



e-ISSN: 3026-5827

Enigma in Education

Journal website: <https://enigma.or.id/index.php/edu>



Application of Blockchain Technology for Innovation in the Education Sector

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ARTICLE INFO

Keywords:

Adaptive learning system
Blockchain
Education records
Online learning
Technology

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All authors have reviewed and approved the final version of the manuscript.

<https://doi.org/10.61996/edu.v1i2.28>

ABSTRACT

The utilization of blockchain technology holds immense potential to profoundly influence the field of education in the forthcoming years. This technology has the potential to enhance the security, transparency, and affordability of education. Blockchain technology can be employed to securely and permanently maintain student education records. Implementing this can enable students to monitor their academic advancement and receive acknowledgement for their accomplishments. Employing blockchain technology can issue educational certificates that possess a high level of security and are impervious to counterfeiting. This might facilitate students in securing employment or pursuing further education at an advanced level. The implementation of blockchain technology can enhance the security and dependability of online learning platforms. One way to achieve this is by using blockchain technology to store educational resources, evaluations, and communication between students and educators. Blockchain technology can facilitate the creation of adaptive learning systems that have the ability to customize learning materials and procedures according to the individual requirements of each learner. Blockchain technology has the potential to establish a learning environment that is decentralized and characterized by increased democratic participation. A collective or network comprising diverse stakeholders, including students, educators, and parents, typically oversees this educational setting.

1. Introduction

Education is a crucial facet of human existence. Education is crucial in shaping one's character, knowledge, and abilities necessary for both personal and professional endeavors. Technology has increasingly been a vital component of education in recent years. Technology has enhanced the efficacy of the learning and instructional processes while also facilitating broader accessibility to education. Blockchain technology is an emerging technology with the capacity to revolutionize the education sector through innovation. Blockchain is a distributed system that uses cryptographic techniques to safeguard data. This enhances the security of educational data, safeguarding it against cyberattacks or tampering. Blockchain technology enables all relevant stakeholders to quickly access and transparently store educational records. This has the

potential to enhance trust among students, educators, and educational institutions. Blockchain technology has the potential to establish a cost-effective and fair education system. Blockchain technology can achieve this by minimizing administrative expenses and streamlining the dissemination of educational resources.^{1,2}

Implementing blockchain technology securely and permanently stores student education records. Implementing this solution can enable students to monitor their academic advancement and receive acknowledgement for their accomplishments. Employing blockchain technology can issue educational certificates with a high level of security and imperviousness to counterfeiting. This might facilitate students in securing employment or pursuing further education at an advanced level. Blockchain has the potential to establish a more

secure and dependable online learning environment. One way to achieve this is by using blockchain technology to store educational resources, evaluations, and communication between students and educators. Blockchain technology can create adaptive learning systems that tailor learning materials and procedures to the specific requirements of individual students. Blockchain technology can establish a decentralized learning environment characterized by increased democratic participation.^{3,4}

Blockchain technology

Distributed network technology that enables encrypted and secure data storage. Blockchain technology ensures the immutability of information, preventing any single person or organization from altering or removing it, which is why it is commonly known as a "distributed ledger." A blockchain is a decentralized system that comprises interconnected blocks of data secured by cryptographic techniques. Every data block has details such as the date, time, and transaction data. The system appends these data blocks to the chain in a sequential manner. The primary characteristics of blockchain technology include: Decentralized: The blockchain does not centralize data in a single location but instead disperses it across the entire network. This enhances data security and prevents sole control by any individual or entity. Transparent: All interested parties have the ability to access data recorded on the blockchain. This fosters greater transparency and engenders confidence among the parties concerned. The use of cryptography safeguards the data saved on the blockchain. This enhances the security of data by safeguarding it against cyberattacks or modification.^{5,6}

Possible applications of blockchain technology

Blockchain technology finds applications in various domains, including: Finance: Blockchain technology enables the creation of digital currencies, such as Bitcoin and Ethereum. This form of currency utilizes blockchain technology to ensure the security of transactions and maintain a permanent record of ownership. Supply chain: Blockchain technology enables the monitoring and tracing of the

transportation of products and services across the supply chain. Implementing this can enhance the efficiency and transparency of the supply chain. Governance: Blockchain technology has the potential to enhance the transparency and accountability of government operations. One way to achieve this is by utilizing blockchain technology to securely store and manage public data, such as civil and election records. Blockchain technology has the potential to enhance the security and transparency of the education system. One way to achieve this is by utilizing blockchain technology to securely store and manage student education data, certifications, and instructional materials.^{7,8}

Utilization of blockchain technology in education

Management of educational records

The utilization of blockchain technology enables the permanent and highly secure storage of student education records. Implementing this can enable students to monitor their academic advancement and receive acknowledgement for their accomplishments. Individuals or entities cannot modify or erase student education records due to the blockchain. This enhances the security of education records by decreasing the risk of tampering. Storing student education records on the blockchain ensures a decentralized network stores them. This enhances the reliability of education records and eliminates the risk of loss or damage. All individuals with an interest can access student education records maintained on the blockchain. This fosters greater transparency and instills trust among students, educators, and educational institutions. Implementing blockchain technology can effectively decrease the expenses associated with managing and disseminating educational records. This has the potential to enhance the accessibility and fairness of education.^{8,9}

Educational institutions can employ blockchain technology to securely store and maintain comprehensive records of students' academic performance, attendance, and accomplishments. This tool facilitates pupils in monitoring their academic advancement and attaining acknowledgment for their accomplishments. A university can employ blockchain

technology to securely store and manage students' academic transcripts. This might facilitate students seeking employment or pursuing further education at an advanced level. A government can employ blockchain technology to securely store and manage degrees and educational certifications. This might facilitate students in attaining acknowledgement for their qualifications. The implementation of blockchain technology for the storage of student education records is now in its nascent phase. Nevertheless, this technology has the capacity to exert a substantial influence on education in the forthcoming years.¹⁰

The certificate issuance process

Blockchain technology can issue educational certificates with a high level of security and imperviousness to fraudulent replication. This might facilitate students in securing employment or pursuing further education at an advanced level. Any individual or organization cannot alter or remove education credentials issued on the blockchain, making them immutable. This enhances the security of educational certificates, reducing the risk of manipulation. Blockchain technology holds educational certifications on a decentralized network. This enhances the reliability of educational credentials, as they are impervious to loss or destruction. Stakeholders can obtain educational certifications issued on the blockchain. This fosters greater transparency and instills confidence among students, businesses, and educational institutions. An educational institution can utilize blockchain technology to offer educational certificates to students upon successful completion of their academic program. This might facilitate students in acquiring acknowledgement for their qualifications. An organization can utilize blockchain technology to provide training certificates to its staff. This can facilitate the professional growth of personnel and enhance their prospects for career advancement. A government can employ blockchain technology to distribute competency certificates to professionals. This might facilitate professionals in attaining acknowledgment for their qualifications. The utilization of blockchain technology for the issuance of

educational diplomas is still in its nascent phase of advancement. Nevertheless, this technology has the capacity to exert a substantial influence on education in the forthcoming years.¹¹

Distance education

Blockchain has the potential to establish a more secure and dependable online learning environment. One way to achieve this is by using blockchain technology to store educational resources, evaluations, and communication between students and educators. Recording educational resources, evaluations, and communication between students and educators on the blockchain ensures their immutability, preventing any alteration or removal by individuals or organizations. This enhances the security of the data by reducing the risk of manipulation. In addition, the blockchain stores educational resources, exams, and interactions between students and educators on a decentralized network. This enhances the reliability of data and ensures its immunity against loss or destruction. Educational resources, evaluations, and student-teacher interactions maintained on the blockchain are accessible to all stakeholders. This fosters enhanced transparency and a sense of confidence among students, educators, and educational institutions.¹²

An educational institution can utilize blockchain technology to securely store and manage educational content, including videos, modules, and exercises. This facilitates students' ability to retrieve educational resources at any time and from any location. An educational institution can use blockchain to securely maintain evaluations, such as tests and assignments. Implementing this can enable educational institutions to monitor student advancement and offer more precise feedback. An educational institution can use blockchain to securely store and record various interactions between students and professors, including communications, discussions, and forums. This facilitates students' collaboration with educators and peers. The utilization of blockchain technology for the establishment of online learning systems is still in its nascent phase of advancement. Nevertheless, this

technology has the capacity to exert a substantial influence on education in the forthcoming years.¹²

Adaptive learning

Adaptive learning systems can use blockchain technology to customize learning materials and methodologies to cater to the individual requirements of every student. Adaptive learning systems employ machine learning technology to monitor student progress and tailor learning materials and procedures according to specific student requirements. Blockchain can serve as a storage mechanism for essential data required by adaptive learning systems, encompassing information pertaining to student advancement, student profiles, and learning resources. Storing the necessary data for an adaptive learning system securely on the blockchain ensures its immutability and protection against deletion by any single individual or entity. This enhances the security of the data by reducing the risk of manipulation. Hosted on a distributed network, a blockchain saves the necessary data for an adaptive learning system, enhancing its security and reducing the risk of manipulation. This enhances the reliability of data and ensures its immunity against loss or destruction. Interested parties can access the necessary data for an adaptive learning system stored on the blockchain. This fosters enhanced transparency and a sense of confidence among students, educators, and educational institutions.^{11,12}

An educational institution can employ blockchain technology to securely store and manage data pertaining to student progress, encompassing exam results, assignments, and engagements with learning materials. Educational institutions can use this data to customize learning resources and techniques based on the individual requirements of each student. A corporation can employ blockchain technology to securely store information pertaining to student profiles, encompassing their interests, skills, and learning styles. This data can tailor learning materials and methodologies to cater to the diverse requirements of individual students. The government can utilize blockchain technology to securely store and manage data pertaining to educational resources, including

videos, modules, and exercises. Blockchain technology can utilize the data to create adaptive learning systems that are inclusive of all students, irrespective of their geographical location or socio-economic background. The utilization of blockchain technology for the creation of adaptive learning systems is still in its nascent phase of advancement. Nevertheless, this technology has the capacity to exert a substantial influence on education in the forthcoming years. Blockchain-based adaptive learning systems have the potential to enhance students' learning outcomes by improving effectiveness and efficiency.^{11,12}

Blockchain technology based learning

Blockchain technology has the potential to establish a learning environment that is decentralized and characterized by increased democratic participation. A decentralized learning environment refers to a learning environment that is not reliant on a single entity or group. A collective or network comprising diverse stakeholders, including students, educators, and parents, typically oversees this educational setting. Blockchain technology can provide a decentralized learning environment through the following means: Establish a reliable and trustworthy platform for the exchange of educational resources with enhanced security measures.

Blockchain can serve as a repository for instructional resources, including videos, modules, and activities. These instructional resources are available to individuals of all backgrounds and locations. Enhance visibility and confidence by utilizing blockchain technology: Blockchain can serve as a repository for storing information pertaining to student advancement, evaluations, and engagements between students and educators. All stakeholders can access this data, therefore enhancing transparency and fostering confidence in the educational setting. Enhancing the development of learning systems that are more inclusive: Blockchain technology enables the creation of inclusive learning systems that provide universal accessibility to students, regardless of their geographical location or socio-economic background.

Blockchain technology can establish a decentralized and more democratic learning

environment. Here are a few illustrations: A community can utilize blockchain technology to construct an inclusive online learning platform accessible to all individuals. This website offers educational resources and evaluations and facilitates communication between students and educators. An organization can leverage blockchain technology to create a global learning platform accessible to its employees throughout the globe. This strategy facilitates the enhancement of employees' abilities and promotes career progression. A government can employ blockchain technology to cultivate a more comprehensive and accessible education system. This system facilitates equitable educational opportunities for students from underprivileged backgrounds. The utilization of blockchain technology to provide a decentralized and more democratic learning environment is now in its nascent phase of progress. Nevertheless, this technology has the capacity to exert a substantial influence on education in the forthcoming years. Utilizing blockchain technology in educational settings can foster a more equitable and egalitarian learning experience for all individuals.¹³

4. Conclusion

The utilization of blockchain technology has great promise for revolutionizing the field of education in the next few years. This technology has the potential to enhance the security, transparency, and cost-effectiveness of education. Blockchain technology can be utilized to securely and permanently store student education records. Implementing this can enable students to monitor their academic advancement and receive acknowledgement for their accomplishments. Blockchain technology can issue educational certifications with a high level of security and imperviousness to counterfeiting. This might facilitate students in securing employment or pursuing further education at an advanced level. Blockchain has the potential to establish a more secure and dependable online learning environment. One way to achieve this is by using blockchain technology to securely store educational resources, evaluations, and communications between students and educators. Blockchain technology can facilitate the creation of

adaptive learning systems that have the ability to tailor learning materials and procedures to the specific requirements of individual students. Blockchain technology has the potential to establish a learning environment that is decentralized and characterized by increased democratic participation. A collective of stakeholders, including students, instructors, and parents, typically oversee the management of this learning environment.

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