
Application of Blockchain Technology at Sekolah Islam Terpadu Al-Madinah

Mohammad Kahfi Abdul Azis^{1*}, Dewi Wahyuningsih², Yuyun Elizabeth Patras³

¹SD Islam Terpadu Al-Madinah, Kabupaten Bogor, Indonesia

²TK Islam Terpadu Al-Madinah, Kabupaten Bogor, Indonesia

³Universitas Pakuan, Kota Bogor, Indonesia

*Corresponding Author: mohammadazis39@guru.sd.belajar.id

Abstract: The purpose of this study is to discuss Blockchain Technology and the application of Sisko at the Al-Madinah Integrated Islamic School, where the student's cognitive development varies from 4 years to 17 years old. This article uses the library research method which refers to 19 articles downloaded from Google Scholar and Crossref. Blockchain technology is a system that limits its users according to its boundaries but can still relate to other users. One of the systems for implementing Blockchain Technology at the Sekolah Islam Terpadu Al-Madinah is Sisko SIT Al-Madinah, which contains a database about education from Kindergarten to High School within the Al-Madinah Integrated Islamic School. The menu in the Sisko system is different for each user, for example, students use Sisko for exams and assignments, teachers use Sisko to input grades and savings, principals and vice principals use Sisko to manage curriculum, add and edit student data, map students into classes, and finally the Sisko admin uses it to add and edit report formats, map user accounts, and archive school databases. Sisko is highly recommended for schools that want to be more effective and efficient in managing data, finances, learning outcomes, and in archiving all of their data because schools must be ready to shift into school digitalization in this era.

Keywords: *Al-Madinah integrated Islamic school, Sisko, technology blockchain.*

INTRODUCTION

Education is an essential thing every individual should own in the country. In the Qur'an, it is said that the prophet Muhammad (peace be upon him) is the one who teaches the children all sorts of things. Education is also very closely related to where education occurs, one of which is the place of formal education (Indonesia, 2003). Formal education is divided into several levels: 1. Basic Education (Elementary School) Junior High School; 2. Middle Education (High School); 3. Higher education (Bachelor's degree, Master's degree, residency, and doctoral program). Bafadhhol (2017) in his explanation, institutions providing formal education, among others such as: (a) Kindergarten (TK), (b) Raudatul Athfal (RA), (c) Elementary School (SD), (d) Madrasah Ibtidaiyah (MI) (e) Junior High School (SMP), (f) Madrasah Tsanawiyah (MTs), (g) Senior High School (SMA), (h) Madrasah Aliyah (MA), (i) Vocational High School (SMK), (j) Higher Education, including; Academies, Polytechnic, College, Institute, and Universities.

In the theory of children's cognitive development, Jean Piaget divided the stages according to the child's age. The stages of cognitive development are the sensory-motor stage (age 0-2 years), the pre-operational stage (age 2-7 years), the concrete operational stage (age 7-11 years), and the formal operational stage (age 11-15 years) (Mu'min, 2013).

Early childhood is a child aged 0-6 years with more rapid and fundamental growth and development in the early years of life. Development refers to a process in a more perfect direction that cannot be repeated (Khadijah, 2016). Elementary school education (6-12 Years) is an essential, fundamental, and important endeavor. When children reach this age, they begin to think, see, and make good movements and behaviors (Elihami, 2022). Junior High School (13-15 Years) is a basic education level that aims to lay the foundation of intelligence, knowledge, personality, noble character, and skills to live independently and take part in further education (Mawaddah & Maryanti, 2016). The development of high school students (15-18 Years), the formal operational stage, is still the same as the previous stage, only the development is more complex, where they develop new tools to manipulate information, further develop their intellectual skills, integrate what they have experienced with theory or concepts (Asih, 2018)

Sekolah Islam Terpadu Al-Madinah has students covering all stages of Jean Piaget's cognitive development within the scope of one environment separated from each educational unit building from kindergarten, elementary school, junior high school, and high school. Realizing that children's development determines their future abilities, Sekolah Islam Terpadu Al-Madinah has created a learning support system in schools with properties such as blockchain technology for mapping and organizing databases.

The system is a set of interconnected components that work together to achieve some goals. Besides that, another understanding of the system consists of elements and input, processing, and output (Agustin, 2018). An information system is a combination of people, technological facilities or tools, media, procedures and controls intended to organize a communication network that is important to users or recipients (Ahmad & Hasti, 2018). *Sistem Informasi sekolah* (Sisko) is a means or tool for conveying information owned by schools, such as announcements of activities, use of budgets, reports on student learning outcomes and others to parents who are entitled to obtain this information. Ruoti et al., (2020) explain that Blockchain technology was originally the name given to the design that underlies the operation of the digital currency Bitcoin. The essence of the operation of the Bitcoin blockchain is that whenever two network members do a transaction, they announce their transaction to all network members (nodes), who record the transaction into a block with limited capacity. Blockchain consists of a collection of data consisting of a chain of data packets (blocks), where one block consists of several transactions. The blockchain is extended by each additional block and thus represents a complete ledger of transaction history (Nofer et al., 2017). Blockchain is also a distributed ledger consisting of a large number of independent nodes that together maintain the integrity and security of data stored in different blocks (Liang et al., 2021). The purpose of this study is to apply blockchain technology at SIT Al-Madinah, which is to apply a distributed data collection ledger to each user with varying access restrictions to produce various reports. Sisko, which stands for School Information System, is one of the systems used in the Al-Madinah Integrated Islamic Elementary School, whose purpose is to connect school members, such as teachers, principals, students, parents, etc. by producing data and reports that are easily accessible.

RESEARCH METHODS

In this article, writers use the Library Research method, which can be interpreted as a literature study, by reading, studying, and recording matters relating to sources of

information obtained from scientific books, research reports, scientific essays such as scientific articles, journals, theses, dissertations, regulations, decrees, encyclopedias, and written sources both printed manually and electronically. As Explained by Syafitri & Nuryono (2020), literature study is a method that can be used in research by reading and examining matters relating to the object to be studied. Sari & Asmendri (2018) argues that library research is a research activity carried out by collecting information and data with the help of various materials available in the library or from sources on the internet related to the problem to be solved. Activities are carried out systematically to collect, process, and conclude data using certain methods and techniques to find answers to the problems faced.

In this case, the author searches for articles relevant to the theme discussed, and finds 11 articles which form the basis of reference for the discussion of this article, from article Google Scholar and Crossref with the keywords Blockchain. In addition to the library study method, it was also observed that schools other than SIT AL-Madinah had implemented the systems and their benefits were like blockchain technology. For instance, SD IT Aliya had Web Based Technology and Smart School Systems, or in general, all schools with Dapodik and Emis applications. Also, it applies in the Ministry of Education and Culture's E-Rapport, every school that uses it, both Elementary Schools, Junior High Schools, and High/Vocational High Schools.

RESULTS AND DISCUSSION

Blockchain Technology

Less than 17 years ago, Satoshi Nakamoto released Bitcoin, the first network to be considered a blockchain, intending to serve as a peer-to-peer ledger for electronic payments. Bitcoin became the first successful crypto-cash attempt, following the failures of DigiCash, First Virtual, CyberCash, and many others (Allende, 2021). At first, Blockchain Technology was the name given to the design that underlies the operation of the digital currency Bitcoin (Ruoti et al., 2020). Bitcoin is a virtual currency designed for anonymous payments that are made completely independently of governments and banks (Billi & Vredin, 2014). So at first, blockchain technology was born due to the operation of the bitcoin virtual currency. As per the author's understanding, the term blockchain consists of two words, namely "block", which means blocking or limiting, and "chain", meaning a chain; therefore, blockchain technology is a system that limits its users according to their boundaries but can still be connected with other users. Blockchain technology is the latest breakthrough in secure computing without a central authority in an open network system. From a data management perspective, a blockchain is a distributed database that keeps track of a growing list of transaction records by organizing them into a hierarchical

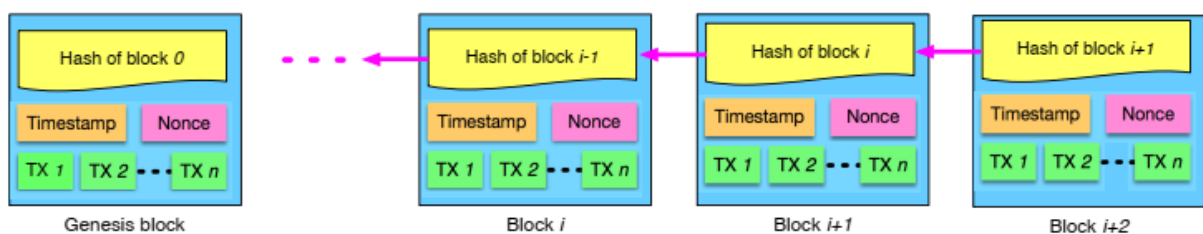


Figure 1. Example Of Teknologi Block Chain (Merkx, 2019)

blockchain. From a security perspective, blockchains are created and maintained using peer-to-peer overlay networks and secured using intelligent and decentralized cryptography with crowd computing (Zhang et al., 2019). An overview of blockchain technology can be seen in Figure 1.

The characteristics of the blockchain are described by [Seebacher & Schüritz \(2017\)](#) in the article *Blockchain technology as an enabler of service systems: A structured literature review* consists of two main characteristics, namely Trust and Decentralization ([Seebacher & Schüritz, 2017](#)). Trust in blockchain technology here is trust between users in data or other users, while decentralization here gives authority to users to fill in each data according to their main daily work tasks which can be seen in [Figure 2](#).

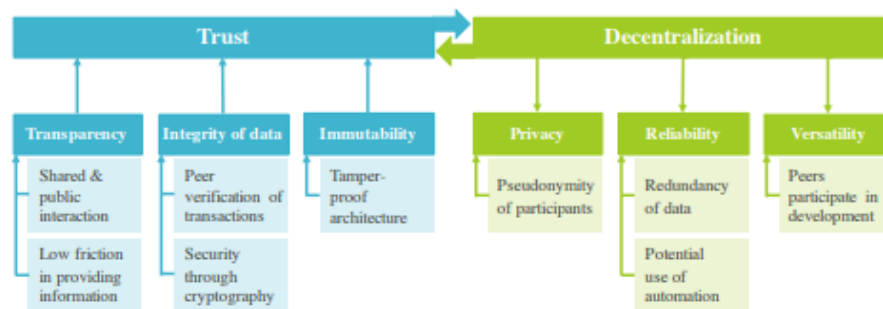


Figure 2 : Trust and Decentralization (Seebacher & Schüritz, 2017)

Application of Blockchain Technology

After reviewing and understanding blockchain technology, it turns out that the author indirectly realizes that the Sekolah Islam Terpadu Al-Madinah has implemented blockchain technology with a system called Sistem Informasi Sekolah, abbreviated as SISKO. Due to some of the characteristics of the blockchain, which include being decentralized, there is collected data and user access rights are limited, but each user can also be connected to the network and system. As [Kosasi \(2020\)](#) explains the characteristics of the blockchain include:

- a. Disintermediation over Intermediation means applying disintermediation to the context of the blockchain-based education world and can decentralize the system while still providing a coherent view to the user.
- b. Decentralization over Centralization ensures that decentralization over centralization can work properly because it reduces the accumulation of work in education service centers.
- c. Trustless over Trust, Tailor-made blockchain applications have the potential to flexibly and robustly solve the difficult problem of sharing student data in untrustworthy educational establishments. Blockchain creates a system of trust in the education sector.
- d. Immutability over Mutability, blockchain which has the character of immutability and has been handled optimally can revolutionize data that was previously mutability in the education sector.
- e. CR/UD (Create, Read, Update, Delete) Database.

Sisko Sekolah Islam Terpadu Al-Madinah was originally created to facilitate the assessment of cross-subject teachers by the homeroom teacher and report it to students and parents. The use of the Sisko application aims to meet the need for administrative services and the benefits of increasing effectiveness and efficiency in administrative management, including academic management, financial management, and data management in decision-making. The management of the Sisko component includes maintenance of facilities and infrastructure, human resource development, application maintenance, and data maintenance so that the implementation of an education management information system can be described as a whole. Based on the elaboration

above, applying a Sisko-based management information system at SIT Al-Madinah Bogor includes using Sisko application and managing its supporting components. The following is an overview of Sisko's implementation of blockchain technology, which can be seen in [Figure 3](#).

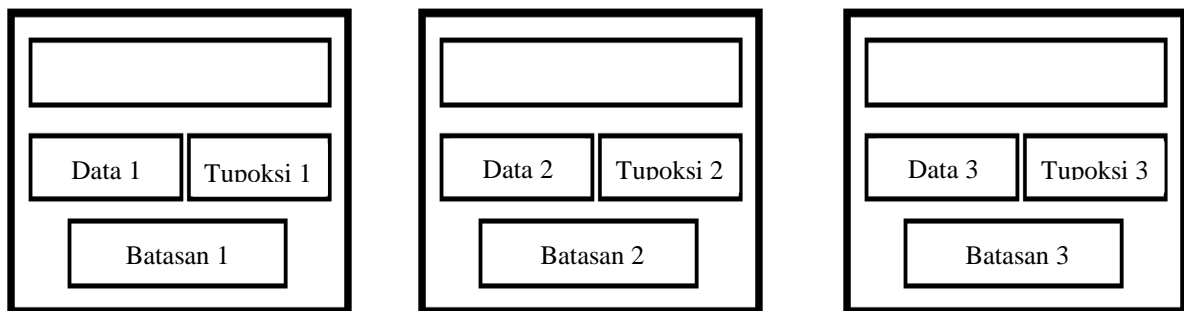


Figure 3. A Simple Overview of Blockchain at SIT Al-Madinah

In its application, each Sisko user also has limitations, such as those of blockchain technology. The Sisko application admin only corrects the report format, checks that the algorithm or formula is correct, and responds to menu or format change requests submitted by the school principal. The limitation is that the admin may not map students, add student data and provide grades. Furthermore, the principal and deputy principal's role is to ensure the system flow according to what the school wants, check how far the teacher fills in the grades, map students and add students' data. Then the teacher in the Sisko application only adds learning data, provides assessments, and updates student savings financial data. The teacher's limitation is that he cannot edit student data or create report formats in the Sisko application. In Sisko, students only work on questions facilitated by the Sisko teacher, check their savings, and print exam cards. The following is an overview of the menu in Sisko.

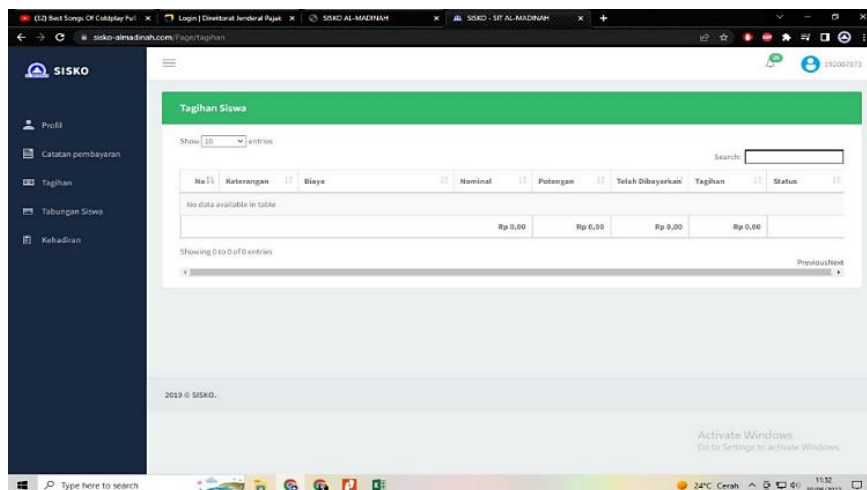


Figure 4. Sisko Menu for Students

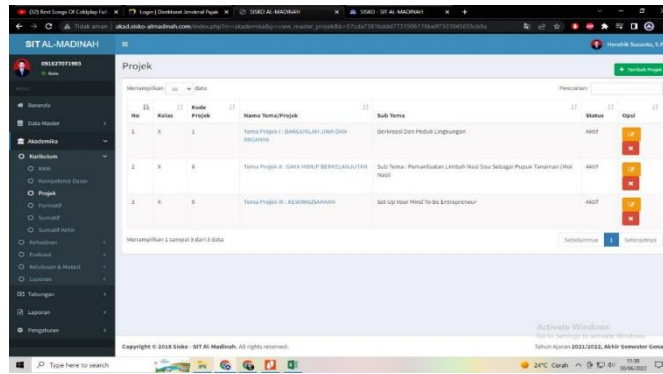


Figure 5. Sisko Menu for Teachers and Principals



Figure 6. Sisko Menu for Sisko Admins

The student menu consists of profiles to check student data, payment notes to check payments, invoices to check kit bills if they have not paid, student savings to check savings amounts and transactions, and an attendance menu to check student attendance at school. The limitations on students are also very clear compared to the menus that the teacher and admin have. The teacher menu that can be accessed is the Academic menu on the curriculum, especially for inputting basic competencies, inputting grades or student evaluations, inputting student attendance, and printing grade ledgers and reports. In addition to the academic menu, the teacher is given a savings menu to input the nominal student savings per day. The limits are very clear, one of which is that teachers cannot access student data and map students into classes. The Sisko Admin menu consists of the Period time for creating learning periods and backing up previous period data, the Authority menu for dividing teacher teaching assignments in their class, and providing access to all users according to their needs. The limit is that this administrator cannot take part in implementing the curriculum or assessing students.

Impact of Blockchain Technology

[Guustaaf et al. \(2021\)](#) explain the usefulness of blockchain for education problems. One that is currently growing is a digital certificate based on blockchain technology, which secures certificates from counterfeiting by verifying and authenticating. The Student-Centered Learning Blockchain (SCi-B) provides many benefits, which is increasing the credibility of student assessment evidence using Hash Blockchain so that it can be authenticated and the learning process is not limited by space and time ([Rahardja, 2023](#)). Aside from [Rahardja's](#) explanation earlier, similar applications are even included in blockchain technology, which is very useful for education. [Nugraha \(2022\)](#) argues that Blockchain technology in its application can be useful (1) as a digital identity, (2) as a distributed storage system, and (3) as a decentralized monitoring tool. [Aini et al. \(2021\)](#) explain in their article that the benefits obtained are: (1) security level; (2) data access

control; (3) accountability and transparency; (4) trust; (5) low cost; (6) identity authentication; (7) student assessment; (8) development of data exchange and management of student records; and (9) expanding interactivity. While the weaknesses described are: (1) triggering an increase in block size due to the large number of transactions; (2) privacy and security from malicious attackers; (3) initial cost to adopt the system; (4) trust to provide data; (5) difficulties in determining the limits for each user; (6) provisions are still weak on data protection; (7) lowering the value of traditional school credentials. These weaknesses are also supported by Noor (2020), which explained that some archival experts consider blockchain unable to provide certainty in long-term use, one of the most underlying reasons is that blockchain does not hold digital archives as a whole but is divided into many locations and this results when the blockchain network dies (for many reasons) can lower the degree of authenticity and be hard to trust.

In addition to the impact described above, the Al-Madinah Integrated Islamic School also experiences some advantages and disadvantages of implementing Sisko. Some of the advantages of its application include: (1) a more efficient way of exchanging data; (2) increasing the selling value of schools; and (3) making it easier to report activities, costs, and student records to other users. (4) more accurate data search; (5) facilitate archiving and tracking. While the weaknesses that we feel are: (1) Working must be connected to the internet where there are a lot of network interruptions, such as when it is raining; (2) the initial cost of implementation is expensive; and (3) users must have access to media such as laptops or smartphones.

CONCLUSION

Blockchain technology was born out of bitcoin's need for its first network to be considered a blockchain, to serve as a peer-to-peer ledger for electronic payments. So blockchain technology is a system that limits its users according to its boundaries but can still stay connected with other users. The characteristics of blockchain technology are the existence of a large database and user limits, as well as the decentralization of users and trust in the database.

In the application of blockchain technology in the Sekolah Islam Terpadu Al-Madinah, by using Sisko (Sistem Informasi Sekolah), each user has a main job, and there are also limitations for each user in the system. This is exemplified by the availability of different menus for each user.

In its application, there are also some advantages and disadvantages. The impacts received by the school management in implementing Sisko at SIT Al-Madinah include more efficient ways of exchanging data, increasing school selling points, easier reporting of activities, costs, and student records to other users (parents and stakeholders), more accurate data searching, and facilitate archiving and tracing.

REFERENCE

- Agustin, H. (2018). Sistem Informasi Manajemen Menurut Prespektif Islam. *Jurnal Tabarru': Islamic Banking and Finance*, 1(1), 63–70.
- Ahmad, R. F., & Hasti, N. (2018). Sistem Informasi Penjualan Sandal Berbasis Web. *Jurnal Teknologi Dan Informasi*, 8(1), 67–72.
- Aini, Q., Rahardja, U., Santoso, N. P. L., & Oktariyani, A. (2021). Aplikasi Berbasis Blockchain

- dalam Dunia Pendidikan dengan Metode Systematics Review. *CESS (Journal of Computer Engineering, System and Science)*, 6(1), 58.
- Allende, M. (2021). *Technical Leader of LACChain and IT Specialist in Blockchain, SSI, and Quantum Technologies at IDB, USA Lacchain Framework For Permissioned Public Blockchain Networks From Blockchain Technology To Blockchain Networks*.
- Asih, T. (2018). Perkembangan tingkat kognitif peserta didik di kota metro. *Didaktika Biologi: Jurnal Penelitian Pendidikan Biologi*, 2(1), 9–17.
- Bafadhol, I. (2017). Lembaga Pendidikan Islam Di Indonesia. *Jurnal Edukasi Islami Jurnal Pendidikan Islam*, 06(11), 59–72.
- Billi, R. M., & Vredin, A. (2014). Monetary policy and financial stability – a simple story. *Sveriges Riksbank Economic Review*, 2, 7–22.
- Elihami, E. (2022). Supporting about ‘education’ in elementary School: A review of literature. *Mahaguru: Jurnal Pendidikan Guru Sekolah Dasar*, 3(1), 42–48.
- Guustaaf, E., Rahardja, U., Aini, Q., Santoso, N. A., & Santoso, N. P. L. (2021). Desain Kerangka Blockchain terhadap pendidikan: A Survey. *CESS (Journal of Computer Engineering, System and Science)*, 6(2), 236.
- Indonesia, P. R. (2003). Undang-undang Republik Indonesia nomor 20 tahun 2003 tentang sistem pendidikan nasional. Khadijah. (2016). *Pengembangan Kognitif Anak Usia Dini*.
- Kosasi, S. (2020). Karakteristik Blockchain Teknologi Dalam Pengembangan Edukasi. *ADI Bisnis Digital Interdisiplin Jurnal*, 1(1), 87–94.
- Liang, W., Zhang, D., Lei, X., Tang, M., Li, K. C., & Zomaya, A. Y. (2021). Circuit Copyright Blockchain: Blockchain-Based Homomorphic Encryption for IP Circuit Protection. *IEEE Transactions on Emerging Topics in Computing*, 9(3), 1410–1420.
- Mawaddah, S., & Maryanti, R. (2016). Kemampuan Pemahaman Konsep Matematis Siswa SMP dalam Pembelajaran Menggunakan Model Penemuan Terbimbing (Discovery Learning). *EDU-MAT: Jurnal Pendidikan Matematika*, 4(1), 76–85.
- Merkx, M. (2019). VAT and blockchain: Challenges and opportunities ahead. *EC Tax Review*, 28(2), 83–89.
- Mu’min, S. A. (2013). Teori Pengembangan Kognitif Jian Piaget. *Jurnal AL-Ta’dib*, 6(1), 89–99.
- Nofer, M., Gomber, P., Hinz, O., & Schiereck, D. (2017). Blockchain. *Business and Information Systems Engineering*, 59(3), 183–187.
- Noor, M. U. (2020). Implementasi Blockchain di Dunia Kearsipan: Peluang, Tantangan, Solusi atau Masalah Baru? *Khizanah Al-Hikmah: Jurnal Ilmu Perpustakaan, Informasi, Dan Kearsipan*, 8(1), 81.
- Nugraha, A. C. (2022). Penerapan Teknologi Blockchain dalam Lingkungan Pendidikan. *Produktif: Jurnal Ilmiah Pendidikan Teknologi Informasi*, 4(1), 302–307.
- Rahardja, U. (2023). *Penerapan Teknologi Blockchain Dalam Pendidikan Kooperatif Berbasis*. 7(3), 354–363.
- Ruoti, S., Kaiser, B., Yerukhimovich, A., Clark, J., & Cunningham, R. (2020). Blockchain technology: What is it good for? *Communications of the ACM*, 63(1), 46–53.
- Sari, M., & Asmendri. (2018). Penelitian Kepustakaan (Library Research) dalam Penelitian Pendidikan IPA. *Penelitian Kepustakaan (Library Research) Dalam Penelitian Pendidikan IPA*, 2(1), 15.
- Seebacher, S., & Schüritz, R. (2017). Blockchain technology as an enabler of service systems: A structured literature review. *Lecture Notes in Business Information Processing*, 279(April), 12–23.
- Syafitri, E. R., & Nuryono, W. (2020). Studi Kepustakaan Teori Konseling “Dialectical Behavior Therapy.” *Jurnal BK Unesa*, 53–59.
- Zhang, R., Xue, R., & Liu, L. (2019). Security and privacy on blockchain. *ACM Computing Surveys*, 52(3).