

ALA CENTER FOR THE FUTURE OF LIBRARIES

LIBRARY FUTURES

3

# BLOCKCHAIN

*Edited by* SANDRA HIRSH *and* SUSAN ALMAN

# **BLOCKCHAIN**

**BOOKS IN THE LIBRARY FUTURES SERIES**

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LIBRARY FUTURES 3



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# FOR THE PRESENT

WHAT CAN LIBRARIANS DO TODAY TO PREPARE FOR blockchain possibilities in libraries? Education is the key ingredient in getting ready to adopt new technologies in libraries—both for librarians and for the community.

## BLOCKCHAIN EDUCATION FOR COMMUNITIES

Link Swanson, Systems Architect, Minitex

A recent survey by the Pew Research Center revealed that a large majority of the American public expects libraries to provide technology education programs: “78 percent of those 16 and older say libraries should *definitely* offer programs to teach people how to use digital tools such as computers, smartphones and apps.”<sup>94</sup> This expectation extends to blockchain technologies. As the attention and hype surrounding blockchain increase, more individuals are

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94. [www.pewinternet.org/2015/09/15/libraries-at-the-crossroads](http://www.pewinternet.org/2015/09/15/libraries-at-the-crossroads).

looking to libraries to help them understand the fundamentals of this technology. This phenomenon was cited at a recent Senate Banking, Housing and Urban Affairs Committee hearing on virtual currencies, where Christopher Giancarlo, chairman of the U.S. Commodity Futures Trading Commission, stated:

America's libraries are a place where a lot of people go and research Bitcoin . . . One of the most frequently searched items from a library computer is "Bitcoin." So, we're teaming up with the U.S. Consumer Finance Protection Bureau to go out to America's libraries and educate librarians to direct patrons to use our Bitcoin website and other resources.<sup>95</sup>

Libraries can meet this growing demand for blockchain education by understanding some of the core challenges that learners encounter in their attempts to acquire a basic understanding of blockchain fundamentals, and by adopting practical, targeted strategies to integrate into their own blockchain education curricula.

## Library-Based Blockchain Education

Library-based blockchain education offerings make sense for a number of reasons. One reason, mentioned above, is that the American public expects libraries to offer education programs that can teach people about new technologies, and blockchain is no exception to this expectation. Because private blockchain education and training services can be very expensive, libraries can help underprivileged and low-income communities become familiar with these emerging technologies and help prevent income-based gaps in access and knowledge, which is one

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95. Senate Banking, Housing and Urban Affairs Committee Hearing on Virtual Currencies, 2018, <https://www.c-span.org/video/?440770-1>.

of the core values of librarianship. Another reason is that blockchain technologies can be applied to use cases that are highly consistent with the traditional mission of libraries, such as accurate record-keeping, information availability, censorship resistance, data transparency, and privacy. Finally, if libraries and library-focused organizations hope to launch successful blockchain projects of their own, the success of these projects is highly dependent upon the level of understanding held by project leaders, designers, stakeholders, and—most importantly—users. This final point is worth stressing: the success of a blockchain is directly proportional to the number of engaged participants on that blockchain, and the key to increasing the number of active participants is *education*.

What do library-based blockchain education programs look like? There are three distinct types of blockchain education. The first is research-based, where learners are provided with a list of educational materials from which they can acquire an understanding of the history of blockchain, the technical fundamentals, and common use cases, such as cryptocurrencies. The second type consists of traditional instructor-led training and hands-on learning, where learners complete courses designed for beginner, intermediate, and advanced levels of blockchain understanding. The third type is the concept of a blockchain “starter kit” or “empowerment package,” which would contain all of the steps needed to install a wallet application for personal use of a cryptocurrency in order to facilitate self-guided, hands-on experience using a blockchain application.

## **Blockchain Education: The Charge and the Challenges**

The task of developing effective blockchain curricula poses a unique set of challenges. At the root of these challenges are *cognitive barriers* to

understanding blockchain. Blockchain-based software systems have novel properties—decentralization, peer-to-peer architecture, and trustless interactions—that make them quite different from traditional systems, which are typically centralized, built on a client-server architecture, and reliant on a trusted authority. While these novel properties make blockchain a uniquely promising technology, they also create cognitive tension in learners who are accustomed to using traditional software systems. For example, years of experience using traditional database applications leads an individual to expect that when an account password is forgotten, it can be recovered—or if a transaction is made by mistake it can be reversed—with the help of the system administrator’s privileged access to the system. However, this expectation does not translate to blockchain systems because there is no administrator who can recover the account or reverse a transaction with privileged access; there is no privileged access to the system, period.

Examples like this (of which there are many) illustrate how expectations and concepts inherited from years of interacting with traditional software systems can create cognitive barriers to understanding blockchain technologies. Blockchain education offerings should target these kinds of cognitive barriers in order to maximize educational effectiveness.

## **Addressing the Challenges with Targeted Implementation**

There are some practical approaches that can serve as starting points for the development of blockchain education offerings, and are designed to target the cognitive barriers mentioned above. Broadly, these strategies aim to impart a combination of three distinct types of learning:

1. Historical understanding of the evolution of blockchain
2. Understanding of the component technologies that blockchain is built from

3. Hands-on experience interaction with and participation in a live blockchain

### ***Historical Understanding of the Evolution of Blockchains***

Knowing the history of Bitcoin and later cryptocurrencies is an effective first step in understanding blockchains. Bitcoin was created to address a need and solve a problem; it combined existing technologies in novel ways to accomplish these goals. Books and documentaries about the birth of blockchain can be integrated into educational offerings to serve as a foundation for explaining how blockchain is different from other software systems.<sup>96</sup>

### ***Understanding the Component Technologies of a Blockchain***

Blockchain technologies are novel and innovative in part because of the ways in which they combine *existing* technologies, such as public key cryptography, decentralized peer-to-peer networks, distributed systems, and open-source software communities. The acquisition of a (basic) understanding of each of these component technologies is a powerful way to understand blockchain fundamentals. Moreover, educational materials *already exist* for these topics and can be integrated directly into blockchain education offerings.

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96. For a book-format introduction, see A. M. Antonopoulos, *Mastering Bitcoin: Programming the Open Blockchain* (Sebastopol, CA: O'Reilly, 2017), available for free at <https://github.com/bitcoinbook/bitcoinbook>. For a documentary film, see C. Cannucciari, *Banking on Bitcoin* (documentary), IMDB.com, <https://www.imdb.com/title/tt5033790/>.

### ***Hands-on Experience: Learners Can Interact with a Live Blockchain***

Hands-on learning is incredibly effective. The most straightforward way to gain hands-on experience interacting with a blockchain is simply by using cryptocurrencies. For example, learners can acquire a small amount of Bitcoin and use it to complete learning exercises, such as:

1. Install a desktop wallet on your local computer and create a new Bitcoin address.
2. Buy five dollars' worth of Bitcoin from an exchange.
3. Send your funds from the exchange to your local desktop wallet.
4. Install a mobile wallet on your smartphone.
5. Transfer funds from your desktop wallet to your mobile wallet.
6. Create a paper wallet.
7. Send some funds to your paper wallet.
8. View the balances of your wallets' public addresses using a block explorer.
9. Back up your private keys from each wallet.
10. Buy goods and services from merchants who accept cryptocurrencies.<sup>97</sup>

It is important to keep in mind that cryptocurrencies are the first *successful live production implementation* of blockchain technology. Experience using cryptocurrencies is a unique and powerful tool for learners to begin to understand the fundamental concepts of blockchain via hands-on learning.

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97. *Banking on Bitcoin* (documentary), IMDB.com, <https://www.imdb.com/title/tt5033790/>.

***Hands-on Experience: Learners Can Run a Full Node on Personal Computers***

Many of the unique advantages of blockchain systems come from the participating *nodes* or *peers* in the peer-to-peer network. A learner can gain an understanding of the function of blockchain nodes by *becoming one*: she becomes a “peer” by running a “full node” on her own computer. During this process, learners download the entire blockchain to their hard drive, which facilitates further understanding of the decentralized nature of the blockchain. Becoming a peer can be an effective educational exercise which can demonstrate how a blockchain functions as a collection of decentralized nodes.

***Hands-on Experience: Learners Can Code an Application That Interacts with a Live Blockchain***

At a more advanced level, learners can build a simple *exercise* software application that interacts with a live public blockchain. This hands-on process will present learners with many opportunities to deepen their understanding of blockchain technologies. Coding exercises of various levels of difficulty could be integrated into blockchain education offerings.

There is an increasing demand for blockchain education—and there is an expectation that libraries will offer these educational programs. Libraries can help ensure that underprivileged and low-income communities have opportunities to become competent and equal participants in public blockchains. Furthermore, education is central to the success of any blockchain project, since it facilitates a clear understanding of the capabilities of the technology among project teams, prevents misapplications of the technology, and promotes greater numbers of users, which are fundamental to the health and success of any blockchain.

