in the transaction is eliminated for a more secure transaction.

This is probably more information than you need. Some videos may help you understand the technology behind blockchain.

- IBM Think Academy, Blockchain, How It Works, at www.youtube.com/watch?v=lD9KAnkZUjU
- United Kingdom Government Office of Science at www.youtube.com/watch?v=Zb0kM1CnXeE
- World Economic Forum at www.youtube.com/watch?v=6WG7D47tGb0
- Institute for the Future at www.youtube.com/watch?v=r43LhSUUGTQ

IMPORTANCE FOR EDUCATION

Tapscott and Tapscott (2017) consider blockchain the second generation of the Internet. The first generation focused on communication and collaboration, but "it's built for moving and storing information rather than *value*" (p. 12). According to these authors, having a secure ledger where one can store information of value (such as money accounts, transcripts, certificates), which has trust built into the technology, can help transform higher education and provide alternative models to ensure lifelong learning. Several examples are provided.

First, Tapscott and Tapscott (2017) describe how the founder of the Institute for Blockchain Studies uses the technology to manage Massively Open Online Courses. (And you thought MOOCs were dead.) The technology can be used to verify that the student who signed up for the course completed it and mastered the content. It can contain a payment feature and allow students to set up smart contracts as a method of developing lifelong learning plans. If learners have the capability to maintain a record of lifelong learning, future employers will be able to see their return on investment for offering professional development benefits. The most detailed example is the development of a mega-university, described as an ecosystem where blockchain provides the infrastructure for students to create their own learning pathways and access content and faculty, and faculty and students engage in collaborative development experiences. The disaggregation of higher education provides quite an interesting perspective, one that is probably not going to happen in the near future.

MIT's Media Lab, which has experimented with blockchain technology for digital certificates, is in the second version of the technology. Some lessons learned in its first experiments are as follows:

1. "It is not a simple solution to fix everything that is wrong with today's credentials" (Nazare, Duffy, & Schmidt, 2016).
2. It is much more difficult to manage public/private keys to authenticate both the issuer and the recipient. Establishing a wallet that maintains certificates, as Bitcoin holds cash, may be a good alternative.
3. The issue of privacy and allowing users the ability to control who has access to reviewing credentials in the network presents a challenge.

MIT's Media Lab has been collaborating with the Learning Machine, which created a wallet app that allows users to have access to their blockchain-based credentials and add them to their digital resumes. As noted by Schaffhauser (2017), digital credentials are growing in demand by employers as they move away from degrees being the only method to demonstrate one's abilities. This is probably true in some disciplines, like engineering and computer science, but may not be accepted as readily in nursing. Schaffhauser mentions a comparison made by the registrar for Carnegie Mellon University, who "likens the future acceptance of blockchain to the previous adoption of the National Student Clearinghouse." This clearinghouse was not readily adopted but is now used by close to 4,000 universities. One of the hurdles for the use of blockchain in universities will be registrars who are worried about monetary losses and losing control of the process.

The Sandbox, a research and development lab at Southern New Hampshire University, has a series of videos that describe disruptive technologies in higher education. Here is a link to a talk on Blockchain in Higher Education featuring the Learning Machine CEO: www.youtube.com/watch?v=9qJchEhV-Eo.

Clark (2015) lists a variety of uses for blockchain in higher education. Here are some highlights: single institution to keep track of project-based education opportunities; shared repository of learning certificate for institutions that have formed a global alliance of universities; global assessment database such as the Sony Global Education (www.sony.net/SonyInfo/News/Press/201602/16-0222E/index.html); continuing professional education; and repository of apprenticeships and corporate learning.

IMPORTANCE FOR HEALTH CARE

Health care suffers from having too many silos of health information, with a lack of full access to shared patient databases. Blockchain, it is believed, can "liberate data from entrenched silos, empowering patients to securely 'own' their data," with skeptics seeing all hype and no value (Gordon, Wright, & Landman, 2017). Gordon et al. offer the following potential uses for blockchain: shared medication prescriptions, with blockchain to help with medication reconciliation; patient-generated database from individual sensors and devices for sharing with clinicians; patient and provider identity sharing; insurance eligibility and claims processing; and, in public health, for influenza reporting and identifying pandemics.

According to Linn and Koo (n.d.), blockchain also offers opportunities for clinical research, real-time access to personalized data for use in personalized medicine endeavors, and the ability to set permissions for data access to ensure security. They also agree that blockchain can be used to gather patient-generated data for patient-reported outcomes and prevention, as well as real-time monitoring of data to improve care coordination and identification of emergency situations.

The Office of the National Coordinator for Health IT initiated a blockchain in health care challenge. There were 15 winners from more than 70 submissions (US Department of Health and Human Services, 2016). Here is a sampling of the winning ideas: alternative payment model, patient-reported outcomes measures, various electronic health record systems, new model for health care delivery for Medicaid population, health information exchanges on state or regional level, and peer-to-peer authorization and authentication within an accountable care organization.

Like all innovations, blockchain will at some point be integrated within higher education and health care. That may not be tomorrow, and, as usual, higher education and health care will be late adopters. Gordon et al. (2017) quote a technology analyst from the firm Gartner, Inc., noting that "new technology often follows a predictable hype cycle: from onset, through a 'peak of inflated expectations,' down the 'trough of disillusionment,' and up the 'slope of enlightenment,' before reaching the 'plateau of productivity.'"

As a faculty member reading this column, you will be ahead of the curve by at least having a basic understanding of blockchain. When this new technology reaches "the slope of enlightenment," you will be able to articulate its importance. In the meantime, I am dreaming of the day that students and patients can have control over their credentials and their health data. As always, you can reach me at Diane.Skiba@ucdenver.edu.

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