

Modeling the tokenomics of the personalized MOOC platform “Edu2Work”

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Abstract

This article analyses the possibilities of using blockchain technology in education. One of the main ones is the creation of new business models, because it is the blockchain technology that makes it possible to effectively implement a new educational paradigm by creating assets or tokens that will form the basis of a new system of rewarding students and teachers. We consider the most popular platforms in the world to be the ones that create payment and reward systems in education through the use of cryptocurrencies and tokenomics. However, it is noticeable that these systems lack a clear focus on personalised learning. This paper presents Edu2Work, a personalised MOOC (Massive Open Online Course) platform based on blockchain technology. The main idea of the platform is not only to provide an opportunity to purchase individual courses, but also to provide access to personalised learning implemented through blockchain technologies. We describe the tokenomics model of the platform and propose an approach to tokenisation of a MOOC platform focused on personalised learning. The proposed model is aimed at increasing the motivation of teachers and students through a well-designed reward system, and the adaptive search for students by companies looking for new employees can significantly simplify the employment and job search process for students. We also present a formalisation of the educational platform tokenisation model using an insertion modelling system. This formalisation mainly aims to identify modelling errors, shortcomings, or potential contradictions and determine practical scenarios for the system's operation.

Keywords

blockchain, tokenomics, tokenomic modeling, educational process, personalized education, MOOC platforms

1. Introduction

Education is a source of innovation in any field of human activity, as it is a base for the formation of future staff and a generator of new ideas. That is why education's development is continuous and must meet the requirements of the time. Digital technologies, which have already shown their effectiveness in economics and management, are an innovative factor in the modern development of the education sector.

Problem statement. One of the breakthrough technologies of the digital economy is blockchain technology. It provides the digital society with all the necessary conditions and technological mechanisms, eliminates intermediaries, confirms the authenticity of operations by network members, and modernises the educational process. Blockchain technology was first described by a group of researchers in 1991. It was practically implemented in 2008 when an anonymous user under the pseudonym Satoshi Nakamoto published a technical description of his cryptocurrency protocol [1].

Blockchain in education is still in its infancy, with only a few institutions implementing it. A 2019 survey by the research firm Gartner found that only 2% of higher education institutions were using blockchain, while another 18% planned to do so within 24 months [2]. The Global Blockchain Ecosystem in Education Market Research Report (2024) states that the use of blockchain technology for credential

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verification has increased by 40% over the past three years, while investments in blockchain technology for education have been growing at an annual rate of 50% [3].

Analysis of recent research and publications. The problems and potential applications of blockchain technology are actively researched. For instance, Shmatko, Borova, and Evseev explored possible scenarios for its use in education [4]. Other notable contributions include works by Sharples, Domingo, and Skiby, who considered blockchain's potential for improving and regulating the educational process [5, 6]. In work [7], authors highlight that blockchain technology offers significant benefits for higher education institutions (HEIs), particularly in administration and student services. Key advantages include secure and tamper-proof credential verification, which reduces fraud and simplifies certificate validation; efficient record-sharing across institutions and with industry partners, supporting student mobility and employability; and cost reduction through automation of administrative tasks.

Blockchain offers several advantages, particularly in the context of distance learning. Digitalising documentation can reduce the need for paper certificates and reports. Another important area is the promotion of online learning, which became especially relevant during the COVID-19 pandemic. Online courses continue to grow in popularity due to their affordability and accessibility.

Thus, the blockchain in educational institutions opens up huge opportunities for effective use. Its infrastructure can record all aspects of the educational process (e.g., documentation, statistics). Moreover, the blockchain's online orientation not only supports online class platforms but also enables effective assessment and document management with possibilities for continual updates and improvements.

In [8], the authors highlight how blockchain enhances the Massive Open Online Courses (MOOCs) ecosystem by providing a secure infrastructure for managing and validating educational records. It can securely store and verify credentials such as diplomas and certificates, making them easily verifiable without intermediaries. Moreover, integrating blockchain with MOOCs allows for features like gamification and cryptocurrency-based financing.

Those who have implemented the blockchain mainly use it to store and share academic records and credentials. However, its true potential lies in enabling new business models. Blockchain technology makes it possible to effectively implement a new educational paradigm by creating assets or tokens that will form the basis of a new system of incentives for students and teachers. However, tokenomics's opportunities for the education sector are still insufficiently explored. Currently, there is very little literature that discusses the use of tokenomics in the educational field. Scientists from the Universiti Kebangsaan Malaysia are exploring using the token economy to ensure the sustainability of education in their work [9]. They review and evaluate token economy applications for managing behaviour and engagement among young learners. The article [10] presents a thoughtful exploration of tokenisation in education, emphasising how blockchain-based reward systems can enhance student engagement, fairness, and institutional efficiency.

We also researched existing educational platforms that create payment and reward systems in the education system through the use of cryptocurrencies and tokenomics. For example, [11] is a blockchain platform for online education where students and teachers are rewarded with TUT tokens – a native platform token. Students earn tokens by completing courses, and teachers earn them based on the quality and popularity of their content. This system creates a balanced ecosystem where students and teachers benefit from financial incentives and educational progress.

ODEM [12] is a blockchain-based platform connecting students and educators directly. It uses the ODE token for payments, enabling learners to buy courses and services while empowering educators to deliver customised content, eliminating intermediaries and reducing costs globally.

SKILLONOMY [13] is an educational platform focused on monetised online learning. This platform allows teachers and students to transfer and acquire skills through online learning and then monetise them in integrated freelance markets. The project uses blockchain technology and allows participants to hold tokens (SKLT) during the learning process, performing productive actions. Tokens, in turn, can be spent on interaction with the platform.

After analysing these platforms, it becomes evident that they often lack a clear focus on personalised learning. This paper presents Edu2Work – a personalised MOOC platform built on blockchain technology. The main idea of the platform is to provide an opportunity not only to purchase individual courses,

but also to access personalised learning functionality implemented through blockchain technologies. The proposed personalised functionality includes:

1. Building educational trajectories: system recommends courses based on career preferences.
2. Access to AI assistants and adaptive AI-based testing.
3. Analysis of students' educational trajectories, personalisation of learning.
4. Course recommendation systems.
5. Intelligent learning and automated tutors.
6. Storing learning outcomes: diplomas and certificates stored in IPFS, with their CID (Content Identifier) written to the blockchain for security.
7. Adaptive user search by certificates to select candidates based on verified achievements.
8. Course rankings based on:
 - popularity (programs with the largest number of users),
 - demand in the labour market.
9. Analysis of students' educational trajectories: based on the numerical series of student grades, teachers who systematically underestimate or overestimate grades will be automatically identified.
10. Use artificial intelligence to display the acquired hard and soft skills. Analysis of student performance.
11. Validation of educational models and detection of competency gaps in market-demanded skills.
12. Use of AI, VR/AR, and gamification in learning.

Later in this paper, we will detail our vision for implementing personalised learning within a tokenised MOOC platform. It is also important to note that to ensure the effectiveness of a tokenomics model, it is essential to accurately analyse, verify, and test it using specialised tools. This approach helps to check the model's viability and find vulnerabilities that may pose a danger to the system and its users in the future.

The purpose of this work is to describe the tokenisation model of a MOOC platform for personalised learning. Additionally, we aim to formalise the proposed model using the insertion modelling system to forecast, test for stability and self-regulation, and identify effective scenarios based on the forecasts. The next part of the work is presented as follows: Section 2 describes in detail the tokenisation model of the personalised MOOC platform Edu2Work, highlighting the main agents within the model and their actions. Section 3 presents the formalisation of the educational platform tokenisation model using an insertion modelling system.

2. Our model of education tokenisation

This paper presents our vision of tokenising the educational process within a higher education institution. The proposed approach aims to increase teacher motivation through the use of bonuses and rewards, as well as to increase students' interest in learning through the ability to receive rewards for active work and good results. This model facilitates interaction between teachers, students, and other stakeholders, contributing to a more effective educational environment and stimulating productivity. Each participant in the system benefits from interaction and receives rewards based on their performance. The list of entities in the model and the main actions between them are presented in the diagram of agent interaction (figure 1).

Let us consider each type of agent and their actions within this model in more detail:

1. TEACHER – a user who can create and host educational courses on the platform and evaluate students for completing courses.

The main actions of the Teacher agent within the model are:

- registration on the platform;
- placing a course on the platform by paying a fixed fee;

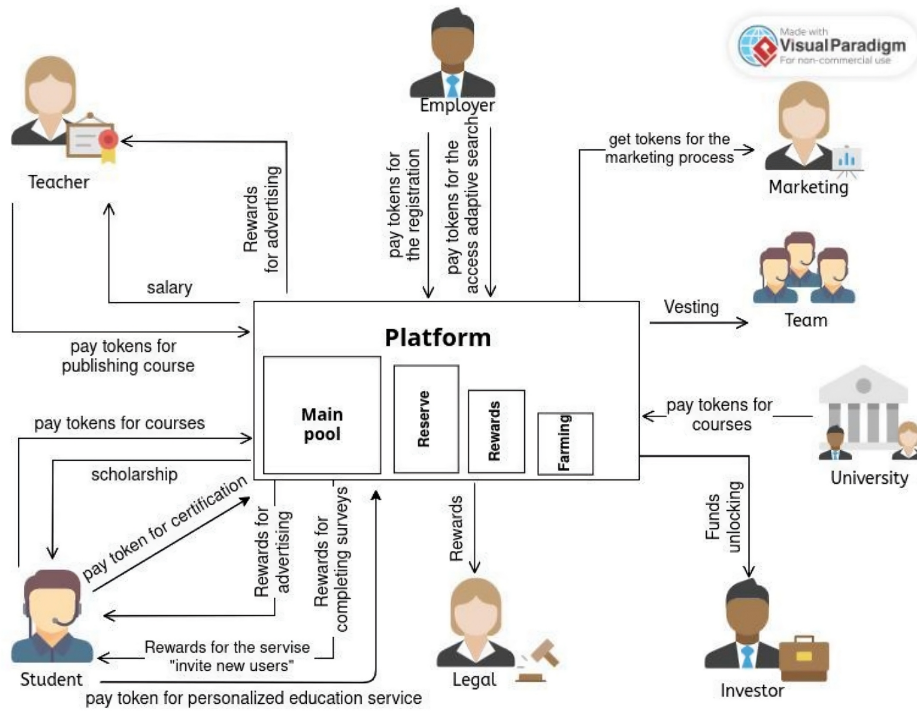


Figure 1: Diagram of agent interaction in the present tokenomics model.

- setting the course cost according to its type. We differentiate three main types of courses:
 - asynchronous (without video materials, only text-based materials and presentations);
 - asynchronous (with video materials prepared by the teacher);
 - synchronous (live online lessons via video conferencing);
- assessing student performance throughout the course;
- advertising courses of other Teachers to receive rewards;
- inviting new users to the platform for referral bonuses;
- purchasing tokens on the Exchange to cover course creation fees;
- selling tokens on the Exchange to convert them into fiat currency;
- receiving payment for teaching a course.

Each teacher's rating is calculated based on student feedback, course type, and duration. The rating is recalculated after each course is completed. Thus, in this model, the teacher's reward depends on the quality of their work. As a result, teachers are motivated to develop high-quality educational content to attract more students to teach and also receive positive feedback from them. This approach allows us to stimulate teachers because the activity of their actions directly affects their rewards. This increases motivation by influencing the quality of courses, which benefits the students' learning experience.

2. STUDENT – the user who can choose courses and enroll in them by paying the specified fee.

The main actions of the Student agent are:

- registering on the platform;
- selecting and enrolling in courses by paying the fee set by the teacher to the platform. Upon course completion, the system generates certificates to confirm the learning outcomes;
- purchasing tokens on the Exchange to pay for studying courses;
- selling tokens on the Exchange to receive fiat currency;
- receiving tokens (scholarship) based on academic performance;
- inviting new users to receive referral rewards;

- advertising the platform to receive rewards;
- receiving a reward for completing the survey;
- obtaining certificates that confirm knowledge levels, for example: CBAP, ECBA or TOEFL, IELTS, Cambridge English. Students pay tokens for each attempt. The certificates are stored in the IPFS, and the CID (content identifier), which is generated during the download, is stored in the blockchain network. This approach makes it impossible to forge certificates, and employers only need to compare the CID (hash) in IPFS and the blockchain network.

The platform will have a personalised learning function: the system generates an individual list of courses that will help students acquire the necessary knowledge and skills to achieve their dream careers. Upon completion of the courses, the system generates certificates to confirm the learning outcomes. The student pays the cost of the courses and, additionally, for using the function of building their own personalised educational trajectory.

This approach also provides advantages for students. They are interested in actively participating in the educational process since good results will allow them to receive more rewards.

3. EMPLOYER Employers are companies, firms, or enterprises that need qualified employees and are interested in working with the platform to find potential candidates among students. They can access student performance information and get the opportunity to chat with the students to discuss cooperation. Thus, the employer can choose a suitable candidate and offer them a job. The main actions of the Employer agent are:

- registration on the platform. In this case, the employer must pay an appropriate fee to the platform. It depends on the number of staff of the company or firm. We differentiate the following types of employers depending on the number of employees:
 - Small: less than 50 employees;
 - Medium: from 50 to 249 employees;
 - Large: from 250 to several thousand employees.
- payment of tokens to the platform for access to student success information. Adapted search for students by certificates confirming learning outcomes and skills;
- payment of the teacher's reward for teaching the course;
- buying the possibility of placing n-number of courses for their employees;
- purchasing tokens to pay for using the platform.

4. MARKETING Expenses of the platform for attracting new users – advertising, content marketing, SEO, and other tools. The main actions of the Marketing agent are:

- receiving tokens from the platform for marketing activities.

5. UNIVERSITY A university can buy access to teacher courses for its students. The main actions of the University agent within the model are:

- purchase of tokens to pay for the use of platform functionality;
- purchase of access to several courses for its students/employees;
- re-enrollment of courses, informal education.

The issue of course standardisation is still open, as such functionality can only be available after courses on LMS, MOOC platforms, and university courses are brought to a single standard. At the same time, we believe such functionality is necessary, as it greatly expands educational possibilities.

6. INVESTOR – an agent in the model who provides financial resources (investments) for the development and operation of the platform.

The main actions of the **Investor** agent are:

- purchase of tokens on the exchange in a specified period:

- Private sale;
- Public sale;
- sale of tokens on the exchange to receive fiat;
- receiving tokens according to the unlocking schedule (after the cliff, the process begins).

7. **TEAM** An agent in the model represents the platform development team.

The main actions of the **Team** agent are the sale of tokens on the exchange to receive fiat.

8. **LEGAL** support costs.

Next, we present the formalisation of the described model in an algebraic form and the results of verifying and simulating this tokenomics model.

3. Formalisation of the tokenomics model

This section considers formalising the educational platform tokenisation model using the Insertion Modelling System (IMS) [14]. Insertion modelling is an approach to modelling complex distributed systems based on the theory of interaction of agents and environments according to specified rules. In this approach, a system is represented as a composition of an environment and the agents inserted into it.

We consider tokenomics as an environment, a set of agents and actions. It represents a multi-level architecture with agents interacting according to predefined business rules. Agents are entities involved in acquiring skills, earning, and managing tokens [15]. All agent data, projected, and initial token allocations are written to the environment description file. Each agent performs actions at specific points in time and changes the environment, namely the distribution of tokens. Actions are performed according to the behaviour represented formally in the behaviour file. This model enables the token flow simulation and analysis of the tokenomic system's properties.

To create the model, we will use the Insertion Model Creator [16] – a platform for modelling algebraic behaviour. The main functionality of the Insertion Model Creator system, details of the implementation of formal models and their analysis are described in detail in the article [17]. The system interface is presented in figure 2.

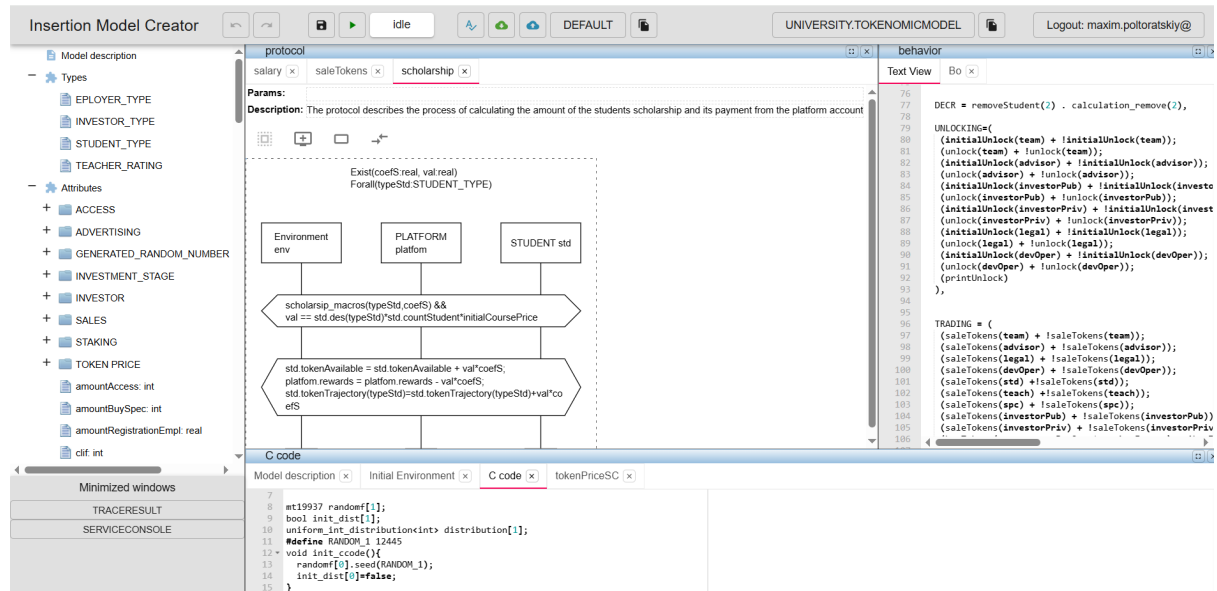


Figure 2: Insertion model creator.

For the described tokenomics model, we define the following agents types (but may not be limited to this number):

- **HOLDERS:**

- Advisor;
- Investor (private, public);
- Legal;
- Speculator;
- Team;
- Developer.

- **PLATFORM ROLES:**

- Employer;
- Student;
- Teacher;
- University;
- Platform.

- **EXCHANGE.**

The interactions between these agents are governed by:

- Tokenomics laws;
- Defined business processes;
- Token unlocking schedules;
- Marketing activities (e.g., the process of attracting new users);
- Other platform-specific logic.

As an environment, we consider a set of business processes formalised in a model, or even the blockchain environment as a whole.

The model consists of an informal description of agent types and their attributes, formal actions, and a pattern of general behaviour. The description is based on the principle of insertion modelling. If the condition for the agent to perform an action is true, then the corresponding change in the environment is allowed.

Next, we consider agents within the insertion modelling system. It is important to note that an agent can represent a collective entity-in this case, the set of all students is modelled as a single Student agent. The Student agent and its attributes in the IMS system are represented as follows:

```
Student:obj(
    tokenAvailable:real,
    countCurrentStudent:int,
    newStudent:int,
    descriptionOfTypeStudent:(STUDENT_TYPE)->real,
    saleFactor:real
)
```

Let us describe each attribute of the Student agent type in detail:

- **tokenAvailable** – a real type attribute that represents the current number of tokens held by the agent.
- **countCurrentStudent** – an int type attribute that indicates the total number of students currently on the platform.
- **newStudent** – an int type attribute that indicates the number of newly registered students due to marketing activity. This value is generated using C++ code with a pseudo-random number generator.

- **descriptionOfTypeStudent** – a function-type attribute that takes a value of the STUDENT_TYPE and returns a corresponding percentage (of type real). It is worth noting that we categorise several types of students based on their academic performance: Excellent (A), Good (B), Average (C), Below average (D), Poor (E), No-grade(for newly joined students). In the insertion modelling system, this classification can be defined using an enumerated type as follows:

STUDENT_TYPE: (A_GRADES, B_GRADES, C_GRADES, D_GRADES, E_GRADES, NONE)

New students without grades are assigned the type NONE.

- **saleFactor** – a real type attribute specifying the percentage of tokens students choose to sell.

It is worth noting the important fact that students receive a scholarship depending on their academic performance according to the following ratios:

- A_GRADES $\rightarrow 1.1 \times \text{priceCourse}$
- B_GRADES $\rightarrow 1.0 \times \text{priceCourse}$
- C_GRADES $\rightarrow 0.9 \times \text{priceCourse}$
- D_GRADES $\rightarrow 0.8 \times \text{priceCourse}$
- E_GRADES $\rightarrow 0.5 \times \text{priceCourse}$

Thus, the number of tokens a student receives as a scholarship directly depends on their academic performance.

The Employer agent is also defined within the model. In this section, we detail the formalisation of this agent using the insertion modelling system. As previously mentioned, we distinguish between several types of Employer agents: LARGE, MEDIUM, and SMALL. This classification is represented in the insertion modelling system as follows:

EMPLOYER_TYPE: (LARGE, MEDIUM, SMALL)

The Employer agent and its attributes can be described in IMS syntax as:

```
Employer:obj(
    tokenAvailable: real,
    countEmployer: int,
    newEmployer: int,
    descriptionOfTypeEmployer: (EMPLOYER_TYPE) -> real
)
```

The attributes of the Employer agent are as follows:

- **tokenAvailable** – a real type attribute representing the number of tokens held by the agent.
- **countEmployer** – an int type attribute indicating the number of employers on the platform.
- **newEmployer** – an int type attribute representing newly joined employers, generated using C++ pseudo-random functions.
- **descriptionOfTypeEmployer** – a function type attribute mapping employer types to percentage values.

The Teacher agent is represented in the insertion modeling syntax as:

```
Teacher:obj(
    tokenAvailable: real,
    countTeacher: int,
    descriptionOfTypeTeacher: (TEACHER_RATING) -> real,
    newTeacher: real,
    saleFactor: real
)
```

The behavior of agents is defined in the form of an algebra of behavior that support both sequential and parallel composition. The general behavior is represented as:

$$Bo = (\text{INVESTMENT_STAGE}; \text{SERVICES}; \text{CLIF_BEH})$$

$$\text{CLIF_BEH} = (!\text{clif} \cdot Bo + \text{clif} \cdot \text{PLATFORM_WORK})$$

The first stage is `INVESTMENT_STAGE`, during which tokens are distributed to investors. It is worth noting that the platform starts working in the eighth month, but the token sale for investors works according to the schedule starting in the first month of the simulation. Tokens sold to investors will be locked. After that, they will be unlocked linearly according to the unlock schedule. The behaviour for selling tokens to the Investor agent will be presented as follows:

```
INVESTMENT_STAGE = (
    (distributeBudget + not_distributeBudget) ;
    (nextMonthInvestment.INVESTMENT_STAGE +
    not_nextMonthInvestment.(
        nextRound.INVESTMENT_STAGE + !nextRound)
    )
)
```

The behavior of the platform is encapsulated in the `PLATFORM_WORK` process:

```
PLATFORM_WORK = (
    REGISTRATION_NEW_USER;
    COURSES_WORK;
    ADVERTISING;
    SURVEY;
    ACCESS_TO_PROFILE;
    TRADING;
    MARKETING_STRATEGY;
    TRANSACTION_BETWEEN_WALLET;
    NEXT_MONTH
)
```

The work of the platform can be divided into several internal processes:

- **REGISTRATION_NEW_USER**: new users register on the platform. Marketing costs are converted into new users.
- **COURSES_WORK**: covers all course-related activity – scholarship and teacher salary calculations, as well as new course registrations.
- **ADVERTISING**: advertising campaign process for the platform.
- **SURVEY**: survey Students and teachers pass various surveys. For this, they receive rewards in the form of platform tokens. Surveys can relate to both the quality of teaching of certain teachers and the convenience of the platform itself.
- **TRADING**: token trading activities on the platform.
- **MARKETING_STRATEGY**: – marketing strategy. We consider three cases:
 1. The number of users is increasing.
 2. The number of users is decreasing.
 3. Volatility is observed.

It should be noted that every month we choose a strategy using a pseudo-random value generator and assign this value to the environment attribute from the C++ code. This action can be represented as follows:

```

randomStrategyCCode() = (
  Exist(str:real)
  CCode("Env.val = getValue(1,3)") -> strategy=str
)

```

Then the behavior can be represented as follows. Depending on the generated value, we will use one of the alternatives to this behavior.

```

MARKETING_STRATEGY = (
  (randomStrategyCCode); (
    selectStrategy(strategy, 1) . INCR +
    selectStrategy(strategy, 2) . DECR +
    selectStrategy(strategy, 3) . VOLATILITY
  )
)

```

Thus, we have the opportunity to test the model for stability and sustainability in various marketing cases.

- **TRANSACTION_BETWEEN_WALLET:** Monthly token distribution across different wallets, including the reserve, reward, farming pool, and fiat/token liquidity pools.
- **NEXT_MONTH:** Advances the simulation to the next month.

Interaction between agents is carried out using action. Each action is a Hoare triple $\alpha \rightarrow \langle P \rangle \beta$, where P is a process, α and β are the precondition and postcondition of the process P , correspondingly. α and β are represented by the logical expressions of the basic language and define conditions on the set of states of the system. For more details about the syntax of the action language, refer to [18].

The actions use macros to implement calculations that can be reused across different actions. Macros enhance flexibility and reduce code duplication. For example, the `scholarship_macros` returns the scholarship ratio based on the student's type.

```

scholarship_macros(score, coef) = (
  score == A_GRADES && coef == 1.1 ||
  score == B_GRADES && coef == 1.0 ||
  score == C_GRADES && coef == 0.9 ||
  score == D_GRADES && coef == 0.8 ||
  score == E_GRADES && coef == 0.5
)

```

Let us consider in figure 3 an example of the scholarship distribution action in the form of a message sequence chart (MSC), which graphically represents the sequence of interactions between different agents involved in the process.

Another important point is that in the model we consider the distribution of students at the time of adding new users. Below is the macro that calculates the percentage distribution at the time of the arrival of new users – Students.

```

recalculationCountStudentINCR(type, countNews, val_distr) = (
  type == NONE &&
  val_distr == (countNews * 100 / (std.countStudent + countNews)) / 100 ||
  val_distr == (std.countStudent * std.des(type) * 100 / (std.countStudent + countNews)) / 1
)

```

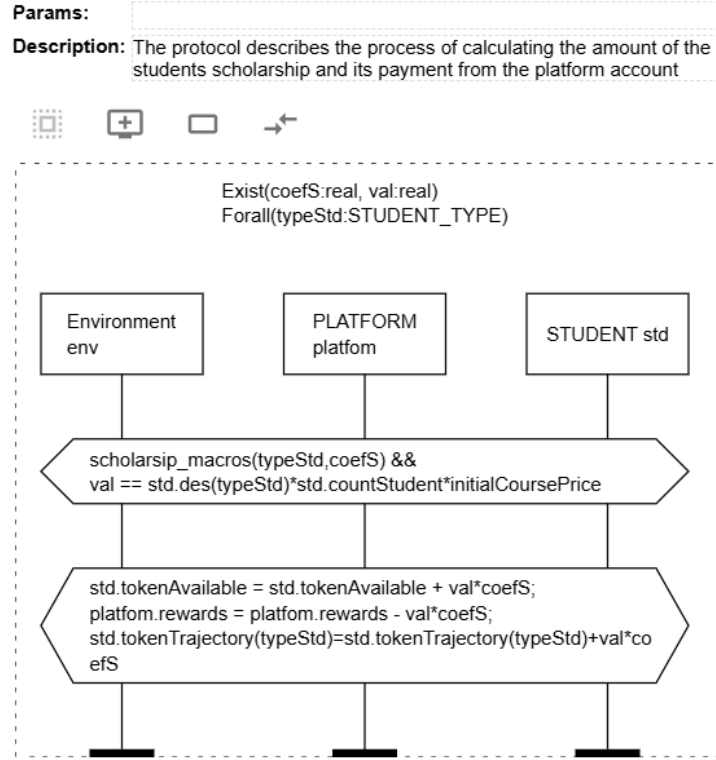


Figure 3: Graphic representation of the action of the distribution of scholarships among students.

Behavior algebra formalizes the sequence of actions. Formally, the algebra describes a specific business process of the platform.

The process of unlocking tokens for Team and Investor agents (private and public) can be represented using the behavior algebra as follows:

```

UNLOCKING = (
  (initialUnlock(team) + !initialUnlock(team));
  (unlock(team) + !unlock(team));
  (initialUnlock(investorPub) + !initialUnlock(investorPub));
  (unlock(investorPub) + !unlock(investorPub));
  (initialUnlock(investorPriv) + !initialUnlock(investorPriv));
  (unlock(investorPriv) + !unlock(investorPriv));
  ...
)
  
```

where

- **initialUnlock** – an action that unlocks the initial number of tokens at the moment of the start of the token unlocking process;
- **unlock** – an action that determines the unlocking of tokens according to the unlocking schedule.

Let's consider the unlocking action in more detail:

```

unlock(x) = (
  x.endUnlocking >= month > x.startUnlocking ->
  <"Unlocking process">
  x.tokenAvailable = x.tokenAvailable + x.dUnlock;
  x.tokenLocked = x.tokenLocked - x.dUnlock
)
  
```

where:

- x – parameter that represents the agent for which the tokens are unlocked;
- $startUnlocking$ – month the unlock process begins;
- $endUnlocking$ – month the unlock process ends;
- $tokenAvailable$ – number of available tokens;
- $tokenLocked$ – number of locked tokens;
- $dUnlock$ – a value indicating the number of tokens to be locked each month.

The formula for linear unlocking of tokens can be presented as follows:

$$x.dUnlock = \frac{x.tokenLocked \cdot (1 - x.initialUnlock)}{x.endUnlocking - x.startUnlocking}$$

Completing the formal model description allows one to analyse the properties of tokenomics. This includes visualising the change in model indicators over time. The following section will explore the simulation results based on this formal specification.

4. Simulation results

After creating a formal description of the model, we can see the trajectories of the tokens, which significantly facilitates the process of analysing and studying the properties of the built model. The advantage of using the insertion modelling system is the use of flexible technology that allows us to effectively and fully formalise any economic behavioural model. In addition, the proposed approach and used technologies make it possible to build charts that reflect the change in model indicators over a certain period.

The approach described in this paper allows us to use concrete and symbolic modelling.

A concrete simulation is one in which a model value is initialised to specific values. Thus, we have the opportunity to simulate the situation and make the visualisation based on the results obtained. It is worth noting that the main feature of the system's reliability is the preservation of tokenomics indicators. For the described model, we will analyse the following indicators:

- token price trajectory
- amount of tokens in platform pools

The simulation results are presented below. So in figure 4 the process of unlocking tokens according to the unlocking schedule is presented. As we can see in the chart, each agent has its own schedule and amount of blocked tokens. It is important to note that the number of locked tokens was unlocked for each agent according to the linear token unlocking process.

As we can see, for some agents, unlocking starts in the first month of the tokenomics operation. For a Legal agent, unlocking starts in the eleventh month. Accordingly, this agent can start spending his share of tokens on the exchange or bet on farming or staking.

The blocking/unblocking mechanism is an important mechanism for controlling the number of sales at the beginning of the project. It allows for the control of a relatively large initial amount of possible token sales.

While researching the Tokenomics model, it is also important to analyse the token price trajectory. Since the token's price is one of the most important indicators, we can talk about the correctness and stability of the developed model. The token price formation schedule is shown in figure 5 below. It should be noted that the trajectory of the token's price has a clear linear growth. This testifies to the correctness of the built model in accordance with the laws of tokenomics. From the first to the third month, investor tokens are sold according to static prices (0.1, 0.2, 0.3), and then tokens begin to be unlocked by some agents. The sale of tokens by agents such as team, investors, legal and others begins.

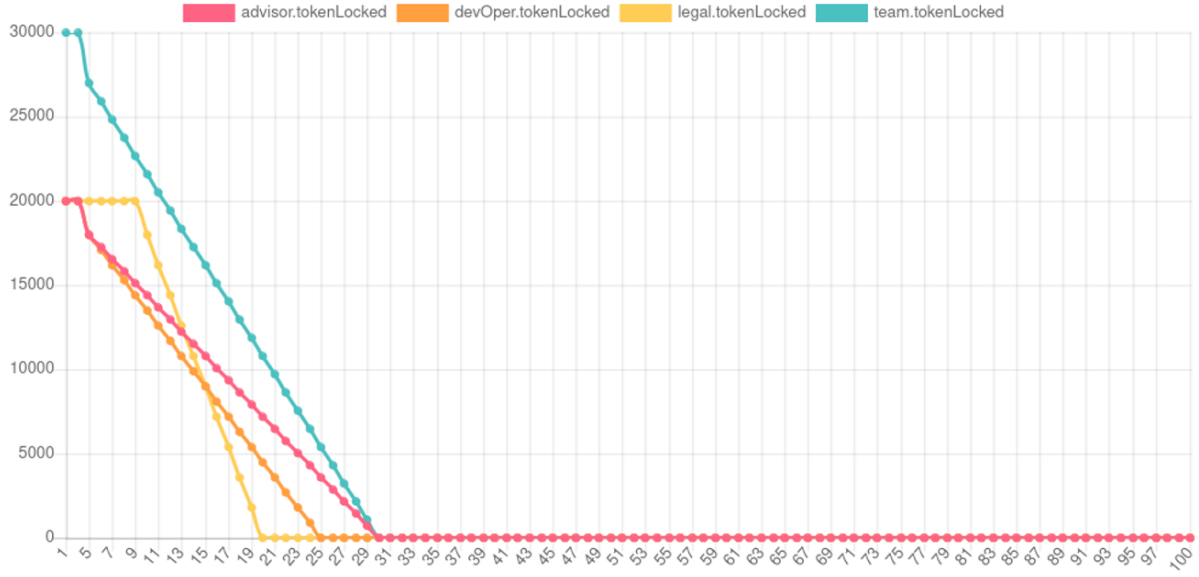


Figure 4: Tokens unlocking for agents.

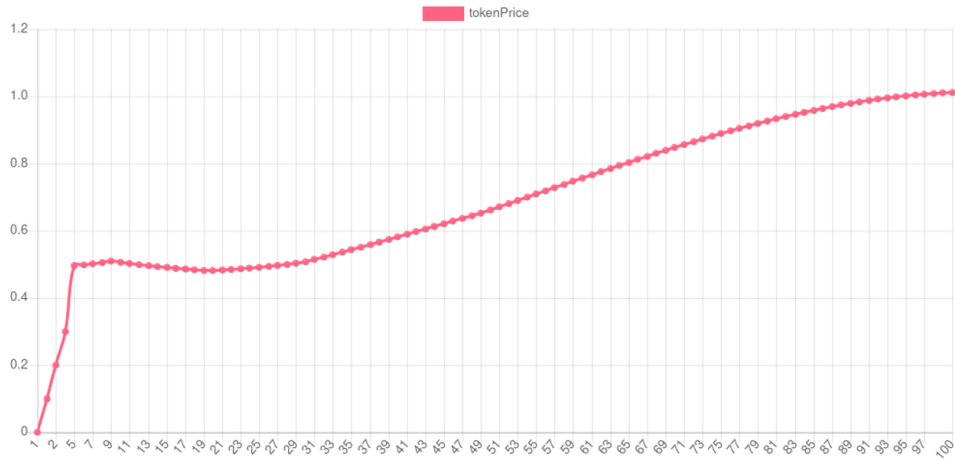


Figure 5: Token price trajectory.

Starting from the 10th month (clif), the platform’s functioning begins, with teachers selling tokens and students purchasing tokens to pay for education. All these processes affect the value of the platform token.

Also, during the platform’s operation, it is important to consider speculators who buy and sell tokens to profit from the token pricing. Based on the figure 5, we observe linear growth without various anomalies and jumps, indicating the constructed model’s correctness.

On the curve, we can see:

- there are no sharp jumps or drops that could indicate instability;
- the curve demonstrates an almost linear growth pattern, which corresponds to the expected economic dynamics;
- the system’s behaviour is consistent with the predicted market model without “anomalous noise”.

This means that the algorithm correctly implements the price formation mechanism: it smooths out local fluctuations and ensures a consistent increase in the token value.

5. Conclusion

The present paper describes the prospects and benefits of using blockchain in education. Using this technology in personalised MOOC platforms offers tremendous opportunities and will help solve many problems. However, the most significant potential is in creating new business models in education using assets or tokens, which will form the basis of a new system of rewards for students and teachers.

In the article, we offer our vision of tokenising the educational process. The described model helps increase teachers' motivation through the use of bonuses and rewards and students' interest in learning through the ability to determine their own curriculum.

During our work, we formalised the educational platform's tokenomics model using the insertion modelling system. The main purpose of formalisation is to search for modelling errors, shortcomings, or possible contradictions and to find effective system operation scenarios.

During simulation, we can analyse changes in key indicators of the tokenomics model over a specific period. Thus, we examined the process of unlocking tokens for various agents of the model. We also analysed the change in token price in the model over 100 months. The trajectory of the token's price has a clear linear growth. Having analysed the results obtained during the simulation, we were convinced of the correctness of the developed tokenomics model per the laws of token economics.

Author contributions

Conceptualization, Volodymyr Peschanenko and Maksym Poltorackiy; methodology, Volodymyr Peschanenko and Maksym Poltorackiy; software, Volodymyr Peschanenko and Maksym Poltorackiy; validation, Volodymyr Peschanenko, Maksym Poltorackiy, Olha Konnova and Maksym Vinnyk; formal analysis, Maksym Poltorackiy and Olha Konnova; investigation, Maksym Poltorackiy and Olha Konnova; data curation, Olha Konnova and Maksym Poltorackiy; writing—original draft preparation, Olha Konnova and Maksym Poltorackiy; writing—review and editing, Olha Konnova and Maksym Vinnyk; visualization, Olha Konnova and Maksym Poltorackiy; supervision, Volodymyr Peschanenko; project administration, Maksym Poltorackiy. All authors have read and agreed to the published version of the manuscript.

Declaration on Generative AI

During the preparation of this work, the authors used ChatGPT (GPT-5) in order to: Grammar and spelling check. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the publication's content.

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