

HACETTEPE UNIVERSITY
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BBM 443 FUNDAMENTALS OF BLOCKCHAIN



FINAL REPORT
BLOCKCHAIN IN EDUCATION

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Introduction

We decided on a research for the educational purposes of Blockchain. We analyzed varying papers on the topic. We want to discuss about the observations we gathered from analyzing these papers. We found a limited number of fields that the papers consider currently viable for Blockchain use. In this presentation we will talk about them and their potential, their shortcomings and our improvements on them.

State Of The Art

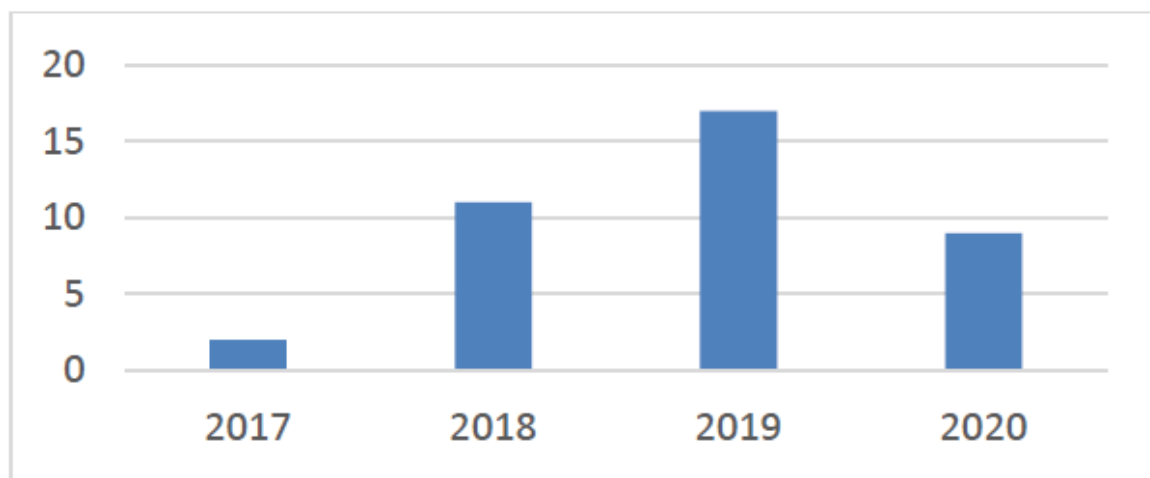


Fig. 1: Number of Papers per year

As we can see in figure 1; blockchain in education has gained popularity in recent years. Many projects have been proposed over the years but most of them have only been addressed in theory. Few have been implemented. As the number of projects and applications dependent on this innovation expands, it has become more and more important that researchers have access to the current state-of-the-art and practice. In recent years, because of the many advantages, blockchain began to be applied in many areas such as transportation, supply chain etc. but blockchain in education isn't the priority at the moment. Blockchain offers, other than high security, the ability to incorporate information from divergent information sources, for example; instruction records put away in data sets of various educational providers.

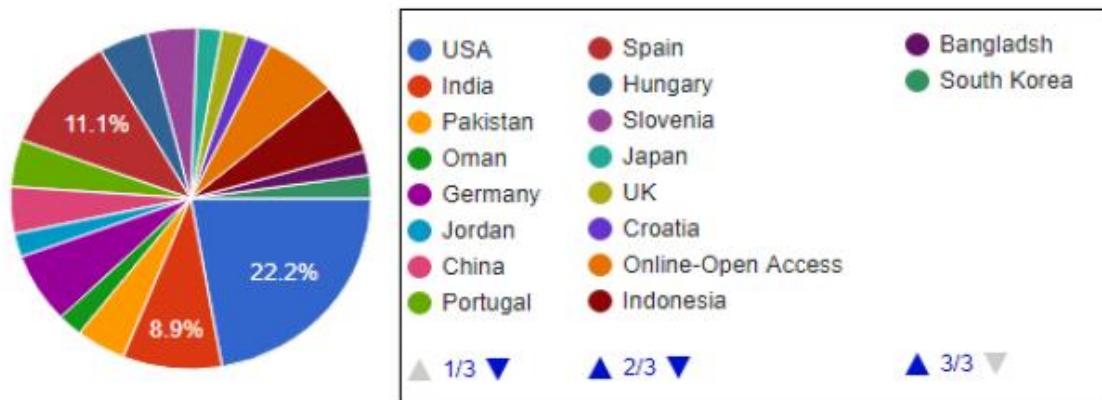


Fig. 2: Researches by country

Researches conducted by countries are shown in figure 2. As we can deduce from the figure 2 above, there have been many studies made on the topic of education in the last couple of years by many countries, however not one country has been shown to be in the best at blockchain in education by a decisive amount.

Main Topics:

1. Certificate/Degree Verification: This categories' main focuses are transcripts, student certificates, academic credentials etc. so academic accomplishments are focused on in certificate/degree verification category. This might help with better control of how students earn certificates and access them. There are some programs developed already in this category.
2. Student Assessment: Articles in this category described automated mechanisms for the creation of exams and assessment procedures for students and their evaluation process also this might shorten the time it takes to do these actions.
3. Credits Transfer: This category included research on blockchain applications for storing student records and transcripts and transferring academic credits between universities. This eliminates the third party during these processes and makes doing these transfers faster.
4. Data Management: This category contained articles on blockchain applications for connecting student's records across institutions as well as smart contracts for managing student data and also for storing their records for future purposes like occupational reasons.
5. Admission: The articles that was on this category, proposed blockchain applications to help the students when applying to universities by storing and sharing the admission procedures and required documents to apply to get into a particular university.
6. Review Papers: These articles included literature review studies conducted by researchers that are made for educational purposes or research purposes.

7. Copyrights Management: Credits transfer is basically quite similar to credential records blockchain category, that's why copyrights management resembles certificate/degree verification but it mainly focuses on transferring data between educational institutes, organizations or courses. As of now, most of the institutes use third party organizations to verify the legitimacy of credits.

Some examples of state of the art technologies:

1) NESPOR:

Nespor is one of the proposed blockchain platforms.

Nespor gives authorization to higher level academics and lets them provide students with official certificates that they can share after their academic years with their employers.

This helps with the legitimacy of the documents and also makes requesting official documents easier.

2) SONY GLOBAL EDUCATION:

In 2019 with the initiation of Sony Global Education, Fujitsu Limited, and Fujitsu Research Institute, a field trial for blockchain was started.

Purpose of this field trial is to assess the versatility of blockchain in records of courses and student evaluation data.

Side note: Just like Nespor the credits are stored and shared securely. But with SGE blockchain to confirm a document is real it is necessary to submit the original transcript.

3) BLOCKCERTS:

Initially designed by MIT Media Lab and by Learning Machine, now Hyland Credentials; it's a standard for creating, issuing, viewing, and verifying blockchain-based certificates.

These digital records are registered on a blockchain, shareable secure and cryptographically signed.

4) CHILO:

CHILO is a system that is discussed but not yet implemented.

Copyrights management is an important part of education where the ownership rights of a product is reserved with blockchain.

It is used for protecting especially e-books ownership rights and copyrights.

There is a need for this kinds of systems because of the internet there are a lot of resources that are stolen or anonymous.

5) EDUCTX:

EduCTX system is one of the credits transfer blockchain technologies that uses tokens to efficiently transfer credits.

EduCTX address of each institute is unique to each one of them. The most important benefits of this system are provability of the documents, scalability because there are unlimited number of institutes that can join the network. Also it makes less paperwork and makes application, verification and request processes much easier and faster.

Limitations

The public blockchain could be very well suited for currency, but when it is applied to other areas such as education, its positive uses(perks) are limited by a number of reasons. One problem is the high cost of ensuring consensus when large records are accepted into the public ledger. Another problem is the acceptance of the public blockchain does not guarantee the record's value or quality but its immutability. Limitations like these come up in relation to using the public blockchain to manage educational records.

It's Not Free

- Bitcoin's blockchain has been almost free to users but it's not been free to miners.
- They pay a high computational price to validate new blocks.
- A group of miners should be willing to spend almost a bitcoin of processing energy to mine a bitcoin.
- Potential users will get onboard with the public blockchain as long as it provides positive value after fees are subtracted.
- Users who put high-value financial assets will most likely be willing to pay escalating fees but others who have less important assets like diploma records are not likely to accept that bitcoin's public blockchain is a cost-effective infrastructure.

The Limits of Trust

The public blockchain's openness could be a compelling infrastructure for many users, but it could also pose many challenges. For example, if a public blockchain credential claims that Ali got a card from Ayşe, it means that anyone can now be confident that Ali did indeed get a particular card from Ayşe. So, while the public blockchain's openness and low barriers to entry could lead to new educational providers offering digital credentials for consumers, if there is no regulation, it is ambiguous if this will improve the available educational resources in this case.

Tokenization

Tokenization of assets is the process of issuing a blockchain token that digitally represents a tradeable asset. Using this as a replacement for the enrollment system the 'enrollment' procedure will be as a token transaction. The central school account will hold all the 'tokens'(class quotas) and will give a token to everyone requesting in order till there are no tokens left of that class.

A big issue that we, students, have been dealing with is that a lot of students will register into a class and then sell the said class to another student with money. But the problem eliminates itself since all students will possess a copy of the blockchain any alteration is easily detected. Also say that the tokens are sold between parties, since the school will back trace the transactions all the misconducts can be detected by the program and necessary course of action is taken. Benefits of tokenization: A token economy reduces the friction involved in the creation, buying and selling of securities. This increases the fairness of the financial world. Since smart contracts are used in the transaction of tokens, certain parts of the exchange are automated. This can reduce the intermediaries needed, leading to faster deals and lower transaction fees.

Our Take

The Problem:

Our school's enrollment system is impractical and causes many problems and injustices. It is prone to crashing and takes hours to function properly. There is the view as to "Unnecessary Spending" for upgrading the schools servers which is fair to some degree. However with students not being able to choose their mandatory classes(maybe even consecutive years) is a big problem. In addition to this the system is not esthetic and doesn't reserve the chosen courses until the decisions are finalized. This causes a repetitive failure because when a quota gets full while a student who already added that course will not be notified and later when the student tries to finalize the decision it will fail and it will continue to fail as the quotas fill. The only upside of our new system is that it prevents the buying and selling of classes.

Our Proposal:

A system that uses the tokenization of courses and trading credits(AKTS) for those specific tokens. In this system students will have a personal account just as in the current system, however it will be a blockchain based account. The school will be represented by another account as the 'Admin' of the system. Courses will be uniquely added by the school to the system represented with a specific token and the quotas represented as the number of tokens. The amount of credits that students will hold is to be specified by the school board every term and they will trade these credits for the class tokens thus creating the 'enrollment in the class' system. Any trading between the students will be prohibited. When the enrollment week ends, the blockchain will be back traced by the school, regulating the data in the normative way and store it. This way any misconduct will be detected and actions can be taken accordingly. For every term this process will be repeated, this will accomplish a simpler system, not prolonging the chain unnecessarily and providing an easily convertible data system.

The Main Problem:

The main problem with using a blockchain system in replacement of the enrollment system is the time delay caused by the blockchain's block verification and the number of blocks necessary to accommodate a 'registration week'. In order for it to work we propose that the 'work of proof' part of the block will be dismissed, reason for this is to speed up the block creation process. One of the possible drawbacks from this is that it is a safety feature against someone trying to modify the records. But since every student and teacher retains a copy of the original blockchain, if any manipulation occurs on the main block it will be quickly recognized by the sheer number of users (if not by the school of course) and eliminated.

Using tokenization for the enrollment system the 'enrollment' procedure will be as a token transaction. The central school account will hold all the 'tokens' (class quotas) and will give a token to everyone requesting in order, until there are no tokens left of that class or the need for it has been fulfilled.

Another problem is course trade (selling/buying) between the students. However this problem is already eliminated since all students will possess a copy of the blockchain, so any alteration is easily detected. Also say that the tokens are sold between parties, since the school will back trace the transactions, all the misconducts can be detected by the program and necessary courses of action can be taken.

Conclusion

Blockchain technology is quite new in education and because it is such a new technology, it has not been researched enough. There are mostly theoretical systems, ideas of what could be implemented, rather than the systems that have been implemented and usable now.

Blockchain education is a developing field which yields great results in some education based applications, and it may become increasingly more useful in the future. But our opinion is, Blockchain cannot singlehandedly overcome a problem. It will need modifications and/or integration to other solutions to be effective against specific problems and to yield efficient results. We chose this specific problem which we think many of our classmates here also find troublesome. So we tailored and modified the system to better fit our needs, using Blockchain's strengths but not the weaknesses, while also taking the already existing systems strengths.

About our model:

This system will allow students to enroll in the classes that they want without the system failing. The only tradeoff is that the school will need to keep their computers working during the back tracing process. If the system manages to keep steady, the most profound problem that students face today can be solved using blockchain technology. There will be no more complaints that students couldn't enroll in the classes they want because they couldn't get into the system.

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