Design of Educational Learning Management Cloud Process with Blockchain 4.0 based E-Portfolio

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A R T I C L E   I N F O

A B S T R A K

Perkembangan teknologi di bidang pendidikan telah menghasilkan banyak inovasi untuk mendukung proses pembelajaran. Banyaknya ragam media pembelajaran salah satunya adalah kompetensi digital pendidikan, yang sangat dibutuhkan dalam perguruan tinggi. Namun dari beberapa perguruan tinggi, masih banyak yang belum memiliki kompetensi digital yang memadai. Tujuan penelitian ini yaitu sebagai platform sastra bagi para peneliti yang akan memulai penelitian pada teknologi Blockchain untuk digital pendidikan, agar hasil kompetensi digital tidak dapat dimanipulasi oleh pihak ketiga dan bersifat transparan. Penelitian ini menggunakan metode survey yang akan dihitung secara kuantitatif melalui perhitungan Skala Likert. Perancangan sistem manajemen pendidikan kooperatif ini menggunakan E-Portfolio Integration yang tersimpan dalam komputasi awan berbasis teknologi Blockchain. Hasil penelitian dengan menghadirkan Skala Likert maka variabel penelitian yang ingin dicapai dapat dijadikan sebagai tolak ukur untuk dapat menemukan ide atau pertanyaan yang ditujukan kepada responden. Berdasarkan hasil penelitian yang diperoleh dapat disimpulkan bahwa Student-Centered iLearning Blockchain (SCi-B) dengan E-Portfolio didukung dengan teknologi Blockchain yang dapat memenuhi kebutuhan perguruan tinggi dan meningkatkan pendidikan kooperatif pada kompetensi digital.

A B S T R A C T

The development of technology in education has produced many innovations to support the learning process. The large variety of learning media is the digital competence of education, which is very much needed in higher education . However, from several universities, there are still many that do not have adequate digital competence. This study uses a survey method that will be calculated quantitatively through a Likert Scale calculation. The design of this cooperative education management system uses E-Portfolio Integration stored in cloud computing based on Blockchain technology. The Blockchain process will be helpful as a literary platform for researchers who will start research on Blockchain technology for digital education so that the results of digital competence cannot be taken over by third parties and are transparent, and this is the solution to the problems in this research. Based on the study results, it can be seen that the Student-Centered iLearning Blockchain (SCi-B) with E-Portfolio is supported by Blockchain technology that can meet the needs of universities and improve cooperative education on digital competence.

1. INTRODUCTION

Education is one of the needs of every human being. Education will always experience changes, developments, and improvements in all areas of life (Bosica et al., 2021; Pal et al., 2021; Sasmita, 2020). Changes and improvements in the field of education include various components involved in it, both implementing education in the field (teachers' competence and quality of teaching staff), quality of education, curriculum devices, educational facilities and infrastructure, and quality of education management, including changes in learning methods and strategies used. More innovative (Crawley et al., 2019; Genc et al., 2018; Putro et al., 2017). Efforts to change and improve are aimed at bringing the quality of education in Indonesia to be better. In order to educate the nation's life, improving the quality of education is essential for sustainable development in all aspects of human life (Bal-Taştan et al., 2018; Harmawati et al., 2020; Sumirattana et al., 2017). The needs and developments must constantly develop the national education system.

The Industrial Revolution 4.0 is an era of technological disruption due to the need for automation and superior Human Resources (HR) connectivity (Aini et al., 2019; Rahardja, Harahap, & Christianto, 2019). The Industrial Revolution 4.0 demands an adaptive and flexible learning outcomes-based curriculum. With computer systems and automation, data recording in all areas can be managed in a computer network. Blockchain technology is an innovation to face the challenges of remaining competitive in the movement in the education sector (Chandra et al., 2020; Sudaryono et al., 2020). The rapidly growing blockchain technology has been supported by the information transformation process in the 4.0 revolution marked by the number of digital learning media in the world of education that has never been seen before (Alruwais et al., 2018). The goal contained in cooperative education is to improve the process of assessing student learning that is carried out effectively (Sudaryono et al., 2020). Therefore, to enter this digital era, designing a development process in the cooperative education system can improve digital competence by integrating Blockchain technology in an efficient learning process. Blockchain technology has a decentralized and secure network (Prawiyogi et al., 2021). The data in the Blockchain is stored permanently and is run peer-to-peer in the internal network because the Blockchain has a distributable ledger so that this technology provides a way for information to be recorded and shared by a community where each member keeps a copy of their information, and each transaction occurs. All members will validate the update collectively. This distributed system is used to track transactions that have occurred. All parties have the same control, so there is no possibility of data manipulation because Blockchain creates centralized data that related parties can access. Blockchain can be used as an alternative medium for storing digital documents.

This research aligns with digital developments in education that previously used conventional methods that had shorter time and inefficient learning processes (García-Peñalvo et al., 2021; Rohaeti et al., 2020). Furthermore, it is known that the student assessment system is not carried out transparently because it is limited by time, and there is no track record of assessment (Dahalan & Hussain, 2010; Xiaoming et al., 2021). This study designed a Learning Management System (LMS), where lecturers can manage learning materials, blockchain-based E-portfolios, and E-Assessments to record student information data (Bilik et al., 2020; Kamil et al., 2020). The problem in this era is that many learning systems use digital technology, but the digital strategy is not adequate, and its security is not guaranteed. With this design, the student learning process becomes flexible, and information can be accessed online anytime and anywhere (Danniels et al., 2020). In the world of education, the application of Blockchain technology is still not widely applied. This technology is often used for handling financial transaction information and the lack of concern for stakeholders in the education world for the benefits and potential of Blockchain technology in the learning process. The purpose of this research is as a literary platform for researchers who will start research on Blockchain technology for digital education so that the results of digital competence cannot be manipulated by third parties and are transparent. It is hoped that this research will facilitate the learning process.

2. METHOD

This Student-Centered iLearning Blockchain (SCi-B) learning model uses blockchain technology because of its transparent, guaranteed security and decentralized nature of digital transaction records. This study uses a survey method which is another factor in supporting this study with 150 participant responses supported by 30 questions regarding their level of satisfaction using the SCi-B learning model which will be explained in the results section.
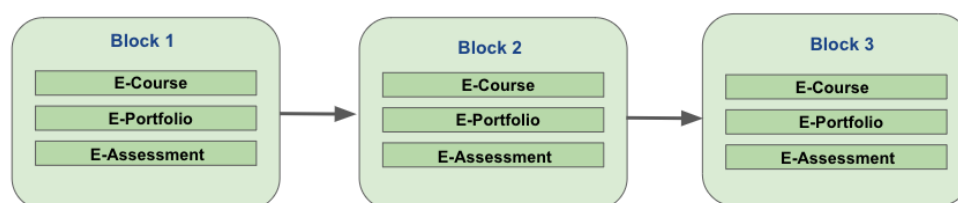

Figure 1. Blockchain Asset Structure.

Blockchain is a new transaction technology used as a digital data storage system connected via cryptography that is managed by a distributed computer network. Blockchain has data that can be verified by one server by another server. On the blockchain network, some members can find an agreement about the status of shares for the distribution process and share transaction data across computer networks (Agustin et al., 2020). The process does not have to rely on a reliable central point for each member of the network system. A transaction no longer needs to depend on one server using blockchain because the transactions made have been replicated across the existing network. Therefore, blockchain provides unmodified storage

so that its security is guaranteed (Agustin et al., 2020). The process for adding or updating transactions without deleting transaction data appears on the blockchain to prevent interference and modification from third parties (Aini, Badrianto, et al., 2020). According to blockchain's reliability features, it has become the core of today's cryptocurrencies (Aini et al., 2021). Every block on the blockchain is an interrelated system, and if there is an attempt to change data in one block, it is required to change data in another block. Because every block that is protected by cryptography is connected with blocks to one another to create an existing network. Each peer-to-peer network on the blockchain is interconnected and certified to record new data using a consensus mechanism stored on the blockchain technology information (Rahardja, Hidayanto, Hariguna, et al., 2019). Blockchain technology is also decentralized so that no single authority has full control, but it is broken down into each computer that installs special softwarex (Devilly et al., 2021).
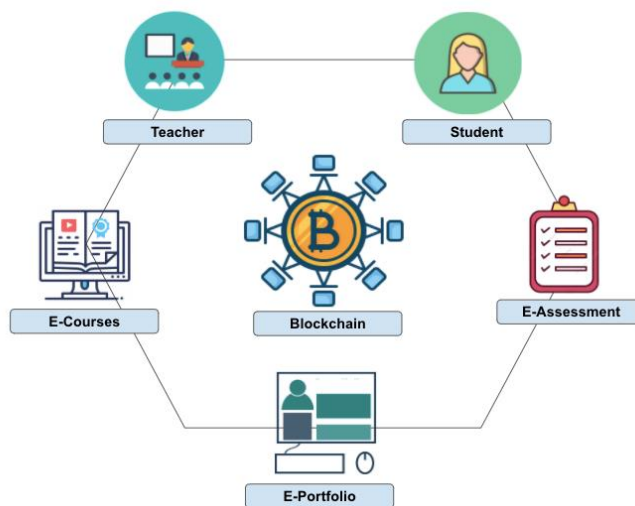

Figure 2. Integration of the Student-Centered iLearning Blockchain (SCi-B),

Figure 3 describes the Integration of the Student-Centered iLearning Blockchain (SCi-B), which consists of Blockchain users enjoying the three elements of E-Course, E-Portfolio, and E-Assessment. A management system has defined these three elements to run with Blockchain technology (Sunarya et al., 2020). E-Course is a teaching material provided by lecturers to students by using Blockchain, which can make it easier for students to access online learning without any time limit so that this system is guaranteed security (Rahardja, Hidayanto, Putra, et al., 2021). E-Portfolio is a digital student learning system that uses a Blockchain network with a transparent system that cannot be modified by third parties and can be done online. And E-Assessment is an assessment carried out by lecturers on the Blockchain network online (Lutfiani et al., 2020). All value information can be accessed safely and quickly because it is stored on the Blockchain network so that it can avoid data being changed by others.

3. RESULT AND DISCUSSION

Result

This study uses quantitative methods related to the types of data and numbers aimed at analyzing a study. This method is also useful for assisting in drawing the right theoretical conclusions and ensuring the validity of the data. In this study, SPSS was used to calculate instrument reliability with Cronbach's Alpha. It can be said that the Cronbach Alpha> 0.6 is a reliable instrument.

Table 1. Readiness Performance

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Less satisfied	3	2.0	2.0	2.0
	Quite satisfied	15	10.0	10.0	12.0
	Satisfied	29	19.3	19.3	31.3
	Very Satisfied	103	68.7	68.7	100.0
	Total	**150.0**	**100.0**	**100.0**	

Furthermore, 30 questions based on the research instrument items were distributed to 150 respondents who had run the Student-Centered iLearning Blockchain (SCi-B) [30]. Research variables by presenting a Likert Scale are also the results of this study. By using the Likert Scale, the variable to be achieved can be used as a benchmark to be able to find an idea or question that is intended for the respondents. In this study, in order to accurately calculate the reliability of the instrument, the authors used SPSS with Cronbach's Alpha. The next step is to distribute a questionnaire of 30 questions to 150 respondents via email. Based on 30 questions and statements from 150 respondents, the calculation was carried out using the Cronbach Alpha formula, thus producing a value of 0.863. Based on these data, it can prove that the existence of the prototype brings many benefits for students and provides efficiency for academics in distributing learning models with the SCi-B framework (Lestari et al., 2021; Rahardja, Hariguna, & Baihaqi, 2019).

Discussion

So that the E-Portfolio is used as a tool to measure students' attitudes in participating in cooperative education, which can reflect authentic competencies from the world of work and in the psychomotor realm that measures students' abilities in skills, students can gain Portfolio competencies to present their work freely with digital media. Research studies found that several studies applied E-Portfolio to help assess cooperative education run by students, for example. E-Portfolio is part of a cooperative education program to create reflective activities. As a source for students to assess student achievement, the study of professional competence in integrated learning with collaborative E-Portfolio assessment, including assignment reports, uses the method within a predetermined time limit to ensure the ability and evidence collected by the supervisor so that the E-Portfolio reports student activities and provide sufficient space for students to respond to assignments in their way within the allotted time limit (Buchory et al., 2017; Panagopoulos et al., 2018).
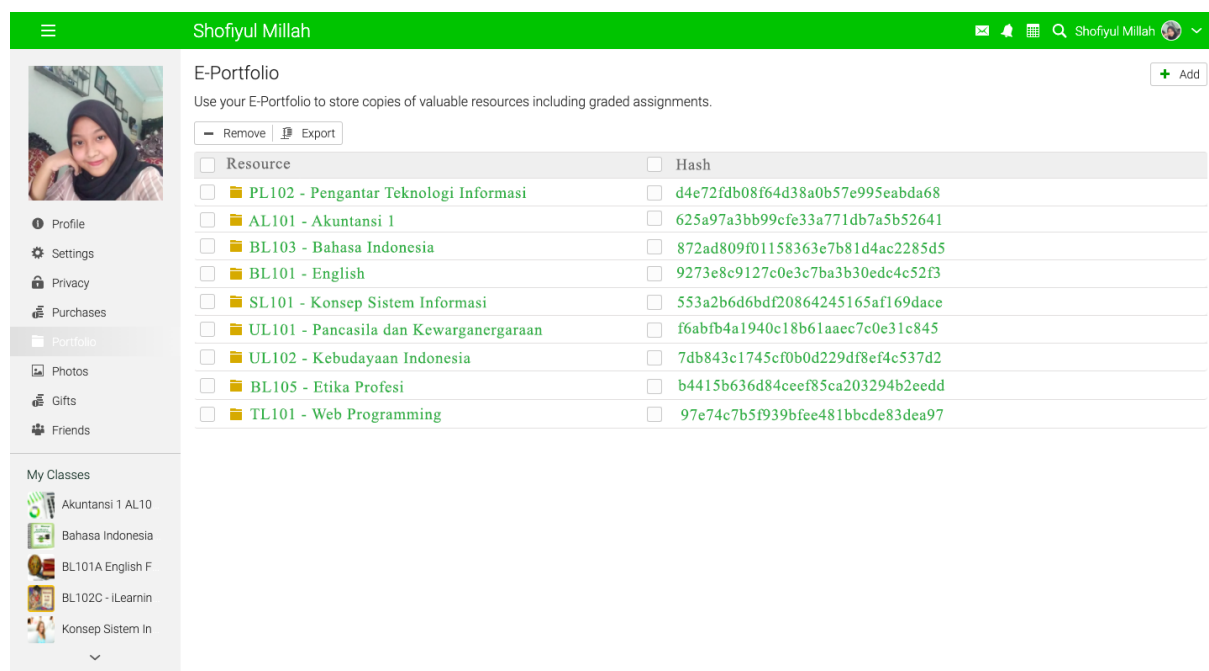

Figure 3. E-Portfolio With the SCi-B Framework.

Furthermore, the combination of the use of computer technology and the development of an online computing framework where the capabilities related to information technology are presented as services provided to users according to their needs, which stems from easy access to remote processing sites provided by the Internet, has provided a cloud component (Al-Hariri & Al-Hattami, 2017; Ale et al., 2017; Hatlevik et al., 2018). For specific software when used primarily for users (Sunarya et al., 2017). Online computing made it possible to use the software delivered to the Internet in browsers without installation and hosted on the Internet and can be installed remote file storage, so the trend of cloud computing continues to develop (Hardini et al., 2020). Storage media is available virtually by online computing (Aini, Rahardja, & Khoirunisa, 2020). Cloud providers have guaranteed data security so that data systems are not easily damaged and manipulated (Ediyanto, 2016). Online computing aims to make data and information systems more secure than the conventional methods used by most people today (Harahap et al., 2019). Computing does not need to use

storage media in the form of an external hard disk because online computing already has storage media centralized on the blockchain server, so its security is gratuaded (Tuma et al., 2021; Vuong et al., 2019).

Figure 1. This section is a digital competency framework that has been extracted into a rubric for conducting a blockchain 4.0 based E-Portfolio assessment (Rahardja, Aini, et al., 2021). There is integration between headers and E-Portfolio merges (Edy et al., 2019; Panagopoulos et al., 2018). After that, part of the E-Assessment Form will be created, and the resulting assessment value is recorded into blockchain technology (Alruwais et al., 2018; Lukita et al., 2020; Tsivitanidou & Constantinos, 2016). This technology can play an important role in capturing educational digital proof transactions and having a digital competency assessment because blockchain has a mechanism that makes it difficult to fake, because the data recorded on the blockchain is permanent. And the Rubric turns digital competencies into E-Portfolio assessment criteria (Bilik et al., 2020; Kamil et al., 2020).
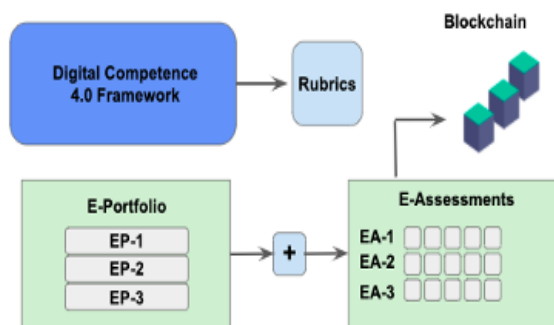

Figure 1. Integration in the E-Portfolio system for cooperative education
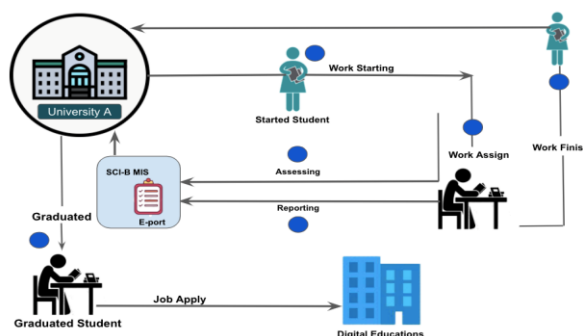

Figure 2. Blockchain cloud-based E-portfolio

Figure 2. shows various cooperative education information about the use of blockchain technology in digital education (Aini, Rahardja, Tangkaw, et al., 2020). Starting with cooperative education where the information system is recorded into the blockchain 4.0 technology network, with the Student-Centered iLearning Blockchain (SCi-B) model, students begin to learn cooperatively by recording final project reports. After that, the final project will be assessed by the lecturer as a graduation process by means of a digital competency assessment of the data center system using blockchain 4.0 technology, so that the information system is more secure than the conventional methods used by most people today and the data system is not easily manipulated (Watini et al., 2020).
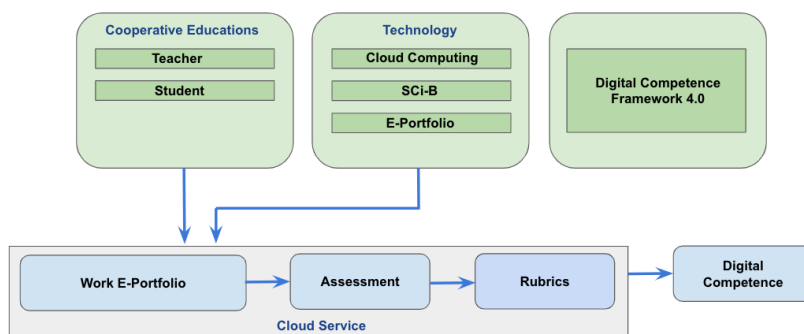

Figure 3. Conceptual framework for Student-Centered iLearning Blockchain (SCi-B)

Design process for cooperative education management system After the conceptual framework is created, the next step is the process of implementing the conceptual framework to design the process of overcoming the problems encountered in the cooperative education information system (Rahardja, Hariguna, & Aini, 2019). The Student-Centered iLearning Blockchain (SCi-B) conducts learning with the E-Portfolio system to increase the information resources that are needed by the community (Rahardja, Hidayanto, Lutfiani, et al., 2021). Universities in recording data in digital formats that are easily falsified by others. And increasing the digital competency framework with blockchain 4.0 technology into the rubric and adapting it to the E-Cooperative Education Portfolio to create digital forms of competence (Prawiyogi et al., 2021). This digital 4.0 competency framework is used as a tool to support skills in the field of digital technology systems (Rahardja, Hidayanto, Putra, et al., 2021).

4. CONCLUSION

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 facing the development of science and technology. Using Blockchain can avoid data being manipulated by third parties because the data is stored on 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 by using this system process. Thus, the Student-Centered Learning Blockchain (SCi-B) provides many benefits, namely by 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. This research can be further developed towards implementing an integrated Blockchain education platform with other institutions and further analysis.

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