Implementing Effectiveness and transparency in education using Blockchain

Santosh Kumar[*a], Piyush Raja[*b]
[a] *Department of Computer Application, PSIT College of Higher Education,Kanpur*
[b]*Dept. of CSE,College of Engineering Roorkee,Roorkee*
**Corresponding author email id:*
piyushraja2009@gmail.com

ABSTRACT

After the current era of Net Neutrality and Big Data, blockchain may be the next technology- mediated socioeconomic megatrend. In this theoretical article, we investigate how blockchain could influence the classroom. Network neutrality, widespread Internet access, and the Internet's positive impact on education are all things that, it is argued, we cannot assume will continue in their current forms in the future. Among the many benefits of blockchain education funding and investment, educational project implementation, a standardized certification and accreditation system, and student learning are most promising. The distributed ledgers used in the education blockchain would establish new benchmarks in crypto-learning and crypto-administration that are mutually acceptable across organizations and countries, improving the objectivity, validity, and control of information without being vulnerable to socio-economic instability. Slow blockchain adoption in education mirrors that in the finance and management sectors, but it also presents some critical challenges, such as a lack of tangible incentives for technology upkeep or 'blockchain mining' (inward sustainability) and a relatively weak orientation toward the collective development of education (outward sustainability).

Keywords: Blockchain, Education System, NEP, Crypto-learning

1. Introduction

Blockchain, one of many DLTs, has been dubbed "Google's System of the World" because to its status as a technologically-mediated socioeconomic system that is gradually replacing Net Neutrality, Big Data, the oligopoly of global market capitalization, and other related concepts (Gilder, 2018). This essay explores the current and future use of blockchain technology in the classroom. The blockchain introduces a new way of thinking about the storage and transmission of digital information.

Being both a subject of study and a social institution for the dissemination of information, education has a long tradition of embracing new technologies, including those developed for use in industry, finance, and the armed forces. There is currently a period of relative prosperity for Big Data, broad social media, STEM curricula, data mining/analytics, and subservient technologies like AI and ML in the classroom. These are then followed by more modern approaches to instruction and evaluation, such as the "flipped classroom" and other forms of assessment made possible by technological advancements. Some of these, like Big Data, have been problematic zed due to important questions of validity and purposefulness that are hidden and culturally intrusive in the techniques of getting and processing data, such mass surveillance, and so generate challenging ethical issues (Park, 2019).

Although its validity and value borders are still poorly defined, Big Data has persistently relied on the concept of Net Neutrality. Yet, resolution could arrive soon. According to George Gilder's (2018) book Life after Google, blockchain will replace the current era of the open Internet, Big Data, and Google as the technology-mediated

socioeconomic megatrend. If implemented, blockchain technology might become the new standard in Internet security, allowing users to privately store and share sensitive data.

In this piece, we look at how blockchain technology is changing the face of learning. Education reformers, including researchers and international agencies, have relied on previously published reports and studies to inform their work. The essay begins with a brief overview of blockchain technology before arguing that its widespread implementation in the real world has occurred only lately and that its further development is uncertain. Afterwards, we'll take a look at the existing literature on blockchain's possible uses, both inside and beyond the cryptocurrency industry. In the next section, we will discuss the ways in which blockchain technology may and has already benefited the field of education. Towards the end of the study, a two-part rationale is presented for the sluggish pace at which blockchain technology is being accepted in the academic community.

Along with other rapidly developing technologies like AI and augmented reality, blockchain technology in the education sector has brought about fresh waves of change and introduced solutions drawn from diverse industries that go beyond its initial financial and cryptocurrency focus.
Accessing credentials, academic records, and transcripts was a murky process in the traditional educational paradigm, which hampered its expansion and growth. These issues may be easily resolved with the use of blockchain-based solutions.
Benefits of blockchain include decentralised storage, immutability of data, traceability, and transparency. Perhaps, people from all walks of life and all corners of the globe will benefit from the educational opportunities made possible by blockchain technology.

Because of their adaptability, the characteristics can be employed in a wide range of contexts, making them really innovative. A growing number of schools in the public sector are exploring adopting blockchain-based solutions. Educators and policymakers would benefit from being made aware of this new information since it would help them contextualise the problem and devise effective responses.

Taking a look at some of the use cases for blockchain technology in education may help you get a better grasp on the topic.

In order to confirm the authenticity of credentials and certifications, blockchains can be utilised to generate one-of-a-kind digital assets. Blockchain technology has applications beyond credential verification in the areas of employment and higher learning. The following are some examples of applications in the real world.

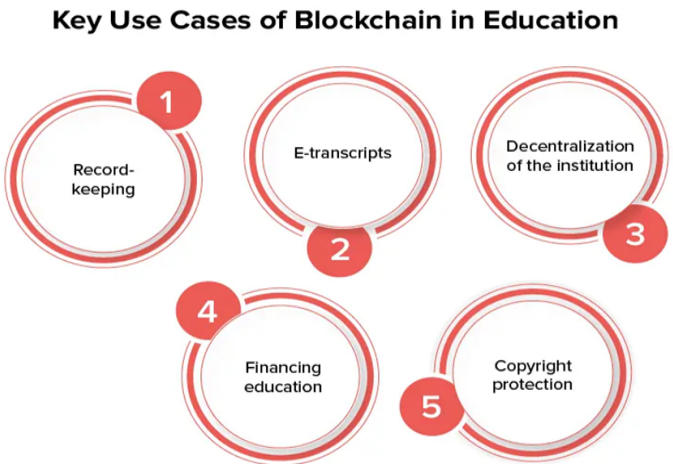

Fig. 1 Key use cases of Blockchain in Education

2. Record Keeping

Blockchain technology has the potential to transform record-keeping procedures, which have historically been mostly unreliable, in a way that has been long needed.
Blockchain can automatically verify and save on file a variety of educational documents, such as diplomas, certificates, or credentials, that at the moment need validators. Smart contracts enabled by blockchain can handle all the work with instant, self-triggered document approval once the predefined requirements are satisfied.
It makes it possible for learners to securely share their information with potential employers while also allowing them easy access. Additionally, it relieves companies of the burden of conducting time-consuming background checks to verify applicants' accomplishments. Its positive quality is that it endures no matter what happens outside of it.

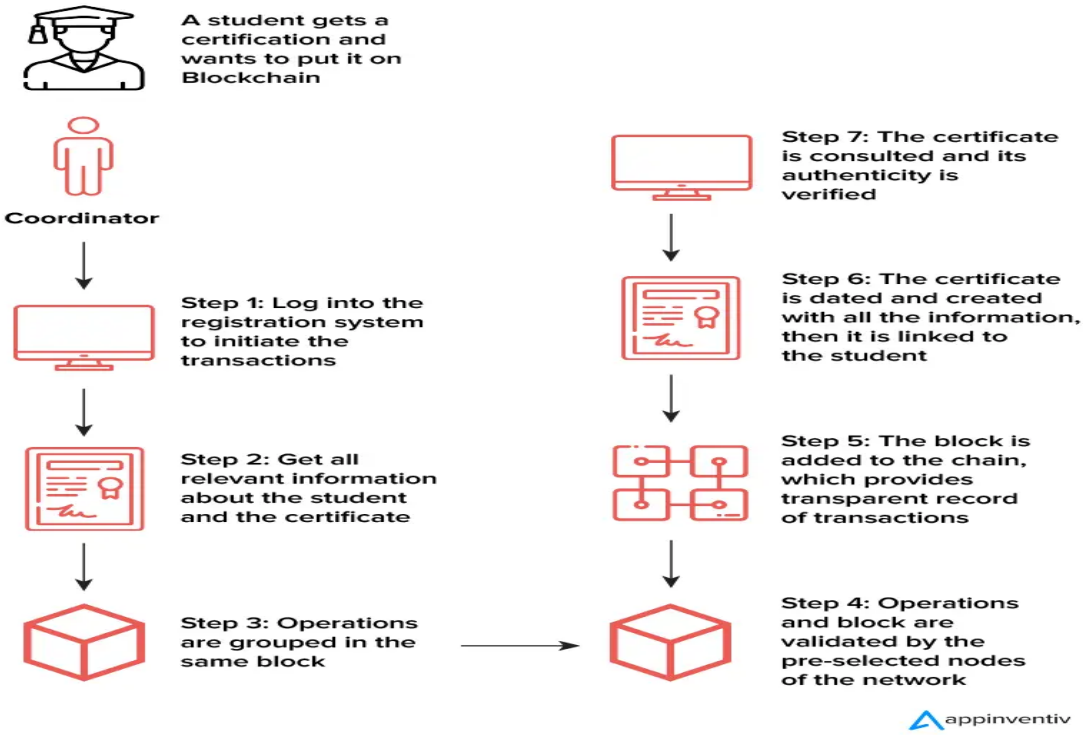

Fig.2 The info graphic on top shows how the sharing and storing of information works.

E-transcripts
The incredible potential of E-transcripts goes hand in hand with how easy verification is. Transcript production is the time- and labor-intensive task that academic institutions around the world struggle with the most.
Each entry in a transcript needs to be thoroughly reviewed to verify accuracy. A mound of paper documents from high school through university must be inspected case by case. Most institutions continue to distribute and receive transcripts using antiquated methods like mail even in 2022.

Distributed ledger technology and associated solutions may be easily able to improve the efficiency of these procedures, which would also aid in lowering the amount of fraudulent claims for unearned academic credits.

By enabling the tamper-resistant storage of sensitive data, such as a student's independent grades, blockchains can surely do wonders for schools. Not only does it help educational institutions, but it also streamlines the screening process for staffing agencies and recruiters. Additionally, it saves a lot of time and money.

Institutional decentralization

Blockchain has the enormous potential to transform business models and function as a whole infrastructure for institutions, not simply a technology.

The platform introduces online courses by utilising smart contracts to support and automate agreements and payments between students and lecturers. Students benefit from low tuition costs and trustworthy service as a result.

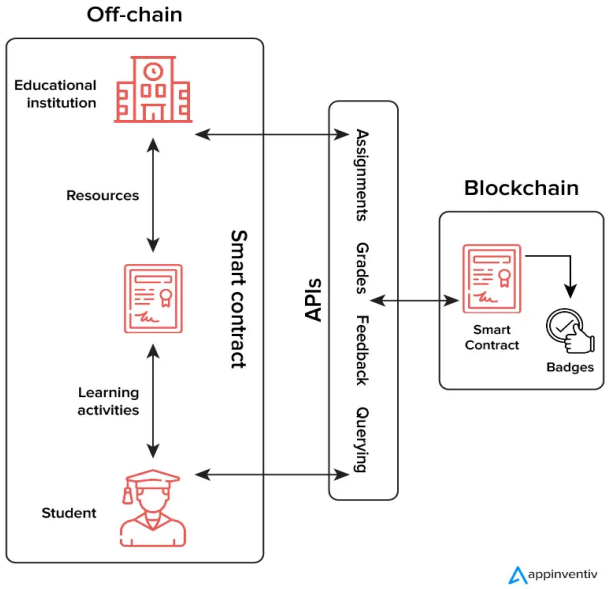

Fig.3 Presentation of Off-chain and Blockchain

On the other hand, automation has freed educators from a variety of administrative duties, protected faculty and student data using blockchain cryptography, and reduced administrative costs by doing away with middlemen.

Education funding

There is a significant need for accurate financial accounting in the classroom, and blockchain technology presents novel opportunities for its integration into the field. Blockchain technology can be used to manage educator compensation and student scholarship funds, creating a more equitable and transparent method for financing programmes and projects.

Copyright defence

In the academic world, plagiarism is a serious problem. Years of work might be wasted when a research paper is copied or stolen. Stealing an assignment can result in poor grades. Blockchain-based systems can be used to control the online distribution of protected content.

The fundamental objective of the technique is to safely keep the data that has been recorded in a chain. This data is safeguarded by cutting-edge encryption, so once it is stored, it cannot be manually modified.

Students can now safely access educational materials thanks to this. Because consumption of the content is traced throughout the chain, the owner may easily control access. It is simple to establish ownership and track usage online.

3.Related Work

The distributed ledger, or blockchain, is a secure way to store information that has numerous applications. This technology is widely used for safe data storage and data provenance tracking thanks to its decentralised design and anti-tampering features. This is why there is so much focus on developing this technology right now. Not only that, but more and more sectors are using this technology.

Several schemes for protecting intellectual property in digital form have been presented. In [2], the authors propose a blockchain-based smart contract-based system for managing digital watermarks that logs file usage history and compensates copyright holders for losses. Two distinct blockchain apps are used by the DRMChain project to store plain and encrypted summaries of original digital content, respectively, for the purposes of digital rights management. Because of the magnitude of media files like photos and movies, it is recommended to use a flexible external storage mechanism for both plain and encrypted content. The database stores the actual files or content, while the chain stores the hash of the data. In order to combat the problems of insecure data sharing and protection, the authors of [4,5] propose a secure storage and service architecture for medical records in the healthcare sector. In order to aid diabetic patients, a blockchain and IoT based health management system is proposed in [6]. A remote monitoring system that can also detect changes in a patient's health would be extremely useful. To protect energy data from cybercriminals, the authors of [7,8] describe a secure data storage method that makes use of blockchain technology. The logistics of transport and supply chains can also be managed with the use of blockchain technology [9].

Moreover, due to their centralised nature, conventional methods of charging electric vehicles are easily disrupted by DDoS assaults directed at the charging server. To address these problems, a blockchain-based billing system has been proposed. This system provides safe key management, solid mutual authentication, and effective fees. To ensure safe and effective traffic operation while assessing the trustworthiness of crowdsourced data, the authors of [10] use smart contracts on the blockchain to remove a centralised authority from such systems and propose a secure and real-time traffic event detection solution. Furthermore, numerous studies have been conducted on improving the safety and dependability of communication data within the vehicle network [11,12]. In order to strengthen the IoT's resistance to sophisticated cyberattacks, the authors of [13] devise a security architecture that makes use of blockchain technology and the software-defined network (SDN). IoT is a rapidly expanding industry, and blockchain technology has found numerous applications there. Data storage security in the IoT is the primary topic of study in [14–16], and a blockchain-based electric business model is proposed in [17].

Blockchain technology has many potential applications, including in the academic world. Many studies have been conducted, and some schools have already begun to implement this technology for administration in the real world. Using the European Credit Transfer and Accumulation System as inspiration, [18] proposes a blockchain-based network for high school credit. A globally trusted, decentralised higher education credit that can give a unified global perspective for students and higher education institutions should be part of this platform. As a result, using blockchain technology is a logical next step.

In [19], the authors propose using blockchain to safely keep track of academic credentials and honours.

By discussing the advantages and features of blockchain technology, [20] investigates some of the current blockchain applications for training. A number of potential negatives of using blockchain technology in schools are also discussed in the report. One such drawback is the inability to make legitimate changes to students' records. The University of Nicosia [21] is the first institution to use blockchain technology to manage student credentials gained from MOOC sites. Sony Global Education has developed blockchain-based technology [22] for the transparent distribution of student grades and other academic records. [23] The Massachusetts Institute of Technology (MIT) has developed a blockchain-based online education platform. Argentinean College uses blockchain technology for student data management [24]. Researchers at San Francisco's Holberton School have said they hope to use blockchain technology to help verify academic credentials for potential employers [25].

According to Bartolomé et al. [26], once blockchain technology is complete for digital currency, it will be an open source to other fields, although it will be troublesome. One of its advantages is that it can replace a centralised data recording system with a decentralised one that protects data integrity and confidentiality.

The novel applications of blockchain technology in the field of education were outlined in a paper by Alammary et al. [27]. Hence, they conducted numerous studies, combed through numerous scientific literatures, and provided a framework for three primary themes: applications, benefits, and problems. So, it is now evident that blockchain technology is primarily used to validate and issue academic credentials, distribute student competences and academic accomplishments, and evaluate student professional potential. Also, it provides major benefits to education, such as lowering costs, increasing trust and openness, and providing a secure platform to communicate student data.

Yumna et al. conducted extensive research into and analysis of all aspects of blockchain technology, and proposed solutions that will effectively meet the challenges currently encountered in the field of education in their paper[30].

Distributed consensus methods and cryptographic approaches are used by the blockchain technology developed by to create properties such as decentralisation, traceability, and monetary attributes, as reported by the Chen et alstudy[31]. Blockchain technology can be used to encourage students to study harder. Furthermore, it maintains a comprehensive and trustworthy record of all learning activities, including their techniques, outputs, and outcomes in both official and informal settings. Keeping track of a teacher's in-class activities and results can also serve as a useful reference point for evaluating their work as an educator. In conclusion, blockchain has vast potential in education, especially in the areas of pedagogical application, data analysis, and formative assessment in both the classroom and the home.

The concern of Hoy et alkey. has been how to justify the use of a blockchain ledger that includes verifiable time-stamped records of production and ownership for applications like medical records and library checkouts. The system could be used to prevent tampering with data, to recognise changes to documents, or to promote value exchange between users. In their research, Casino et al.[32] present a comprehensive review of the many use cases for blockchain technology. Distributed ledger technology (blockchain) applications in areas as diverse as supply chain management, business, healthcare, the Internet of Things, security, information management, and the list goes on. The limitations of the research were also covered, with a focus on the difficulties presented by blockchain technology and how these hurdles may affect different segments of the industry and different kinds of businesses. More industries and fields are likely to use blockchain as the technology advances. Blockchains have also been proposed as a possible database solution. In addition, there are plenty of occasions where it would be a good idea to use classic databases in addition to the newer ones.

Mikroyannidis et al.[33] explored the potential of Smart Blockchain Badges to enhance instruction in the field of information science. They focused particularly on how students might be advanced in their professions in information science depending on their academic performance. In this way, the initiative contributes to reducing the skills gap in data science by tying together academic and professional data science education. Learners can get valuable feedback and guidance towards their professional goals through the usage of these smart blockchain badges. It is also possible to assess a student's level of openness to lifelong learning through the correct application of Smart Blockchain Badges provided to authentic pupils.
In a study conducted by Muhamed et al. [34], they found that the use ofblockchain .'s technology allowed for the creation of decentralised apps without the need for third parties to oversee data transmission. The history of every trade is recorded publicly and cannot be altered. For this reason, they advocated the use of EduCTX, a worldwide system that allows universities to jointly grant credit for courses. The platform is based on the European System for Credit Transfer and Accumulation (ECTS).

It is a decentralised credit and reviewing structure for higher education that is widely trusted and has the potential to unite the perspectives of students, universities, and other potential partners in business, government, and beyond. It provides a working sample of the platform's open-source foundation to illustrate the idea. Connections between users that are not centralised The widely dispersed ArkBlockchain Platform. Credits earned by students in courses like ECTS are represented by ECTX tokens, which are created, managed, and regulated by EduCTX.

Funk et alstudy[28] .'s found that it was exceptionally challenging for educators in the health professions to update their pedagogical practises to reflect advances in the field. Tracing the creation, dissemination, and acquisition of information is essential for judging the efficacy of these novel tools since it allows for the identification of any potential biases in the data. If health professional education were to adopt a blockchain-based model, we might be able to evaluate the effectiveness of different courses on students of varying skill levels and analyse the data to determine which courses are the most effective overall. When it comes to the long-term goals of health professions education, blockchain has the potential to radically alter the ways in which patients, professionals, educators, and students engage with private and substantial data. In order to stay up with developments in the biological sciences, health professions education (HPE) is constantly adapting.

Changes in learning theories are instances of modern administrative systems, technology advances, and efforts to make healthcare professionals function at the best level of proficiency.

Chen conducted yet another study on blockchain's role as the revolutionary technology behind the creation of bitcoin and other digital currencies [29].

After the steam engine, the electric motor, and the computer, the development of blockchain technology is part of the fourth mechanical uprising. The study's main focus was on the potential uses of blockchain technology in the classroom, namely in illuminating how to solve a few pressing issues in the field of education. This article first presented the highlights and main characteristics of blockchain innovation, then discussed several recent blockchain applications for education. Yet, most of these ideas are just concepts at this point in time. Unfortunately, we were unable to find any documentation detailing how precisely blockchain technology could be implemented in the academic setting.

5.Education-Related Applications of Blockchain

As part of this preliminary research into potential educational uses for blockchain technology, we have been thinking about the following. To wit:

A. Data and internet technology are used in online education, also known as remote learning or electronic learning, to rapidly distribute content. They use what is known as a "web-based educational technique" to educate their students. With blockchain technology, the problems of trustworthiness and safety in online education can be solved to the greatest extent possible. Moreover, the blockchain can provide equitable course credit recognition by creating immutable learning records for online education that don't require a central authority to oversee them. Several online learning sectors may benefit from the implementation of blockchain technology. [13]

1. A document detailing how well a kid did in school. The blockchain is a distributed ledger that records data in blocks and keeps track of the timestamps and locations of each block. Unfortunately, it can't modify or delete the supplemental data chunks.

2.Reliable authentication of educational accomplishments: We have certification issues in the field of online learning because of inefficient third-party organisations. As an answer, Blockchain technology provides a simple and reliable verification of learning outcomes, analogous to academic accreditation. Student certificates can be verified without the originals even if they are misplaced. Cryptography and an asymmetric encryption method are used by the blockchain to ensure the data's integrity and authenticity.

3. The blockchain software allows for instantaneous execution and does not require third-party verification. If this system is put into place, financial dealings will be simplified, automated, and decentralised, and security will be improved [14].

4.Data privacy and parental consent - Parents and guardians are often asked to sign a number of paperwork attesting to the institution's right to use their children's personal information. Yet, it's possible that these parents

are confused about which consent forms they signed and when they'll be used. Blockchain technology, along with hyperledger fabric and composer, was presented by Gilda, Shlok, and Mehrotra, Maanav [15] as a means of avoiding this problem. This structure is used as a legally binding digital contract that may be signed online without the requirement for a notary public or other intermediary. The proposed framework, which comprises of blocks of repeated authorization, will allow the educational institution to grant access to data for any valid cause after getting parental consent via smart contract. IBM is credited with starting the Hyperledger Fabric initiative. It is a segmented architecture that provides high degrees of anonymity, privacy, and resilience in both design and implementation. Privacy, scalability, and other desirable characteristics can be attained with the help of design versatility. The fabric is meant to support interchangeable implementations of different features. It also supports the usage of chaincodes written in a wide range of languages, while Go is the primary language used and it is deployed in Docker containers[16].

6.Hyperledger Composer Hyperleger Composer (Hyperleger)

A free and open-source framework that streamlines and cheapens the creation of blockchain apps. Composer is an abstraction layer that allows blockchain applications to make use of Hyperleger to execute smart contracts. [17].

Learning outcomes and the meta-degree: Using the university's graduation requirement index as a guide, blockchain-based technology for learning outcomes can make use of automated evaluation tools. Course-learning outcomes accomplishment values are based on a quantitative and qualitative combination of grades, process, and evidence, and can be included in the block alongside the course's name, learning outcomes name (graduate requirement indication), and weight. The curriculum can receive feedback on how well it is meeting the program's continual quality improvement goals by evaluating students' competencies. Student performance ratings can be transformed into indicators of future professional success. Students who have completed a series of educational building blocks have not only acquired the diplomas necessary to enter the workforce, but also the body of knowledge that serves as the indicator capacity for graduate admission. In contrast to the previous rudimentary approval based just on diploma, this could approve the structure of the educational process, verify the gold content of the diploma, and build a classification of the different students who acquire the diploma. The learning outcomes are the bedrock of internationalisation and talent exchange in higher education since they provide the basis for credit transfer and reciprocal recognition. Success in many fields can be attained through a variety of learning strategies, including traditional classroom instruction, on-the-job training, distance education, and other methods. A diploma may be awarded to students if and only if certain index points in the school's graduate requirements are met, in accordance with the outcomes-oriented pedagogy. [18]

7.Operational Skill Competition - Schools can evaluate student learning achievement and quality of instruction education by having students mimic operations and games on a complex instruction operation framework. It improves the competitive mode by utilising blockchain technology innovations in the field of digital education. Streamlining processes, expanding expertise, and maintaining a safe distance from the problem of skewed data are all to your advantage. It can also offer a permanent electronic transcript of academic performance. This study compared the standard and trustworthy issue in contemporary competitions and assessment mode with a focus on blockchain technology, outlined blockchain's application mode and outline, analysed assessment criteria and calculation, outlined an operational expertise assessment show, and developed an operational aptitude competition assessment framework based on existing investigate foundation.

Grades in College: An Ethereum-based blockchain architecture was developed so that universities may use it to issue their own currencies and keep track of students' grades. Based on an exploratory, subjective evaluation [27], the authors observed little differences between the concept of a college as an association and the concept of distributed autonomous organisations (DAOs) in Ethereum. Mechanisms of trust, limits on openness, and methodological values are all included. The authors also provide details on how to put the design into action and how to conduct an evaluation.

Work-Based Learning: According to [21], in the current education-industry partnership, there is a huge data asymmetry between educational institutions and firms that use them. Undergraduate credit frameworks and student history data needed a safe place to live for future use. Taking use of the Hyperledger blockchain infrastructure's ease of use and resistance to manipulation, the authors develop a collaborative framework between the education and business sectors. By taking advantage of the Certificate Authority benefit and

exchanges in the Hyperledger system, the framework outlined the roles that educational institutions and commercial entities would play inside the framework.

As a result, universities and projects can share information freely with one another, levelling the playing field in terms of student knowledge, project enrollment requests, and employment opportunities. The Hyperledger Fabric was used to build a foundation for a mutually beneficial partnership between academia and business.

Academic Standing, Status, and Pay:- The blockchain is a decentralised ledger that records transactions and other data like as the validity of unspent squares, the terms of automated smart contracts, and the data structure tied to each individual piece. a decentralised, immutable ledger of intellectual labour and the reputational recompense that goes along with it, stored on the blockchain, that democratises and instantiates academic status beyond the ivory tower. Our previous research into reputation management for scholastic frameworks informs our tests with a private blockchain for archiving educational records. The key benefit is having a centralised, secure, and easily available record of academic achievement that can be shared throughout other schools [22].

Academic Credential:- Because most organisations issuing such certificates cannot ensure the security and accuracy of student data. Blockchain technology has the potential to tackle the trust issues at hand, but it is limited by design, which prevents its widespread use. Blockchain has slow access times and low throughput. To address the aforementioned issue and ensure a prompt and accurate response to certificate enquiries, the concept of an educational certificate blockchain (ECBC) was proposed. In order to efficiently answer to requests, ECBC builds a tree structure known as a multi-partition tree (MPT-Chain). There's also the option to look at past transactions made with the account in question. [23].

How Will The Nep Utilise The Blockchain?

Over the past decade, the Internet and digital innovation have revolutionised classrooms around the world. The educational system in India has also seen dramatic change. Based on projections from KPMG and Google, the online education market in India will grow to $2 billion by 2021. Proof of this can be seen in the country's fast expanding Internet and smartphone penetration, which is driving the creation of digital textbooks and content, online assessments, and cloud-based platforms. Technologies like virtual reality (VR), artificial intelligence (AI), and e-learning tools are helping to increase the popularity of immersive and experiential learning. This trend of innovative use of cutting-edge methods and technology is expected to quicken throughout 2020, according to experts.

Some current and emerging trends and practises that are altering the face of Indian education are as follows.

8. AI-based personalized learning

In personalised learning, each student's needs and objectives are considered when making decisions about things like learning pace, content, and instructional technique. As a result of AI's ability to collect, synthesise, and analyse data from many sources, a comprehensive learning profile may be produced for each individual learner. As a result, the instructor may gain insight into how to better individualise their lesson plans.

AI can analyse a student's academic data and reveal patterns that would be otherwise undetectable by a human teacher using techniques like machine learning and pattern recognition. AI can inform educators, for instance, as to whether a student learns best through reading homework, listening to lectures, or watching videos. Aside from that, AI can use pattern recognition to figure out which concepts pupils are having trouble with and then notify the teacher so that they can adjust the lesson plan accordingly.

10. Strategies for experiential learning

Experiential education is being implemented in India through the use of gamification, social media, VR/AR technology, and virtual labs. Active learning allows students to take part in the process of problem definition, question generation, experimentation, data analysis, and the construction of meaning.

"More educational institutions are looking for an immersive, real-life experience," says Beas Dev Ralhan, co-founder and CEO of Next Education India Pvt. Ltd. "This is so they can maximise student motivation and engagement while developing and instilling in them 21st-century skills like communication, collaboration, and

creativity." She predicts that in the coming year, educators will place more value on strategies that give students agency in their own education and foster a more integrated understanding of subject matter.

Blockchain fresh face on the block:-

Academic dishonesty and fraud pose serious challenges to the current system of certifying students' proficiency in subject areas. Institutions of higher education and their students would benefit from a transparent, shared database based on trust. In this case, blockchain technology may be able to successfully combat academic and learning fraud, and ensure that the certificate remains secure so that it is recognised around the world by educational institutions and employers.

Although blockchain technology is still in its infancy, it has the potential to save money by digitally archiving student certificates and degrees, eliminating the need for paper copies and the associated printing and litigation costs that come with them.

Prof. John Domingue, head of the Center for Knowledge and Media Studies at the Open University in the United Kingdom, believes that blockchain technology will facilitate increasingly decentralised learning models and prompt shifts in the way people learn. Learning certification, CPD, massive open online courses (MOOCs), blockchain badges, and other uses of blockchain technology in education are all on the rise. At the moment, Sony Global Education is the most well-known platform for teaching about blockchain technology. The platform integrates learning resources and takes a non-traditional approach to curriculum creation to improve the educational experience for its users.

An emphasis on data.

2019 was a year of major and promising transformation for India's education system. The establishment of the National Research Foundation (NRF) is helping to foster R&D with a stronger emphasis on innovation, and the implementation of the New National Education Policy is reshaping India's higher education system. Amol Arora, vice chairman and managing director of the Shemford Group of Futuristic Schools, believes that more edtech startups with a focus on data analytics will contribute to the ecosystem in 2020, but that in order for these initiatives to succeed, a number of fundamental structural reforms must be implemented.

The heightened attention on data security brought about by the Personal Data Protection Bill necessitates that edtech companies and educational institutions take extra measures to protect the data they gather, such as updating to the latest IT systems, firewalls, and malware prevention software.

In 2020, some organisations may establish the position of Chief Data Officer to oversee the implementation of enterprise-wide data analytics and the creation of new data analytics capabilities. In the coming year, interactivity will be front and centre. As EdTech platforms proliferate, they will gradually replace traditional classroom-based learning with alternatives like peer-to-peer learning portals and video-based information.

11. Conclusion

The use of blockchain technology allows for a trustworthy distributed ledger to be made available. Several areas of education are identified in the study as prime candidates for the implementation of blockchain technology: online education; student data privacy and consent; learning outcomes and meta-diplomas; operational skill competitions; university grades; education-industry cooperative systems; educational records; reputation and reward; and certificates of completion. The research can be improved upon by integrating data from other blockchain-based educational apps.

This research will assist schools determine which applications of blockchain technology in education will be most beneficial to them given their specific structures. The usage of blockchain technology with confidential documents like electronic transcripts and a few others is the focus of this research report.

References

1. Chen, Guang & Xu, Bing & Lu, Manli & Chen, Nian- Shing. (2018). Exploring blockchain technology and its potential applications for education. Smart Learning Environments. 5. 10.1186/s40561-017- 0050-x.
2. B. Zhao, L. Fang, H. Zhang, C. Ge, W. Meng, L. Liu, and C. Su, (2019) "Ydwms: A digital watermark management system based on smart contracts," Sensors, vol. 19, no. 14, p. 3091.
3. Z. Ma, M. Jiang, H. Gao, and Z. Wang, (2018)"Blockchain for digital rights management," Future Generation Computer Systems, vol. 89, pp. 746– 764.
4. Y. Chen, S. Ding, Z. Xu, H. Zheng, and S. Yang, (2019) "Blockchain-based medical records secure storage and medical service framework," Journal of medical systems, vol. 43, no. 1, p. 5.
5. Z. Shae and J. J. Tsai, (2017) "On the design of a blockchain platform for clinical trial and precision medicine," in 2017 IEEE 37th International Conference on Distributed Computing Systems (ICDCS). IEEE, 2017, pp. 1972– 1980.
6. T. M. Fernández-Caramés, I. Froiz-Míguez, O. Blanco-Novoa, and P. Fraga-Lamas, (2019) "Enabling the internet of mobile crowdsourcing health things: A mobile fog computing, blockchain and iot based continuous glucose monitoring system for diabetes mellitus research and care," Sensors, vol. 19, no. 15, p. 3319.
7. C. Pop, M. Antal, T. Cioara, I. Anghel, D. Sera, I. Salomie, G. Raveduto, D. Ziu, V. Croce, and M. Bertoncini, (2019) "Blockchain-based scalable and tamper-evident solution for registering energy data," Sensors, vol. 19, no. 14, p. 3033.
8. G. Liang, S. R. Weller, F. Luo, J. Zhao, and Z. Y. Dong, (2018) "Distributed blockchain-based data protection framework for modern power systems against cyber attacks," IEEE Transactions on Smart Grid, vol. 10, no. 3, pp. 3162–3173.
9. M. Kim, K. Park, S. Yu, J. Lee, Y. Park, S.-W. Lee, and B. Chung, (2019) "A secure charging system for electric vehicles based on blockchain," Sensors, vol. 19, no. 13, p. 3028.
10. J. Mihelj, Y. Zhang, A. Kos, and U. Sedlar, (2019) "Crowdsourced traffic event detection and source reputation assessment using smart contracts," Sensors, vol. 19, no. 15, p. 3267.
11. Z. Yang, K. Zheng, K. Yang, and V. C. Leung, (2017) "A blockchain-based reputation system for data credibility assessment in vehicular networks," in 2017 IEEE 28th annual international symposium on personal, indoor, and mobile radio communications (PIMRC). IEEE, 2017, pp. 1–5.
12. G. Rathee, A. Sharma, R. Iqbal, M. Aloqaily, N. Jaglan, and R. Kumar, (2019) "A blockchain framework for securing connected and autonomous vehicles," Sensors, vol. 19, no. 14, p. 3165.
13. Derhab, M. Guerroumi, A. Gumaei, L. Maglaras, M. A. Ferrag, M. Mukherjee, and F. A. Khan, (2019) "Blockchain and random subspace learning-based ids for sdn-enabled industrial iot security," Sensors, vol. 19, no. 14, p. 3119.
14. E. Gaetani, L. Aniello, R. Baldoni, F. Lombardi, A. Margheri, and V. Sassone, (2017) "Blockchain-based database to ensure data integrity in cloud computing environments.
15. K. Christidis and M. Devetsikiotis,(2016) "Blockchains and smart contracts for the internet of things," Ieee Access, vol. 4, pp. 2292–2303, 2016. 16 VOLUME 4, 2016 This work is licensed under a Creative Commons Attribution 4.0 License. For more information, see https://creativecommons.org/licenses/by/4.0/. DOI 10.1109/ACCESS.2019.2956157, IEEE Access Author et al.: Preparation of Papers for IEEE TRANSACTIONS and JOURNALS
16. Q. Xu, K. M. M. Aung, Y. Zhu, and K. L. Yong, (2018) "A blockchain-based storage system for data analytics in the internet of things," in New Advances in the Internet of Things. Springer, 2018, pp. 119–138.
17. Y. Zhang and J. Wen, (2017) "The iot electric business model: Using blockchain technology for the internet of things," Peer-to-Peer Networking and Applications, vol. 10, no. 4, pp. 983–994.
18. M. Turkanovic, M. Hölbl, K. Koši ´ c, M. Heri ˇ cko, and A. Kamišali ˇ c,´ "Eductx (2018) A blockchain-based higher education credit platform," IEEE access, vol. 6, pp. 5112–5127.
19. M. Sharples and J. Domingue, (2016) "The blockchain and kudos: A distributed system for educational record, reputation and reward," in European Conference on Technology Enhanced Learning. Springer, 2016, pp. 490–496.
20. G. Chen, B. Xu, M. Lu, and N.-S. Chen,(2018) "Exploring blockchain technology and its potential applications for education," Smart Learning Environments, vol. 5, no. 1, p. 1.
21. Y. Chen, H. Xie, K. Lv, S. Wei, and C. Hu, (2019) "Deplest: A blockchain-based privacy-preserving distributed database toward user behaviors in social networks," Information Sciences, 2019.
22. Knowles, C., (2016) Sony Global Education looks to revolutionise education with blockchain tech., [Online]. Available: https://futurefive.co.nz/story/sony
23. BEN provides a community where students can dream about how blockchain can change the world., [Online]. Available: https://blockchainedu.org/
24. C. H. Liu, Q. Lin, and S. Wen, (2018) "Blockchain-enabled data collection and sharing for industrial iot with deep reinforcement learning," IEEE Transactions on Industrial Informatics.
25. Bartolomé, Antonio & Torlà, Carles & Castañeda, Linda & Adell, Jordi. (2017). BLOCKCHAIN IN EDUCATION: INTRODUCTION AND CRITICAL REVIEW OF THE STATE OF THE ART. 61. 10.21556/edutec.2017.61.

26. Alammary, Ali; Alhazmi, Samah; Almasri, Marwah; Gillani, Saira. (2019). "Blockchain-Based Applications in Education: A Systematic Review." Appl. Sci. 9, no. 12: 2400.
27. Yumna, Hafiza & Khan, Muhammad Murad & Ikram, Maria & Ilyas, Sabahat. (2019). Use of Blockchain in Education: A Systematic Literature Review. 10.1007/978-3-030-14802-7_17.
28. Chen, Guang & Xu, Bing & Lu, Manli & Chen, Nian- Shing. (2018). Exploring blockchain technology and its potential applications for education. Smart Learning Environments. 5. 10.1186/s40561-017- 0050-x.
29. Hoy, Matthew. (2017). An Introduction to the Blockchain and Its Implications for Libraries and Medicine. Medical Reference Services Quarterly. 36. 273-279. 10.1080/02763869.2017.1332261.
30. Casino, F., Dasaklis, T.K., & Patsakis, C. (2019). A systematic literature review of blockchain-based applications: Current status, classification and open issues. Telematics and Informatics, 36, 55-81.
31. Mikroyannidis, Alexander & Domingue, John & Bachler, Michelle & Quick, Kevin. (2018). Smart Blockchain Badges for Data Science Education. 10.1109/FIE.2018.8659012.
32. M. Turkanović, M. Hölbl, K. Košič, M. Heričko and A. Kamišalić, "EduCTX: (2018) A Blockchain-Based Higher Education Credit Platform," in IEEE Access, vol. 6, pp. 5112-5127.