

BLOCKCHAIN IN THE EDUCATION MANAGEMENT INFORMATION SYSTEM (SIMDIK): A SECURE AND SUSTAINABLE DIGITAL GOVERNANCE TRANSFORMATION

Andi Syahrul Ramadhan^{1*}, Nurul Hidayah², Irmayani³, Harmilawati⁴

^{1,2,3,4} Universitas Islam Ahmad Dahlan

*Correspondence email: andisyahrulramadhan66@gmail.com

ABSTRACT

This study aims to explore the perceptions and opinions of academic subjects regarding the integration of Blockchain technology in the Education Management Information System (SIMDIK). The main focus of this study is to understand how stakeholders view Blockchain's potential as a solution to the phenomena of data integrity vulnerabilities and document verification bureaucracy in higher education. Using a qualitative approach with a phenomenological research type, this study explores the essence of the subjects' experiences and critical views on digital data security. Data were collected through an open-ended questionnaire instrument distributed to students at Ahmad Dahlan Islamic University. The results of the study provide an in-depth overview of user expectations regarding data transparency and decentralization, as well as obstacles that may arise in the adoption of this technology. This research contributes to the development of the concept of accountable digital governance to support the achievement of Sustainable Development Goals (SDG) 4 related to education quality.

Keywords: Blockchain, SIMDIK, Phenomenological, Opinions, Data Integrity

1. INTRODUCTION

The implementation of an inclusive and technology-based academic information system has become a vital instrument in supporting the global agenda of the Sustainable Development Goals (SDGs), especially the SDG 4 target to ensure equitable quality of education. (Prasetyo et al., 2025). As a critical component in improving instructional quality, educational technology must be adopted through a framework that ensures long-term scalability and sustainability to address the challenges of technology redundancy (Ling et al., 2023; Moro et al., 2023). The strategic use of Information and Communication Technology (ICT) has proven to be able to expand access to knowledge and address the limitations of conventional resources, although in its implementation it still faces complex obstacles such as bureaucracy and the digital divide (Das & Barman, 2023; Pramjeeth et al., 2023). Therefore, the synergy between progressive

digital policies and inclusive infrastructure is the main key to realizing the vision of sustainable education towards 2030. .

Achieving the 2030 Sustainable Development Goals (SDGs) targets requires a comprehensive transformation in the governance of higher education, which has now become a data-rich entity and is highly dependent on large-scale information technology systems (Damarched, 2026). However, current conventional management methodologies often fail to adapt dynamically to the needs of students and teachers due to over-reliance on static policies and historical data, leading to inefficiencies in decision-making (Song & Wang, 2026). This condition is exacerbated by the use of systems that are not yet integrated, thus hampering the overall productivity of the institution due to data management that is still partial (Deep et al., 2024). In order to overcome this fragmentation, educational institutions rely on a comprehensive management system to unify all academic administration variables

The Education Management Information System (SIMDIK) is an integrated system designed to accelerate the process of collecting, processing, and distributing data to support faster and more accurate educational decision-making (Anjani & Nurahmayanti, 2025). As an information control center, SIMDIK covers the entire process from planning to monitoring institutional elements to continuously improve the quality and performance of the institution (Lokollo & Rumfod, 2024). The presence of this system is crucial in managing large volumes of academic data so that it remains well organized.

However, the effectiveness of data management in SIMDIK often still faces the challenge of fragmentation which requires stronger integration to ensure the accuracy of academic information (Mutmainah et al., 2025). Apart from technical problems, the strategic implementation of this system in the institutional environment also still faces resource and network constraints which affect the overall performance of the institution (Setiawan et al., 2025). This gap between the system's potential and the reality on the ground is what triggers the need for more advanced data security technology.

This need is becoming increasingly urgent given that navigating the current digital era requires special attention to the privacy and security of academic data, which often pose gaps in conventional management systems. This underpins the urgency of using supporting technologies like Blockchain to ensure data integrity and transparency, creating a secure and accountable digital ecosystem (Mulyati et al., 2021). The implementation of Blockchain-based smart contracts offers a solution for storing and verifying academic certificates in a decentralized manner, thus avoiding administrative barriers while speeding up the document validation process efficiently and securely (Leka & Selimi, 2021). Blockchain technology, introduced by Satoshi Nakamoto, serves as a decentralized digital ledger for permanently and transparently recording academic data. This integration will transform SIMDIK into an intelligent administration system capable of eliminating the risk of academic data manipulation. (Kayikci & Khoshgoftaar, 2024).

The implementation of blockchain technology in educational information systems is crucial because of its ability to guarantee that all data entered cannot be easily falsified, lost, or damaged (Ajeng et al., 2023). Through a decentralized approach, this technology offers higher data security guarantees as well as cost and time efficiency compared to conventional systems (Iskamto & Juariyah, 2023). This transition from centralized to decentralized computing supports the creation of a more transparent and secure educational environment, so that the quality of data storage is maintained in a dynamic ecosystem (Haryani et al., 2023).

More than just a technical aspect, the use of blockchain is also able to create technical accountability that supports the values of social justice and transparency, thereby building deeper trust in institutional governance (Semenzin, 2023). With its immutable nature, this synergy ensures that all professional achievements and academic data are permanently stored and grants users full data ownership rights. With its immutable nature, this technology ensures that all evaluation and certification data managed within the system remains credible and grants users full sovereignty over their own data (Sakhipov et al., 2023).

Based on this urgency, this study aims to explore in-depth the perceptions and opinions of the academic community regarding the planned integration of Blockchain technology into the Education Management Information System (SIMDIK). This phenomenological study is expected to dissect the extent to which the use of Blockchain technology is seen as capable of addressing the gap between the demands for absolute data security and the reality of current education management. By focusing on the user perspective, this study goes beyond simply discussing the digitization of administrative processes, but also seeks to map the readiness of institutions to create a transparent, secure, and accountable academic ecosystem. This transformation of thinking is a strategic step towards realizing modern education governance that is robust with integrity and aligned with the vision of quality education by 2030.

To realize this grand vision, this research tactically addresses three key research gaps that differentiate it from previous studies and emphasize its urgency and scientific novelty. First, from a technological functionality perspective, blockchain technology was initially created for one primary purpose: to provide a secure, transparent, and decentralized record-keeping system for the world's first digital (crypto) currency, Bitcoin. However, in this research, this function is applied transformatively to the educational landscape to secure academic management information systems and graduation documents.

Second, there is a gap in the practicality of qualitative data collection instruments, where this study deliberately uses an open-ended questionnaire rather than conventional interviews in order to obtain high efficiency in collecting data from a large number of respondents simultaneously with relatively minimal costs and time; this instrument also provides flexibility for respondents to answer honestly without feeling pressured, maintains privacy through the option of anonymity, and minimizes researcher bias because each question is presented consistently without direct intervention, thus producing more objective and structured narrative data.

Third, from a methodological perspective, this study employs a phenomenological approach, specifically focusing on the opinions, real-world awareness, psychological anxiety, and expectations of English Language Education (TBI) students at Ahmad Dahlan Islamic University, who are both research subjects and end-users, regarding blockchain technology. By integrating these three dimensions, this research aims to fill a gap in the qualitative educational management literature that has been largely unexplored by previous researchers.

2. LITERATURE REVIEW

Blockchain Technology: Architecture, Characteristic, and Data Sovereignty

Blockchain technology, historically initiated by Satoshi Nakamoto in 2008 as the underlying infrastructure for Bitcoin, has now mutated into a new paradigm in global data storage architecture. Fundamentally, blockchain is defined as a decentralized digital ledger that operates without relying on a central authority (clearing house). The absolute advantage of this technology lies in its key characteristics: immutability, transparency, and massive distribution. When academic data or transactions are validated by the network through a consensus mechanism (such as Proof of Work or Proof of Stake), the data is locked within a chronologically linked cryptographic block. This mathematical structure absolutely guarantees that data entered into the network can never be falsified, restructured, moved without permission, or unilaterally deleted by any party (Ajeng et al., 2023).

By implementing a decentralized computing approach, blockchain reduces dependency on a single server, a key target for cyberattacks. This encrypted cybersecurity not only enhances data protection to the highest level but also reduces long-term operational costs and increases processing time efficiency compared to rigid, layered conventional system architectures (Iskamto & Juariyah, 2023). Furthermore, the immutable nature of blockchain restores data sovereignty to the end-user. Within this ecosystem, students and academics have full access to their own data. Consequently, every professional track record, study plan card completion history, and academic evaluation certification managed within the network maintains absolute validity, authenticity, and credibility in the public eye (Sakhipov et al., 2023).

Educational Management Information System (SIMDIK): Framework, Functionality, and Conventional Vulnerabilities

The Educational Management Information System (SIMDIK) is a crucial pillar in the governance of modern educational institutions, functioning as an integrated information control ecosystem. This system is specifically designed to automate, accelerate, and simplify the cycle of collecting, processing, storing, and distributing large-scale data to support fast, accurate, and data-driven strategic decision-making (Anjani & Nurahmayanti, 2025). Functionally, the scope of SIMDIK covers the entire managerial matrix of higher education institutions, from curriculum planning and student database management to monitoring teaching staff performance and regular financial accountability oversight to boost the institution's academic performance sustainably (Lokollo & Rumfod, 2024).

However, despite its vital functionality, empirical reality shows that conventional SIMDIK management in various universities is currently hampered by massive structural challenges. One of the most acute weaknesses is data fragmentation due to sectoral egos between work units, limited local network infrastructure, and inefficient human resource competencies (Mutmainah et al., 2025). The biggest problem stems from its architecture, which still relies on centralized server control. This centralized design creates a fatal weakness in the form of a Single Point of Failure (SPoF), making it highly vulnerable to cyberattacks, data privacy leaks, student identity theft, and even scandals involving the manipulation of academic grades for personal gain. This technical vulnerability is exacerbated by persistent manual bureaucratic inefficiencies, such as the slow process of verifying graduation documents and legalizing physical diplomas, which takes days, is costly, and opens wide opportunities for the proliferation of diploma forgery (Mulyati et al., 2021).

Blockchain Integration in Educational Management: Technological Rigor and Human-Centered Phenomenology

The tactical integration of blockchain technology into the SIMDIK architecture presents both the antithesis and the definitive solution for transforming fragile conventional administrative governance into an intelligent administration system immune to the risks of data manipulation (Kayikci & Khoshgoftaar, 2024). Through the use of smart contract protocols, higher education institutions have the ability to issue, lock, and verify graduation documents, academic transcripts, and digital competency certificates in a decentralized manner. This system automatically cuts through the slow bureaucratic chain of traditional legalization, as third parties (such as recruitment companies or government agencies) can verify the authenticity of documents instantly and independently without needing to contact the original campus (Leka & Selimi, 2021). The application of this cutting-edge technology should not be viewed narrowly as merely a computer hardware or software update, but rather as a form of technical accountability that upholds the values of social justice, transparency, and openness to restore public trust in the integrity of educational institution governance (Semenzin, 2023).

However, the successful implementation and migration of this blockchain-based macro-management system will never be optimally achieved if it only focuses on technological sophistication without measuring the readiness of human subjects in the field. In line with the theoretical foundation of John W. Creswell in 2014 in the study of educational methodology presented by (Hisaanah et al., 2026), the main essence of qualitative research in the educational realm is not simply calculating numbers or static statistical data, but rather exploring in-depth the meaning, real life experiences, and the complexity of the social context experienced directly by the individuals involved. The qualitative approach emphasizes the importance of a comprehensive understanding of the dynamics of social interactions within the educational environment.

Therefore, this literature review emphasizes the theoretical urgency that to realize modern education governance that is resilient, secure, and accountable in line with the vision of global quality education by 2030, the maturity of programming codes and blockchain cryptography

systems must be in line with empirical mapping in the field. This study requires an in-depth exploration of real awareness, subjective perceptions, psychological anxieties towards new technologies, and concrete expectations from the perspective of students, especially non-technical students such as those in the English Language Education Study Program (TBI), as end-users who will interact directly with the digital ecosystem.

3. METHODS

This study employs a qualitative approach to obtain a comprehensive and in-depth picture of the reality of data governance at Ahmad Dahlan Islamic University through a naturalistic perspective. This approach positions the researcher as a key instrument, conducting descriptive exploration to capture the meaning behind the subjects' interactions and perspectives on the information system (Safarudin et al., 2023). By focusing on inductive and holistic data analysis, a qualitative approach allows researchers to dissect underlying assumptions and participants' real-world needs regarding digital data security and integrity. This approach ensures that the data collected is not merely superficial but also reveals high functional relevance to data security needs in academic settings. (Alaslan et al., 2023).

The type of research used in this study is phenomenology. This method was chosen based on the researcher's goal of exploring the essence of individual subjective experiences and the meaning behind phenomena experienced by the academic community regarding digital data integrity (Nasir et al., 2023). This is in line with the basic view of John W. Creswell as cited by (Hisaanah et al., 2026), A qualitative approach focuses on a deep understanding of the meaning, experience, and social context behind a phenomenon in order to explore social or humanitarian issues. Through this lens, phenomenology enables researchers to deeply understand the subject's perceptions through direct, unbiased experience (epoche), thereby uncovering the reality of individual awareness of the urgency of Blockchain technology in educational management (Inayah et al., 2025). By using an open questionnaire instrument, the researcher attempted to capture textural descriptions from respondents to map how this decentralized technology is interpreted as a solution to the vulnerability of academic data (Kristiawan, 2023).

The main instrument in this research is the researcher himself as the key instrument (human instrument) who plays a role in planning, implementing, and analyzing data independently (Ardiansyah et al., 2023), supported by an open-ended questionnaire consisting of 9 core questions distributed digitally via Google Form to 25 respondents from the English Language Education (TBI) study program. The selection of an open-ended questionnaire as a data collection technique aims to obtain a rich textural description of the subject's perceptions and experiences without being limited by rigid answer choices, thus enabling researchers to capture the deep meaning behind the academic community's views on the Blockchain integration phenomenon (Anggita et al., 2024). To ensure the quality of the data obtained, the development of this instrument was carried out systematically to ensure that the questions formulated were able to accurately explore the essence of the phenomenon being studied and remained consistent with the objectives of qualitative educational research. (Pujiharti & Isnaini, 2025), where all the raw narrative data from the 9 field questions then went through a data reduction process to

be narrowed down and mapped into 4 main theme clusters in the discussion in Chapter IV to avoid repeating information.

4. RESULTS AND DISCUSSION

Respondent Characteristic

This study involved 25 student respondents from the English Language Education (TBI) Study Program, Ahmad Dahlan Islamic University, consisting of classes TBI-A and TBI-B in semester 4.

No	Characteristics	Frequency	Percentage
1	Class		
	TBI A Semester 4	14	56%
	TBI B Semester 4	11	44%
2	Gender		
	Male	3	12%
	Female	22	88%
3	Academic Status		
	Active Students	25	100%
	Total Respondents	25	100%

Based on Table 4.1 above, it can be seen that the respondents in this study came from class TBI A, namely 14 students (56%) and class TBI B, namely 11 students (44%). In terms of gender, the characteristics of the respondents were dominated by female students, namely 22 people (88%), while male students numbered 3 people (12%). All respondents were active students in the fourth semester who interact directly with the campus academic information system, so they have the relevant capacity to provide views on the urgency of integrity and security of Blockchain-based academic data.

Analysis of Existing SIMDIK Conditions and Vulnerabilities of Conventional Systems

Before presenting a thematic analysis of respondents' perceptions of decentralized technology integration, this section first outlines the characteristics and urgency of updating the conventional Education Management Information System (SIMDIK) in general. The researchers conducted a structural evaluation of the existing SIMDIK through theoretical and literature reviews to identify security gaps and limitations in administrative efficiency, which will then serve as benchmarks for why new technology alternatives are needed. Essentially, the implementation of SIMDIK in educational institutions is designed to support the quality of educational services, streamline institutional administration, and ensure the standardization of the accuracy of user data recording on a periodic basis. (Putri & Sutapa, 2026).

In its development, SIMDIK acts as an integrative instrument that combines data from various work units into real-time strategic information (Putera & Laxsniky, 2025). This information system plays a vital role in supporting the efficiency of strategic decision-making to improve the quality of governance of educational institutions as a whole (Barus et al., 2025).

The integration of data from manual patterns to the digital ecosystem has also proven to be able to cut bureaucratic barriers between departments, thereby accelerating administrative services to the academic community (Apriyani, 2026), while simplifying the process of evaluating the performance of the institution's basic services (Ansori et al., 2026). However, despite its positive contribution to daily operational efficiency, the majority of conventional SIMDIK platforms currently still rely on a centralized database architecture.

Based on technology governance analysis, this type of completely centralized data storage model harbors massive structural vulnerabilities (data security vulnerabilities). Centralized systems pose weaknesses in the form of data breach risks, potential system-wide failures if the main server experiences a technical failure, and opportunities for internal manipulation by individuals with absolute access rights (privileged admin) (Astuti et al., 2026). The weaknesses of this centralized architecture, when combined with physical verification procedures such as conventional diploma legalization using wet stamps, create new inefficiencies. System users lack the transparency to autonomously track data change history (audit trail), so the level of trust in the authenticity of digital data depends entirely on the subjectivity of the central server administrator. These structural limitations and security gaps in the conventional SIMDIK model serve as the theoretical basis for researchers to underpin subsequent analysis regarding the urgency of integrating decentralized technology.

Thematic Analysis of Research Results and the Urgency of Blockchain Integration

This section presents the results of an in-depth analysis of the narrative responses obtained from a questionnaire completed by 25 respondents from the English Language Education (TBI) study program. Based on a phenomenological approach, qualitative data in the form of students' views, perceptions, and psychological reflections are grouped into several main themes. This grouping serves to map how the weaknesses and structural gaps in the centralized information system discussed previously can be intervened and resolved through the urgent integration of Blockchain technology. In the context of modern educational management, the transition from conventional information architecture to a blockchain-based digital ecosystem is no longer merely a technological trend, but rather a crucial research agenda for mapping the future of adaptive academic administration governance (Nuryahati et al., 2025). The phenomenology of student perception in this chapter becomes an important instrument to track the extent to which conventional platforms trigger user anxiety, considering that blockchain systems are proven to offer absolute transparency as well as strengthen accountability in public administration and institutions (Nadry et al., 2025).

Through a decentralized model, blockchain integration combined with a self-storage system such as the InterPlanetary File System (IPFS) is able to restructure the way educational data records are stored without absolute dependence on a single server. (Ayare et al., 2025). This cryptographic protection not only secures university credentials through the robust "Academic Chain" network (Sharipova et al., 2025), but also acts as a vanguard in detecting and combating academic fraud globally (Arowolo-ayodeji, 2025). By utilizing smart contract

automation, graduation document validation can be shifted to a digital system that is sophisticated, instant, and free from the risk of unilateral manipulation. (Fartitchou et al., 2025).

Based on the latest theoretical foundation, the results of data reduction from the expressions of awareness of 25 TBI respondents are described in the following thick description theme clusters to capture the essence of students' needs for decentralized technology:

a. Theme 1: Concerns about the Existence of Loopholes for Traceless Data Manipulation

The questions in this first theme were designed and explored in depth to assess the level of critical awareness a The questions in this first theme were designed and explored in depth to assess the level of critical awareness and anxiety of students as end-users regarding data security risks in the conventional centralized storage architecture currently commonly used in academic information management platforms (SIMDIK).

Based on qualitative data reduction collected from 25 respondents from the English Language Education (TBI) study program, a consistent psychological pattern emerged, namely a crisis of trust regarding the transparency and authenticity of current digital data tracking. The majority of respondents openly expressed real concerns about the potential for grade manipulation, falsification of academic achievements, or unilateral database changes by internal or external parties with absolute access rights. As one respondent descriptively explained:

"Pernah. Saya merasa khawatir kalau data nilai atau prestasi bisa saja diubah oleh oknum tertentu tanpa adanya jejak yang jelas di sistem. Karena itu, menurut saya sistem penyimpanan data akademik harus memiliki transparansi dan riwayat perubahan agar setiap aktivitas bisa dilacak dengan jelas." (Responden 08, TBI A).

"Yes. I'm worried that grades or achievement data could be changed by certain individuals without any clear trace in the system. Therefore, I believe that an academic data storage system must have transparency and a history of changes so that every activity can be clearly tracked." (Respondent 08, TBI A).

The concerns reflected in the respondents' awareness were reinforced by the views of other students. Respondents highlighted that the widespread abuse of administrative authority and cyber-hacking vulnerabilities in various public institutions today have fueled a persistent sense of insecurity regarding the authenticity of the academic records they painstakingly accumulated during their studies:

"Pernah, tentu saja kekhawatiran tersebut beberapa kali muncul karena semakin maraknya oknum yang beredar di berbagai instansi... Jadi tidak menutup kemungkinan jika ada nilai atau prestasi yang bisa saja diubah oleh oknum-oknum tertentu." (Responden 21, TBI B).

"Of course, this concern has arisen several times due to the increasing number of individuals circulating in various agencies... So it is not impossible that certain individuals could change values or achievements." (Respondent 21, TBI B).

From a phenomenological perspective, the anxiety and digital powerlessness experienced by these students stem from the characteristics of conventional servers, which place absolute administrative privileges in a single, centralized database. When all academic performance data is completely under the control of a third party or a single administrator, students lack the independent tools to monitor, validate, or verify that their grades are completely safe from manipulative external intervention.

Theoretically, the manifestation of respondents' concerns regarding the loopholes of traceless data changes confirms the urgent need for structural transformation toward a new technological architecture capable of ensuring radical public transparency. The use of blockchain technology in education management systems has proven capable of breaking the chain of illegal intervention through a distributed ledger framework. In a decentralized ecosystem, every attempt to add, change, or delete data will be transparently propagated across all network nodes, making any unauthorized data changes instantly detectable and auditable (Nadry et al., 2025).

Furthermore, the basic characteristic of blockchain which cannot be changed unilaterally after being approved (immutability) acts as the highest security instrument (front guard) in detecting and combating academic fraud, falsification of grade documents, and abuse of bureaucratic authority at the level of higher education institutions globally. (Arowolo-ayodeji, 2025). This triangulation proves that the perception of anxiety of TBI students in the field is directly correlated with the urgency of adopting decentralized cryptographic architecture in order to create academic administration governance that is integrated and free from hidden manipulation.

b. Theme 2: The Paradox of Wet Stamp Legalization: Traditionally Safe, But Inefficient

Based on the results of data collection and narrative reduction of questionnaires from 25 respondents of the English Language Education (TBI), a very significant paradox was discovered. On the one hand, the majority of students still consider wet stamps as a form of physical legality that provides a traditional sense of security. However, on the other hand, when faced with the realities of modern-day needs, all respondents complained about this manual bureaucratic aspect because they considered it very outdated, time-consuming, inefficient, and not in line with the current digital acceleration. These operational obstacles were explained frankly by one respondent:

"Menurut saya, legalisir stempel basah masih cukup aman, tetapi kurang efisien di era digital sekarang. Kadang prosesnya memakan waktu, harus datang langsung ke kampus, dan cukup merepotkan kalau digunakan untuk daftar kerja atau beasiswa di luar daerah..." (Responden 02, TBI B).

"In my opinion, wet stamp legalization is still quite safe, but it is less efficient in today's digital era. Sometimes the process takes time, requires coming directly to campus, and is quite troublesome if used to apply for work or scholarships outside the region..." (Respondent 02, TBI B).

In addition to the inefficiencies of space, distance, and time, several students with more advanced digital awareness also highlighted the structural weaknesses of paper-based documents. They realized that in an era of massive digital technological advancement, traditional wet stamps and physical signatures are highly vulnerable to forgery using artificial intelligence-based software, making them difficult for external parties to distinguish from genuine documents:

"Menurut saya masih belum aman dan efisien, melihat banyaknya kasus pemalsuan ijazah dengan mudah di luar sana. Menurut saya stempel basah masih dapat dengan mudah dipalsukan, apalagi dengan adanya teknologi canggih seperti artificial intelligence yang dapat dengan mudah membuat ijazah palsu." (Responden 20, TBI A).

"I don't think it's safe or efficient, considering the many cases of diploma forgery that are easily available. I think wet stamps can still be easily counterfeited, especially with advanced technology like artificial intelligence, which can easily create fake diplomas." (Respondent 20, TBI A).

Phenomenologically, this pattern of responses indicates a shift in students' trust orientation. Students no longer rely on the validity of a document to rely on physical aspects (such as thick paper and stamp ink), but instead desire a new trust mechanism based on encrypted digital data (cryptographic trust). The inefficiency of legalization bureaucracy and the high risk of forgery of physical certificates represent a significant gap that requires the intervention of cutting-edge technology.

Theoretically, the paradox and anxiety felt by TBI respondents can be completely mitigated through the implementation of smart contract technology running on a blockchain network. Through a digital credential management system architecture, every graduation document and diploma issued by a university is locked using a unique cryptographic signature that is inseparable from the institution's identity. This system allows third parties (such as recruitment companies or scholarship providers) to verify the authenticity of students' academic documents instantly, securely, and automatically, without requiring the student's physical presence on campus to request a re-stamping. (Fartitchou et al., 2025). The synchronization between student complaints in the field and the theory of decentralization proves that the adoption of blockchain in the higher education administrative services sector is no longer just a complement to digitalization, but rather an urgent need to restructure service management to be more transparent, fast, and immune to the threat of forgery in the future (Nuryahati et al., 2025).

c. Theme 3: The Urgency of Self-Sovereign Identity for Students

The questions in this third theme were specifically aimed at exploring respondents' perceptions, needs, and critical reflections regarding ownership and control rights over their own academic data. In conventional, centralized education management information systems (SIMDIK), students are in a passive position, constantly relying on campus bureaucracy, faculty operators, or manual administrative queues simply to access, download, or officially share their academic record and transcripts with external parties.

Based on the results of qualitative data reduction from 25 respondents from the English Language Education (TBI), it was found that the conventional bureaucratic interaction model was considered to significantly hinder students' academic and professional mobility. Respondents expressed a strong desire to have full sovereignty over their academic documents within a valid, secure, and legally recognized personal digital ecosystem without intermediaries. This inner feeling and need for autonomy was described by one respondent as follows:

"Sangat perlu. Menurut saya mahasiswa harus memiliki akses penuh dan kontrol mandiri terhadap data akademik mereka sendiri tanpa harus terus bergantung pada sistem birokrasi yang lambat. Dengan adanya kendali mandiri, kita bisa membagikan riwayat nilai atau sertifikat secara instan kapan pun dibutuhkan." (Responden 12, TBI A).

"Absolutely necessary. I believe students should have full access and independent control over their own academic data without having to constantly rely on a slow bureaucratic system. With independent control, we can share grade history or certificates instantly whenever needed." (Respondent 12, TBI A).

This complaint about bureaucratic dependency was reinforced by other respondents. Students recognized that independent data sovereignty would be a significant factor in facilitating their post-campus career integration, especially when dealing with global job recruitment schemes or international scholarship applications that require fast, documented track record verification and freedom from internal technical constraints on campus servers:

"Tentu saja sangat butuh, karena jika data akademik dipegang penuh secara mandiri dengan sistem yang aman, kita tidak perlu khawatir kehilangan akses jika server kampus sedang down atau bermasalah saat kita sangat membutuhkannya." (Responden 05, TBI B).

"Of course it's really needed, because if academic data is fully managed independently with a secure system, we don't have to worry about losing access if the campus server is down or has problems when we need it most." (Respondent 05, TBI B).

From a phenomenological perspective, this pattern of responses reflects the emergence of a mature, intentional awareness among students regarding their right to privacy and digital autonomy based on Self-Sovereign Identity (SSI). Students no longer view themselves as passive data objects forever bound to the blessings of the institution's central server, but rather as the rightful owners of every intellectual achievement they produce.

Theoretically, students' fundamental desire for instant, independent control over their data can be realized through the integration of blockchain architecture with a peer-to-peer decentralized storage system such as the InterPlanetary File System (IPFS). This blockchain-IPFS-based framework transfers control over data encryption from the institution's centralized database directly to students' cryptographic wallets, radically eliminating the risk of single points of failure while simultaneously reducing cumbersome administrative bureaucracy (Ayare et al., 2025).

Through a decentralized credential model called "Academic Chain", TBI students' educational track records can be permanently secured while providing absolute autonomy for them to distribute or share proof of their graduation to third parties (such as recruiting companies or further education institutions) directly, securely, and independently verified without requiring a manual re-verification process from the campus. (Ayare et al., 2025). This triangulation proves that the vision of data autonomy expected by 25 TBI respondents is very much in line with the principle of decentralized information governance offered by today's global blockchain technology.

d. Theme 4: Anticipating Human Error and Immutability Characteristics (Permanent Data)

This fourth theme critically examines students' cognitive awareness and in-depth reflection on the fundamental nature of blockchain technology, which is immutable (data that has been successfully validated and entered into the network is permanent, so it cannot be changed, manipulated, or deleted unilaterally). The main focus of the analysis shifts to examining how the data input administration system in SIMDIK must be thoroughly prepared to eliminate the potential for human error before the data is permanently locked.

The results of the field data collection revealed a very interesting, critical, and cautious pattern of thinking among the 25 respondents from the English Language Education (TBI). On the one hand, students highly appreciate and desire permanent data characteristics to guarantee the integrity and authenticity of their graduation documents, thus preventing external forgery. However, on the other hand, a logical concern arose: if campus operators or administrators make typos in names, student ID numbers, or grades early in the input process, the administrative error will be locked forever within the blockchain network. Therefore, all respondents emphasized the importance of confirmation mechanisms, input transparency, and multi-layered verification processes before data is uploaded to the digital ecosystem. This pattern was described by one respondent:

"Karena sistem ini tidak bisa diubah setelah di-upload, maka tingkat ketelitian saat input data di awal harus 100% akurat. Harus ada verifikasi ganda antara dosen dan mahasiswa terlebih dahulu sebelum data tersebut dikunci secara permanen di dalam blockchain." (Responden 17, TBI B).

"Because this system cannot be changed once uploaded, the initial data input must be 100% accurate. Double verification between the lecturer and the student is required before the data is permanently locked in the blockchain." (Respondent 17, TBI B).

This concern about human operational aspects was also emphasized by other respondents. Students believed that the reliability of advanced encryption technology must be balanced with careful work procedures at the study program or university administration level to avoid harming students' academic records:

"Sifat permanen blockchain itu bagus untuk mencegah pemalsuan ijazah, tapi mengerikan kalau ada salah ketik nama atau nilai dari admin kampus. Jadi menurut saya, sistem inputnya harus memiliki konfirmasi berlapis agar mahasiswa bisa memeriksa ulang sebelum data disahkan." (Responden 14, TBI A).

"The immutability of blockchain is great for preventing diploma forgery, but it's scary if a campus administrator mistypes a name or grade. So, I think the input system should have multiple levels of confirmation so students can double-check the data before it's validated." (Respondent 14, TBI A).

From a phenomenological perspective, this cognitive phenomenon demonstrates that students are fully aware that adopting cutting-edge, cryptographically secure technology cannot be achieved in isolation but must be accompanied by rigorous human governance. The immutable nature of blockchain is indeed a globally recognized advantage in disrupting the chain of document forgery and ensuring the long-term integrity of educational records. However, to uphold the principle of public accountability and minimize human error, the implementation of smart contract systems must not grant absolute single input rights but must be rigidly designed, involving multi-party authorization.

In response to the multi-layered verification expectations of TBI students, the institutional information technology governance architecture can adopt a rigid digital role-sharing scheme, similar to the BlockMEDC model. The validation mechanism before data is broadcast to the network (on-chain) must clearly separate roles into three compartments: lecturers/admins as the initial input of grade data (validators), study program heads as accuracy reviewers, and the rectorate/academic bureau as the official issuer after students confirm approval (user-checking process). Through this synchronization, the implementation of blockchain technology or Blockcerts in higher

education can align the power of decentralized data protection with human operational precision, thus creating a transparent, secure, and error-free educational management information system.

5. CONCLUSION AND LIMITATION

Based on the results of thematic analysis and qualitative data reduction on the narrative answers of 9 open-ended questionnaire items filled out by 25 respondents from the English Language Education (TBI) study program, this study concludes that there is a very real urgency for the transformation of academic information architecture in higher education. Field findings indicate a crisis of psychological trust among students regarding the security of conventional centralized servers that are considered vulnerable to loopholes for manipulation of grades without a trace. This concern collaborates with sharp criticism of the traditional legalization process based on wet stamps that are considered outdated, inefficient, time-consuming, and easily falsified in the era of advances in artificial intelligence.

As a solution, students collectively desire a shift in governance toward self-sovereign identity, with autonomous control of digital access or private keys. This transfer of control would automatically and instantly verify the authenticity of diplomas and graduation documents to external parties or companies, eliminating the need for lengthy campus bureaucracy.

While the immutable and transparent characteristics of blockchain data are widely accepted as a frontline measure to curb administrative fraud, students continue to highlight the challenges of this technology's rigidity and vulnerability to human error. Therefore, the implementation of blockchain technology at the institutional level must synergize the strength of cryptography with a layered confirmation system and multi-party authorization to ensure data validity before it is permanently locked. Ultimately, this study confirms the very high level of acceptability and user readiness among TBI students to learn and adopt a digital wallet application specifically for academic credentials to ensure the security, authenticity, and integrity of their data for life.

6. REFERENCES

- Ajeng, M., Kirei, A., & Amanda, K. (2023). Blockchain Technology Application for Information System Security in Education. *Journal Pandawan*, 3(1), 25–31.
- Alaslan, A., Amame, A. P. O., Suharti, B., Laxmi, Rustandi, N., Sutrisno, E., Rustandi, Rahmi, S., Darmadi, & Richway. (2023). *Metode Penelitian Kualitatif*.
- Anggita, L., Sulistri, & Dewi, D. E. C. (2024). Perbandingan Teknik Pengumpulan Data dan Instrumen Penelitian Tesis Pada Pendekatan Kualitatif dan Kuantitatif. *INNOVATIVE: Journal Of Social Science Research*, 4(6), 1187–1196.
- Anjani, M., & Nurahmayanti, A. (2025). Penerapan SIMDIK dalam Meningkatkan Akurasi Data untuk Perencanaan Pendidikan di SMA Negeri 1 Cigugur. *Literasi: Journal of Innovation Literacy Studies*, 2(2), 241–250.

- Ansori, A., Hidayah, N., Prawesti, I., Surya, A., & Choir, M. (2026). The Role of Educational Management Information System In Improving The Quality of Education at SDN 19 Pekanbaru. *Jurnal Manajemen Pendidikan Islam*, 11(01), 32–40.
- Apriyani, A. (2026). Transformasi Digital Dalam Manajemen Pendidikan: Integrasi Sistem Informasi Untuk Efisiensi Di Sekolah. *Jurnal Pendidikan Islam Dan Sosial Keagamaan*, 05(02), 113–120.
- Ardiansyah, Risnita, & Jailani, M. S. (2023). Teknik Pengumpulan Data Dan Instrumen Penelitian Ilmiah Pendidikan Pada Pendekatan Kualitatif dan Kuantitatif. *IHSAN: Jurnal Pendidikan Islam*, 1(2), 1–9.
- Arowolo-ayodeji, A. (2025). The Role of AI and blockchain in combating academic fraud. *World Journal of Advanced Research and Reviews*, 25(2), 1341–1357.
- Astuti, N., Nurhasanah, Nurfitriani, T., Elisa, N., Azzahra, S., Fitri, M., & Anwar, M. (2026). Tantangan Dalam Implementasi Sistem Informasi Manajemen Pendidikan. *Jurnal Pedagogi Dan Inovasi Pembelajaran*, 2(1), 5–9.
- Ayare, A. A., Jadhav, V. A., Banatwala, M. K., Changlere, S. V, Mote, A., & Joshi, P. (2025). A Systematic Review on Blockchain-Based Framework for Storing Educational Records Using InterPlanetary File System. *Cureous Journal of Computer Science*, 1–28. <https://doi.org/10.7759/s44389-024-00745-y>
- Barus, R., Fardila, A., Zulaikha, S., & Takdir, M. (2025). Peran Teknologi Informasi dalam Pengambilan Keputusan Strategis di Lembaga Pendidikan : Kajian Sistematis. *Jurnal Pengabdian Masyarakat Dan Riset Pendidikan*, 3(4), 5505–5517.
- Damarched, M. K. (2026). Digital Transformation Strategies for Higher Education - Enterprise IT Systems. *International Journal of Novel Research and Development*, 11(1), 780–791.
- Das, P., & Barman, D. P. (2023). International Journal of Research Publication and Reviews Does ICT Contribute Towards Sustainable Development in Education ? An Overview. *International Journal of Research Publication and Reviews*, 4(7), 544–548.
- Deep, S., Athimoolam, K., & Enoch, T. (2024). International Journal of Current Science Research and Review Optimizing Administrative Efficiency and Student engagement in Education : The Impact of AI. *International Journal of Current Science Research and Review*, 07(10), 7792–7804. <https://doi.org/10.47191/ijcsrr/V7-i10-34>
- Fartitchou, M., Lamaakal, I., Makkaoui, K. El, Allali, Z. El, & Maleh, Y. (2025). BlockMEDC : Blockchain Smart Contracts System for Securing Moroccan Higher Education Digital Certificates. *IEEE Access*, 13(February), 39152–39175. <https://doi.org/10.1109/ACCESS.2025.3546177>
- Haryani, H., Wahid, S. M., Fitriani, A., & Ariq, M. F. (2023). Analisa Peluang Penerapan Teknologi Blockchain dan Gamifikasi pada Pendidikan. *Jurnal Mentari: Manajemen Pendidikan Dan Teknologi Informasi*, 1(2), 163–174.
- Hisaanah, K., Hayadi, B. H., Nurlena, E., Zikriyanto, W., Oktalia, H., & P, M. W. S. (2026).

- Metode kualitatif dan kuantitatif dalam penelitian pendidikan. *Jurnal Ilmiah Pendidikan Dan Keislaman*, 6(1), 37–43.
- Inayah, P., Habsy, B. A., & Nursalim, M. (2025). Kajian Literatur Metodologi Penelitian Fenomenologi. *Jurnal Pendidikan Integratif*, 6(2), 760–770.
- Iskamto, D., & Juariyah, L. (2023). Blockchain Technology Challenge in the Future : Data Security and Efficiency. *International Journal of Law Policy and Governance*, 2(2), 65–75.
- Kayikci, S., & Khoshgoftaar, T. M. (2024). Blockchain meets machine learning : a survey. *Journal of Big Data*, 11(9), 1–29. <https://doi.org/10.1186/s40537-023-00852-y>
- Kristiawan, Y. B. (2023). Pendekatan Fenomenologi Pada Proses Pemrograman Arsitektural. *Jurnal Arsitektur Arcade*, 7(2), 335–341.
- Leka, E., & Selimi, B. (2021). Development and Evaluation of Blockchain based Secure Application for Verification and Validation of Academic Certificates. *Annals of Emerging Technologies in Computing*, 5(2), 22–36. <https://doi.org/10.33166/AETiC.2021.02.003>
- Ling, L. Y., Tahir, M. H. M., & Chsing, L. C. (2023). Bibliometric Visualization of Literature on Information and Communications Technology (ICT) in Education. *Malaysian Journal of Communication*, 39(1), 490–513.
- Lokollo, L. J., & Rumfod, S. (2024). *Sistem Informasi Manajemen Pendidikan*.
- Moro, C., Mills, K. A., Phelps, C., & Birt, J. (2023). The Triple - S framework : ensuring scalable , sustainable , and serviceable practices in educational technology. *International Journal of Educational Technology in Higher Education*, 20(7), 1–15. <https://doi.org/10.1186/s41239-022-00378-y>
- Mulyati, Aris, Gunawan, I. K., & Zahran, M. S. (2021). Blockchain Technology : Can Data Security Change Higher Education Much Better ? *International Journal of Cyber and IT Service Management*, 1(1), 121–135.
- Mutmainah, L., Rostika, I., & Nurlatipah, D. (2025). Integrasi SIMDIK dengan Sistem DAPODIK : Peluang dan Tantangan dalam Meningkatkan Pengelolaan Data Pendidikan. *Literasi: Journal of Innovation Literacy Studies*, 2(2), 261–269.
- Nadry, Z., Sirat, A. W., Hakimi, M., & Quraishi, T. (2025). Integrating Blockchain in Educational Management Systems: Transparency and Accountability In Public Administration. *Jurnal Ilmiah Dinamika Sosial*, 9(2), 286–309.
- Nasir, A., Nurjana, Shah, K., Sirodj, R. A., & Afgani, M. W. (2023). Pendekatan Fenomenologi Dalam Penelitian Kualitatif. *INNOVATIVE: Journal Of Social Science Research*, 3(5), 4445–4451.
- Nuryahati, I. K., Assim, M. I. S. A., Kurniasih, N., Nuriman, H., Pradana, M., & Pramiyanti, A. (2025). Blockchain in education : a bibliometric study and future research agenda. *Cogent Arts & Humanities*, 12(1), 1–13. <https://doi.org/10.1080/23311983.2025.2508028>

- Pramjeeth, S., Nupen, D. M., & Jagernath, J. (2023). Challenges Impacting Higher Education Leaders in Achieving the Sustainable Development Goal of Quality Education in South Africa. *African Journal of Inter/Multidisciplinary Studies*, 5(1), 1–13.
- Prasetyo, I., Nugroho, A. A., Damayanto, A., & Fathoni, M. I. (2025). ASEAN Journal of Science and Engineering Developing an Inclusive ICT-Based Academic Information System Using REST API to Promote Sustainable Development Goals (SDGs) in Higher Education. *Asean Journal of Science and Engineering*, 5(2), 395–416.
- Pujiharti, E. S., & Isnaini, U. (2025). Instrumen dan Pengumpulan Data Dalam Meningkatkan Kualitas Data Pada Penelitian Pendidikan. *AH NAHDLIYAH: Jurnal Manajemen Pendidikan Islam*, 4(1), 35–47.
- Putera, R. A. K., & Laxsniky, R. S. (2025). Peran Sistem Informasi Manajemen Pendidikan Dalam Mendukung Pengambilan Keputusan Strategis Untuk Peningkatan Kinerja Lembaga. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, 10(4), 817–829.
- Putri, F. N. W., & Sutapa, M. (2026). Implementation of the Primasi Application-Based Management Information System to Support the Quality of Educational Services at the Prima Swarga Bara Education Foundation, East Kutai Regency. *Journal of Educational Sciences*, 10(5), 443–461.
- Safarudin, R., Kustati, M., & Sepriyanti, N. (2023). Penelitian Kualitatif. *Journal of Social Science Research*, 3(2), 9680–9694.
- Sakhipov, A., Baidildinov, T., Yermaganbetova, M., & Ualiyev, N. (2023). Design of an Educational Platform for Professional Development of Teachers with Elements of Blockchain Technology. *International Journal of Advanced Computer Science and Applications*, 14(7), 519–528.
- Semenzin, S. (2023). ‘ Blockchain for good ’ : Exploring the notion of social good inside the blockchain scene. *SageJournals*, 10(2), 1–14.
<https://doi.org/10.1177/20539517231205479>
- Setiawan, U., Bagus, S., Wulandari, D., Megawati, I., & Salman. (2025). Digital Transformation of Madrasahs : The Strategic Role of EMIS-Based SIMDIK in Improving Institutional Performance. *Tafkir: Interdisciplinary Journal of Islamic Education*, 6(2), 499–512.
- Sharipova, Z., Mardonova, R., Begbutayev, A., Makhkamova, S., Sapaev, I. B., Karimova, S., Nigmatova, K., & Rakhmatova, G. (2025). Academic Chain : Securing Educational Credentials with. *Journal of Internet Services and Information Security*, 15(2), 374–386.
<https://doi.org/10.58346/JISIS.2025.I2.027>
- Song, Y., & Wang, N. (2026). Application of Big Data Analytics in Education Management: Enhancing Teaching Quality and Resource Allocation Efficiency. *International Journal of High Speed Electronics and Systems*, 35(4), 1–39.
<https://doi.org/10.1142/S0129156425406370>