

EMPLOYING BLOCKCHAIN TECHNOLOGY IN INSTRUCTIONAL DESIGN AND LEARNING CONTENT CREATION

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2 CONTENTS



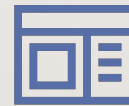
Basis of
Blockchain



Goals



Blockchain in
Education



Consensus
Algorithms



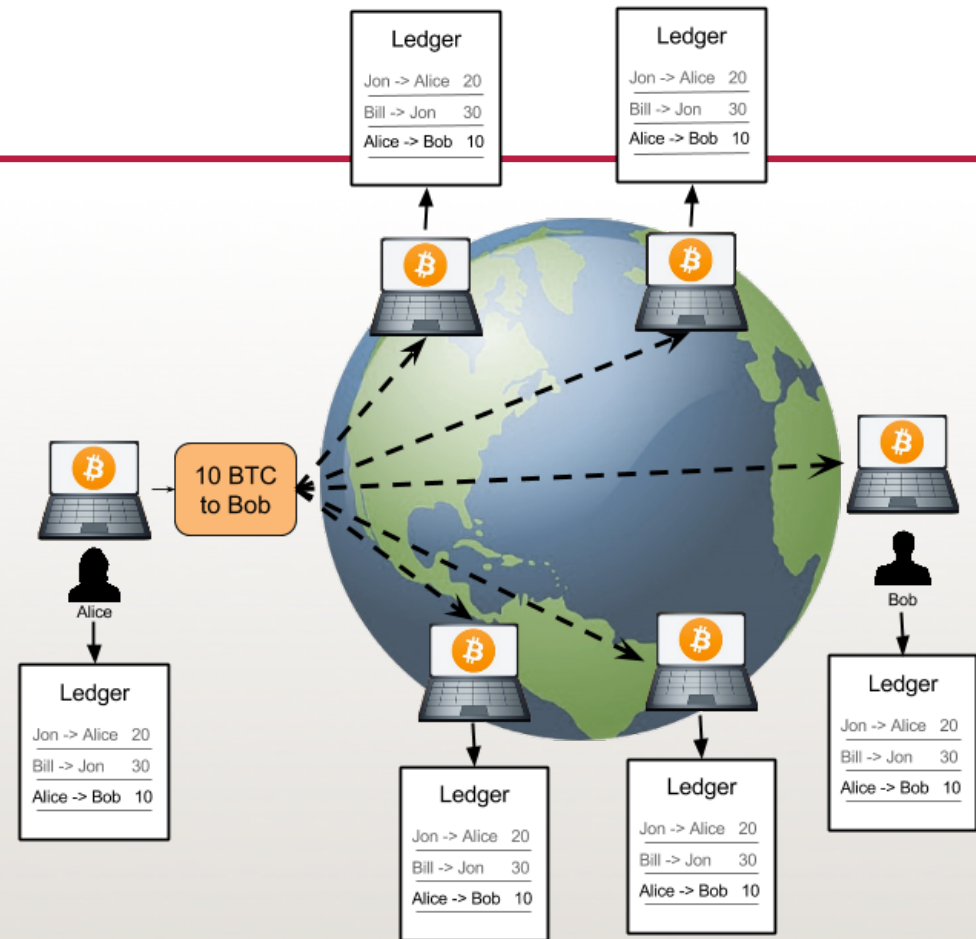
Our proposal of
Blockchain



Conclusions and
Future work

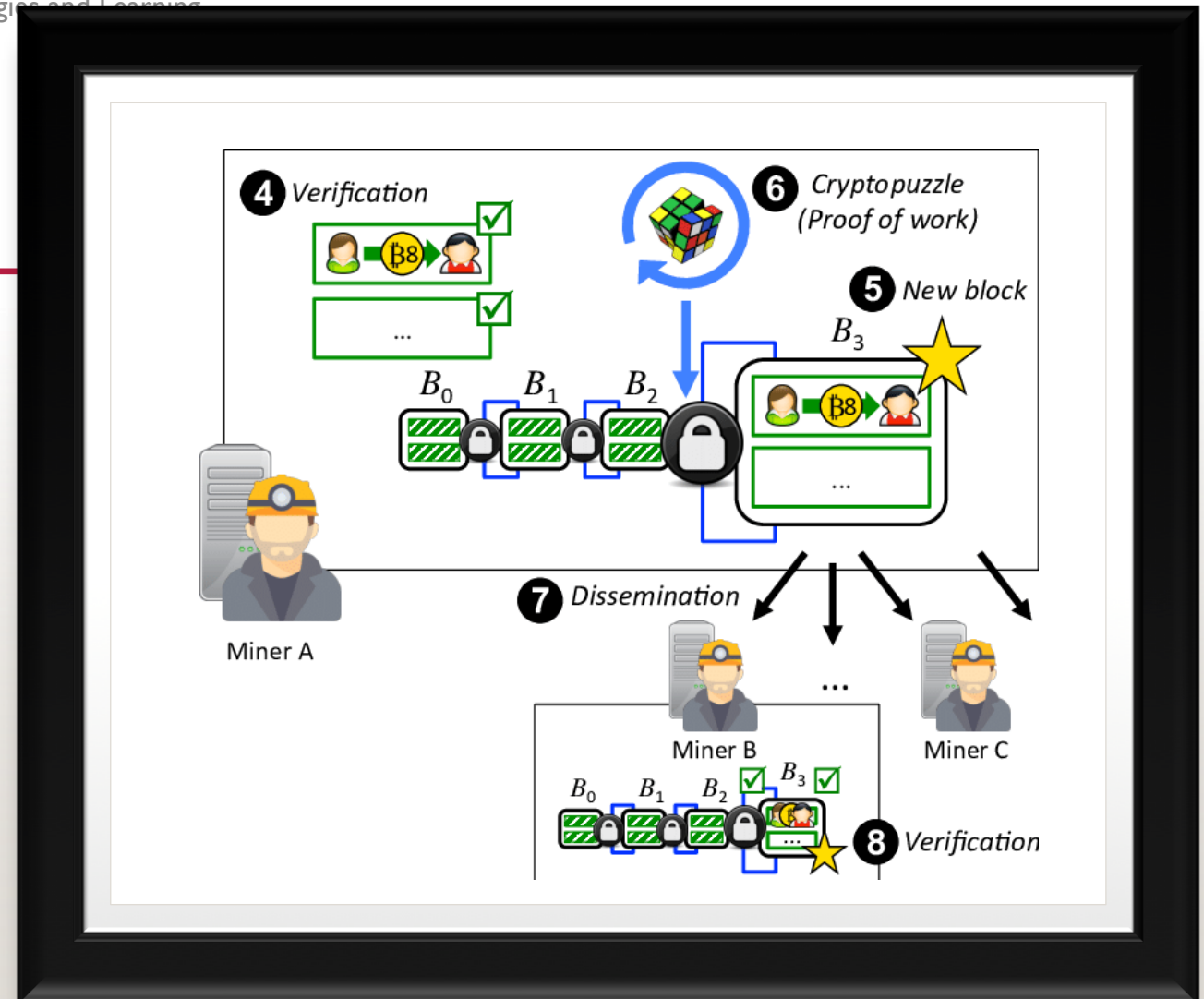
3 BASIS OF BLOCKCHAIN

- Blockchain technology also known as Distributed Ledger Technology
- Contrast
 - **Relational databases:** centralize the management of data by **entrusting** this activity to a **trusted authority**
 - **Blockchain** decentralizes it
- Originally linked to **Bitcoin** and the underlying technology for other cryptocurrency applications
- The idea of **public & decentralized ledger** can be exported to various applications in other industries (**training contents** included)



4 BLOCKCHAIN – MORE DETAILS

- **Distributed ledgers attributes:**
 - **Recorded:** stored information is time-stamped.
 - **Transparent:** anyone can see the ledger of transactions.
 - **Decentralized:** the ledger exists on multiple computers, often referred to as **nodes**.
- Users **send** their unconfirmed transactions to several pools (queues) of
- Miner/Node: the agents responsible of:
 - **Select unconfirmed transactions** from the pools
 - **Verify** the transactions (4),
 - **Add then to** a new block (5)
 - **Solve** the Mathematical Challenge for this block(6) and
 - **Disseminate** the new block to the remaining Miners. (7)

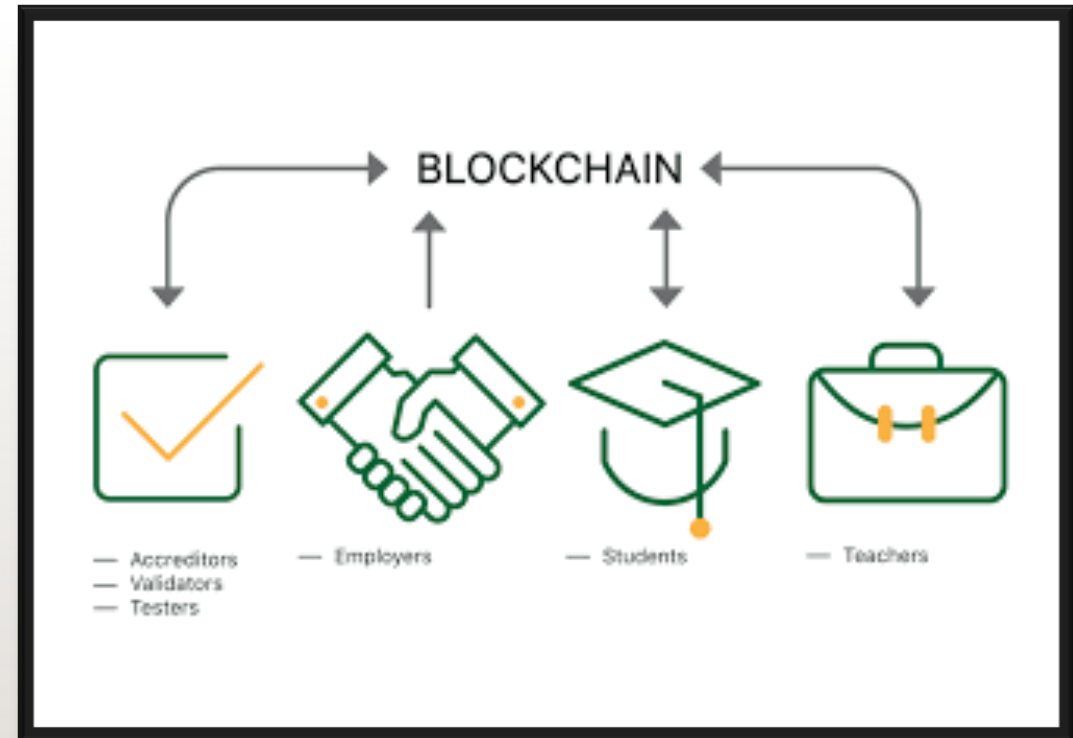


5 GOALS

- Adapt Blockchain for other educational applications such as the **creation of learning contents**, the **right consensus algorithm** is needed
- Learning Content Creation will have little or **no reward for participants** and also not need “mining”, **the consensus model selection** will need to treat participants fairly so to **not push** them away

6 BLOCKCHAIN IN EDUCATION

- **Traditional application of BC in Education** is support academic degree and **certificate** management and **evaluation** of learning outcomes
- *Though blockchain provides an evidence of an award with a student's identity, it is **not able to verify trustworthiness** of either party*
- Blockchain technologies have the ability to **create data management structures** giving users control and ownership of their data, reducing the educational organizations' data management costs
- Blockchain technology can help **protect** teachers' **intellectual property**



7 CONSENSUS ALGORITHMS I

- **Consensus definition:** Consensus is a dynamic way reaching a collaborative agreement within a group
- **Determinants of a consensus algorithm:**
 - **Security**
 - **Real-time value**
 - **Fault Tolerance**
- **Blockchain categories:**
 - **Public Blockchain** – a permissionless distributed ledger open to anyone's participation,
 - **Federated Blockchain** – a distributed ledger that operates under the leadership of a group and doesn't allow just anyone to participate in the validation and verification process, and
 - **Private Blockchain** – where participating members are known and trusted by the network [12].

8 CONSENSUS ALGORITHMS FOR DIFFERENTS BLOCKCHAINS

- **Proof of Work (PoW)**

- 1st used by Bitcoin.
- Complex and energy demanding mathematical challenge (SHA256)
- Low probability to find the HASH

- **Proof of Stake (PoS)**

- A random system to choose the next creator of blockchain
- In part depend of the economy of the user holds and how long the user has held that stake

- **Proof of Elapsed Time (PoET).**

- Every validator picks a random wait time from a trusted function

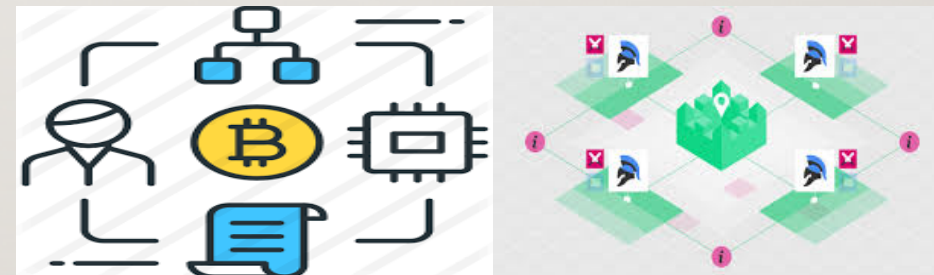
- **Byzantine Fault Tolerance (BFT)**

- the ability of a distributed network to function correctly despite malicious attacks from its peers

- **SIEVE**



- Public Blockchain: **[POW, BFT, SIEVE, POS, POET]**
- Private Blockchain: **[BFT, SIEVE, POS, POET]**

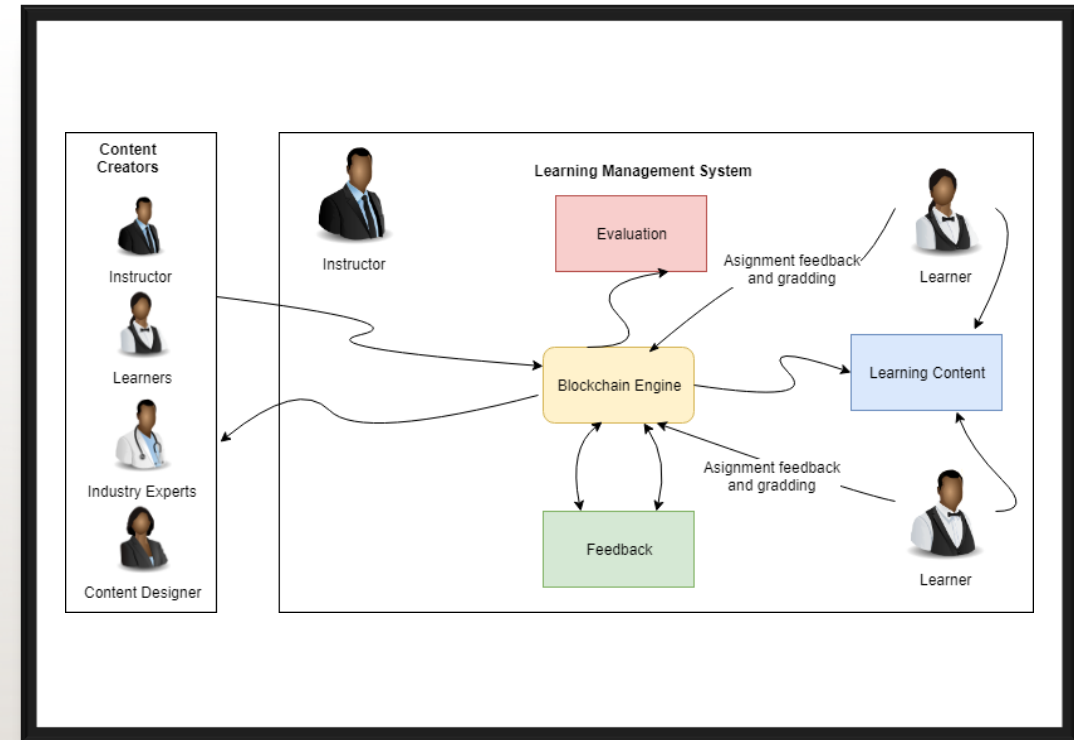


9 THE PROPOSAL – CONTENTS DESIGN PROBLEMS

- **Traditional** Learning Content Creation and Instruction Design is primarily **owned by one party or entity**
 - To ensure validity of content data, making changes there are **Strict Rules**
- Common challenges for **instructional designers** are:
 - Designing and developing eLearning courses, Identifying key issues, choosing the right instructional design model, managing the eLearning project, resolving problems, and overcoming mistakes.
 - **Tracking revisions** and release versions of learning contents is also a great challenge
- Some of these problems mentioned by Pappas can be solved with the introduction of a **distributed ledger framework like blockchain.**

10 THE PROPOSAL – ADVANTAGES OF BC

- Introduce **decentralization** of data
- Making the content creation data available to and **owned by all parties involved.**
- Once a block is added to the chain, it **cannot be modified**
- Every block is created with timestamped generated data which can be easily traced since it will have an **immutable audit trail**
- The timestamped data can help with the **tracking of revisions and release versions**
- Blockchain's **security**, improves the security of **intellectual property**



II THE PROPOSAL – THE CONSENSUS

- Adapt blockchain framework to learning content creation, **requires a different approach of consensus algorithm** in order to encourage participation:
 - There may **be little or no reward** in this model
 - Care must be taken so **not to push people away** from **participation**
- **Areas to consider:**
 - **Leader** – Who has the most stake and right to lead and/or choose participants? Should all have and deserve equal rights and opportunities?
 - **Participants** – Who can participate and how will participants be trusted? One of the objectives of a consensus mechanism is inclusiveness, which states that, as many people (or nodes) as possible should be involved in the process. Can this include inputs from Big Data Analysis and Machine Learning?
 - **Classification** – Classify the participants based on creating various criteria and roles in learning content creation and instructional design
 - **Validation** – How will verification and validation take place? How can make sure each and every vote has equal weighting when participants can be of varied backgrounds e.g. subject matter experts (SME), instructors, course designers, students etc. Can any of the blockchain consensus algorithms be used for validation and verification?
 - **Security** – will 51% attack be an issue in such use case where participants will be somewhat known and trusted?
 - **Privacy and transparency** – In a permissioned blockchain where participants are known, how can the notion of privacy be preserved, and at the same time make contributions and/or inputs transparent?

12 CONCLUSIONS

- BC can be extended **for learning content creation and management**
- The main aspect of BC to study in this new contexts is the **Consensus Algorithm (CA)**, since **the traditional (CA)** are not suitable for this kind of application.
- **No much reward for participants**, the model should make participants feel welcome and appreciated and not push them away. Participants from different domains and levels of experience.
- BC will **solve** many of the **instructional designer's dilemma**.
- **Learning Management System based on the blockchain** technology will be developed

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Any Questions?

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SPAIN, REALLY?