

A Blockchain-Based Framework Gamification for Securing Learners Activity in Merdeka Belajar-Kampus Merdeka

Henderi
University of Raharja
Master of Computer Science
Indonesia
henderi@raharja.info

Muhamad Yusup
University of Raharja
Master of Computer Science
Indonesia
yusup@raharja.info

Po Abas Sunarya
University of Raharja
Master of Information Technology
Indonesia
abas@raharja.info

Ninda Lutfiani
University of Raharja
Master of Information Technology
Indonesia
ninda@raharja.info

Efa Ayu Nabila
University of Raharja
Department of Information System
Indonesia
efaayunabila@raharja.info

Abstract—In the life of Education 4.0, information is very vulnerable to security. Assessment is an integral part of learning. In addition to attendance, assignments are the main point in determining the graduation of a course. However, there are some safeguards for student activity assessment input platforms, which are dangerous, and data leaks can occur. Taking advantage of its open-source, transparent, and immutable or immutable nature can help secure the various platforms used. The University's need for various information makes the application of Blockchain technology a very appropriate thing to use. With the use of Blockchain, the security of student activities is more guaranteed, and it is easier to control by the Lecturer Board. This study aims to secure student activities from forgery and fraud when inputting activities using blockchain technology. The framework created also uses gamification as something that motivates learning activities. The author has analyzed the security needed for activity verification in the form of levels on several applications, one of which is a platform-based application used for the Merdeka Learning-Independence Campus platform. The method used in this research is descriptive research in the form of a literature study that prioritizes gamification in a platform framework. The urgency of this research is to secure the Merdeka Learning-Independence Campus platform for students who need more security in their data storage. If security is increased, student confidence and learning motivation towards the activities carried out will increase so that learning motivation will be better so that the quality of learning will be better.

Keywords—Blockchain, Gamification, Kampus Merdeka

I. INTRODUCTION

In this section, we aim to improve learning innovation in the Era of Society 5.0 to become a call for educators to understand learning strategies by using and adopting, as well as developing various learning strategies for students [1]. The current generation that is focused on cyberspace is growing very fast in multiple fields. Especially the information used by various students also requires tight security. The Blockchain integrated into the learning area is a slick and applicable collaboration with multiple things that

can work today; this is also known as a feature of Blockchain that also appears in various fields [2].

Implementation of Blockchain in this study refers to the learning platform and activities initiated by the Ministry of Education and Culture of Indonesia, Nadiem Anwar Makarim, especially Merdeka Belajar-Kampus Merdeka [3].

This is related to the Merdeka Belajar-Kampus Merdeka Policy; The Independent Learning Policy-Independent Campus is by Permendikbud Number 3 of 2020 concerning National Higher Education Standards. which will be discussed in the image below.

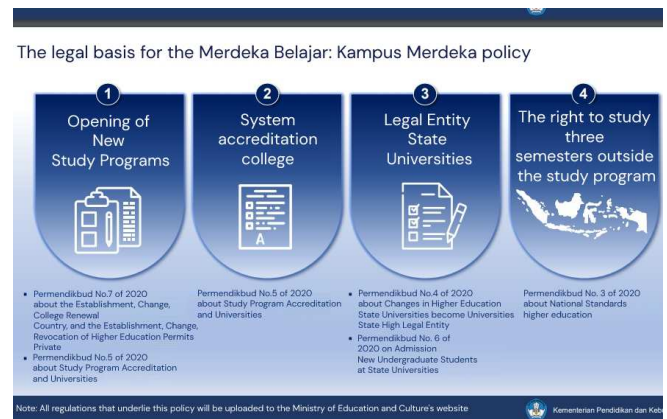


Fig. 1. Merdeka Belajar-Kampus Merdeka Policy. Source: Permendikbud No. 3 Tahun 2020

In Fig. 1 above the Independent Campus there are 4 new policies, namely:

- 1) Autonomy for opening new study programs where both State Universities (PTN) and Private (PTS) have the autonomy to open new study programs
- 2) The re-accreditation process is carried out automatically and voluntarily to the study program.
- 3) The requirements for becoming a PTN-BH are made more accessible, the Ministry of Education and Culture will simplify the requirements for PTN

BLU and Satker to become PTN-BH without being tied to accreditation status.

- 4) The right to study for three semesters outside the study program and changes in the definition of credits, students are given the freedom to take or not take credits (Semester Credit Units) outside their campus for two semesters or equivalent to 40 credits.

Merdeka Campus, which was Nadiem's initial idea, identified and analyzed student interests and design activities to be carried out. The display of the software platform used by students must create the latest learning methods to motivate students. One of them is adopting Blockchain technology in a forum. Blockchain is one of the most in-demand subjects in today's many social, technological, and educational gatherings [4]. Blockchain was initially the inspiration for virtual currencies like Bitcoin [5]. In its development, Blockchain can be used in several fields, including gym maintenance, various document reports, and platforms [6]. Multiple approaches and efforts with the assistance of the authorities to increase the degree of enjoyable education in Indonesia are helpful in building the Indonesian nation.

However, increasing student motivation towards lectures remains the main subject of this study [7] [8]. The lack of gamification on the platform and its boring user interface reduce student motivation in courses; this is a problem in research. At Society 5.0, the Ministry of Education, Culture, Research and Technology (Mendikbud Ristek), namely Nadiem Makarim, made new coverage in education, especially the Independent Learning Campus. The Merdeka BelajarKampus Merdeka has four rules: the addition of new study programs, a higher education accreditation platform, changing the name of PTN to PTN-BH, and what is discussed is the right to study for three semesters for international students. Study program that has been implemented. The four rules are regulated in Permendikbud No.3, four, 5, 6, and 7. In this study, when conducting education, a platform will be designed that educates and motivates students.

There is three research questions for this research:

- RQ1. What is a promising Blockchain technology framework for higher education in Indonesia?
- RQ2. How can Blockchain be applied to improve the quality of education in Indonesia?
- RQ3. How does Blockchain ensure the security of information entering and leaving education in Indonesia?

II. RELATED WORKS

In this section, the Blockchain has attracted attention because it relates to bitcoin [9], [10], [11]. Blockchain properties are decentralized, transparent, and irreversible[12] [13]. With a decentralized platform, Blockchain allows all participants in the network to demonstrate the power of computing to correct and secure transactions [14]. This is the reason Blockchain security is widely used, one of which is in education. Blockchain will authenticate transactions and be recorded in the public ledger, and every node on the network will have a copy, so it is easy to verify [15] [16]. Blockchain finally approved

this ledger accountability by looking for the previous block. Block security and privacy are protected using consensus algorithms, such as Proof-of-Work (PoW) [17]. This study used two approaches, namely case study, and literature study to produce research evidence. With the recent emergence of Blockchain technologies such as Blockchain, qualitative methods present a pragmatic approach to engaging with current technology at an early stage. Case studies involving Blockchain in education take the form of pilot exploration and initiatives. The first step in our research is to review the literature published in the field of Blockchain technology applications for education. Educational-based application review of Blockchain technology used in digital asset methods to store, share, secure, and verify educational credentials. Desk Research is conducted on significant sources covering critical technical aspects of Blockchain implementation. In particular, Bitcoin and Ethereum offer specialized products built on Blockchain technology for their structure, arrangement, operation, and intellectual property. The survey will be conducted with a sample of researchers, educators, and students from relevant stakeholders in Blockchain education.

Blockchain has four main features that support the development of Blockchain in the world of education today:

- 1) Transparent: Blockchain has an evident nature; that is, all activities entered or carried out by a user will be recorded so that there is a transaction history that can be seen by other users [18].
- 2) Immutable: One of the features possessed by a robust Blockchain is Immutable or cannot be changed or modified. If a record or history has been Blockchain, the form will always be recorded in the system and cannot be limited to minimize fraud [19].
- 3) Open Source: Most Blockchain systems are open source. So the user can use the Blockchain technology and modify it according to the user's wishes or needs. But users will not be able to change an existing Blockchain system [20].
- 4) Immutability: Various transaction histories will be recorded, such as the use of credit scores. Blockchain immutability means security, maintaining integrity, and confidentiality. Blockchain immutability has immutable characteristics and is very strong. Cryptography and public keys using hash codes that are part of the Blockchain protocol are basic security. Once established, Blockchain immutability is unlikely to change. This feature dramatically increases trust in virtual transactions and eliminates the possibility of fraud [21] [22].

From the 4 main features of Blockchain that have been mentioned above, it can be concluded that Blockchain is very supportive of the security of the system used during education. Safe features and easily accessible sources can facilitate system management and make it easier for users such as lecturers and students concerned.

III. METHODS

The qualitative research method used in this study uses two approaches, namely literature studies and case studies. With the recent advent of Blockchain technology, qualitative methods make for a pragmatic approach in the

early stages of building a platform. Case studies involving Blockchain in education as examples and exploratory applications. The first step in our research is to review the published literature in the field of applying Blockchain technology to education and the application of gamification.

Various reviews on using Blockchain to store, share, secure, and verify educational credentials have been carried out by researchers worldwide. This includes user security, one of which is a student when conducting lecture activities. The safety of using the platform at the university can be overcome by Blockchain. Blockchain can provide security in various ways, but the aspect that will be carried out is the student view board, which will be seen every day during lectures. View board contains a lot of essential student data, including grades. So Blockchain is needed for data and platform security. Desk Research is conducted on critical sources covering critical technical aspects of Blockchain implementation. The survey will be conducted with a sample of researchers, educators, and students from relevant stakeholders in Blockchain education.

IV. RESULT AND DISCUSSION

The results of the implementation of Blockchain technology are then recorded into the application history. The following discussion describes the implementation of Blockchain technology and the application of gamification.

A. Blockchain Structure

Each block in the Blockchain contains three elements: 1) Main data; 2) the hash of the translucent block; 3) the hash of the current block [23]. Main Data. The data depends on the type of transaction; this is generally a transfer between nodes A and B but can be of any kind, such as a money transfer or a record transfer [24]. Hash from Previous Block. When a transaction can be executed, the hash is generated and propagated across the network. There are several hashing algorithms used, but the most dominant one is the Merkle Tree. This algorithm allows easy hash options, which is why the Merkle Trees is a common choice [25]. Hash of Current Block. The last hash value is recorded in the header block (the current block's hash), while the content itself is stored in the block body. Blocks are generally bound to a size to allow several transactions per block [26].

B. Gamification in the Student Viewboard of Merdeka Belajar-Kampus Merdeka

Various activities that the Students have input will be recorded on the informative view board. The process of inputting activities carried out by students through the platform does not require a long time. This platform framework has used the gamification method where students who successfully input many activities during learning will get rewards in the form of ECP and an increase in Activity Level. Gamification is valued vital because it can affect student learning motivation [27] [28]. With the gamification method on the platform, the lecture process becomes more interactive.

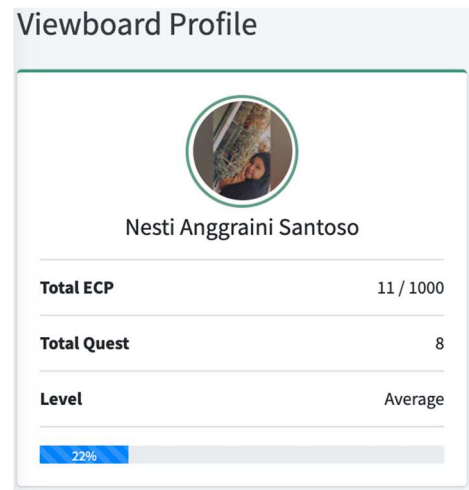


Fig. 2. Informative Viewboard based on Gamification

Fig. 2 Explain the Informative Viewboard based on Blockchain Gamification. In this informative view board, there are 4 (four) collections of information, including:

- 1) Student profiles such as name, faculty, department, study program, concentration, and GPA are the main focus when viewed by the user. This makes it easier for lecturers and students to find information about other users.
- 2) There is a Total ECP (Enrichment Cumulative Point), this is the main point in student assessment.
- 3) The Total Quest contains the total assignments and lecture activities that have been done by students.

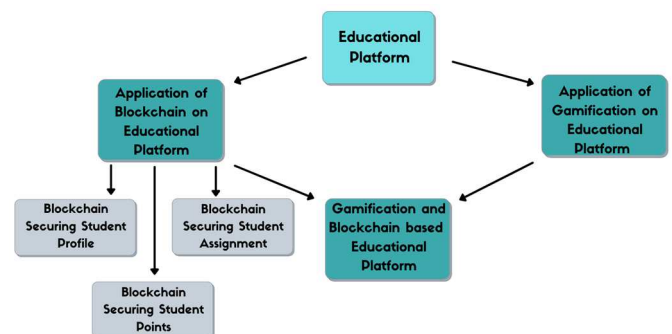


Fig. 3. Application of Blockchain in Platform Framework

In Fig. 3 It is explained that the implementation of Blockchain is in the security of the student viewboard which contains: student profiles, student assignments, and student points or student assignment assessments. Total ECP and Total Quest affect the Level on this view board. This is supported by the increasing number of activities carried out by students, the more ECP they get, and the level will also increase.

```
//method for Check the Total Exp for every User
function massExperience($id){
    $exp = Experience::whereUserId($id)->first();
    $sum = Record::whereUserId($id)->whereStatus('verified')->sum('value');
    $count = Record::whereUserId($id)->whereStatus('verified')->count();
    $level = Level::where('min_value', '<=', $sum)->where('max_value', '>=',$sum)->first();

    if($exp->total_value != $sum){
        $exp->update([
            'total_value' => $sum,
            'total_quest' => $count,
            'level_id' => $level->id,
        ]);
    }

    return true;
}
```

Fig. 4. Gamification algorithm in the system framework Kampus Merdeka-Merdeka Belajar

Fig. 4 There is a line of gamification code using the Laravel PHP framework so that students who have input their activities in lectures will get a ranking based on the points earned and are named as Activity Level. There are 21 Activity Levels in the framework created.

```
//Progress Level
public function progress($id){

    $exp = Experience::where('user_id',$id)->first();

    $levelMax = $exp->level->max_value;

    $nextLevel = Level::where('min_value',$levelMax+1)->first();

    return response()->json([
        'detail_user' => $exp->user()->first(),
        'total_value' => $exp->total_value,
        'detail_level' => $exp->level()->first(),
        'next_level' => $nextLevel,
    ],200);
}
```

Fig. 5. Algorithm progress for student viewboards

Home			
Name	Min Value	Max Value	Hash
Disruption	1001	5000	aa70a305f3f29f69960858fbb87922006e799bfc72fc731ee060673ecc877dd2
Untouchable	951	1000	aa70a305f3f29f69960858fbb87922006e799bfc72fc731ee060673ecc877dd2
Unbelievable	901	950	aa70a305f3f29f69960858fbb87922006e799bfc72fc731ee060673ecc877dd2
Marvelous	851	900	aa70a305f3f29f69960858fbb87922006e799bfc72fc731ee060673ecc877dd2
Impressive	801	850	aa70a305f3f29f69960858fbb87922006e799bfc72fc731ee060673ecc877dd2
Overwhelming	751	800	aa70a305f3f29f69960858fbb87922006e799bfc72fc731ee060673ecc877dd2

Fig. 6. Blockchain features in the Gamification Viewboard


In this section, the gamification display board will be backed by its security using Blockchain technology. Total ECP and Total Quests that affect Level will be secured using a cryptographic code in the form of a Blockchain hash where there is a unique code that cannot be changed and imitated. This will eliminate the possibility of fraud in every activity carried out by independent campus students during the system.

C. Evaluation Process

In the evaluation process, conclude the answers to the three Research Questions as follows:

RQ 1. What is a promising Blockchain technology framework for higher education in Indonesia?

Viewboard Profile



Viola Tashya Devana

Total ECP 946 / 1000

Total Quest 697

Level Unbelievable

90%

About Me

Faculty

Degree

Study Program

Concentration

GPA / 4.00

Fig. 7. Algorithm progress for student viewboards

This research produces data that Blockchain can secure learning activities for students [29], including the security of personal data such as profiles, grades, and assignments that are very vulnerable to being hacked as shown above. With the application of Blockchain on the platform (in this study, it is still a framework), Blockchain can secure student data, which supports user privacy security so that the Blockchain can be implemented properly on the platform for higher education [30] [31].

RQ 2. How can Blockchain be applied to improve the quality of education in Indonesia?

Daily Quest

Quest Name

BBC Post

Quest Hash

a61d00661142b2d5c6ab4e7fcfd13c6

NIM

Name

Muhammad Iqbal

Rinfo

iqbal@raharja.info

Submitted at

dd/mm/yyyy

Result

*Upload link is required to use Rinfo and ensure file privacy in public

Example: [Click Here](#)

Fig. 8. Student Quest using blockchain

By implementing Blockchain in higher education in this study, students use security on the platform that will be used. We can see in the explanation in Fig. 8. where Blockchain Features and gamification are unified. The use of Blockchain has data protection where user privacy will be guaranteed so that no one can change it. A sense of security will be felt by students so that learning motivation increases along with the use of gamification in learning. By increasing

student motivation, it can also improve the quality of higher education in Indonesia.

RQ 3. How does Blockchain ensure the security of information entering and leaving education in Indonesia?

Blockchain ensures the security of information entering and leaving education in Indonesia in several ways. One example is user data, such as an assessment certificate that is not easily forgotten. Using a unique code on the Blockchain in the form of a hash with a block-to-block security system can also increase security. The nature of Blockchain has been described in related works on the use of Blockchain, such as in assessment certifications and other certificates [32].

These three research questions have been answered in the results and discussion of Blockchain in universities in Indonesia. After the system is released and is no longer a framework, evaluation is to determine user satisfaction with the student task verification system using the System Usability Scale (SUS); SUS can find out the benefits and effectiveness of the system that has been designed through questionnaires distributed to students using the system.

In this study, we use "Simple Random Sampling" to determine the implementation of the Blockchain framework to secure student activity. The solution formula makes it easier to choose the correct number of samples. We use Slovin's formula as follows:

$$n = \frac{N}{(1 + N.e^2)} \quad (1)$$

$$n = \frac{320}{(1 + (320).(0.1)^2)}$$

$$n = \frac{320}{(3.21)}$$

$$n = 99.6$$

If you follow the Slovin formula, the sample results, the number of students (N = 320 samples) will produce a model of 100 students who will find it a more accessible and secure platform for students.

V. CONCLUSION

This study discusses how Blockchain plays a role in the security of student learning activities, one of which is the total points or ECP (Enrichment Cumulative Point) for the activities of Merdeka Belajar-Kampus Merdeka students and implement them using the gamification method. In the Merdeka BelajarKampus Merdeka platform framework, encryption on the Hash Blockchain will be applied as security and gamification as a supporting platform to increase student motivation. Issues regarding the use of Blockchain technology-based educational platforms are discussed in research through a literature review. In this study, we support the development of Blockchain on academic factors. For example, the application of Blockchain cryptography proves that the information received by the student or lecturer concerned and or issued by the platform can be trusted for security. Blockchain authorization proves that students have permission to gain their rights through gated information. For future research

suggestions, the proposed framework will be applied and adopted in selected educational institutions.

The results of the accumulation of ECP in the history of student activities are discussed in this study. The ECP accumulation for each student will be safeguarded so that no student is cheating. Various activities in the ECP will be verified, then recorded on the platform, and total points; this can be seen again as a reference for lecturer assessment. With the framework on this platform, both students and lecturers will trust each other to increase scientific knowledge or during lectures.

Gamification contained in the ECP based on total points will be applied to make students compete in doing activities and assignments and get the best results. A positive impact will be achieved for students, lecturers, and universities. Further development will be undertaken so that this research will have more value and be more helpful. Researchers hope that this research can develop globally for the success of an Independent-Learning Campus not only in Indonesia.

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