A Blockchain Platform For Teaching Services Among The Students

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Abstract: - The lack of digital literacy in the student community is high and depends on the academic background of the student. Although the skills gap can be filled by hiring additional academic staff and improving learning methods, it is obvious that funds or teaching time are not enough to cope with these changes. Our academic effort proposes a blockchain platform maintained by the students, which allows the students to exchange teaching duties and teach each other digital skills. The students adopt the role of the lecturer or the learner and receive reputation points as a reward. The platform is designed by using a gamified type of blockchain technology because it empowers a trustful and entertaining method for the exchange of teaching duties between the students.

Key-Words: - Blockchain, digital literacy, smart contract, digital skills, higher education, gamification

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1 Introduction

Digital literacy is a term synonym with the sufficient knowledge of the information communication technologies by the people and especially the workforce. The term was initially defined by Paul Gilster in 1997. According to Gilster digital literacy is the smart use of the digital technology and the retrieved information in the context of the everyday life [1]. In 2019, the government of the United Kingdom of Great Britain commissioned a research through the Department for Digital, Culture, Media and Sport (DCMS). The scope of the research was to detect the demand for digital skills in the UK and then define a skills' policy. The statistics were impressive and demonstrated the value of the digital skills. Digital skills are in demand from at least 82% of the online-advertised job openings in the UK and companies requiring digital skills pay 29% higher salaries than those that do not [2]. The need for digital skills is obvious, especially in our era where the Covid-19 situation forces most of the workers to adjust themselves in a distant working environment with the help of ICT. Even if the demand for digital skills is high, the actual capability of digital skills is low at the European Union level. As stated in the report of the Eurostat, during the year 2019, almost half of the European population (56%) has basic or above basic overall digital skills [3]. In other words, due to lack of digital skills, the other half of the EU population is being prevented from having access to a job with a high salary. The fact that the EU population lacks of digital skills, raises the opportunity to develop a platform for digital skills learning. While there are many digital skills platforms (e.g. Coursera) that you can use free, the majority of them use a mass teaching method. The space for customized teaching services is limited because the purpose of those platforms is to offer digital skills to as many learners as possible. The platforms for customized learning services for digital skills usually charge for their services, and not all the potential students can afford this type of learning. The aim of this paper is to set up the conceptual design for a digital skills platform, which offers a customized and affordable method of learning.

2 The platform

Higher education is a sector where the digital skills are being taught by the teaching staff including lecturers, professors and guest tutors. Although this seems to be the formal way of teaching, several issues arise and prevent the students from learning the digital skills. For instance, most of the lectures are being delivered during times that the students might not be available. On the contrary, a teaching session on demand would be more attractive for the

students who have to work during their studies. Usually, the problem is that the tutors do not have available time for video recordings of their lectures or the university does not fund this option. One possible solution to solve the problem is to develop a platform on which students with the appropriate knowledge will teach each other digital skills. Consequently, the official teaching staff of the university will not participate in the teaching process at all and the students will gain knowledge and the desired experience of becoming virtual lecturers! The platform's users will be students from the same university so that the platform's system can confirm their log in details from the registration at the official system of the university. The users will have the right to learn or teach, which assigns them a role of "students lecturers" or "students learners." The student learners will have the right to request a series of private lessons from the students lecturers, upon registering on the platform's system. The capability of the students lecturers to teach a course will derive from their performance in the real university. As long as a student has passed a digital skills course in the real academic program, then he has the right to teach this course at the platform. Regarding the infrastructure of the platform, we believe that the students have to trust the platform before using it. That is why the technology of the platform should be a trustful one, which minimizes the risk of unauthorized access from intruders. Our suggestion regarding the development of this platform is a secure technology with aspects that will boost the intention to use the platform. Thereupon, this paper discusses the design of a blockchain platform with gamification features [4].

On technological level, the advantages of the blockchain technology are many [5], [6]. First, this is a decentralized technology [7], which means that the technology is not managed by a central authority. This is meaningful for the students because they are free to develop a self-administered platform without the consent of the university's authorities. Moreover, the blockchain technology allows multiple stakeholders to collaborate on a common project even if they do not trust each other [8]. The implementation of a collaborative scenario between entities that are probably unknown, poses the risk of potential fraud during the transaction. In this case, a technology such blockchain that offers a secure method of transaction based on cryptography [9], might be the best solution. This fact encourages the collaboration between the students because it reduces the risk of the invasion of privacy.

Apart from the used technology, it is crucial for the long-term lifecycle of the platform the actual participation of the users on the platform. The engagement of the students with the operation of the platform requires a suitable motivation schema. The motivation for the providers of the teaching services could be a financial or non-financial reward to keep the stakeholders involved in the project. If the reward is financial, then the "students learners" will probably turn to the MOOCs (Massive open online courses) because they are free and already popular in the academic community [10]. Furthermore, the financial reward is a challenge because there could be lack of trust between the "students lecturers" and the "students learners" regarding the quantity of the financial reward, and the quality of the delivered services (teaching services).

Consequently, we propose a non-financial reward of reputation points with extended advantages for the students lecturers. This is a gamified method featuring elements that will affect the intention of the students to use the platform [11]. Gamification is the use of game elements in a non-gaming environment [12] and according to many scholars, affects positively the intention to use a new system [13], [14]. Examples of its use are present in both public [15] and private sector, several of the gamified elements that could be used are:

- Leaderboard with rating for the best tutors of the community.
- Special badges and reputation points as a digital currency.
- Easter eggs that open virtual doors on the platform for additional learning sessions.
- Reward of free courses to encourage the new users to participate on the platform.
- Virtual battles between the most popular tutors to gain more popularity between the learners.
- Cartoon characters that encourage the passive users of the platform to become active by offering teaching services.

For our platform, we are going to use reputation points as a virtual currency and reward for the teaching services. Depending on the amount of the reputation points, the students lecturers will receive virtual badges as a sign of achievement and experience of becoming virtual lecturers. The most active users with the most valuable actions will receive a high amount of points. This number of points will lead to the acquisition of defined badges. In table 1, you can read the association between the required actions, amount of reputation points and the offered badges.

Table 1. Actions and Reputation points earned

Actions	**Reputation Points Earned**
User registration in the system	20
Course registration in the system	30
Teaching 1 course	50
Teaching 10 courses	600
Suggesting an idea for the platform	1000

In table 2 you can read the types of badges and the required reputation points.

Table 2. Badges and required Reputation points system

Badges	**Reputation Points Required**
Participant	1-50
Supporter	51-200
Junior Lecturer	201-400
Super Lecturer	401-1000
VIP Lecturer	1001-2000
Influencer	2001- 5000

As an extended advantage, the owners of the academic badges could use them to benefit from special advantages in the real university. For instance, VIP lecturers will be preferred in MSc and PhD studies in comparison with other candidate students. Moreover, Influencers will be preferred over other candidates for teaching assistant positions in the real university. Except, the students lecturers, the students learners will benefit from the gamified blockchain platform too. They will participate in a low risk environment because they do not risk their financial status and will learn new digital skills as well. The synergy between blockchain and gamification is going to create a platform that is both secure and entertaining.

2.1 Smart contract's design

For the design of the platform, we are going to use Ethereum [16], which is a software that simulates the building of a permissionless blockchain [17]. The main feature of the permisionless blockchain is the fact that allows any user to read or write on the system without a permission from a central authority [18]. In our case, a choice for a public blockchain seems a wise one because it will inspire many students to participate in the network and will boost its popularity. Ethereum includes the EVM (Ethereum Virtual Machine) a decentralized computing entity that is managed through the creation of accounts. The students lecturers and students learners will be externally owned accounts (EOA) controlled by their private keys. Under this condition, both lecturers and learners could remain anonymous and become capable of sending messages. Another type of account inside the system is the contract type of account. This type of account is an autonomous one, which is controlled by the smart contract code and its scope is to create smart contracts [19]. Most of the transactions and business processes on this blockchain platform could be developed as a series of smart contracts.

The structure of the smart contracts consists of the initial set up of the nodes on the Ethereum, the business services and the smart contract functions [20]. The suggested nodes on Ethereum are:

- The students lecturers that offer teaching services and create the smart contract.
- The students learners who create their Ethereum wallet to enjoy the learning services and gain access at the blockchain nodes.

The business services of the learning platform will be:

- User registration
- Course registration
- Course teaching
- Financial transaction (reputation points)

Based on the aim of its smart contract, the suggested smart contract functions of the smart contract are:

- Contract creation: The lecturer creates the contract by defining its terms and conditions, including the course's name and the lecturer/learner details.
- Contract starts: The learner signs the contract with the obligation that will send the X amount of reputation points to the lecturer.
- Smart contract: The system executes a code when the lecture starts and sends the agreed amount of reputation points to the lecturer.
- Contract ends: When the lecturer terminates the contract, it means that he is no longer available to deliver the rest of the lectures to the learner. In this case, the learner receives back any deposit of

reputation points. The whole architecture of the platform is depicted in figure 1.

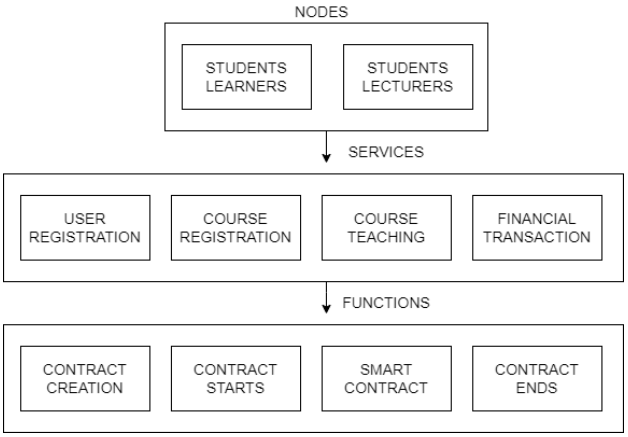

Fig. 1. The structure of the Blockchain teaching platform.

According to our needs, there are three types of smart contracts that could be used for the operation of the platform:

1. User Registration Smart Contract
2. Course Registration Smart Contract
3. Course Teaching and Financial Transaction Smart Contract.

User Registration Smart Contract: The new users could be only students of the same university. The authorities of the educational institute have given the students a pair of public and private keys to use it for registration on new courses and to sign digitally their examination papers. The new users register on the blockchain platform by using their public keys, and the system either recognizes and accept them on the platform as official students or enables them to browse the platform as guests without participating as lecturers or learners.

Course Registration Smart Contract: Any registered student is able to update his courses profile and add the courses that he/she is capable of teaching. The new user adds courses to the profile by using the public key, which was used during the registration. Moreover, the same public key could be used to register in the official courses of the university. In this case, when the student has passed a university course of a digital skill, the public key that he used could be identified by the smart contract. Consequently, if the student has passed the university's course, the platform identifies the person and allows him to add the course on the profile with the tag "verified". Otherwise, the smart contract rejects his application to add "verified" courses and allows him to add the courses with the tag "not verified".

Course Teaching and Financial Transaction Smart Contract: The users of the platform are able to learn or teach a skill. When the user finds on the platform a lecturer with the preferred available courses, he can book a new learning session with him depending upon his availability. The learner uses his public key to be identified as a verified user of the system and requests the teaching services from the lecturer. If the lecturer agrees to the deal, the smart contract arranges the transaction of the reputation points between the learner and the lecturer. The reward is an agreed amount of reputation points that improve the lecturer's reputation status. The more badges acquired from teaching services, the more popular students become among the community and has access to special benefits.

3 Conclusion

The scenario of a teaching platform, which is managed by the students, is not far from the truth. In special occasions, such the Covid-19 situation, the status quo of reality is being dissolved, and the communities have to redesign their activities. A form of education, which is student orientated will, possibly, persuade them to participate and adopt it as long as the transparency of transactions will prevail. Blockchain as a technology increases the transparency and reduces the risk for potential conflicts between non-trusted entities. Additionally, gamification as a method of motivation to use the system will trigger a boosted intention to use the platform. The research challenge for the improvement of the platform is an augmented operation in collaboration with other communities. For example, the ability of the students lecturers to teach digital skills to people registered in other self-administered blockchain platforms. This goal of this action would require the development of a multi chained blockchain and a large amount of computing power for its processes.

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Klimis Ntalianis has authored the introduction part.

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Report potential sources of funding if there is any