



CSUDH Technology in Education Conference
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Building Blocks on Campus: Blockchain Technology Applications in Higher Education

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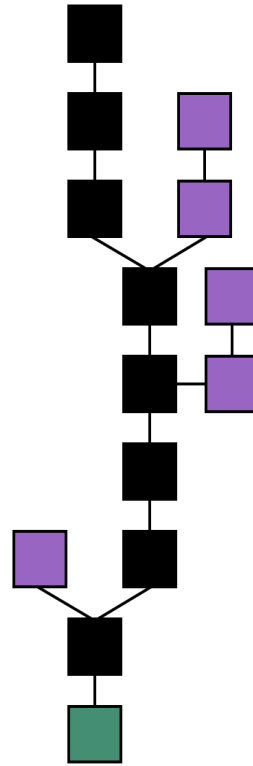
Jet Propulsion Laboratory
California Institute of Technology

CL# Pending



BLOCKCHAIN IN HIGHER ED

- ➡ What is a blockchain? Do I need one?
- ➡ Current thinking in the literature
- ➡ Blockchain National Forum SJSU – summary
- ➡ Applications in higher ed
- ➡ Even more applications in higher ed
- ➡ What's next?





WHAT IS A BLOCKCHAIN?

Means of recording information

Use when trust, versioning, provenance are issues

Scalable – public, private, or consortial/hybrid

Distributed system for persistence (ARPAnet model)

Integrity via consensus over content

- Digital signatures used to enforce integrity of data
- Change only after consensus



BLOCKCHAIN CHALLENGES

Proof of Work VS Proof of Stake

- energy and time consumption
- connection vs computation needs
- economic requirements



CURRENT USES

Cryptocurrency – Bitcoin

Micropayments

MIT digital diplomas



REVIEW OF THE LITERATURE - Essential reading

Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*

- <https://bitcoin.org/bitcoin.pdf>
- “A purely **peer-to-peer** version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. **Digital signatures** provide part of the solution, ... The network **timestamps** transactions by hashing them into an ongoing chain of hash-based **proof-of-work**, forming a record that **cannot be changed without redoing the proof-of-work**. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of CPU power. ... The network itself requires **minimal structure**. ...”



REVIEW OF THE LITERATURE - For starters

- *What is the Difference Between a Blockchain and a Database.*
 - <https://www.coindesk.com/information/what-is-the-difference-blockchain-and-database/>
- American Library Association, Center for the Future of Libraries. *Blockchain.*
 - <http://www.ala.org/tools/future/trends/blockchain>
- Joris van Rossum. *Blockchain for Research: Perspectives on a New Paradigm for Scholarly Communication.* Digital Science, November 2017.
 - <https://www.digital-science.com/resources/digital-research-reports/blockchain-for-research/>



REVIEW OF THE LITERATURE - More reading

- Gideon Greenspan. *Do you really need a blockchain for that?*
 - <https://coincenter.org/entry/do-you-really-need-a-blockchain-for-that>
- Joris van Rossum. *Blockchain for Science: Part One – A Primer*
 - <http://www.copyright.com/blog/blockchain-for-science-part-one-a-primer/>
- Sönke Bartling. *Blockchain for Science: Part Two – A (R)evolution in Research*
 - <http://www.copyright.com/blog/blockchain-for-science-part-two/>
- Lambert Heller. *Blockchain for Science: Part Three – Advanced Peer-to-Peer Systems in Research*
 - <http://www.copyright.com/blog/blockchain-for-science-part-three-advanced-peer-to-peer-systems-in-research/>



REVIEW OF THE LITERATURE - In depth

- Alexander Grech, Anthony F. Camilleri. *Blockchain in Education*.
 - https://www.pedocs.de/volltexte/2018/15013/pdf/Grech_Camilleri_2017_Blockchain_in_Education.pdf
- Eric Funk, MD et. al. *Blockchain Technology: A Data Framework to Improve Validity, Trust, and Accountability of Information Exchange in Health Professions Education*
 - https://journals.lww.com/academicmedicine/Abstract/publishahead/Blockchain_Technology_A_Data_Framework_to.97880.aspx



REVIEW OF THE LITERATURE - Specific applications

- Blockchain for Peer Review
 - <https://www.blockchainpeerreview.org/>
- EduCTX: A Blockchain-Based Higher Education Credit Platform
 - <https://eductx.org/>
 - <https://ieeexplore.ieee.org/abstract/document/8247166>
- MIT Digital Certificates Project
 - <http://certificates.media.mit.edu/>

Full bibliography available at

<https://www.library.caltech.edu/blockchain>



Blockchains for the Information Profession

A project of the SJSU iSchool

SJSU SAN JOSÉ STATE
UNIVERSITY



Blockchain National Forum

- <https://ischoolblogs.sjsu.edu/blockchains/national-forum/>
- Sponsored by SJSU iSchool, grant from IMLS
- Discuss and make recommendations about the future uses of blockchain technology within the information professions

Info tech experts from various areas

- Industry
- Academe, mostly academic library
- Public library, state library
- NISO, ALA
- PhD/postdoc



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SUMMARY OF RECOMMENDATIONS

- Increase **public awareness** via increased play/hands on opportunities with blockchain, encourage hackathons and other outreach models.
- Develop **curriculum** to educate/inform practitioners, students about blockchain (data carpentry model)
- Foster **partnerships** with info and blockchain communities to explore opportunities.
- Select blockchain **use cases** for libraries and educational institutions to pilot/sandbox.
- Watch online <https://livestream.com/accounts/20480259/events/8179548>



POTENTIAL APPLICATIONS

Expertise or Data Sharing

Provenance

Replacement for IP/location-based authentication

Acquisitions/Special Collections in Libraries

Orphan Works (without copyright owner)

Eliminates escrow in real estate transactions



HIGHER ED-SPECIFIC APPLICATIONS

Credentialing/Badges (Education and Identity), licensing rights/transaction verification

Expertise or Data Sharing

Curriculum Development; integrate (via API or other) into LMS platforms

Reclaiming academic rights after non-disclosure

Peer review process

Self-maintenance of identity data; self-sovereign identity

Any and all transactional data

Course descriptions from past class schedules

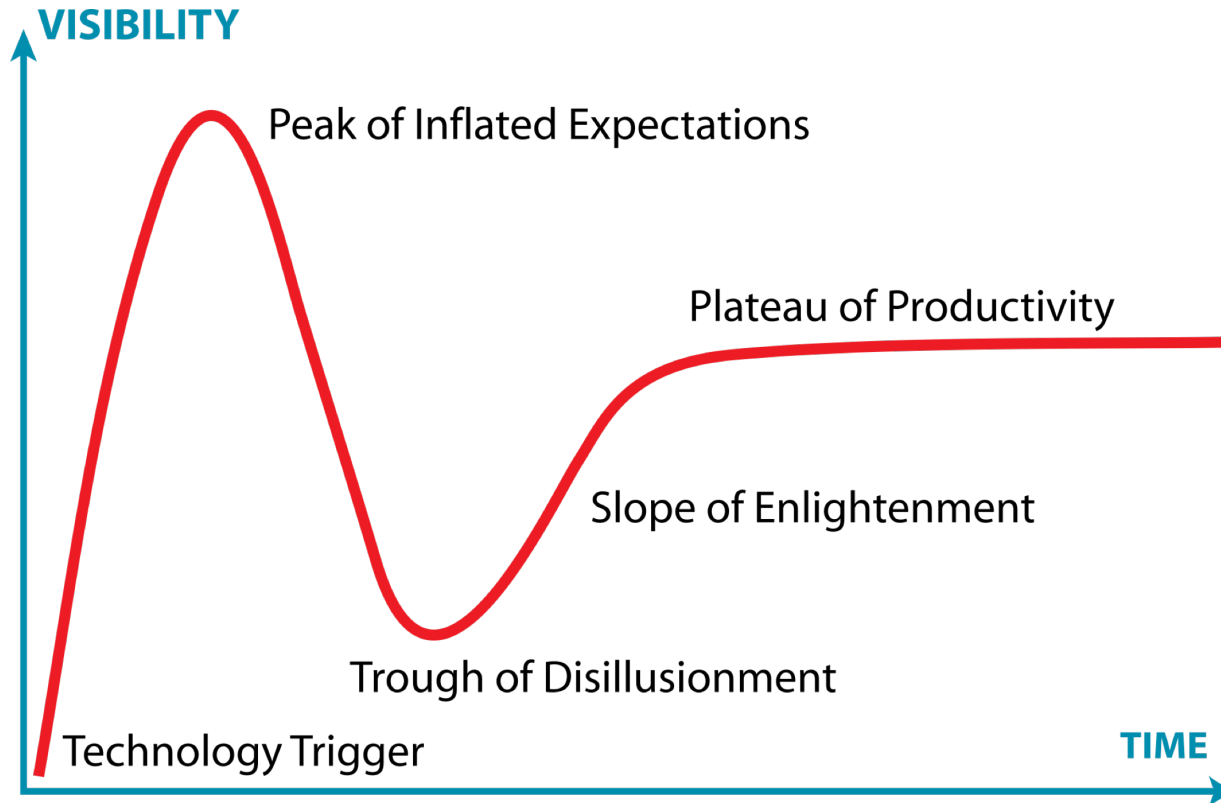
Digital transcripts

Portable certifications with date stamps

Records management – grades, accounting, policy and procedural changes

FINANCIAL AID

TURNING POINT – from nerd scary to mainstream





TURNING POINT – from nerd scary to mainstream

Get into the hands of the end user

Seamless, ubiquitous, invisible

Stephen's Java applets example



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- MIT Digital Certificates Project
 - <http://certificates.media.mit.edu/>



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FINALLY...

Do you need a blockchain?

<https://medium.com/@sbmeunier/when-do-you-need-blockchain-decision-models-a5c40e7c9ba1>

QUESTIONS?



Jet Propulsion Laboratory
California Institute of Technology

jpl.nasa.gov