# Analysis of the potential context of Blockchain on the usability of Gamification with Game-Based Learning

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***Abstract***

*Within the world of gaming, there has been a move from diversions being utilized exclusively for excitement, to recreations being utilized as a medium to teach. For this matter, there are two strategies of making amusement which are gamification or game-based learning. The previous is the utilization of diversion components, such as wellbeing focuses or pioneer sheets, and they are connected to a non-gaming stage. The last mentioned, game-based learning, incorporates creating a full-fledged amusement where the means towards the conclusion, that's to say triumph, are set in a world where the player needs to apply the lessons given to progress. Since typically an IT-related investigation, the subject chosen for this study is Blockchain, an ever-expanding division over the past decade. Diverse parts of Blockchain's makeup have been dismembered into little, comprehensible pieces of data within the applications made, which innovative understudy to the frame can take in at their claimed pace. Should this study transcend this research, it might be beneficial for the experiments to possess two games designed and created by someone who has the artistic and technical capabilities of making their own assets. This is able to leave a far better impression with the test subjects and ideally receive a far better data set for examination.*

*Keywords: Blockchain, Gamification, Game-Based Learning, Education*

## 1. Introduction

This investigation will be exploring the viability of combining educating with video recreations to deliver a learning environment for endless and complex points. To conduct the tests required, the subject of Blockchain was chosen, due to its noticeable quality in many

spheres of impact within the world. In order to educate students almost the immensity of Blockchain, there has to be a framework in place [1]. To decide which strategy would be most advantageous for the instruction of this theme, there will be a diversion actualized utilizing Gamification components, and another amusement that will make use of a Game-Based Learning framework. In other words, this investigation centers on deciding whether gamification or game-based learning is most viable for instructing concepts around Blockchain.Game-based learning is training that uses elements of the game to teach a particular ability or achieve a particular learning result. Gamification is the use of game mechanics to facilitate desired actions and drive learning outcomes in a non-game setting. The leftover portion of this paper is organized as takes after: segment 2 gives center data almost gamification, game-based learning and blockchain and audits current work in these investigated ranges. Segment 3 gives a clarification of our technique and Segment 4 presents our thoughts about what our client thinks about[2]. Segment 5 concludes the paper by giving an in general talk and long run steps of this work. Game-based interventions can be effective for learningIn the entertainment industry, computers and video games are significant, having experienced rapid growth and success over the past few decades[3].

Across a wide spectrum of ages, the gaming industry has 2.2 billion users. In the United States (US), gaming income in 2017 was three times higher than that of the movie industry. In fact, 65% of U.S. households have at least one member of the family who plays games at least three hours a week. It is unsurprising, then, that Prensky thought that by incorporating educational content into a game, motivation for learning could be rekindled [4].In reality, Katsaliaki and Mustafee said that games are a great alternative to teaching, training, and entertainment (education or educational entertainment), contributing to positive results in learning. Game-based learning (GBL) through the medium of play provides information and awareness. In order to increase user interaction with crafted information and knowledge, a game-based approach is required [5]. In numerous subjects, such as industry, engineering, economy, and politics, GBL products have been demonstrated. In environmental education, GBL methods have also been used widely For major architecture students, Juan and Chao implemented a green building strategy game, while Ye et al [6]. designed an educational game to raise understanding of water, pollution, and land problems. GBL in addition. Game-inspired techniques have also attracted interest, such as gamification. Gamification is recognised for its capacity in all kinds of sectors to educate citizens. Gamification also lacks a clear meaning as an evolving term. It has been defined as the use of elements of game design for non-game settings, including the introduction into a game of game features such as users, challenges, scores, levels, badges, and rankings to achieve a certain objective.Gamification has been shown to be common in many fields, such as trade, the environment, education, and medicine. It has been successful in increasing the participation of individuals and the effectiveness of an initiative [7].

Gamification was first created by Xbox Live, an online game and media distribution service, in 2002 for the gaming industry. This success was accompanied by the use of gamification, for example, to help school children become more involved and motivated in learning, to overcome social and environmental challenges [8].GBL and gamification share similarities, but they have different purposes and definitions.In order to provide information and skills, GBL utilizes real games, so that people learn when engaged in a game activity. Gamification, on the other hand, merely adds game elements to the design of operations or interventions. People engage in an activity embedded with game elements in gamification, such as earning badges for completing a mission. In industry, education, government, the nonprofit sector, and healthcare, gamification is a growing trend.The advances in technology and ubiquitous computing have prompted the widespread adoption of digital government systems, and a number of organizations in the public sector are willing to involve their people in the smart governance process, addressing urban issues in particular [9]. Recent case studies describe the advantages of using gamification in public service provisioning and

co-creation by incorporating the principle of open innovation: game-based platforms and seminars can help participants gather deeper and more diverse perspectives and encourage collective reflection Gamification can also allow users to engage with urban data and better understand it, provide incentives to use a service without altering the motivation behind it, and effectively drive people towards sustainable behavior [10].

More broadly, gamification can be used to enhance citizens' understanding of digital government structures and increase participation, especially in the context of m-participation.In digital government services, however, challenges related to game elements still exist, such as: the dominance of elites as participants (inclusiveness issues), increased implementation costs (both financial and time expenditure), and public perception (some participants may perceive gamified elements as manipulative) [11] . Therefore, in the light of the recent Government 3.0 definition, exploiting the advantages of gamification involves a detailed analysis of gamification in relation to the latest data-driven services that depend on disruptive technologies . The goal of this paper is to define research needs for the implementation of the concepts and approaches of gamification in the field of Government 3.0. The study is focused on a review of current projects funded by the EU, where gamification is being researched and/or gamification solutions are being created [12]. Scenario methods and seminars are then used to gather expert feedback on gamification research needs in Government 3.0 [13].
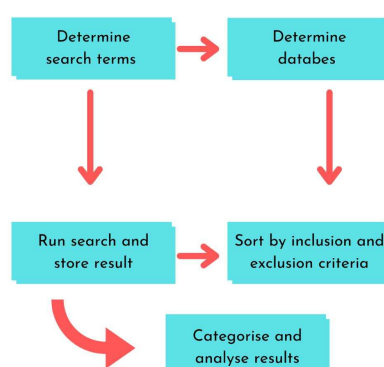
## 2. Research Method



**Figure 1.** Steps in the evaluation process

### 2.1 Search Strategy

The ScienceDirect, EBSCO, Scopus, and Web of Science databases were used to conduct a search of the literature published in any year [57]. Combinations of the following words were used in the search strategy:'gamification," game-based learning," waste management," recycling,' and' schoolchildren.' To locate additional related literature, reference lists of selected publications were reviewed. The quest was restricted to English [58].

### 2.2 Inclusion  And Exclusion Criteria

In order to classify appropriate papers for the study, a set of inclusion and exclusion criteria were applied. Studies were included if they discussed gamification or GBL matching the variables of interest: waste management applications or environmentally friendly behaviors or schoolchild targeting applications [59]. Environmentally-friendly behavior was described in this paper as involving activities that minimize environmental harm, such as energy saving, water conservation, and so on. School Children in pre-elementary, elementary, and high

school education referred to children. The papers were also expected to meet the following criteria: (1) analytical, analysis or philosophical research, chapters of books or books, opinion articles, theses and dissertations, or letters to the editor; (2) qualitative or quantitative studies; and (3) published in any year The studies were omitted if: (a) the use of gamification was not investigated (in particular, articles based solely on serious studies); and (3) published in any year.

## 2.3 Technologies Used

Since this is a game-related experiment, game engine selection is paramount [60]. With regard to the experience the developer has with it, the efficacy of the game-engine in the given two cases, and the ease of creating and publishing a game to be distributed among the test subjects, the final choice of engine needs to be taken. The choice of engine was Unity, after careful consideration of these details.The games were developed on a WebGL Unity build option that allows for deployment on an online website at the end of the life cycle of development. The build option for WebGL creates a folder with an index. HTML connect, compiled construct data, and TemplateData from Unity, which can be seen at the beginning of the game. This decision was made due to the ease of delivery that a game hosted on a website provides [61].

## 2.3 Gamification Design

It clarified that game components can be repurposed in order to achieve the aim of educating an individual on a given subject. The elements that were added in this implementation were progression through several steps, points awarded for correct questions, resource selection, randomly generated avatars and an end screen showing what was accomplished and what was not. A narrative that gave movement to the game was added to these elements [62]. In order to help the user create their own experience, within the logic of the game, the use of narrative can be introduced as mentioned.An asset called Fungus was used to create objects like menus to create the game, and another asset called "2000+ Faces" was used to create a player's randomly created avatar. The player is then treated to a short history of what is trending around the world at the moment [63]. The story has a pessimistic undertone, meaning the system of the avatar is being hacked. This gives the player, by being the character itself, the feeling of being part of the scenario. Instead of having to rely on basic instructions, it also gives the game a more dynamic feel. This is accompanied by a description of the incentive structure of the game. The winning and losing conditions of the game are attached to the health points of the player, and the keys earned [64].

For the game, the following rules are used:

- A player has up to three chances in the game to guess a question that is incorrect. If at least two keys are reached, a player can advance to the next level.
- If the player misses two keys at any given level, even if they still have 3 opportunities, the game is over. This offers a sense of urgency for the player to ensure that the game is played attentively. Three sections of information are given to the player, each section given at different stages of the game. The option is then given to either try the questions or re-read the results.

Two variables were given to any query, later used as part of the data collection, which were the variables "Attempted" and "Correct". It can be safely concluded that the player lost the game if the three questions were tried, but only one was correct. The player could continue without having to answer the third question if two of the questions were correct. The result sheet also shows what keys the player has managed to accomplish, so that the parts that have not been completely learned are given special consideration when the game is played again. The game will go through the knowledge supply loop, waiting for responses and advancing three times [65].

## 2.4 Game-Based Learning Design

This game was made possible using a complex game engine that can be imported into Unity, called TopDown Engine, compared to the Gamification portion, where an orange rectangular blob is the character inside the game. The game starts playing now, instead of making a start button, with two simple instructions given to the player. These are "Press WASD to move" and "Press SPACE to communicate with doors." The player is transported to another space in this game, where an instruction sheet is presented [66]. A number of colored doors, which are used as modes of transport between spaces, are assigned to the questions. Green and Blue doors provide forward or backward progression, while Red doors give either victory or loss. This setup was made to test how well the player does when faced with familiar data, provided that previously proper implementation was given. The player should move and read the instructions at their own speed, and a timer begins to count, which will be used in the final data analysis [67].
A different set of rules applies to this game:

- A player will go back and forth in order to read at their own speed through questions and instruction sheets.
- If a player responds incorrectly, they are transported to a room with a red door that will end the game in defeat.
- If the player does it through all 9 questions and goes through the red door at the end, the game is won, which means victory this time round.

### 2.5 Data Collection
The subjects chosen all varied as much as possible in age, education and IT experience in order to collect data. The subjects chosen would range from 18 to 35 years of age, with different IT experiences, as well as different gaming experiences. The design of the game was done with the intention of picking up and playing until the end for someone with no previous gaming or IT expertise. Since gender was not a factor included in the findings, gender was not a criterion that would be stated in any questionnaire [68].For both games, if the delivery method was selected correctly, then the portion of Gamification could display a high attempt to correct the ratio. Low timer numbers should be given in the game-based learning section. After trying both games, a questionnaire was supplied to the test subjects, targeting both quantitative and qualitative results. Using a 10-point rating scale, the former was aimed where 1 represented the least desirable outcome and 10 for the best outcome. Using two opinion oriented questions, the latter was obtained [69].

### 2.6 Literature Review
In order to get it how instruction can be moved forward, there has to be an understanding on the strategies of education.discussed an examination of classroom-teaching in order to confirm its quality at a given time [14]. They watch how the diverse variables display within the classroom influence the end-result, which is how much the understudy learned. Among the variables that concluded was that the requirement for the quality of education and how to spur the understudies to memorize way better ought to be given its due significance, which is able result in way better instruction by and large [14].

### 2.6.1 The theory of learning that supports game-based learning growth
Game-based learning is a type of model designed to arouse student enthusiasm so that the possibility of longer stored concepts, information or skills they are supposed to get from the game can be increased [15]. The game type (game) presented here still refers to the learning process, and learning activities while playing are expected to occur with this formatted interactive software. This is not something the consumer thinks they are really knowing [16]. The game is a well-designed curriculum to inspire and develop the awareness and skills of students. Research studies must combine proof with fundamental theories. The game-based learning model may also apply to behavioral theory, claiming that learning as a result of the interaction between stimulus and response is a shift in behavior. The creation of habits that tend to be learning outcomes is highlighted by this theory. There is also a philosophy of

constructivism, in addition to the behavioral theory behind the growth of game-based learning [17].This philosophy of constructivism states that students must discover themselves and convert complex information, check new data with old rules, and revisit it if the rules are not sufficient. Students must work to solve problems, find all their own things, and aspire with their own ideas to better understand and be able to apply knowledge.One of the most important concepts of educational psychology, according to this theory of constructivism, is that educators are not only offering students information. In their minds, students must develop their own knowledge [18]. By offering students the ability to discover or apply their own ideas, educators will promote this process and teach students to be aware and conscious of using their own learning strategies [19].

### 2.6.2 The learning in mathematics

More than any other subject, mathematics has the capacity to teach logic (developing reasoning skills, the ability to agree logically from what was originally given, and sufficient requirements to determine concepts, make decisions, find ways to solve problems) [20].Mathematical learning is a method of instructor interaction. The method plays an active role in investigating a problem, searching for relationships, measuring, making predictions, and checking the development of mathematical concepts and knowledge in students, as well as between students and students. To such concepts, mathematical learning must pay attention [21]. This is in line with the school mathematics principles and standards of the National Council of Teachers of Mathematics, which sets out six principles in school mathematics, namely equity, curriculum, teaching, learning, assessment, and technology [22]. In addition, it is stated in NCTM's school mathematics principles and standards that "effective mathematics teaching requires students to learn and then challenge and support them to learn it well" The instructor must, therefore, have an understanding of the knowledge and needs of the students and be able to provide motivation for their learning activities In addition, Van de Walle, Karp, & Bay-Williams indicated that: To supply High-quality instruction in mathematics. Teachers must [23]. Understand the math ematics they teach in detail. Understand how children learn mathematics, including knowledge of their own students' individual mathematical progress,Select instructional and learning-enhancing techniques [24].

### 2.6.3 In Education, Mobile Technology

Augmented reality is becoming mobile due to the rising success of mobile technologies (Huang et al., 2013). In reality, the built-in camera, sensors, computing resources, and cloud-sourced data power are resources that enable mobile devices to use AR [25]. Moreover, regardless of some hardware-related limitations, its portability makes the use of MAR more common than on conventional desktop computers. This contributes in many fields to a growing use of MAR. Several scholars, for instance, have produced research related to, among others, marketing, tourism, business, navigation, or medical training. The significance and effect of MAR in education is discussed in this section [26]. In reality, several studies supporting the inclusion of AR and MAR in education are presented in the literature. The authors established a thematic analysis of the literature on Mobile Technology and Augmented Reality in K-12 education in this respect. They suggest, based on their studies, that the use of these methods in education has many advantages. For instance, they state that "AR is a tool that can be used to support students to become thinkers and problem solvers of the 21st century" (p. 288) [27]. "In addition, they argue that by highlighting four affordances such as "authentic learning, student-centered learning, contextualized learning, and visualization of subject content" AR "can broaden and strengthen teaching and learning (p. 288). In this sense, several scholars have carried out some analyses. Saltan and Arslan conclude that AR will boost the academic performance of students in the sense of formal education and increase their commitment and motivation to learn. With regard to primary education (6-13 years of age), a systematic analysis of game-based augmented reality learning is given by some scholars, who conclude that this method has many

benefits:Information acquisition, increased motivation, increased participation, and strengthened teamwork[28]. In addition, they argue that AR technology provokes optimistic attitudes towards the learning process for students, thus enhancing learning efficiency. Another example is a gaming approach to support AR-based ecology-related learning activities carried out in real-world contexts [29]. They conclude that this approach will enhance students' learning attitudes and their learning success in the field on the basis of an experience conducted at an elementary school. In fact,' empirical evidence shows that AR can make a positive difference to how students learn, and there is hope and potential for AR's future.'(p. 288) [30].

### 2.6.4 Blockchain Technology characteristics

Traceability is the capacity within the blockchain network to trace a particular transaction. Useful details for monitoring the transaction would be discovered by examining the block detailed information of each transaction, since blockchain is time-order organized, and each block is linked to the other blocks nearby [31]. Transparency enables transactions to be monitored by all participants of the blockchain as transactions are broadcast and published as when inputted [32]. Within the network, participants can detect and reject distrustful transactions and thus build a sense of openness, transparency and security.Without the permission of other participants, knowledge on the blockchain cannot be changed, thereby creating mutual confidence, security and resilience against internal or external attacks [33]. Decentralization facilitates the distribution according to the distributed framework of data processes such as input, dissemination, verification, update, storage on the blockchain network. This ensures that program execution and data processing risk and liability are shifted from centralized systems to decentralized blockchain networks, where trust is built between network nodes through strong encryption and decryption techniques.Immutability property ensures that at all times the details and logs of transactions that are mutually generated within the blockchain network are consistent [34]. It is also not possible to alter or delete authenticated transactions or committed blocks [35].

### 2.6.5 Gamification

To get it what is required to form a gamified application, one must get it what the term Gamification implies. Coined for the computerized media industry, clarifies how the concept was built without an real clear definition of its substancen [36]. It was coined by Scratch Pelling in 2002, agreeing to, but got to be broadly known in 2010. Its most common highlight is that it makes utilize of game-elements in a setting that's not as a rule ascribed to recreations, which lead this include to become its widely acknowledged definition. said that it may be a concept that relates to the "diversion" portion of a framework, rather than the "play" parcel. These two components are what characterizes a diversion made for recreation or a framework made with game-elements included on best of it to be made more engaging to clients or understudies [37]. As expressed some time recently, in arrange for a framework to be considered as a gamified one, it cannot be plan as a full amusement, but or maybe as a framework that takes certain components into itself to create the utilitarian angles of the framework less dull or more educative [38]. gives different illustrations of what components can be considered for such a framework. The examples below are fair a number of from the ones said [39]:

- Advance Bar: A framework that records the encounter picked up by activities completed, and deciphers it into visual criticism for the player to take after.
- Avatar: The virtual representation of the player online, this component is utilized for the social perspective of such frameworks.
- Identifications: A image of accomplishment, the identification is utilized to show the triumphs of the player's activities. These are comparable to the identifications given out by Boy Scouts.
- Focuses: The foremost essential of compensate frameworks, focuses are given when the client performs an activity that reflect the application's usefulness.
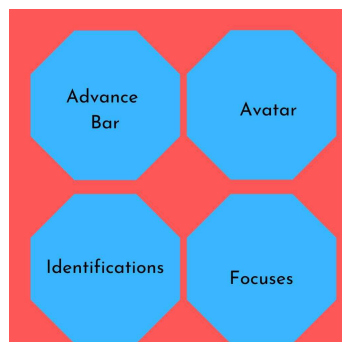
**Figure 2.** The examples below are fair a number

As sketched out by, in arrange for a framework to appropriately actualize gamification, the framework itself must appear a degree of flexibility, so that each player feels comfortable inside the community of the benefit [40]. This flexibility must be taken from diverse points, between components such as amusement mechanics and flow, or identity and social demographics .There are different segments in society that make utilize of such frameworks. Once more, offers a few cases, a few of which are [41]:

- Instruction : This will be seen in Duolingo and Codecademy, where the previous may be a dialect instructing framework, though the last mentioned is utilized by software engineers to memorize their make. These two frameworks make use of the previously mentioned diversion components that recorded, which incorporate encounter focuses, focuses that are displayed as cash and identifications to exhibit advance [42].
- Assignments : Gamification makes a difference individuals fulfill their objectives on the Habitica stage fair as their trademark is: Motivate yourself to do something. The site does this fulfilling dynamic individuals with gold and encounter, and dormant ones with misfortune of wellbeing. Besides, each client can construct an avatar on the site, but a few highlights are as it were accessible by means of coins and gold. In this way clients can "spend" the gold they have collected [43].
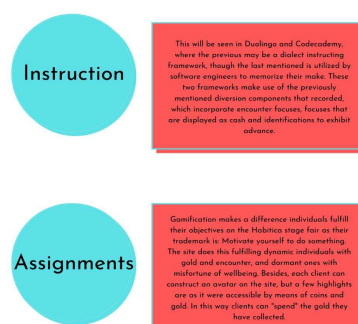
**Figure 3.** support level framework

**2.6.6 Gamification Diversion Based Learning**

In differentiate to utilizing Gamification, Diversion Based Learning is the utilize of centered recreations to shape a learning environment. talks about the utilize of centered diversions and notices what should be combined with instructive utilize [44]. It is significant to note that non-focused diversions can be totally as a lasting substitute based on conventional instructive strategies. A vital angle based on such sort of play is that it can improve the understudy learning environment, & offer assistance instructors to superior recognize subjects they are utilizing [45]. In their report, for a case ponder supported by the European Union to appear how compelling a diversion is at educating its members. The amusement highlights a 3D reenactment based on an clearing situation, in which players must escape based on a burning building [46]. On the other hand, 3D diversions are not the as it were way to form instructive recreations. frame a multi-touch perplex that instructs rudimentary understudies the concepts of Taiwan's geology. In his inquire about, he looked at utilizing Minecraft's instructive highlights to see how compelling they truly are. In his research, he collaborated on employing a expansive number of educates who utilize this diversion to educate more youthful understudies [47].

**2.6.6 Blockchain**

In 2008, Satoshi Nakamoto discharged the paper "Bitcoin: A Peer-To-Peer Electronic Cash Framework", which cleared the way for the well known blockchain framework [48]. gave a nitty gritty rundown on how the framework works. A blockchain is an expanding set of information squares that are associated within the frame of a single long chain. These pieces are associated by a secure cryptographic hash. This chain of connected information pieces is seen as a common record and is spread over a peer to peer network. Each computer that's associated to the arrange has an overhauled duplicate of the same common record [49]. Most imperatively, the record itself is secure, and the database can be amplified as it were by including modern squares into the chain. Changing records which have as of now been relegated to the chain is incomprehensible. In arrange to get it how blockchain works, clarify the 4 fundamental focuses of its security [50].



**Figure 4.** 4 fundamental focuses of its security.

- Data encryption There are two sorts of encryption plans for different purposes: Symmetric and Hilter kilter. In topsy-turvy calculations, different keys are utilized for plaintext encryption and ciphertext unscrambling. Sender and recipient in this frame of encryption both have a key match of a open and private key. Since the information is scrambled by open key beneficiaries, it is as it were the beneficiary who can decode the information [51].
- Modification prevention: The information put away within the chain isn't simple to alter. Employing a Hash Reference, the squares are bolted together and each unused piece contains past block's hash esteem. A hash function's main property is that in the event

that anybody changes a single bit within the input, the whole esteem will alter in yield[52] .

- Inserting new blocks: Bitcoin mining is the method of including exchange records to the open record of past exchanges. The mineworkers unravel a complex numerical issue alluded to as 'Proof of Work' to add a unused piece. Within the same arrange, there may be numerous diggers, but as it were one can be effective at any given time [53].
- Data verification in blocks: Interior a block the information or exchanges are put away within the shape of a hash-based tree information structure called a Merkle Tree. In the event that somebody does not take after the structure of the tree, and a single exchange is as of now controlled, at that point the complete hash yield will be distinctive. As it were those exchanges that have been altered with will be erroneous, though the rest will be the same [54].

The foremost celebrated utilize of blockchain is the cryptocurrency Bitcoin which was discharged in 2009. Bitcoin works beneath blockchain innovation and takes after the same controls and rules. In arrange to store money a client needs a web wallet, which contains a collection of software-controlled Bitcoin addresses and private keys [55]. A private key could be a cryptographic hash of 64 characters which demonstrates proprietorship of a particular address. too give a down to earth utilize for blockchain, this time inside the circle of Genuine Bequest. The cash utilized by this investigate isn't Bitcoin, but Ethereum, which makes utilize of Ether. Ethereum is another cryptocurrency that stemmed from Bitcoin. The esteem of this cryptocurrency is distant less than its forerunner [56].

## 3. RESULTS AND DISCUSSION
The results for both games are described and discussed in this section.
### 3.1 Gamification
During the entire experiment, Table 1 indicates the frequency of the attempts and correct answers. Overall, the findings indicate a positive number of attempts, and also a high number of right responses. Based on this knowledge, because the game required the player to correctly answer two questions to advance, it can be inferred that only one player failed the game and that the player failed during the first segment. Just 44\% of the questions had an attempt rate equal to the correct response rate, according to the results, while 33\% of the questions had two more attempts than correct answers, and 23\% had just one attempt to correct answers [70].

| Question ID | Attempted | Correct |
|:---:|:---:|:---:|
| S1_Q1 | 9 | 7 |
| S1_Q2 | 9 | 8 |
| S1_Q3 | 10 | 8 |
| S2_Q1 | 9 | 9 |
| S2_Q2 | 8 | 8 |
| S2_Q3 | 9 | 8 |
| S3_Q1 | 9 | 9 |
| S3_Q2 | 9 | 7 |
| S3_Q3 | 8 | 8 |

Table 1. indicates the frequency of the attempts and correct answers.

### 3.2 Game-Based Learning

The frequency of the type of message that was shown, as well as the amount of time it took to display the message, is shown in Table 2 below. "The winning screen is represented in the table by the letter "V" and the losing screen is represented by the letter "L. It can be deduced from the data obtained that something in the experiment was amiss. With just 10\% of the dataset winning, it can be inferred that the game failed to provide all the knowledge it was capable of. It took each player 195.4 seconds on average, about 3-4 minutes, to play the game [71].

| Player ID | Time(Seconds) | Message Shown |
|---|---|---|
| Player 1 | 170 | V |
| Player 2 | 76 | L |
| Player 3 | 237 | L |
| Player 4 | 139 | L |
| Player 5 | 165 | L |
| Player 6 | 125 | L |
| Player 7 | 370 | L |
| Player 8 | 152 | L |
| Player 9 | 192 | L |
| Player 10 | 278 | L |

Table 2. Player's duration in the game and the result

Based solely on this test between Gamification and Game-Based Learning, the results given by the test subjects show that Gamification should be applied when addressing a new, complex topic. In view of the two systems being applied as they were in the experiment, this deduction is made. If more design and layout decisions, such as those given by the views of the test participants, had been made, the results would definitely have been quite different.

### 4. Conclusion

Two implementations, Gamification or Game-based learning, were implemented and tested in this study to determine what is more effective. In order to decide whether the established systems could provide a good enough basis for the selected subject, which was Blockchain, the games were handed out to random people from different backgrounds. Gamification managed to achieve an overall better outcome from the test subject than Game-Based Learning on the basis of the data . Gamified systems tended to have better average scoring than their counterparts in the experiments presentedThe Gamification method was able to obtain a 90\ percent win rate from the test participants, while in Game-Based Learning, the direct opposite was found, with only a 10\ percent win rate achieved. In the opinions of the test subjects, who gave significant feedback on how to strengthen the system, the explanation for this disparity in victories for the second

system can be found.The introduction of game-based learning has gained acclaim for its graphical qualities. It did not fulfill the functional requirement for the player to instruct others or to provide enjoyment. To distribute the details, more RPG (Role Playing Games) elements, such as questing, monster killing and NPC transactions, could be made, which makes it more interesting. To have several text areas that the student must click through, gamification was created. The reading problem of these types of games needs to be solved by potential implementations. In fact, reading is an important part of learning, but it can make or break the game by the way the players are made to read.

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