AN ANALYSIS OF STUDENT PERCEPTIONS OF BLOCKCHAIN TECHNOLOGY AND ITS IMPLICATIONS FOR EDUCATION

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ABSTRACT

This study evaluates student perceptions of blockchain technology and its implementation in education. This research was conducted using the interview method with Bina Nusantara University students majoring in Information Systems and analyzed using the NVivo software. The results of this study indicate that students have a positive perception of blockchain technology and see the potential it embodies in the process of verifying educational qualifications, learning management, payment and management of educational debt, educational inclusion, distance learning, and management and distribution of educational assistance. However, students are also aware of security and privacy issues that may arise in the use of blockchain technology in education. Word Cloud also pointed out that the words that frequently came up from the interview results were "security", "accountability", "transparency", "validity" and "authentication". In addition, the results of this study also show that students see the potential of blockchain technology in the management of educational data and information, with the ability to store secure and verified data automatically. Students also see the potential of blockchain technology in increasing efficiency and effectiveness in educational administration processes. However, students also realize that implementing blockchain technology in education requires clear regulations and standards as well as support from the government and industry. The conclusion of this study is that Bina Nusantara University students have a positive perception of blockchain technology and see its implicit potential in education. The advice given by students is that there is a need for higher education and awareness about blockchain technology as well as the development of infrastructure and regulations needed for the implementation of blockchain technology in education.

Keywords: *Blockchain, Education, Students, Qualitative, Perception*

1. INTRODUCTION

In today's digital era, technological developments are increasing rapidly and have a significant impact on the education system. At universities, the use of information and communication technology (ICT) is increasingly being improved in various aspects, including in the implementation of recording academic grades in general, both assignments and exams.

However, there are still many weaknesses in the system for recording academic grades at universities, such as a lack of transparency in scoring and announcement of grades, misappropriation of grades, and a lack of equality in assessment between students.

In 2019 until now there have been several cases of diploma forgery. As a result, the company or organization doubts the authenticity of the data listed on the academic transcript and needs to cross-check the data back to the university. This is a challenge for the university to maintain the integrity and security of data from any manipulation. According to the case that occurred in 2019, employees who work in companies can also be threats that manipulate data [1].

This problem requires universities to update the technology used, especially regarding data integrity and security. Blockchain technology is immutable, immutable. It is also peer to peer, distributed (transparent), validated, and secured, which is perfect for solving data integrity and security issues. Therefore, an innovative solution is needed to overcome this problem.

Blockchain is a technology that provides a secure and decentralized distribution system that can be used for a variety of purposes, including in education. However, while blockchain technology has demonstrated the potential to increase efficiency and transparency in various sectors, the public's perception of this technology remains unclear. Therefore, it is important to assess students' perceptions of blockchain technology and make it happen in education.

This study will conduct an analysis of student perceptions of blockchain applications in the process of verifying educational qualifications, learning management, payment and management of educational debt, and educational inclusion. In addition, this research will also evaluate blockchain technology which is embodied in the management and distribution of educational assistance, distance learning, and management of data and information in education.

To achieve this goal, this study will use qualitative methods through interviews with students from the Information Systems department at Bina Nusantara University. The data obtained from the interview will be analyzed to assess student perceptions of blockchain technology and its implications for education.

The background of this study comes from the rapid development of blockchain technology and its potential applications in various sectors including education. However, the lack of public knowledge and understanding of this technology, including students, is the reason for assessing student perceptions of blockchain technology and making it happen in education.

In addition, with more and more universities starting to integrate blockchain technology into the education system, it is important to evaluate students' perceptions of this technology and how to embody it in educational development. The results of this research are expected to provide important information for universities and interested parties in the development of blockchain technology in education, to increase effectiveness and efficiency in the educational process.

In addition, this research is also expected to make an important contribution in understanding and improving students' perceptions of blockchain technology, to increase understanding and awareness of the potential and realizing this technology in the education industry and others.

Overall, this research is expected to make an important contribution in understanding student perceptions of blockchain technology and its implications for education and can be used as a reference for the development of blockchain technology in better education in the future.

This research will be conducted by interviewing 10 Bina Nusantara University students majoring in information systems who understand blockchain to explore how blockchain can support the education system.

2. BASIC THEORY

2.1 Blockchain

Blockchain is a continuously growing record (database), called a block, which is linked and secured using cryptographic techniques. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data. Each block in this system is interrelated and if there is an attempt to change the data in one block, it must change the data in another block. Each block protected by this cryptography is connected to each other and forms a network. All computers in the network continuously and mathematically verify the restoration of the Blockchain with all other recoveries in the network. Blockchain is a combination of several techniques, namely cryptography, mathematics, algorithms, and distributed context algorithms [2].

2.2 Advantages of Blockchain

According to [2], there are five key features in blockchain that offer significant possibilities beyond current technology are:

1) Self-sovereignty:

Users can take control as an administrator to manage their education profile. In an educational context, the term has become synonymous with empowering individual learners to maintain and manage their credential details, without the need to call on institutional authorities as a form of trusted intermediary. Students or academic staff members gain significant self-authority over the way personal data and identities are shared online. They can choose to release part or all of it as they wish – without the need to constantly seek third party approval to validate data identity.

2) Trusts:

The organization has sufficient confidence in the validity of any educational transactions. In the digital world, trust depends on many actors, to act in good faith. Trust is often given for a certain period, in a certain context and application. Maintaining trust is always a challenge and often expensive and time consuming in this global digital economy. The decentralized public ledger, as well as the cryptographic algorithms offered in blockchain technology, promise to increase trust among stakeholders. Blockchain guarantees that transactions approved in a distributed ledger are immutable once validated.

3) Transparencies:

Each party can verify transactions. Blockchains authenticate participants with information about the origins of each asset and track how their ownership changes over time — this transparency is linked within the blockchain by means of a public identifier. Blockchain transactions are translated and tracked related documents using these public identifiers. Since each block contains a hash code about the previous block, blockchain provides an undeniable tool for verifying the transparency of transaction data that exists over a certain period. Therefore, the joint ledger provides a single place for determining transaction settlement and asset ownership.

4) Immutability:

Records such as credit income, once stored permanently, cannot be changed. Immutability is related to security, while maintaining integrity, availability, and confidentiality. Eternity also has the characteristic of being tough and unchangeable. Blockchain data remains undisturbed due to constant replication across many different locations. Public and private key cryptography using hash codes is part of the underlying blockchain protocol and transactional security. Immutability means that once established, it is impossible to change records. This feature, in turn, increases confidence in the integrity of transactions and virtually eliminates the possibility of fraud.

5) Disintermediation:

Transactions are carried out without a mediation party or controlling authority. In the blockchain, mathematical calculations and algorithms replace all the necessary intermediaries in a transaction. Participants in a distribution network carry out transactions and transfer of ownership without the presence of intermediaries.

Peer-to-peer consensus algorithms record transactions transparently without intermediaries, potentially reducing costs, complexity, and delays. Blockchain guarantees the validity of records across institutional boundaries and will likely help parties focus on new ways to authenticate content transactions in new ways. Instead of relying on cloud platforms operated by Google or Amazon, the decentralized internet places greater control in the hands of users.

2.3 Previous Research

The first research is [2]. In this study it can be concluded that blockchain technology is very feasible to be applied in the field of education, especially in the management of artifacts, digital documents as well as certificates and academic community portfolios at JTK POLBAN (Department of Computer Engineering and Informatics, Bandung State Polytechnic). The socio-technology referred to in the application of Blockchain technology in this study is grouped into the following 6 features:
1) Self-Sovereignty
2) Trusts
3) Transparency and Provenance
4) Immutability
5) Disintermediation
6) Collaboration.

Based on the results of research and the existence of assets as well as the results of interviews in the article, it is currently identified that several processing and asset management can apply Blockchain technology in JTK POLBAN.

The four scopes that can be implemented immediately are:
a) Digital document management, whether in the form of academic transcripts, teaching materials or accompanying diploma certificates, are several digital documents that can be modeled and published in digital form to make it easier to access documents globally.
b) Storage and management of the JTK POLBAN academic community portfolio for staff career advancement purposes.
c) Management of Intellectual Property, in the form of Patents and Intellectual Property Rights for artifacts and software products as well as ideas generated by both JTK POLBAN staff and students.
d) The ledger of research conducted by JTK. The application of Blockchain technology to the research ledger at JTK will facilitate scientific

development and evaluation of the JTK research roadmap within a certain period and can be used as a JTK profile when collaborating with industry or partners who will develop research results in the future.

The second research is [3]. From the research it can be concluded that the use of blockchain technology in education can increase the effectiveness of teaching and learning processes, increase the security of certificates and facilitate the dissemination of diplomas and certificates for job seekers to make it easy to find work, demonstrated by digital platforms in education that use blockchain technology that is already in use several universities abroad.

Unfortunately, because this technology is still new, there are several weaknesses that should be considered if you want to apply it in the world of education in Indonesia. Such as the absence of laws that regulate blockchain technology in the field of education, the issue of adoption fees, the risk of blockchain technology failure, and the weaknesses of blockchain technology itself.

The third research is [4]. From this research it can be concluded that with an ontology approach that is able to contribute theoretically and views on blockchain, in addition to assisting in the process of analyzing, extracting, and integrating information on the web, making it easier to create a strong knowledge base, ontologies have been recognized as useful instruments. to reduce conceptual ambiguity and inconsistency when identifying values in a particular domain.
This research can also be a reference for identifying solutions from digital hand-encoded certificates Q&A for archiving, authentication, and digital verification in the framework design of a new breakthrough in ontology approach to blockchain technology design.

The fourth research is [5]. From this research it can be concluded that blockchain has shown its potential in industry and academia as it can store a complete and reliable set of records of educational activities including informal processes and outcomes as well as informal learning environments.

As proof of concept, it is proposed to design a blockchain architecture for learning solutions. The proposed PETS (Proof of Educational Transcript System) architecture is a global blockchain-based architecture for higher education learning systems. The proposed architecture addresses a globally unified view for students and educational organizations. The beneficiaries of the proposed architecture are potential employers, who can directly validate the information provided by students, students benefit from a single and transparent view of their completed courses and HEIs (Higher Education Institutions) have access to the latest data regardless of education. original student. The proposed solution is based on a distributed P2P (Peer to Peer) network system. As for data management, blockchain can be used to store important data, because it is distributed and secure. Blockchain can also ensure the data is genuine. When it comes to data analytics, transactions on the blockchain can be used for big data analytics. In the future, it is planned to introduce an architecture based on big data analytics and a suitable version of blockchain technology.

The fifth research is [6]. From this study it can be concluded that blockchain can optimize the world of education because in its approach it uses the characteristics of the blockchain framework, this can support learning activities and monitoring in the education administration sector more optimally.

And because of that this research also leads to blockchain for education adopting agile methods that can prove the existence of blockchain characteristics more usefully to produce blockchain implementations automatically using a proven modeling approach.

The sixth research is [7]. From this study it can be concluded 3 (three) things, namely:
1) The certificate system is currently running at tertiary institutions, it is still felt that it is not running optimally as it can still be manipulated by irresponsible parties.
2) Implementing an e-certificate system based on blockchain technology by agencies. So that it can simplify the process in real time, accurately and safely. And eliminate the occurrence of manipulation.
3) With the existence of e-certificate software based on blockchain technology, it can easily process e-certificates with automatic data matching. So that the e-certificate is very safe.

The seventh research is [8]. From this research it can be concluded that blockchain has

main areas that can be of great benefit in the form of collaboration and partnerships between educational institutions. Various educational institutions are trialing blockchain as a secure and reliable ledger to record the academic achievements of their students. Not only as a record of student certificates, but also the skills they acquire and the various learning outcomes they achieve.

Blockchain can also be used to facilitate collaboration and partnerships between educational institutions, future research will investigate. Recording and sharing student academic information, the use of smart contracts will allow educational institutions to do so, such as academic transcripts, program descriptions, major/minor requirements, and academic probation.

Through any of the participating institutions, students can take courses. Educational institutions may also offer joint academic programs. Will increase students' flexibility by giving them access to all academic programs at every other institution is a benefit of the technology. And can help cut operational costs by leveraging shared academic infrastructure, services, and programs.

The eighth research is [9]. From this research it can be concluded that blockchain technology in teaching information management systems is realized through chain block core technology: distributed ledger technique, asymmetric encryption algorithm, intelligent contracts.

At the data level, first ensure data storage security and strengthen information security step by step from data level, contract level to application level.

At the consensus level, distributed ledger technology, cryptographic asymmetric encryption algorithm technology provides reliability and security to users.

At the application level, effectively reduce the cost of teaching information management system and enhance the security of teaching information management information system.

The application of the three core blockchain technologies in the teaching information management system improves the security of information storage, the reliability of system uses and the credibility of supervision. This reduces the teaching costs of information management and improves the efficiency of university information management.

The ninth research is [10]. From this research it can be concluded that blockchain can increase the efficiency and effectiveness of blockchain in learning performance and has advantages such as process and resource optimization and disadvantages such as renewal costs.

In other words, the practical implications in terms of intervention, blockchain can be used to facilitate access, and at the same time the beneficial impact in terms of prevention, blockchain can increase the trust, transparency, and security of this access. In addition, it affects learning performance. Student learning performance depends on collaborative work, student motivation, engagement, and blockchain tools such as MOOC, AR, VR, online courses, and gamification.

In short, blockchain can support learning performance by bringing people together and promoting knowledge sharing, enhancing it. Regarding research limitations, HE Cloud can be stored on multiple blockchains.

The tenth research is [11]. From this study it can be concluded that cooperative learning using Blockchain technology has a set of teaching strategies designed to educate students to collaborate to achieve learning goals by thinking actively and creatively. This thinking ability is one of the assets that students must have as a provision in dealing with the development of science and technology.

Using Blockchain can avoid data being manipulated by third parties because data is stored in a centralized network, allowing user data to be stored centrally without the need to provide infrastructure. Therefore, it is possible to link cooperative education with digital competence through Blockchain technology using the processes of this system. Thus, the Student-Centered Learning Blockchain (SCi-B) provides many benefits, namely by increasing the credibility of student assessment evidence using the Hash Blockchain so that it can be authenticated, and the learning process is not limited by time and space.

2.4 Summary of Previous Research

The summary of the findings from the previous studies:

1. Research [2]: Blockchain technology is feasible for application in education, particularly for managing artifacts, digital documents, certificates, and academic portfolios. The study identified several immediate implementation scopes, including digital document management, academic community portfolio management, intellectual property management, and research ledger management.

2. Research [3]: The use of blockchain technology in education can enhance the effectiveness of teaching and learning processes, increase certificate security, and facilitate the dissemination of diplomas and certificates. However, certain challenges need to be addressed, such as the absence of relevant laws, adoption fees, technology failures, and inherent weaknesses of blockchain.

3. Research [4]: The ontology approach combined with blockchain technology can contribute to reducing conceptual ambiguity and inconsistency in identifying values within a specific domain. This approach can assist in analyzing, extracting, and integrating information on the web, creating a strong knowledge base, and providing solutions for archiving, authentication, and digital verification.

4. Research [5]: Blockchain has the potential to store complete and reliable records of educational activities, including formal and informal processes and outcomes. A proposed architecture, the Proof of Educational Transcript System (PETS), aims to provide a globally unified view for students and educational organizations, facilitating information validation, transparency, and data analytics.

5. Research [6]: By leveraging the characteristics of blockchain, this study suggests that blockchain implementation in education administration can optimize learning activities and monitoring processes. Agile methods and proven modeling approaches can be used to develop blockchain implementations automatically.

6. Research [7]: The existing certificate system at tertiary institutions can be enhanced by implementing an e-certificate system based on blockchain technology. This implementation can simplify the certification process in real-time, ensure accuracy and security, and eliminate manipulation.

7. Research [8]: Blockchain can be utilized to record academic achievements, skills, and learning outcomes of students, fostering collaboration and partnerships between educational institutions. Smart contracts and shared academic infrastructure can enhance flexibility, access to programs, and cost-efficiency.

8. Research [9]: Blockchain technology, through its core components such as distributed ledger, asymmetric encryption, and smart contracts, can improve the security, reliability, and efficiency of teaching information management systems in universities.

9. Research [10]: Blockchain has the potential to increase the efficiency and effectiveness of learning performance by optimizing processes and resources. It can enhance access, trust, transparency, and security in learning, impacting collaborative work, student motivation, engagement, and the use of blockchain tools such as MOOCs, AR, VR, online courses, and gamification.

10. Research [11]: Cooperative learning using blockchain technology can promote active and creative thinking among students, providing credibility to student assessment evidence through hash blockchain authentication. Blockchain enables centralized storage of user data without requiring additional infrastructure, allowing for flexible and location-independent learning experiences.

These previous studies highlight the potential benefits of blockchain in education, including improved management of digital documents and certificates, increased security and transparency, enhanced collaboration and partnerships, and optimization of learning processes and performance. However, challenges such as regulatory frameworks, adoption costs, technology limitations, and the need for further research and development still need to be addressed.

2.5 Novelty
1. Student Perceptions:

While blockchain technology has been explored in various contexts, focusing specifically on student perceptions of blockchain technology in the education sector adds a unique perspective. Understanding how students perceive this emerging technology and its potential implications for education can provide valuable insights.

2. Implications for Education:

    The research aims to investigate the implications of blockchain technology for education. This focus on exploring the potential benefits, challenges, and opportunities that blockchain brings to the educational landscape distinguishes the work from studies that may have primarily focused on technical aspects or implementation strategies.

3. Analysis of Perceptions:

    By conducting an analysis of student perceptions, you will provide an in-depth understanding of how students perceive blockchain technology in an educational context. This analysis can shed light on their expectations, concerns, and attitudes toward the use of blockchain in education.

4. Educational Context:

    The research specifically targets the implications of blockchain technology in the education sector. By examining this context, you can identify the unique challenges and opportunities that arise in educational settings, such as student records, certification, academic integrity, and collaboration.

5. Empirical Study:

    The research involves conducting interviews to students in the university, it will contribute original data and insights. This primary research approach allows you to gather firsthand information about student perceptions, which can provide a novel perspective on the topic.

3. RESEARCH METHOD

3.1 Method

The following are the stages carried out by researchers for an analysis of student perceptions of blockchain technology and its implications for education:

1) Data collection: qualitative data collection is first carried out through interviews, observations, or related documents. The data is then stored in text form.
2) Transcribe data: audio or video data that has been recorded must be transcribed using Google Live Transcribe into text before it can be imported into NVivo.
3) Import data to NVivo: after the data has been transcribed, then the data is imported into NVivo using the appropriate format.
4) Data analysis: after the data has been imported into NVivo, data analysis is then performed

using the features available in the software. One of the features is Word Cloud.

5) Interpretation of the results of the analysis: after completing the data analysis, an interpretation of the results of the analysis obtained is then carried out, which will then be used as a basis for concluding the results of the research.

3.2 Interview Questions

Researchers ask questions about student perceptions of blockchain for education.

1. Have you ever heard or learned about blockchain technology?
2. In the process of verifying educational qualifications, do you think blockchain technology can be used to increase efficiency and transparency?
3. In learning management, do you think blockchain technology can be used to increase efficiency and transparency?
4. In paying and managing educational debt, do you think blockchain technology can be used to increase efficiency and transparency?
5. In educational inclusion, do you think blockchain technology can be used to increase efficiency and transparency?
6. In distance learning, do you think blockchain technology can be used to increase efficiency and transparency?
7. In the management and distribution of educational aid, do you think blockchain technology can be used to increase efficiency and transparency?
8. In managing data and information in education, do you think blockchain technology can be used to increase efficiency and transparency?
9. Do you see the potential for blockchain technology in education in the future?

3.3 Data Collection

Data techniques commonly used in collecting qualitative information, namely, planned interviews. (Hamdi and Bahruddin, 2012, p.47 - 48).

Qualitative interviews are conducted when the researcher intends to gain knowledge about the subjective meanings that are understood by individuals regarding the topic under study, and intends to explore the issue, something that cannot be done through other approaches.

Before plunging into the interviews, the researcher will conduct study research of 10

journals regarding blockchain for education as a model for making questions for qualitative analysis. After that, the researcher will conduct interviews and the data from the interviews will be used for qualitative analysis.

After that, the interview will be conducted with an online meeting with respondents via zoom meeting and recording the results of the conversation about the questions that have been made before.

3.4 Data Analysis

The recorded data obtained from the interviews will be analyzed, so that the raw data can be processed so that it becomes data that is meaningful, easy to understand, and conclusions can be drawn that are in accordance with the objectives and problems of this study. NVivo software will be used in this study to assist researchers in analyzing data.

The recording results will then be transcribed into text so that it can be processed by NVivo. The results of the transcript will be uploaded, and the researcher will sort out the words that show the respondent's perception of Blockchain. After the words are ready to be processed, the researcher will choose to use the Word Cloud feature from NVivo to issue a Word Cloud output, which is an image that shows words that often appear in the text transcripts of the interview results.

4. RESULTS AND DISCUSSION

4.1 Interviewee profile

The author uses 10 interviewees who are students of the Faculty of Information Systems at Bina Nusantara University who understand Blockchain, aged 18-24 years as interviewee candidates. The author collects data from candidates by being interviewed directly using zoom.
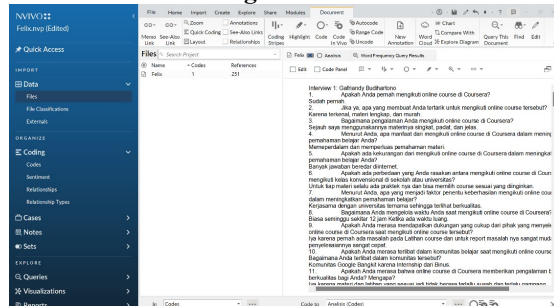
4.2 NVivo Processing

Figure 1. Import File in NVivo

The results of the interview were then processed using NVivo by transcribing the interview results using Google Live Transcribe & Notification into a txt file and finally uploaded to NVivo.
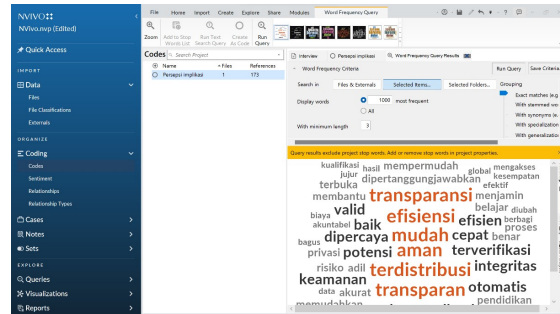

Figure 2. Visualization of Code Result

Next I created a code called "Perception of implication" as shown in Figure 2 as the keyword to be researched and then I analyzed all the candidate words included in the perception then took the basic word and added it to the code. After that, the code can generate a Word Cloud.

Figure 3. Word Cloud

From the word cloud in Figure 3, there are 15 words that appear most often, namely:

1) Transparent/Transparency

Blockchain can be used to increase transparency in education by making the data and information needed in the educational process available in a transparent and easily accessible manner. This can assist in the process of verifying educational qualifications, learning management, payment and management of educational debt, educational inclusion, distance learning, management and distribution of educational assistance, and management of data and information in education. Blockchain can make education systems more efficient and transparent by providing fast and easy access to valid and officially recognized data.

2) Efficient/Efficiency

Blockchain technology can be used to increase efficiency in education by making processes such as verification of qualifications, payment and debt management, inclusion, distance learning, management and distribution of aid, and management of data and information faster and more accessible. Blockchain can also help reduce the possibility of fraud or fraud in these processes, making it more efficient in terms of management and supervision. With blockchain technology, the education system can also become more transparent because all transactions and information stored on the network can be accessed and verified by all authorized parties, thus facilitating the process of decision-making and supervision.

3) Easy

In education, blockchain technology can be used to increase convenience in processes such as verification of educational qualifications, learning management, payment and management of educational debt, educational inclusion, distance learning, management and distribution of educational assistance, and management of data and information in education. By using blockchain, these systems can be managed automatically and transparently, thereby reducing the need for manual intervention, and making the processes more efficient.

4) Safe

Blockchain can be used to increase security in education by providing protection to the data and information stored in it. Blockchain has a decentralized nature which makes it impossible to change or be deleted by any party, so the data and information stored in it remain safe and protected from unauthorized access. In addition, blockchain technology can also be used to increase security in the process of payment and management of educational debt, as well as the process of verifying educational qualifications.

5) Distributed

In terms of educational aid distribution, blockchain technology can be used to increase security and transparency in the aid distribution process. By using blockchain technology, educational aid transaction data can be accessed and verified openly, enabling more efficient and transparent monitoring of the educational aid distribution process. In addition, blockchain can also be used to increase security in the process of

paying educational aid because transactions made using blockchain cannot be changed or annulled.

6) Valid

In education, blockchain technology can be used to guarantee the validity of stored data and information, such as value data, educational certificates, and more. The blockchain guarantees that the data stored cannot be changed or deleted without the consensus of the parties involved, so that the data stored on the blockchain is considered valid. As such, blockchain technology can be used to increase transparency and trust in the process of verifying educational qualifications.

7) Fine

Blockchain can be used to improve the quality of education by providing transparency in the process of verifying educational qualifications, increasing efficiency in learning management, payment and management of educational debt, educational inclusion, distance learning, management and distribution of educational assistance, and management of data and information in education. By using blockchain technology, these processes will be easier, safer, and valid. Therefore, blockchain technology can be a good choice in improving the quality of education in the future.

8) Trusted

In education, blockchain technology can be used to create a trusted and valid system for verifying educational qualifications. By using blockchain technology, educational qualification data and information can be stored and transferred safely, transparently, and efficiently. Blockchain can assist in the process of managing educational data and information so that it can improve the distribution of educational assistance that is good, inclusive, and easily accessible.

9) Potential

The potential of blockchain technology in education can be used to increase efficiency in the process of verifying educational qualifications, learning management, payment and management of educational debt, educational inclusion, distance learning, management and distribution of educational assistance, and management of educational data and information. In addition, the potential of blockchain technology can also be used to increase transparency and validity in these processes, as well as improve security and better and more reliable distribution.

10) Security

Blockchain can be used to increase security in education by storing educational data and information on a blockchain network that cannot be changed and deleted, thereby ensuring that the data and information remains valid and can be trusted. It can also be used to prevent acts of falsification or misuse of educational data. Apart from that, blockchain can also be used to increase security in the payment process and management of educational debt.

11) Decentralized

In education, blockchain technology can be used to create a decentralized system that allows educational data and information to be managed and shared safely and efficiently without centralization of authority. This can increase data transparency and validity and make decision-making processes more effective and efficient. In addition, blockchain technology can also be used to improve security in the payment and management of educational debt, educational inclusion, distance learning, management and distribution of educational assistance. The potential of blockchain technology in education is to increase efficiency and transparency in the process of managing data and information, as well as increasing security in the process of payment and management of educational debt.

12) Fast

Blockchain technology can be used to increase speed in the process of verifying educational qualifications, learning management, payment and management of educational debt, education inclusion, distance learning, management, and distribution of educational assistance, as well as management of data and information in education by optimizing the transaction process carried out online. electronic and real-time. This can reduce the time needed in the process and make it faster and more efficient.

13) Verified

In education, blockchain technology can be used to quickly and easily store and access verified educational qualification data. This system is decentralized allowing for better and more reliable distribution of data. High data security can be achieved through blockchain technology which guarantees that the data stored can only be accessed by authorized parties. The potential for blockchain technology to increase efficiency and transparency

in the verification of educational qualifications is enormous.

14) Integrity

Blockchain can be used to increase integrity in education by storing educational data and information in a decentralized and verified manner, thereby ensuring that the data and information cannot be changed or manipulated. In addition, blockchain technology can also be used to store proof of educational qualifications, such as diplomas or certificates, which can be easily accessed and verified, thereby ensuring the validity and integrity of educational data.

15) Automatic

In education, blockchain technology can be used to ensure the integrity of data and information such as educational qualifications and credentials that can be automatically accessed and verified using decentralized technology. This can improve security and efficiency in the educational qualification verification process as well as increase transparency in learning management and payment of educational debt. In addition, blockchain technology can also be used in educational inclusion, distance learning, management and distribution of educational assistance and management of data and information in education.

4.3 Discussion

1) How do students perceive blockchain technology?

Student perceptions of blockchain technology are generally said to be positive. From the results of the analysis that has been carried out, it shows that students see the potential of blockchain technology in increasing efficiency and transparency in the education system. Students also see the potential of blockchain technology in overcoming the problem of cheating in the education system, such as in verifying learning activity and payment. However, some students also indicated difficulties in understanding blockchain technology and there needs to be efforts to improve blockchain technology education and literacy among students.

In addition, some students also expressed concerns about data privacy and security associated with blockchain technology. However, it can be said that student perceptions of blockchain technology are generally positive and see its potential in improving the education system. However, there is

still a need for better blockchain technology education and literacy to enhance students' understanding and reduce any concerns that may exist.

2) What are the implications of blockchain technology in the process of verifying educational qualifications?

Blockchain technology can have positive implications in the process of verifying educational qualifications. Blockchain is a technology that provides an immutable digital ledger system that can be used to store trustworthy and verifiable data.

One of the implications of blockchain technology in verifying educational qualifications is to simplify the verification process. With blockchain technology, educational qualification data can be stored in digital form and can be easily accessed by authorized parties, such as companies or universities, for verification.

In addition, blockchain technology can also be used to increase the security of educational qualification data. Because the data stored in the blockchain cannot be changed, the educational qualification data stored in the blockchain can be trusted and cannot be contested.

In addition, blockchain technology can also be used to increase transparency in the process of verifying educational qualifications. With a decentralized system, education qualification data can be accessed by anyone who has access, making it possible to carry out verification more quickly and efficiently.

Overall, blockchain technology can help improve efficiency, security, and transparency in the process of verifying educational qualifications. However, further studies and proper implementation are still needed to evaluate the credibility and implementation of blockchain technology in the broad educational qualification verification process.

3) What are the implications of blockchain technology in learning management?

Blockchain technology can have positive implications in learning management. Blockchain is a technology that provides an immutable digital ledger system that can be used to store trustworthy and verifiable data.

One of the implications of blockchain technology in learning management is to simplify the process of verifying learning activity. With blockchain technology, learning activity data can be stored in digital form and can be easily accessed by authorized parties, such as universities or authorized agencies, for verification.

In addition, blockchain technology can also be used to increase the security of learning activity data. Because the data stored in the blockchain cannot be changed, the learning activity data stored in the blockchain can be trusted and cannot be contested.

In addition, blockchain technology can also be used to increase transparency in the learning management process. With a decentralized system, data on learning activity can be accessed by anyone who has access, making it possible to carry out faster and more efficient verification.

Overall, blockchain technology can help improve efficiency, security, and transparency in the learning management process. However, further studies and proper implementation are still needed to evaluate the credibility and implementation of blockchain technology in learning management broadly.

4) What are the implications of blockchain technology in the payment and management of educational debt?

Blockchain technology can have positive implications in the payment and management of educational debt. Blockchain is a technology that provides an immutable digital ledger system that can be used to store trustworthy and verifiable data.

One of the implications of blockchain technology in the payment and management of educational debt is to simplify the transaction process. With blockchain technology, transactions can be carried out easily and quickly because transactions can be carried out electronically and can be accessed by authorized parties, such as universities or authorized agencies, to verify.

In addition, blockchain technology can also be used to increase security in transactions. Since the data stored in the blockchain is immutable, transactions stored in the blockchain are trustworthy and inviolable.

In addition, blockchain technology can also be used to increase transparency in the payment and management of educational debt. With a decentralized system, transaction data can be accessed by anyone who has access, making it possible to carry out faster and more efficient verification.

Overall, blockchain technology can help improve efficiency, security, and transparency in the payment and management of educational debt. However, further studies and proper implementation are still needed to evaluate the credibility and implementation of blockchain technology in the payment and management of educational debt broadly.

5) What are the implications of blockchain technology in educational inclusion?

Blockchain technology can have positive implications for educational inclusion. Blockchain can be used to store trustworthy and verifiable data, which can be used to increase educational inclusion.

One of the implications of blockchain technology in educational inclusion is facilitating access to educational data. Blockchain can be used to store educational data digitally, so that it can be accessed by anyone who has access, including individuals who previously did not have sufficient access or were less facilitated.

In addition, blockchain technology can also be used to increase transparency in the educational process. With a decentralized system, education data can be accessed by anyone who has access, making it possible to carry out faster and more efficient verification.

Overall, blockchain technology can help increase efficiency and transparency in educational inclusion. However, further studies and proper implementation are still needed to evaluate the credibility and implementation of blockchain technology in educational inclusion broadly.

6) What are the implications of blockchain technology in distance learning?

Blockchain technology can have positive implications in distance learning. Blockchain can be used to store trustworthy and verifiable data, which can be used to enhance remote learning.

One of the implications of blockchain technology in distance learning is that it makes it easier to verify learning activity. Blockchain can be used to store digital learning activity data, so that it can be accessed by authorized parties, such as universities or authorized agencies, to verify.

In addition, blockchain technology can also be used to increase the security of distance learning data. Since the data stored in the blockchain is immutable, the distance learning data stored in the blockchain is trustworthy and inviolable.

In addition, blockchain technology can also be used to increase transparency in the distance learning process. With a decentralized system, distance learning data can be accessed by anyone who has access, making it possible to carry out faster and more efficient verification.

Overall, blockchain technology can help improve efficiency, security, and transparency in distance learning. However, further studies and proper implementation are still needed to evaluate the credibility and implementation of blockchain technology in distance learning widely.

7) What are the implications of blockchain technology in the management and distribution of educational aid?

Blockchain technology can have positive implications in the management and distribution of educational aid. Blockchain is a technology that provides an immutable digital ledger system that can be used to store trustworthy and verifiable data.

One of the implications of blockchain technology in the management and distribution of educational aid is to simplify the verification process for beneficiaries. With blockchain technology, beneficiary data can be stored in digital form and can be easily accessed by authorized parties, such as universities or authorized agencies, for verification.

In addition, blockchain technology can also be used to increase security in the management and distribution of educational aid. Because the data stored in the blockchain cannot be changed, beneficiary data stored in the blockchain can be trusted and cannot be contested.

In addition, blockchain technology can also be used to increase transparency in the process of

managing and distributing educational aid. With a decentralized system, beneficiary data can be accessed by anyone who has access, making it possible to carry out faster and more efficient verification.

Overall, blockchain technology can help improve efficiency, security and transparency in the management and distribution of educational aid. However, further studies and proper implementation are still needed to evaluate the credibility and implementation of blockchain technology in the management and distribution of educational aid widely.

8) What are the implications of blockchain technology in managing data and information in education?

Blockchain technology can have positive implications in the management of data and information in education. Blockchain is a technology that provides an immutable digital ledger system that can be used to store trustworthy and verifiable data.

One of the implications of blockchain technology in managing data and information in education is to facilitate access and verification of educational data. Blockchain can be used to store educational data digitally and can be accessed by anyone with appropriate access, including government agencies, universities, and authorized organizations.

Apart from that, blockchain technology can also be used to improve the security of educational data. Because the data stored in the blockchain cannot be changed or deleted, educational data stored in the blockchain can be trusted and cannot be contested.

In addition, blockchain technology can also be used to increase transparency in the management of data and information in education. With a decentralized system, education data can be accessed by anyone who has appropriate access, making it possible to carry out faster and more efficient verification.

Overall, blockchain technology can help improve efficiency, security, and transparency in managing data and information in education. However, further studies and proper implementation are still needed to evaluate the credibility and

implementation of blockchain technology in the management of data and information in education broadly.

4.4 Result

4.4.1 The effectiveness and efficiency of the designed blockchain technology solutions

In interviews with students, a number of questions were asked to test the effectiveness and efficiency of the blockchain technology solution that had been designed for the university's academic grade recording system. These questions include:

• How do you think blockchain technology can help increase transparency and security in academic grade recording systems?

• What do you think of the visual appearance of this blockchain user interface design? Is it easy for users to see and recognize?

• How do you think the blockchain user interface design makes it easier for users to access and understand value information on the blockchain platform?

From this interview, it can be concluded that students have a positive perception of the use of blockchain technology in the academic score recording system. Students argue that blockchain technology can increase transparency, security, and efficiency in the process of recording academic grades at universities.

4.4.2 Collection of data and information from students regarding their opinions in the design results of blockchain technology solutions in the academic scoring system at universities

To collect data and information from students regarding their opinions in the design results of blockchain technology solutions in the academic score recording system at universities, a number of questions were asked in interviews, including:

• What is your impression of the user interface of the designed blockchain-based academic score recording system?

• Do you feel the design of the blockchain user interface adopts good design principles and why?

• Do you think this blockchain based academic score keeping system makes it easier for users to keep track of their academic score history?

From this interview, data and information can be collected regarding the advantages and disadvantages of blockchain technology solutions in

a blockchain-based academic grade recording system. Students stated that the user interface of this system was quite easy to use and made it easy for users to track their academic grade history. However, some students also provided input to improve the user interface to make it more intuitive and easy to understand.

4.4.3   Analysis of data and information that has been collected to evaluate the effectiveness and efficiency of blockchain technology solutions in academic assessment systems at universities

After the data and information from the interviews have been collected, the next step is to carry out an analysis to evaluate the effectiveness and efficiency of blockchain technology solutions in academic assessment systems at universities. This analysis includes:

• Evaluation of the effectiveness of blockchain technology solutions in increasing transparency, security, and efficiency in the process of recording academic grades.

• Evaluate the effectiveness of the user interface in ease of use and tracking historical grades.

From this analysis, it can be found that blockchain technology solutions have the potential to increase transparency, security, and efficiency in academic grade recording systems at universities. The user interface of this solution has also proven to be quite effective in making it easy to use and tracking history of academic scores.

4.4.4   Evaluate the advantages and disadvantages of blockchain technology solutions and provide recommendations for further development

After doing the analysis, the final step is to evaluate the advantages and disadvantages of the blockchain technology solution that has been designed for the university's academic grade recording system. In addition, it is also necessary to provide recommendations for further development. This evaluation can be carried out by considering the data and information that has been collected and analyzed previously.

From this evaluation, it can be found that the advantages of blockchain technology solutions are increasing transparency, security, and efficiency in the academic score recording system at universities. However, there are still flaws in the user interface that need to be improved to make it more intuitive

and easy to understand. Therefore, the recommendation given is to develop the user interface to make it easier for users to use and provide a better user experience. In addition, there is also a need for more intensive outreach to users about the benefits and how to use blockchain technology solutions in the academic score recording system.

5   CONCLUSION AND SUGGESTIONS

5.1   Conclusion

Blockchain technology has the potential to increase efficiency and transparency in education, but students' perceptions of this technology are still being researched. Therefore, it is important to evaluate students' perceptions of blockchain technology and its implications for education through qualitative methods, namely interviews with students from Bina Nusantara University majoring in Information Systems.

From the research results, it can be concluded that blockchain technology has great potential in increasing efficiency, security, and transparency in education. The students studied have positive perceptions of blockchain technology and see its potential in applications in education, such as verification of educational qualifications, learning management, payment and management of educational debt, educational inclusion, distance learning, management and distribution of educational assistance, and management of data and information in education.

However, further studies and proper implementation are still needed to evaluate the credibility and implementation of blockchain technology in education widely. This research makes an important contribution in understanding students' perceptions of blockchain technology and its implications for education, as a basis for further research and implementation in the future.

5.2   Suggestion

After conducting the research, the advice that can be given by the researcher is:

Advice for students:

1)   Students should increase awareness and education about blockchain technology, including its potential and implications for education.

2) Students must participate in discussions and initiatives related to the implementation of blockchain technology in education.

3) Students should pursue careers in blockchain technology and education to help develop this technology and apply it to education.

4) Students should pursue opportunities to learn and develop skills in blockchain technology through courses, workshops, or graduate programs.

5) Students should actively and critically pursue opportunities to evaluate and evaluate the implementation of blockchain technology in education.

6) Students should pursue opportunities to evaluate and evaluate applications of blockchain technology in different educational fields and conduct case studies.

Advice for universities:

1) Universities should increase awareness and education about blockchain technology, including its potential and implications for education.

2) Universities must provide special programs related to blockchain technology and education for students.

3) Universities should provide opportunities for students to participate in discussions and initiatives related to the implementation of blockchain technology in education.

4) Universities should provide facilities and means for skills development in blockchain technology for students.

5) Universities should provide opportunities to make connections with industry and government in the development of blockchain technology and education.

6) Universities must pay attention to regulations and laws that apply to the use of blockchain technology in education and ensure that they comply with applicable regulations.

7) Universities must pay attention to security and privacy aspects in the use of blockchain technology in education and coordinate with other parties involved.

8) Universities should provide study and research programs that evaluate the implications of blockchain technology in education.

9) Universities should provide support and tools for students and lecturers who wish to evaluate and evaluate the implications of blockchain technology in education.

Advice to the government:

1) The government should provide the necessary financial and regulatory support for the development of blockchain technology in education.

2) The government should provide educational programs and capacities to increase awareness and competence about blockchain technology in education.

3) The government must provide support for the development of blockchain technology infrastructure in education.

4) The government must pay attention to regulations and laws that apply to the use of blockchain technology in education and ensure compliance with applicable regulations.

5) The government should provide support for the development of blockchain technology applications and solutions in education.

6) The government should provide support for the development of studies and research evaluating the implications of blockchain technology in education.

7) The government should provide support for the development of standards and protocols in blockchain technology for education.

8) The government must provide support for the development of collaboration between government, industry, and academia in the development of blockchain technology in education.

9) The government must pay attention to security and privacy aspects in the use of blockchain technology in education and coordinate with other parties involved.

10) Governments should provide support for the development of initiatives and programs that evaluate the implications of blockchain technology in education.

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