



## ADOPTION OF BLOCKCHAIN IN EDUCATION: EVALUATION SYSTEM

<sup>1</sup>Md Sher Ali Khan, <sup>2</sup>Tarandeep Singh Walia, <sup>3</sup>Ajay Shriram Kushwaha

<sup>1</sup>Research Scholar and Assistant Professor, <sup>2</sup>Assistant Professor, <sup>3</sup>Associate Professor

<sup>1</sup>School of Computer Application

<sup>1</sup>Lovely Professional University, Punjab, India

### Abstract

Blockchain the most popular innovation of recent technology, is a stretched-out network that holds the info using the services of a peer group surroundings. Different algorithms have been developed to assure the safekeeping and validation of transactions. The exclusion of intermediary has encouraged researchers globally to study the influence of blockchain on education. In our research, we worked on the different review paper directed towards utilization of blockchain in education. The aim of this research work is to look for review paper and determine various possibilities for evaluation of student performance using blockchain based on different attributes such as attendance, presentation given, home task submission on time, performance based on class test and term end performance.

**Keywords:** *Blockchain, decentralization, evaluation, education.*

### I. Introduction:

Blockchain was developed to manage Bitcoin [1]. The technology proved to be the boon for cryptocurrency. Blockchain led to the development of several decentralized applications [2]. Logically blockchain is defined as, “chain of blocks that comprises of precise materials (database), but in a protected and authentic way that is connected in a peer-to-peer network. In other words, blockchain is a combination of computers that exist as distributed network” [3]. Most researchers’ belief that blockchain is still in its early stage in the field of education and still enough research work needs to be worked on to reveal the benefit of blockchain in education [4].

The researcher in their research work highlights the potential of blockchain in the field of online education as well as maintenance of digital certificates [5].

This research work provides an analytical view on the current literature and the future potential of blockchain in education related to evaluation. The education sector is growing with the development of technical knowledge. To successfully implement new technologies in education it requires regular upgradation and management of educational system. Assessment will be carried out using peer evaluation methodology. In order to get the best outcomes students work will be shared with five peers so that efficient evaluation is done. This will help in monitoring the performance of the student as per the feedback provided by individual evaluators. The score card generated will be used to prepare the progress report.

### II. Outline of Blockchain Technology and Literature Review

Education is the backbone of the society. The education system needs to be managed with utmost care. Education without technology stands nowhere because education without technology will be similar to a handicap person. To implement upcoming technology in education is a great challenge. The recent development in technology i.e., **blockchain** has already made a greater impact on most of the disciplines of our life such as finance, healthcare, industry etc. The **blockchain** is referred to as, “**distributed database** that chronologically stores chain of data packed into sealed blocks in a secure and immutable manner” [20]. The sequence of blocks also called ledger is regularly increasing, thus fresh blocks are being attached to the end of the ledger whereby each new block holds a reference to the content of the previous block [16][3]. Blockchain technologies offers a safe and inventive means of understanding the thought of self-sovereignty, stating an individual’s utmost power over and complete possession of individual’s personhood [13]. Blockchain technology has proved to be a technology to work on with since its introduction by Nakamoto in 2008 in bitcoin: A peer to peer electronic cash systems [1]. In current period, blockchain technology has been implemented in various arenas such as cryptocurrencies in the field of finance, that comprises of Bitcoin, Ethereum, and Zcash (Zerocash), etc [22][3].

The features of blockchain such as records one entered cannot be modified, it does not hide anything from the miner and the complete reliability of transactions being executed has forthcoming applications in the management of data in the field of education using blockchain. The needless reproduction of reports along with the copies of documents has been reduced greatly by using the techniques related to

management of data, handling of forms and managing of reports and at the same time it helps in improving the efficiency of the reports along with the creation of the documents [9][22].

With the introduction of blockchain on system, the cost and time of this process can be immensely reduced [21]. The Professors in the system will not be challenged for evaluating exams and awarding credits as every single detail for awarding marks and credits can be covered using pre-programmed smart contracts [20].

Blockchain technology is going to prove vital for the education system as it will add value to existing education system. The features of blockchain such as efficiency, reliability, security, trust, improved traceability and reduced costs [21].

**Efficiency:** Blockchain technology has proved to be an efficient tool in managing the financial transactions and keeping the mediators to a minimum resulting in the speedy clearance and management of transactions related to finance [22].

**Reliability:** The concept of blockchain technology has totally changed the prospect of databases. It has helped in developing trustworthiness by transforming it from the centralized ledger to distributed ledger where each nodes have the complete information of the database [22][7].

**Security:** Blockchain makes use of the hash function that accepts inputs of different length and transforms it into binary series of values with definite length [22]. This has led to the safety of the system.

**Trust:** The nodes involved in blockchain uses consensus that is being shared with different nodes involved resulting in the reliability of the information in the block chain [21]. To establish trust and to become connected in network, the objective of the involved parties must be clear [21].

**Improved traceability:** Since all the transactions are recorded permanently on the blockchain network, any exchange of data or requests ever made can be completely and effortlessly traced [21].

**Reduced costs:** Cost reduction is priority for most of the enterprises. With blockchain, no middlemen are needed to make guarantees. Instead, all the participants must trust the data on the blockchain [21].

Literature review was conducted to understand the concept and working of blockchain in education. To solve double spending problem, “the author suggested the idea of using a dispersed network through proof-of-work to maintain record of past transactions that rapidly becomes computationally unrealistic for an intruder to change if genuine nodes manage most of CPU control” [1].

The researcher presents an idea of how to utilize blockchain in online education system highlighting the importance of transparency, trust and data privacy [2]. These features play an important role in education system. The use of smart contract will make the education system more powerful and will provide solid way to protect intellectual rights of the teachers [3]. This will provide opportunity to school, college and university management worldwide to evaluate the teaching performance that will lead to their development.

The risk of mass attack can be tackled by the use of block maturity level consensus protocol [4]. The author states, “the pattern of utilization of Block Maturity Level in blockchain based operation. The different issues highlighted by the research was: the issue related to expandability and utilization of blockchain on mini projects. Issues related to security was also highlighted by the researcher. The researcher revealed the different ways to handle security, reliability and efficiency of data in real-world applications of blockchain”.

Blockchain has already been used in issuance of certificate but the technology is still in its early stage in education and the potential of blockchain in education still needs researcher to carry their research work in the field of education [5].

“The latest attribute of blockchain will help schools, colleges and universities to provide official documents which will work as evidence of accomplishment” [6]. “These documents can be gathered by individuals and shared directly with everyone in need of certificates. It will further boost in handling of documents by individuals after they complete their college education” [6].

“The objective is to bring in light the use of blockchain in digital cities collaborative ecosphere. In brief, it points the time-related development of the various blockchain architectures and consensus protocols, giving a backdated review of attributes in addition to their contributions and drawbacks. Additional study is required to evolve a blockchain structure that is free to extensive collaboration, redesign, adjustability, adaptable, and energy efficiency to identify the differences between the actual framework and protocols. To design and develop nature friendly and economic computing for improved consumer support” [7].

Formative assessment contributed in the improvement of motivational beliefs and behaviours that is the integrated part of the self-regulation of learning. The study reveals the importance of offline class that is important for individual evaluation” [8].

“Working towards the development of blockchain technology in education for the creation of single learning domain, creation of network communities as well as copyright protection of the network participants” [9].

Blockchain technology has already proved to be handy for students to keep records of their academic and share it with all interested parties [10].

Blockchain technology used in department of chemistry education to tackle chemistry student’s data [11].

“The research work highlights the issues related to oracle in the field of education. Carrying the research further will help in developing the blueprint and determine the chance of acknowledging the oracle problem as mentioned in the research paper” [12].

Blockchain has become a talking point in the field of education due to its impact on different field. “It is assumed that by 2025 around 12% of the world Gross Development Product will be controlled by the use of blockchain technologies” [13].

Blockchain being the nascent technology is going to pose a big challenge in the field of education [14].

“The research work describes the framework, fault-tolerant mechanism, feature and kind of blockchain. It also launches the standard student potential-based assessment system, elaborating the important issues in the process of system evolution and work-out the issues related to SimRank algorithm” [15].

Eductx developed on blockchain technology presents how this technology has helped in developing a platform that is globally trusted. “It also demonstrates how distributed higher education advance standing scoring is taken up by learner and schools, colleges and universities” [16].

Some of the educational institutions have already started using blockchain technology to provide digital certificates or e-transcripts to the student [17].

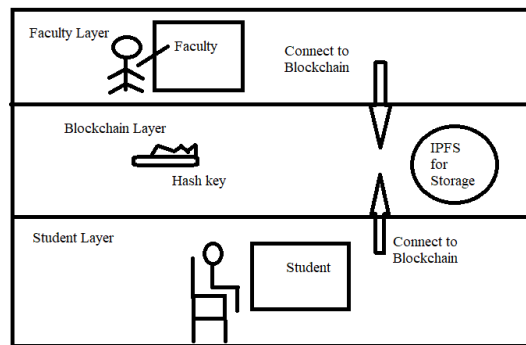
Due to the immense potential of blockchain to provide secured transaction without the participation of intermediary has proved to be vital for its utilization in different sectors [18].

“Digital information is distributed using blockchain methodology, it does not require information to be copied. This shared record provides clarity, faith, and data reliability” [19].

**III. Architecture of Student Evaluation System.**

The architectural environment depicts there are three different layers that will be used for the evaluation purpose. These layers will be as follows:

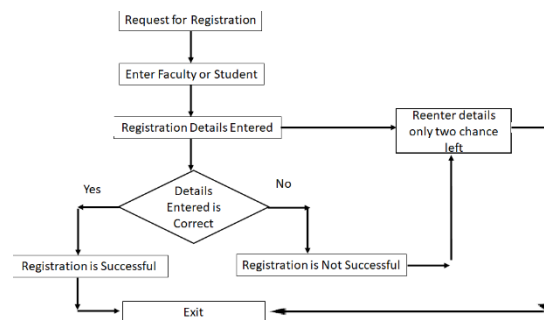
- a) Teacher or Faculty layer
- b) Blockchain based layer
- c) Students layer



**Fig.1** Evaluation System Architecture

- a) Faculty layer: Faculty first needs to register to the environment by providing the mandatory details such as name, highest educational qualifications and the field of expertise as mentioned in the algorithm given below. The entered details will be stored in the IPFS environment and the corresponding hash key will be stored in blockchain.
- b) Blockchain Layer: This is the back-end layer of the given architecture. It is further segregated to (i) Exam and course registration to be managed by the faculty. (ii) Responses registration to be entered by the student (iii) Assessment details and registration to be handled by the faculty
- c) Student layer: Student provide their details for registration. Once registered the student will submit their response and receive acknowledgement from the environment.

**IV. Algorithm to be opted for registration of faculty and student**



**Fig.2** Registration procedure

**Step 1. Request for registration**

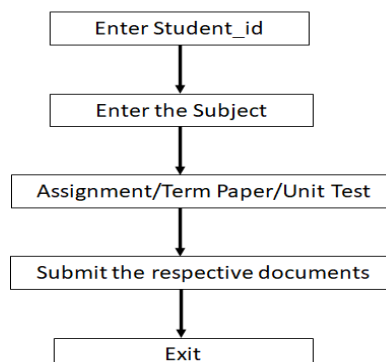
**Step2. Enter whether faculty or student**

**Step 3. Enter Registration details**

**Step 4. Check if details entered is correct if yes than registration is “successful” else “not successful only two attempts left”**

**Step 5. Exit**

**Algorithm for responses to be submitted**



**Fig.3** Response Submission procedure

- Step 1. Enter the student\_id
- Step 2. Enter the subject
- Step 3. Enter the assignment or term paper or unit test paper.
- Step 4. Submit the respective file
- Step 5. End

## V. Proposed Methodology for adopting blockchain based education evaluation system.

Based on the review of different articles an **algorithm** was designed.

**Step 1:** Start

**Step 2:** Login

**Step 3:** Authentication of user using cryptography algorithm – Asymmetric Key Cryptography (**if successful and validated by the miner then the block will be added to the chain**)

**Use of Digital Signature**

“Authentication” and “validation” performed using “Digital Signature”.

It also helps to maintain “security and integrity” of records stored in blockchain.

Asymmetric cryptography is used to share information using public key.

Users providing authentic digital signatures get linked to primary keys, so that the validation is not rejected.

**Use of hash algorithm for private and public key**

**Step 4:** Use of conditional statement to check the course and semester of the student as well as conditional check performed to identify the Course and Semester in which the faculty is conducting classes.

**Once the conditional check is done then the transaction will be broadcasted in decentralized network using SIMrank algorithm as mentioned in STEP 5**

**Step 5:** Use of SimRank Algorithm to cluster the faculty and student as per the courses and semester based on subject.

**Once the transaction is broadcasted then it will be grouped based on the course, semester and faculty.**

**Step 6:** Evaluation of student performance based on regular assignment submitted, class attended, unit test performance and final test performance

**Step 7:** Verification of the evaluation done

**Step 8:** Handing of the report to the student and school/college/university authority based on the evaluation

**Step 9:** This report can be used by student in near future and can be used for higher education as well as employment purpose.

**Step 10:** After dispatching of evaluation report: The process end.

## VI. Conclusion and Future Scope

The in-depth study of research papers has motivated us to conclude that blockchain technology is still in its early era and have already had a huge impact on different discipline. This has forced the researchers globally to work on various utilization of blockchain in education.

This paper tries to present the idea of using blockchain in evaluation of student’s performance as well as providing the educational society an environment where individual rights are protected. Keeping intermediary away have made the education sector more secured. It will also lead to the development of single educational strategy globally.

This also provides us an opportunity to look forward to work for the evaluation system based on blockchain depending on the different requirements related to schools, colleges and universities. Scalability needs to be taken care of because with growing demand the space utilization will play an important role.

## References

- [1] Nakamoto, S. 2008. Bitcoin: A peer-to-peer electronic cash system. Available (online): <https://bitcoin.org/bitcoin.pdf>
- [2] Shukla, A., Patel, N., Tanwar, S., Sadoun, B. and Obaidat, M.S. 2020. BDoTs: Blockchain-based Evaluation Scheme for Online Teaching under COVID-19 Environment.
- [3] Chen, G., Bing, X., Lu, M. and Chen, N. 2018. Exploring blockchain technology and its potential applications for education”, Smart Learning Environments, 5(1), 1-10.
- [4] Memon, M., Bajwa, U.A., Ikhlas, A., Memon, Y., Memon, S. and Malani, M. 2018. Blockchain Beyond Bitcoin: Block Maturity Level Consensus Protocol, IEEE.
- [5] Alammary, A., Alhazmi, S., Almasri, M. and Gillani, S. 2019. Blockchain-Based Applications in Education: A Systematic Review, 1-18, <https://doi:10.3390/app9122400>
- [6] Han, M., Li, Z., He, J.S., Wu, D., Xie, Y. and Baba, A. 2018. A Novel Blockchain-based Education Records Verification Solution, In Proceedings of the 19th Annual SIG Conference on Information Technology Education, Fort Lauderdale, FL, USA, 3(6), 178–183.
- [7] Ismail, L., and Materwala, H. 2019. A Review of Blockchain Architecture and Consensus Protocols: Use Cases, Challenges, and Solutions, Symmetry. <https://doi.org/10.1109/CITS49457.2020.9232480>.
- [8] Granberg, C., Palm, T. and Palmberg, B. 2021. A case study of a formative assessment practice and the effects on students’ self-regulated learning, vol 68, <https://doi.org/10.1016/j.stueduc.2020.100955>
- [9] Fedorova, E.P. and Skobleva, E. I. 2020. Application of Blockchain Technology in Higher Education, European Journal of Contemporary Education, 9, 552-571.
- [10] Sun, H. and Wang, X. 2018. Application of Blockchain Technology in Online Education, International Journal of Emerging Technologies in Learning, 13(10).
- [11] Ezeudu, F.O., Eya, N. M. and Nworgi, H. I. 2018. Application of blockchain based technology in chemistry education students’ data management, International Journal of database theory and application, 11(2), 11- 22.

- [12] Caldarelli, G. and Ellul, J. 2018. Trusted Academic Transcripts on the Blockchain: A Systematic Literature Review, Applied Sciences Journal. <https://doi.org/10.3390/app11041842>.
- [13] Tapscott, D. and Kaplan, A. 2019. Blockchain Revolution in Education and Lifelong Learning, Blockchain Research Institute and IBM Institute for Business Value, 1-46.
- [14] Jain, A. K. 2019. Blockchain Goes to School, Cognizant.
- [15] Zhao, W., Liu, K. and Ma, K. 2019. Design of Student Capability Evaluation System Merging Blockchain Technology, Journal of Physics, 1168(3):032123, <https://10.1088/1742-6596/1168/3/032123>.
- [16] Turkanovic, M., Holbl, M., Kosic, K., Hericko, M. and Kamisalic, A. 2018. EduCTX: A Blockchain-Based Higher Education Credit Platform, IEEE Access, 6. <https://10.1109/ACCESS.2018.2789929>
- [17] Bhaskar, P., Tiwari, C. K. and Joshi, A. 2020. Blockchain in education management: present and future applications, Interactive Technology and Smart Education, 18(1), 1-17. <https://doi.org/10.1108/ITSE-07-2020-0102>
- [18] Okoli, C. and Schabram, K. 2010. "A Guide to Conducting a Systematic Literature Review of Information Systems Research". Sprouts: Working Papers on Information Systems, 1–51.
- [19] <https://lms.simplilearn.com/dashboard>
- [20] Roehrs, A. Rodrigoda, C. A. C. and Righi, R. 2017. OmniPHR: A distributed architecture model to integrate personal health records, Journal of Biomedical Informatics, 70-81, <https://doi.org/10.1016/j.jbi.2017.05.012>
- [21] Bajwa, N. K. 2018. Modelling And Simulation Of Blockchain Based Education System, A Thesis In The Department of Concordia Institute for Information Systems Engineering (CIISE), 1–116.

