DIAGNOSES OF THE INITIAL KNOWLEDGE IN THE CLASSES IN INFORMATICS AND INFORMATION TECHNOLOGIES OF THE STUDENTS ON THE TOPIC "BLOCKCHAING TECHNOLOGIES"

Natalia Staikova

Abstract: The current paper presents the model for initial diagnoses of students' knowledge on the topic "Blockchain technologies". The topic is new for the classes in informatics and information technology and here is a way to assess the initial knowledge gained through non-formal education. The aim is to draw conclusions about both the knowledge and the deficits in students' knowledge. This study and conclusions will be used for a basis within which to build the curriculum. Cloud technologies are used for the test and data analysis.

Key words: *blockchain technologies, cloud technologies, assessment methods, non-formal education*

Introduction

The rapid development of all kinds of technologies, the communication boom and the transition of our lives to an online environment for months, insistently gives us reasons to think about our topics, knowledge and methods in school or virtual classroom.

In recent years in my work as a teacher and as a parent of two growing children, I increasingly feel the demotivation and unwillingness of children to act and study the old way – to learn things that are no longer relevant, by methods that are boring for them. The overall change of the situation is, of course, a long and difficult process, encompassing the teaching of teachers and a complete change in the vision of education. This paper presents a model for diagnosing students' initial, informal knowledge on Blockchain Technology.

Given that the topic is not covered in school at any level, this initial test includes questions related only to basic concepts. After completing course, a higher level diagnostic test should be applied.

This is a small step towards updating topics and ways to introduce knowledge in an innovative and hopefully eye-catching way for children (and teacher).The questions in the presented initial test are based on the experimental curriculum on the topic "Blockchain technologies", which is the subject of another of my works.

The aim of the present work is to offer a tool for diagnosing the initial, informal knowledge of age and education appropriate students (profiled classes with profile Informatics). The test will be actually applied to students in two different schools in Plovdiv in classes with Informatics profile at the begging of October 2021.

Annotation of Blockchain Technology

Blockchain is an emerging technology introduced in 2008. It was first used as a peer-to-peer ledger for registering the transactions of Bitcoin cryptocurrency [6]. The aim was to eliminate any third-party intermediary and allow users to make their transactions directly.

According to Gatteschi [7], the development of blockchain-based applications could be divided into three main stages: Blockchain 1.0, 2.0, and 3.0. Blockchain 1.0 was used for cryptocurrencies and its focus was to facilitate simple cash transactions. Subsequently, Blockchain 2.0 was introduced for properties and smart contracts. These smart contracts impose specific conditions and criteria to be met before registering them in the blockchain. Registration takes place without the intervention of a third party. In Blockchain 3.0, many applications were developed in various sectors such as government, education, health, and science.

The application of blockchain to education is still in its early stages. Only a small number of educational institutions have started to utilize blockchain technology. On the other hand, the technology is so fast adopted in various areas of life and business, that it is important to become a part of curriculum.

Although the volume of literature on the application of blockchain to education has been increasing in the last few years, it is still fragmented, and no systematic review has yet been conducted on the topic [4]. A research made in 2019 year made a conclusion that the blockchain topic (especially in education) is reviewed mainly in conferences and just a small part – only 7 % in journals [4].

Working Flow of Blockchain

The information in a blockchain is stored in cryptographically encrypted chunks known as blocks [8]. The next successive block contains information about the previous block and hence forms a chain. Thereby it gets its name. Each block in a blockchain contains a unique hash, transaction data and hash of the previous block. The initial block is known as genesis block. A genesis block does not contain a previous hash. Participants of the blockchain network can be organizations, individuals or institutions, which share a copy of the ledger that contains their valid transactions in a sequential manner [5, 9]. The new transactions are added to the existing records by consensus of the miners participating in that network. To validate the transactions, miners have to

implement the blockchain's algorithm in order to be rewarded with a native token as per existing economic consensus mechanisms like proof of work, proof of stake, etc. [9].

The fastest miner validate each transaction in a block and add it to the blockchain. In bitcoin, miner nodes take approximately 10 minutes to validate and add to the blockchain. A miner is selected from a pool of miners using a proof-of-work (PoW) consensus mechanism [10]. A blockchain uses a consensus mechanism to allow the miners to agree on a single value. After successful validation by all the miners in the blockchain network, the block is added to the blockchain. The miner obtains a transaction fee and new block addition fee in case of PoW [5] The ledger runs on a peer to peer network and thus all the nodes participating in the network get a copy of the original information.

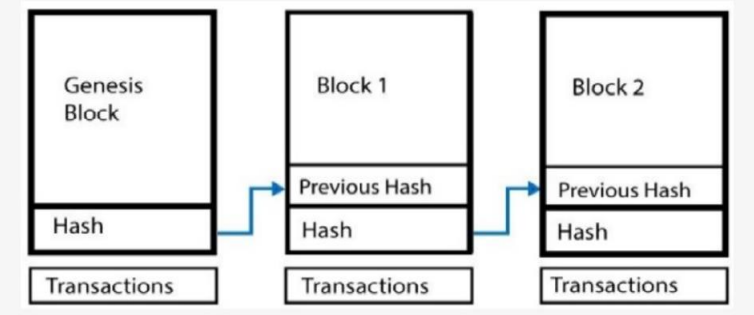


Figure 1. Blockchain architecture

As based on a peer-to-peer network. If any node's information in a blockchain is tampered with, it will not match the information copied on other nodes. As a result, the tampered copy will get discarded as the majority will not agree on the tampered copy to be true. Hence, any third party or broker is discarded by building secured trusted peer to peer network and based on rules implemented by consensus mechanisms.

A blockchain network has the following key characteristics:

- Consensus: All participants must agree on validity of a transaction for it to be valid. Blockchain offer a variety of consensus algorithms, which are chosen by the users according to the requirement of blockchain application.
- Provenance: Participants know where the asset came from and how its ownership has changed over time.
- Immutability: No participant can tamper with a transaction after it has been recorded to the ledger [5]. If there is an error in a transaction, a new transaction must be used to reverse the error. Both these transactions are then visible [5]. The error in transaction means that the transactions are either failed or rejected by miners. Usually the transactions with very low fee are rejected.

- Finality: A single, shared ledger provides one place to go to determine the ownership of an asset or the completion of a transaction.
- Smart Contract: The smart contracts [5] are programs of computer that support in the transmission of money or anything of value. When a particular policy is met, these programs run automatically. Each smart contract contains a contract address, predefined functions and private storage. Ethereum [11], is an open-source and decentralized platform that executes smart contracts. To construct smart contract Ethereum platform uses solidity as programming language.

Basic application of blockchain technology

The most popular application of the technology is related to Bitcoin and other not so well known digital currencies, but the technology allows for keeping digital registers of any type-identity, medical records, register of employee qualifications, etc.

Blockchain technology enables distributed public financial records that store unchangeable data in a secure and encrypted manner, and ensure that transactions cannot be maliciously accessed. While bitcoin and other cryptocurrencies are the most popular examples of using blockchain, this "distributed record technology" (DLT) finds a wide range of applications. It is applicable for data storage, financial transactions, real estate, asset management and many other applications [1].

Figure 2. Applications of blockchain

Voting. Electronic voting is a major topic in Bulgaria, with similar process taking place in many other countries. Blockchain technology can be used to track

and count the votes. The technology makes it impossible to change the vote, and the high level of encryption guarantees the voter anonymity.

Public administration. The Blockchain has a decentralized nature, which is quite discouraging for hackers-the lack of a central server that stores all the information hinders their efforts. The fact that it is impossible to make post-factum changes in block would discourage officials with questionable morals who would make changes to contracts or public tenders. This would increase the transparency of the state administration and make fraud more difficult.

Financial institutions. The banks and the businesses are heading to blockchain technologies more and more. The technology allows everyone to accept and make transactions in the most transparent and secure way. The technology is also very useful for currency storage as it makes the process more secure. Remittances also become faster and without commission, because there is no intermediary in blockchain. The high reliability and security of the technology makes the intermediary existence unnecessary.

Education. Educations is becoming more democratic and decentralized, but the need for certification and keeping high reputation level remains. The focus on relevance and job opportunities, the need for transparency, and things that blockchain technology can provide: it is a huge, open and secure database [1].

There are many others applications of blockchain as social media, Internet of things, smart cities [5].

The diagnosis test

As mentioned before, cloud technology is used for the test -google forms in particular. The google forms technology gives opportunity to collect the e-mail addresses of the users, as I did in the test itself. The names of the participants are also collected. Every user can complete the test only once. Every participant can see the right answers and the generalized answers at the end of the test.

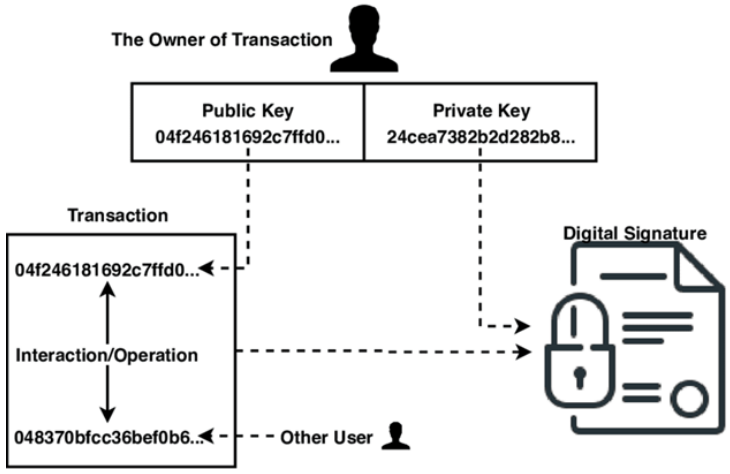
Each answer gives different amount of points. The total amount is seventy points. The test is checking the basic knowledge of blockchain. As it is gained by an informal educationcan it is expected that the students would not have deep knowledge on the topic.

The questions are based on the experimental curriculum I developed in other of my works [2, 3].

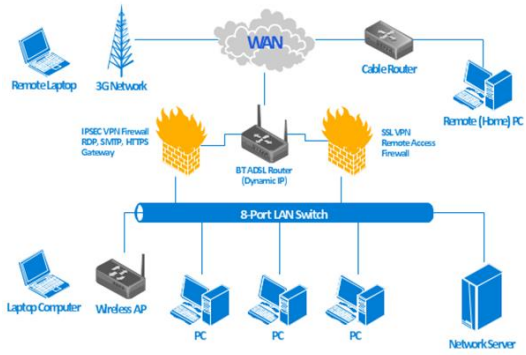
Dyagnostic test "Blockchain Technologies"

Name and sirname:
E-mail address:
School:

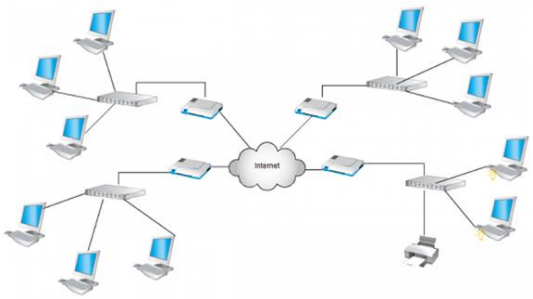
1. Which of the following schemes is a blockchain representation?



Scheme 1.



Scheme 2.



Scheme 3.

2. What is blockchain?
   - Blockchain is a cryptocurrency.
   - Technology for storing information in a computer network.
   - I've heard the term, but I don't know what is means.
   - I haven't heard the term.
3. Please, check two of the applications of Blockchain that you've heard of.
   - Automotive industry.
   - Online commodity exchange.
   - Education.
   - Information technologies.
   - I do not have any information on that topic.
4. Which of the following names of markets for cryptocurrencies are familiar to you?

- www.coindesk.com
- www.kraken.com
- www.markets.com
- coinmarketcap.com

5. Which is the most important component in the digging machine?
   - Processor.
   - Mother board.
   - Video card.
   - Other.
6. Write down one main application of Blockchain (only of you know one).
7. Please, write down few short sentences, describing the main things you know about Blockchain. If you do not have any information, please write down "I don't have information".

Areas for future research

As mentioned, this test is in basic level. The education is in a huge crisis and the last two online years did not help. I think every teacher in the classroom will agree that the tests students covered with ease three or five years ago, are now just impossibly difficult for the students the same age. The education is flying down and we should think of new and interesting topics and methods to have back the kids. This test and the curriculum are not university level, but high school level. The results would be interesting, because the test will be conducted in one of the best schools in Plovdiv and in one of the schools that do not have that success yet. It is interesting to see if the students in both of the schools have the same level of informal knowledge. It will give guidelines for future work with the students.

If the curriculum is applied in the classroom, a new higher level test can be conducted and the results can be compared.

Acknowledgments

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