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Application of Blockchain Technologies and Game Approach in the Educational Process of Universities

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Abstract: This article deals with the use of Blockchain technology and game approach in the context of the educational process in high education institutions. Application of new information technologies and the educational sector general digital transformation in conjunction with Blockchain technology and game mechanics allow, on the one hand, to increase information systems reliability and, on the other hand, to increase the efficiency of learning the information by students. Based on the materials described, the model is developed that can be used for own educational software products elaboration.

INTRODUCTION

The education system is a priority area of the state's internal policy, since economic, social and technological development is closely related to the formation, preservation and enhancement of human capital, as well as improving the quality of training for specialists. Timely response to global changes (for example, the transition to the sixth technological order) contributes to faster adaptation to new conditions of scientific and technological development, more efficient modernization of existing processes, the emergence of social and technological innovations in universities.

The sphere of education itself remains rather fragmented (there is no integral system of education), where each educational institution provides services at the expense of its own resources. There is also a focus on the market economy (the predominance of the service sector, low interest in research and production), low funding [1-3].

To solve the problems identified, it is necessary to change the focus of educational programs towards personal and meta-subject competencies, build the educational process on the balance of theoretical and practical knowledge, introduce modern technologies (blockchain, game approach, etc.) [4-6].

The aim of the study is to create a model of a software product containing the features of blockchain technology and a gaming approach for further use for educational purposes.

METHODOLOGY

Blockchain technologies and a gaming approach fit into the components of innovative development in education (educational process development, technical and technological development), and also have the characteristics of innovative educational models: the use of games and simulations in training, the use of modern information and communication technologies [7, 8].

The blockchain is an unchangeable public distributed (decentralized) data registry that allows transactions without a single central intermediary (a decentralized network or a peer-to-peer network consisting of nodes - individual users). The blockchain is a built-up sequential chain of blocks containing encrypted or open information.

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In addition to information, each block stores its own hash sum and the hash sum of the previous block in the chain. Blockchain was invented already in the 90s of the twentieth century, but found its application only in 2009 due to the advent of the crypto currency Bitcoin. Since then, the technology has found its application in banks, medicine, logistics, etc. [9, 10].

Figure 1 shows a blockchain technology scheme with highlighted structural elements.

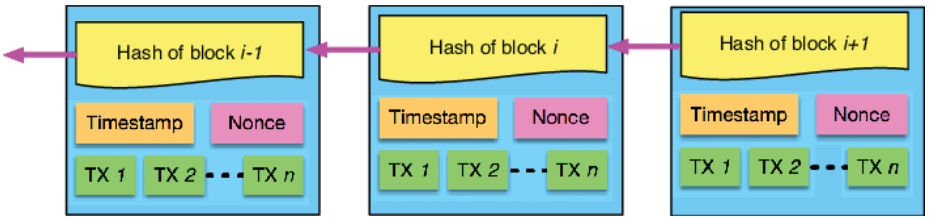

FIGURE 1. Blockchain technology scheme

It can be seen from Figure 1 that any block contains the time of its creation in Unix format, the transaction chain X_1 - X_n in any convenient format, Nonce (the number of iterations of selecting the hash sum of transactions with the Proof-of-Work algorithm), the hash sum the block itself and the hash of the previous block. This structure leads to the immunity of the contents of the block and allow using available software tools (Golang, Java, JavaScript, etc.) to check the validity of the block chain. Also, it increases the security of information in the context of copyright. This feature is supplemented using smart contracts - a computer program aimed at ensuring the fulfillment of contractual conditions between users in automatic mode [11].

Currently, the technology is actively developing. The Committee of the international organization for standardization ISO/TC 307 "Blockchain (BC) and distributed registry (DR) technologies" deals with standardization issues. However, there are still certain problems related to scalability (exponential growth of data volume) and security (personal data protection, stability of cryptographic algorithms) [12].

In addition to its use in crypto currencies, blockchain can potentially be used in the field of education. The University of Nicosia (Greece) uses technology to manage students' electronic certificates, while the Holberton school (USA) stores diplomas in an open decentralized registry [13].

The game approach as a way to positively improve the activity of students, their social interaction, and improve the quality and productivity of work fits into the concept of innovative educational models. In this case, the game is considered not as entertainment, but as a term "serious game" aimed at obtaining skills in the context of a certain field of activity (medicine, production, science, etc.) in the form of an interactive narrative [14]. Figure 2 shows the relationship between these types of games with the inclusion of a serious game as a phenomenon. Video games tend to simplify the game process and avoid reality. In turn, serious games tend more towards relative realism in the gameplay.

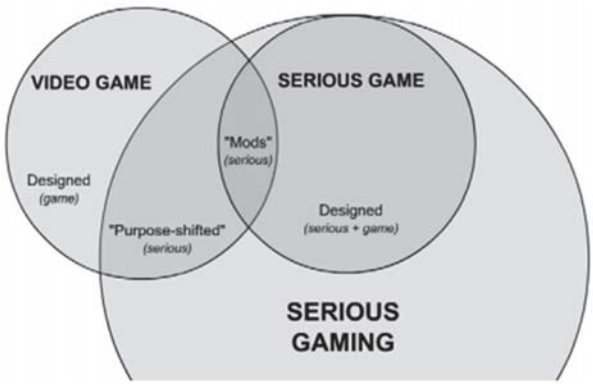

FIGURE 2. Connection between video games and serious games [14]

The Classcraft system [15] is an example of high-quality and successful integration of a classic video game into the educational process. Here, a deep gaming educational system is created in which student players choose a hero for themselves and travel through the virtual world, studying one or another subject, developing their character and

forming their own knowledge base during the game. In [16] it is stated that the Classcraft system is an addition to the existing Tire 1/Universal SEL process of skill formation and development, as well as a tool for implementing PBIS.

The study "Classifying Serious Games: the G/P/S model "[17] provides a model for classifying "serious games" G/P/S, which includes the strengths of other models and focuses on gaming and non-gaming aspects of the educational process. There is a fundamental difference between regular computer games (video games) and serious games – focusing on the gameplay in different contexts.

The G/P/S model is a classification of serious games in three aspects: Gameplay, Purpose (goal of the game: messaging, training, data exchange), Scope (boundaries of the game: market, target audience, etc.). An approximate representation of the model is shown in Figure 3 below:

FIGURE 3. Presentation of the G / P / S Model [17]

RESULTS

The use of blockchain technologies, the principles of gamification in the aggregate will allow adding up efficiency when creating software tools aimed at the educational process.

The integration model of the above technologies can be represented as a three-level system:

1. The first (lower) level. A decentralized network that provides communication between independent nodes. Communication can occur using any system (for example, gRPC).

2. The second (middle) level. This level is represented by a blockchain connected to the lower level, forming a decentralized register of information managed using a DHT (distributed hash table of user addresses) and any DBMS.

3. The third (upper) level. The system level contains the game platform, an add-on above the previous two levels. User data inside the game is stored in a decentralized storage and is not subject to change, which ensures the safety of data and permanent confirmation of ownership of a particular resource in the game.

Further work on the model is appropriate because of the large potential for use in education.

CONCLUSION

The article discusses blockchain technology and the gaming approach in the context of the educational process in higher educational institutions. The use of new information technologies and the general digital transformation of the education sector in conjunction with blockchain technologies and game mechanics allows, on the one hand, increasing the reliability of information systems within educational institutions, and on the other, increasing the

efficiency of students learning information. Based on the materials described, a concept model was compiled that can be used for our own educational software products.

Further work on the model is appropriate because of the large potential for use in education.

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