Blockchain Technology Applications in Education

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***Abstract*—The new technologies have always attracted the educationists and educational planners at different levels to make their optimum use in overcoming constraints and enhancing the teaching and learning experiences of the teachers and the taught alike. Some of the developments are: extensive use of Big Data, Data Analytics and Artificial Intelligence. Another new area that is attracting the education sector is the use of Blockchain Technology. The Blockchain Technology is the addition to the Education 4.0 phenomenon. It is an emerging technology that works on the principles of distribution and decentralisation.**

The article provided a thorough review of the book entitled "Blockchain Technology Applications in Education" edited by Ramesh Chandra Sharma, Hakan Yildirim, and Gulsun Kurubacak. It is one of the few titles which focus on application of Blockchain Technology in the field of Education. The authors of the respective chapters provide a range of possible applications of Blockchain Technology for managing education. The Book also focuses on management of institutional database using Blockchain Technology providing more authenticity and security to the student data pertaining to certificates and grade-sheets by providing a foolproof authentication to all the stockholders. A few of the chapters focus on use of Blockchain Technology in handling bigdata at open and distance education institutions also.

The book is a must read for the educational policy makers, implementers and educationists at large since it gives a new insight into various dimensions of this comparatively new area of technological implementation in education. This would help them in transforming their approach to pedagogical processes.

***Index Terms*— Blockchain, Book Review, Data Analytics, Digital Credentialing, Ethereum, Open and Distance Learning, Open Source, Virtual Identities**

I. Introduction

The Blockchain Technology is attracting the functionaries of the educational sector for use in making the learning experiences more authentic and enjoyable at personal level. The Blockchain Technology is the recent addition to the Education 4.0 phenomenon. It is an emerging technology that works on the principles of distribution and decentralisation. It makes use of the knowledge from different domains of wisdom. Blockchain works with a unique type of database that is created with the help of blocks of information that are connected in the form of chains to one another. Whenever new information is added, a new block is created and connected to the chain chronically. It is a distributed system that finally forms a ledger of transactions controlled by all users collectively. Being a decentralised system, the data once added to a block is irreversible and visible to all users.

The present volume explores the use of this Blockchain Technology in Education from different perspectives. It focuses on the potential transformations that would happen in role-based activities performed by the educational functionaries subsequent to use of Blockchain Technology [1].

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II. Book Review

The book, "*Blockchain Technology Application in Education*" by Ramesh Chander Sharma, Hakan Yildirim, & Gulsun Kurubacak (Eds.) is published by IGI Global, Hershey, PA, USA (2020, pp. i-xxix & 1-336, ISBN 978-1-5225-9478-9). It is divided into three different sections focusing on theoretical understanding of blockchain technology, its usage in Open and Distance learning and Strategic Approaches to the use of Blockchain Technology which are further spread over 14 Chapters in all.

Section 1: Theoretical Understanding has 6 chapters. Chapter 1 visualises the potential infrastructural usage of Blockchain technology in creating an alliance and connection of formal learning process with non-formal and informal learning processes [2]. The authors are of the view that the blockchain technology backed by online networked spaces can augment the learning support services [3] under all the three domains of learning mentioned above.

Chapter 2 explores the ecosystem created by the online learning spaces. The authors believe that the application of blockchain technology for lifelong learning can go a long way in finding educational content and strengthening tutoring services, registration, payment methods and accreditation online. The learning analytics based on different educational contexts can be of great help in furthering lifelong learning. The blockchain database being secure, distributed and accessible to the users, can help the learners in monitoring their own learning strategies and pedagogical approaches to make best of their time spent on learning activities.

Chapter 3 tries to create a framework within which the Blockchain technology can be used as best fit to perform multifarious roles. The author is optimistic, if this technology is used optimally, it has the potential to meet different needs of the 21st century [4]. The framework finds discussion and analysis of different approaches leading to constructivism and connectivism. It, thus, tries to first identify the needs and then proposes to address those needs with the use of Blockchain technology. The solutions put forth by the author are based on the synthesis of the learning issues in the light of use of Blockchain technology.

In Chapter 4, the authors provide a framework for the learners to go beyond the contours of an institution. They believe that the blockchain technology provides the learners with the flexibility to go across the institutions and gather credits of learning and get a certificate. The strategic planning of Blockchain technology will build the pedagogical and other provisions of learning technologies to provide the learner with free hand to create an ecosystem of interaction and relationship [5]. However, the framework of blockchain education would necessitate "authorisation of transactions and certification, new contracts between teachers and institutions, new interactions between intelligent agents and students, and automatisation of bureaucratic and administrative services without intermediaries".

The authors, in Chapter 5, begin with narrating the potential benefits of use of this new technology in higher education. However, they feel that the educational institutions are moving towards adoption of these technologies at a slower than desired pace. The authors have gone beyond the conventional definition of blockchain technology as "distributed ledger technology" and named it as "digital credentialing". The other uses of Blockchain technology could be "to securely store badges, credits and qualifications". The data could be shared digitally with others in a secured way. It supports diminishing the role of an intermediary, and decentralises the controls to the students. The authors narrate the experiences of Woolf University as the first institution to have used blockchain technology in its educational pursuits. The Chapter provides solution to some of the challenges faced by the University.

Chapter 6 deals with potential uses of Blockchain technology in education. It is an exploratory study narrating application of this technology to European Union Education Policy. The study focuses on educational functionaries including the researchers. The authors bank upon the criteria for use of this technology as database in the form of ledger, accommodating multiple writers, transactions in a trust deficit environment, distributed control mechanism, and interdependence in transactions. The processes for certification and its management and prevention of faking of certificates can be handled with the help of blockchain technology with end-to-end encryption and distributed authentication process while maintaining integrity and transparency of the system.

Section 2: Open and Distance Learning has 2 chapters. Chapter 7 focuses on potential uses of blockchain technology in open and distance learning (ODL) system. The author is of the view that the ODL system cannot stay away from using this technology for long keeping in view the competitive advantages that are provided by the use of this technology. Ability to combine infrastructural and educational resources with the help of this technology can provide a competitive edge to an ODL institution [6]. It can be used to bridge the void "between needs, priorities, models and practices for effective decision making anticipating future trends". This is the very focal area dealt with in this chapter by the author who considers blockchain technology as a strategic resource capable of meeting the expectations of the stockholders in ODL system.

Chapter 8 discusses about the open innovation planform for the Brazilian educational system following a blockchain approach. The author explores different possibilities of making innovations with the help of blockchain technology. He expresses a dire need of adopting a blockchain approach to innovation and transformation in education networks. Adaptive learning could be an area, according to the author, that could benefit substantially from application of blockchain technology in education. The lack of school and university education in the country gives rise to many issues including putting the educational institutions under excessively high pressure which can be overcome if blockchain technology is applied in all those crucial areas.

Section 3: Strategic Approaches has 6 chapters in all. Chapter 9 focuses on creation of virtual identities in blockchain technology environment. These virtual identities are capable of using the real identities in the virtual world. This has provided altogether a different dimension to the concept of identity in the social networked environments. The blockchain technology allows the individual to create and manage their virtual identities. These virtual identities can be used by the institution for interaction with their stakeholders at different levels [7]. The virtual communication among the students, the teachers and the institutions are established by these virtual identities performing the role of facilitators.

Authors in Chapter 10, discuss the academic certificate handling mechanism based on blockchain technology. They see application of this technology as an alternative to stand against faking of certificates and enhancing transparency, and easing the process of their verification. The technological viewpoint of the authors further elaborates on technological aspects influencing confidentiality and transparency with reference to performance and reliability. The use of this technology would definitely promote "disintermediation and seamless interaction among the different stakeholders working on the network in a distributed way". However, the standardisation, interoperability and organisational issues are still to be addressed appropriately before enabling the educational institutions to make optimal use of this technology.

The author, in Chapter 11, mutes the idea of application of blockchain technology in corporate education. He is envisioning whether the corporate education will lead an individual "with an opportunity to reframe" with right skills or it will be used to "build a brigade of uniformly skilled individuals". However, the author feels that blockchain technology will potentially replace the trust-based model with an "open and transparent peer to peer model" over the globe. The future use of blockchain should focus on "individualisation, profiling, performance, inclusion, classification, distribution, totalisation and regulation".

In Chapter 12, the authors provide a new strategic framework for Brazilian Higher Education System with application of social media, cyberculture and blockchains for educational development. In this process, a detailed review of the writings on social networking, social media, cyberculture and blockchains with reference to Brazil, is provided. Chapter 13 explores the role of educational technology in social transformation, change and development. The role of blockchain technology is highlighted as part of strategy and management in establishment of social agent for equality, access and openness in education [8]. The authors propagate the use of blockchains in tracking, managing and authenticating the activities on online platforms especially the MOOCs. The low rate of course completion by online learners can be addressed by motivating them with the help of use of blockchains.

The last Chapter explores the potential usage of blockchain in education and skill development with special reference to disintermediation, automation of trust and digitisation in this new technology led environment. They use case study method to study the challenges and opportunities of use of blockchain technology in education. The authors provide current state live illustrations in Indian context with reference to blockchain technology implementation and its implications in different related domains. The authors are of the view that increasing tendency for decentralisation, availability of open-source technologies and cloud computing enabled services have led to extensive use of blockchain technologies in different areas of technological adoption [9]. However, there are still a lot many challenges to be overcome. The authors have proposed an Academic Blockchain Platform (ABP) as part of certificate management system based on "BlockchainCert Protocol" that would lead to issuance of trust-free academic certificates [10]. The university, college, student and verifier would be the major players in the authentic certificate management system.

III. READING REFLECTIONS

The volume in hand is one such accomplishment that focuses on a new area of innovation in education. It not only offers framework for use of Blockchain Technology at different levels, but also puts forth the ways and means to overcome the challenges that pose during adoption and implementation of this technology. The implementation

of Blockchain technology in education provides the educational planners, policy makers, instructional designers and education providers another opportunity to experiment with it for enriching the experiences of the students at different levels. The implementation of blockchain technology can augment the process of automated issue of awards, recognition process, sharing and transfer of academic credits, storage and verification of student records, etc. The authors of the chapters have delved deep into the nitty-gritty of the topic they have dealt with. Each of the chapters provide an overview of the aspects dealt by it in the form of abstract at the beginning of the chapter. Key terms and definitions are provided at the end of the chapters wherever required in addition to the details of the additional readings. I am confident that the book would give a new insight to educational practitioners into various dimensions of this comparatively new area of technological implementation in education which would further help them in transforming their approach to pedagogical processes.

REFERENCES

[1] A. Bozkurt, "Online networks, distributed learning and blockchain technology," *EDUCCON 2018: Education 4.0 Studies* Ankara, Turkey: Academic Press. pp. 102-109, 2018.

[2] J.C. Cheng, N. Y. Lee, C. Chi, & Y. H. Chen, "Blockchain and smart contract for digital certificate," in Proceedings of 2018 *IEEE International Conference on Applied System Invention (ICASI*), pp. 1046-1051, April 2018, DOI: 10.1109/ICASI.2018.8394455.

[3] E. Karafiloski & A. Mishev, "Blockchain solutions for big data challenges: A literature review," in *Proceedings Smart Technologies, IEEE EUROCON 2017-17th International Conference*, pp. 763-768, July 2017. IEEE, DOI: 10.1109/EUROCON.2017.8011213.

[4] M. Swan, "Blockchain thinking: The brain as a decentralized autonomous corporation," *IEEE Technology and Society Magazine*, vol. 34, no. 4, pp. 41–52, 2015, Doi:10.1109/MTS.2015.2494358.

[5] A. Mikroyannidis, J. Domingue, M. Bachler, and K. Quick, "Smart Blockchain Badges for Data Science Education," 2018 IEEE Frontiers in Education Conference (FIE), San Jose, CA, 2018, DOI: 10.1109/FIE.2018.8659012.

[6] R. C. Sharma, "*Innovative Applications of Online Pedagogy and Course Design*," Hershey, PA: IGI Global, 2018, Doi: 10.4018/978-1-5225-5466-0.

[7] R. Rivera, J.G. Robledo, V.M. Larios, and J.M. Avalos, "How digital identity on blockchain can contribute in a smart city environment," *International Smart Cities Conference* (ISC2), pp. 1-4, 2017, Doi: 10.1109/ISC2.2017.8090839.

[8] M. Sharples and J. Domingue, "The Blockchain and Kudos: A Distributed System for Educational Record, Reputation and Reward," In *Adaptive and Adaptable Learning. EC-TEL 2016. Lecture Notes in Computer Science*, K. Verbert, M. Sharples, T. Klobučar, Eds., Springer, Cham, 2016, DOI: 10.1007/978-3-319-45153-4_48.

[9] M. Jirgensons, and J. Kapenieks, "Blockchain and the future of digital learning credential assessment and management," *Journal of Teacher Education for Sustainability*, vol. 20, no. 1, pp.145–156, 2018, Doi: 10.2478/jtes-2018-0009.

[10] S. Kolvenbach, R. Ruland, W. Gräther, and W. Prinz. "Blockchain 4 Education," in *Proceedings of 16th European Conference on Computer-Supported Cooperative Work-Panels, Reports of the European Society for Socially Embedded Technologies*, 2018, Doi:10.18420/ecscw2018_p7.

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Dr Pulist is a Certified Trainer (a Life Member of India Society for Training and Development). He has completed the Studies *"eLearning in Commonwealth Asia 2013"* and *"OER Policy Implementation and Use in Open and Distance Learning"* published by Commonwealth Educational Media Centre for Asia, New Delhi (Commonwealth of Learning). He has co-edited a book entitled *"Education in the Digital World"* and has written over 85 articles/ book chapters/ research papers/ reports/ book reviews/ compilations, etc. His articles have been published in national and international journals. He has been associated with Indian Journal of Open Learning as co-editor during the period 2011-2018. His areas of interest are eLearning, Open Educational Resources, distance education, student retention, student support services, and training & development in ODL. He is involved with ODL activities for the last over 27 years.