Blockchain learning: can crypto-currency methods be appropriated to enhance online learning?

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BLOCKCHAIN LEARNING: CAN CRYPTO–CURRENCY METHODS BE APPROPRIATED TO ENHANCE ONLINE LEARNING?

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My name is Peter Devine, I work at the Institute of Educational Technology, at The Open University. I am a designer, not a developer and the following talk is from a design perspective. If possible I would like to leave any questions until the end of my talk.

During my professional engagement in the design of online educational tools and resources I have observed learners and teachers demonstrating frustration with many of the standard online learning tools available. Whilst the cause of the frustration is open to speculation, I sense the need to review alternative methods of online student engagement.

I have chosen to explore The Blockchain to see if the OpenSource framework behind crypto-currencies can provide any improvements or enhancements to the existing online teaching and learning experience.

This is not an attempt to sell the idea of using the Blockchain, but to begin the process – if it has not already begun in the minds of some – of discussing the relative merits of the technology that are being explored by JP Morgan, Barclays Bank, economists, activists as well as academics and technologists.

WHAT IS THE BLOCKCHAIN?

The Blockchain is the underlying technology used by crypto-currencies such as Bitcoin.

Bitcoin is digital cash managed independently of any central bank. Melanie Swan describes Bitcoin in her recent book Blockchain – Blueprint for a new economy

"it is an online currency and payment system in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds".

The Currencies come into existence through a process referred to as mining. Mining coins is an online peer-to-peer process whereby mining software is downloaded and runs on a users computer. Users create blocks by allowing the mining software to run on their computer. The miners receive coins in exchange for the processing power used to create the blocks.

To be more specific, The Blockchain is the public ledger of all crypto-currency transactions including Bitcoin. It diligently records additional blocks of currency as they are created, or tracks the currency as it is re-allocated between users. Users can also exchange crypto-currencies for normal fiat money such as pounds, euros and dollars.

Every user is a Node on the Blockchain network. Every node has a unique address. Every user has a private key.

The user downloads software that is described as a wallet – a metaphor to help communicate its financial function. Every node performs the function of validating and relaying information about every transaction, but not the user who remains pseudo-anonymous. The Blockchain keeps a complete record about all information pertaining to all balances from the genesis block – the very first transaction. The entire record is public and open.

As the developer community around Blockchain has emerged so too has the innovation around how it can function. One such idea is a Smart Contract. Smart contracts possibly predate both Bitcoin and the Blockchain, although when the cryptographer Nick Szabo theorized them in 1994, no digital framework existed to make them a reality. Smart contracts are programmed triggers that can release funds or execute other agreed arrangements as per the contract without any intermediary.

More information about Smart contracts can be discovered at ethereum.org.

The fact that Blockchain is public makes it interesting and somewhat unique. It is open to scrutiny by anyone and is described as trustless. Normally one would be dependent upon a centralized intermediary such as a bank when handling money. The bank is recognized as a trusted partner in this relationship. However, instead of centralized authority, the Blockchain relies upon all of its users collectively to provide validation services, with each node offering verification that the ledgers sum total is correct.

The Blockchain does not store information about the user, but the user's individual wallet might, depending on how the wallet is configured. A private key protects a wallet and offers security for your finances, but it is important to note that other user behavior such as Google ID's or other account driven interactivity could compromise the anonymity of the user.

Beyond these distinctive characteristics, Blockchain is just another application running on the Internet – another web protocol!
On screen we can see a visualization originally provided by bits.coinlaunch.com. The small blocks of colour represent transactions as they occur on the Blockchain. This is a video sequence I captured using Camtasia and these transactions happened last week. If I were to click on one of the blocks I would see a web page with details about each transaction.

WHAT IS BLOCKCHAIN LEARNING?

Ok, So what might Blockchain learning actually be?

It is useful to return once again to the book Blockchain – Blueprint for a new economy where Melanie Swan attempts to define Blockchain Learning as a smart contract.

Swan thinks that smart contracts could allow for the configuration of peer-to-peer aid to be focused on personal development rather than finance – and that Blockchain Learning is about decentralized learning contracts. I wonder if perhaps it could be both: a framework for personal development as well as a method for managing educational costs?

As already discussed, Blockchain was originally conceived of as a framework to enable currency transactions to occur without interference from central banks. The Blockchain is therefore rooted in finance but the language that defines it sounds somewhat ugly in the context of providing educational technologies.

If the educational market were to be digitally decentralized and a unit of value created to represent learning achievements it might be possible to shape an autonomous learning exchange. Smart contracts would probably need to be be developed and written to provide structure for the exchange.
So, if we consider learning and teaching is the currency of education then we can begin to develop a more appropriate language.

Could it be as simple as a transposition of terminologies – financial on one side, learning and teaching on the other. Presumably the transposition would require consensus of agreement for it to work?

For example, In Bitcoin-speak, the role of the miner is fundamental for the creation of blocks. In Blockchain Learning I suspect the role of teachers as miners might be a good fit. The teacher creates the opportunity for the learning to occur through the planning, delivery and inspirational actions of teaching. Therefore it may well be that teachers magically place learning blocks – through a mining-like process – onto an educational Blockchain, an income – ready to be expended by students.

There is a fundamental problem regarding the method by which mining occurs and the function that it plays in the creation of crypto-currencies. Mining normally involves the solving of complex mathematical problems as part of the validation process without which fraudulent blocks could be added to the chain. So the transposition of mining into the context of the Blockchain Learning will require special consideration, this is not an easy fit.

The word *coin* – often the foundation of the label for most crypto-currencies - may misrepresent the unit of exchange for an open and public learning ledger. A learning token or credit being a better word to describe the unit of exchange,

with the token/credit being convertible to a number of other properties such as digital money in the context of educational finance or in some other form as part of a credit transfer process if and when students swap learning institutions.

Another example is the term *Wallet* to describe the software downloaded by a student. Wallet may not be suitable when describing the software used by the parties involved in the exchange of learning. Yet words such as *ePortfolio* have been tried before when describing the online storage of student activities, and failed to capture the imagination or spirit of what was being attempted. Is it as simple as a single word?
Or is it the complex combinations of these terms and others used consistently that combine to establish these linguistic constructs? Possibly so!

Certainly the contractual nature of the relationship invites scrutiny for the existing relationship between institution and student brokers many concepts from the pre-digital era that are now being challenged in a number of seemingly unacknowledged and apparently unrelated concepts such as 'Digital First', Big Data or Internet of Things.

EXAMPLE 1: EXPOSE THE STUDENT LEARNING RECORD TO THE PUBLIC

For my first example of Blockchain Learning, lets revisit the notion of an autonomous learning exchange where students log an entire learning history onto the Blockchain ledger – possibly in the form of a series of Smart Contracts.

The trajectory of student and teacher personal and professional development would be available for all to see, including potential employers. This accredited educational timeline could be used to make projections of future potential based upon individual student learning histories.

A universal credit transfer between teaching institutions could be considered. A student could use the Blockchain to manage the process of finding the right course, or seek an alternative course and for the transfer process to be managed digitally.

Smart Contracts operate in the same way as normal contracts, however they remove the need for trust: as the contract is defined and executed by the code automatically and without prejudice. The record is not kept by a central office, and does not require input by an administrative member of staff at the institution. Like money moving from one account to another, but decentralized and monitored by a community,

The ability for students to move between institutions and keep an open and verifiable account of their learning achievements in the form of a transferable token or unit of exchange is one example of how Blockchain could influence Learning and teaching.

One concern about this technology might be that the volatility normally associated with Bitcoin could migrate to the allocation of places in higher education. If students were free to move once a contract has been completed then it might introduce jeopardy into the organization of our teachers and lecturers as students migrate from one institution to another based on difficult to detect patterns.

One further opportunity of exposing learning to a decentralized public ledger is that employers will get early insight on the development of future employees. At present, groups representing 'employers' are lamenting undergraduate standards. A register of accredited achievements – designed to enable credit transfer - could have a secondary function to provide employers with a crystal ball in to the future candidates they are likely to interview.

EXAMPLE 2: OFFSETTING COSTS OF LEARNING USING PEER-TO-PEER NETWORKS

The second example I would like to talk about is in many ways coupled to the first. It plays strongly on the financial heritage of the Blockchain and peer-to-peer finance offered by Bitcoin.

This second idea is to utilize the peer-to-peer data management of Blockchain to provide a financial reward scheme for students who offer services to the university. The benefits could be two-fold, provide financial reward for completing pre-agreed tasks and provide an incentive for the adoption of the Blockchain within learning and teaching. It is hoped that by developing a scheme such as this it might be possible to reduce the cost of higher education, which to some potential students is a very real problem.

Not everyone is deterred by debt when considering higher education; the promise of high earnings, family support or the idea that they may never earn enough to need to repay the loan, is sufficient for many to press ahead with their plans to study. So this will not appeal to all.

However, there remains an opportunity to provide an alternative approach to financing ones education in cases where debt is an issue.

One task which could be considered in this frame is some form of peer assessment – or peer-to-peer assessment via the Blockchain. Tokens or Bitcoins could be exchanged in return for services to the university. If adopted, those students assisting their teachers should be rewarded a fee. In addition, teaching staff are liberated from marking 300 documents and could therefore provide additional benefits to institutions that could entail further attention to students. A possible win-win situation!

The question remains: If a student were to provide one of these services in return for a fee – how would the Blockchain manage the process? IE. The technological mechanics of inviting participation, distributing assessments,

collecting results and allocating rewards! Also, how would the proposition be framed and communicated to ensure a fair and reasonable trade on behalf of both parties. These are just two questions which initially cascade from this idea. There are sure to be more.

Some existing service providers can demonstrate the types of service that rewards users, for example the services provided by Storj.io. Storj offers a cloud-based decentralized data storage service based on peer-to-peer technologies and the Blockchain. Storj members receive a fee for leasing redundant hard disk space via the storj.io network. This service is running now and works. Could education appropriate this model to the benefit for teachers and learners?

CONCLUSION

I hope you have found my talk interesting. I have been talking about two ideas, one to place the entire learning record onto the Blockchain which might read like a Linked IN – but accredited. And the second an idea which would hope to reduce student debt or provide additional finance for students using the trustless nature of Blockchain and its ledger to take a full account of newly created learning and teaching transactions.

As a matter of interest, I came to the conclusion that the Blockchain might be a useful technology whilst I was designing an App for mobile learning – a companion App for our VLE. I was trying to figure out how a learner could use an App that was supposed to support their learning, if they did not have an Internet connection. I kept thinking that the problem would be solved if only the database was with the user – instead of being on a central server. I kept thinking, mmm, I wonder if the Blockchain could help here.

I now realize it probably wouldn't have helped my specific mobile App problem, but I still think it might be able to assist, in helping negotiate and transfer educational value on behalf of students, teachers and institutions as Big Data, Internet of Things and Digital First continue to drive demand.
What I was feeling intuitively as a designer about the technology has led me to consider a number of related issues which I need to explore further regarding the language, the mechanics and cultural impact of Blockchain. The opportunity to discuss these thoughts during this Winter Conference, I hope, will stimulate conversation about what this technology offers educational technologists.

As cloud services posture for attention and software subscription models proliferate we nevertheless remain fundamentally routed in the mainframe thinking from the 1970's. I think it is time to review the centralized model? If only to provide a reality check that our basis for centralized services is correct!