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Blockchain Teaching with Bloxxgame

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Abstract. Bloxxgame is a web-based blockchain simulation game with an intuitive graphical user interface. The game is designed as a teaching tool for classroom or online teaching. Bloxxgame enables step-by-step discovery and a basic understanding of the fundamental principles of a blockchain. Once players understand the key principles of a blockchain, the game becomes more playful. You can play it alone against the bots or with any number of players, with or without bots.

Key concepts like hashing, digital signatures, digital identity, tokens, wallets, transaction fees, Proof of Work, and mining are presented in an interactive format. A special and unique feature is the experience of the consensus algorithm with Proof of Work.

Bloxxgame has a sophisticated teacher cockpit with which all players can be easily managed. With seven game levels and mining and transaction robots, the teacher can set up a wide variety of dynamic learning scenarios.

Keywords: Blockchain simulation, Educational tool, Interactive learning, Cryptographic elements, Web 3

1 Blockchain Teaching

1.1 Why Blockchain Teaching is Important

Fifteen years after the launch of Bitcoin and several so-called hypes about cryptocurrencies, the topic of blockchain is no longer at the center of public interest. Nevertheless, development continues and with the steady spread of blockchain in the financial industry, supply chain, healthcare, etc., blockchain-based solutions are becoming increasingly important. Blockchain is also the foundation of Web 3, which will fundamentally change the way the internet is used in the future, regardless of industry. These developments stand in stark contrast to the general knowledge about the basic characteristics and functioning of blockchain technology.

Blockchain teaching is important because it provides students and professionals with the knowledge to understand and use decentralised technologies. Understanding blockchain principles, such as cryptographic security and consensus mechanisms, are fundamental to making decisions about the use of blockchain-based technologies.

However, blockchain teaching is challenging because it requires an understanding of various abstract concepts and how they interact.

1.2 The Objectives of Bloxxgame

Bloxxgame is the result of eight years of research and practice in blockchain teaching at university level [1], [2]. Initially based on a whiteboard model, Bloxxgame has evolved into a web-based simulation tool that mimics a public layer 1 blockchain that has some basic features like Bitcoin, Ethereum and Cardano.

The key ideas behind the development of Bloxxgame were:

- The complex mechanism of a public blockchain should be understandable for students without programming knowledge.
- The core idea of a public blockchain, the concept of a decentralised consensus mechanism, should become tangible.
- Teachers without a background in computer science should be able to teach the principles of blockchain before covering its application in industries such as supply chain, finance, healthcare, etc.
- The material should not only be taught theoretically and abstractly; students should have the opportunity to explore and test the principles.

This is the third edition of Bloxxgame which offers a versatile toolbox for teachers to develop customized lesson plans.

1.3 How Bloxxgame can be played

Bloxxgame does not have a pre-defined course of play. Teachers can use Bloxxgame as a demonstration tool before allowing students to explore it independently. In class, students can work in groups or individually, each student managing their own node. Once students have grasped the basic principles of a blockchain, the teacher can set individual practical tasks or let the students compete against each other.

You can also play Bloxxgame alone against the bots or with any number of players, with or without bots. Experience shows that it's great fun even with just a few players.

A key feature of Bloxxgame is that the playground remains accessible for as long as the teacher permits, allowing students to practice and reinforce concepts through self-study between lessons.

Each player functions as a node in the blockchain, creating transactions, building blocks, and mining coins, learning blockchain concepts—especially the consensus algorithm—through hands-on experience. Bloxxgame improves the understanding of abstract blockchain mechanisms through a didactic breakdown of basic operations such as hashing, signing, transactions and block formation.

Bloxxgame also provides user-friendly administration tools, enabling guided classroom lessons, online instruction, and independent learning.

With seven levels of increasing complexity, the teacher can tailor the lessons to students with varying levels of prior knowledge and covers both basic blockchain principles and in-depth cryptographic theory. Basic topics include creating a blockchain transaction, creating and adding blocks, and the process of transaction and block confirmation. More examples of teaching scenarios can be found in [2] and on the resource page of Bloxxgame [3].

1.4 User Interface

The graphical representation of the blockchain and the didactically designed user interface illustrate the individual cryptographic elements of a blockchain in a practical way. The playground has a graphical interface that evolves as the player progresses through the different levels, offering an increasing number of menus and features. Users can easily interact with blocks and transactions by dragging and dropping them with the mouse or using the keyboard controls. In many places, further information on transactions or blocks is displayed with a mouse over or a click.

Each box of the user interface contains a contextual help function (indicated by a ‘?’) that provides detailed explanations of the respective elements (see Fig. 1).

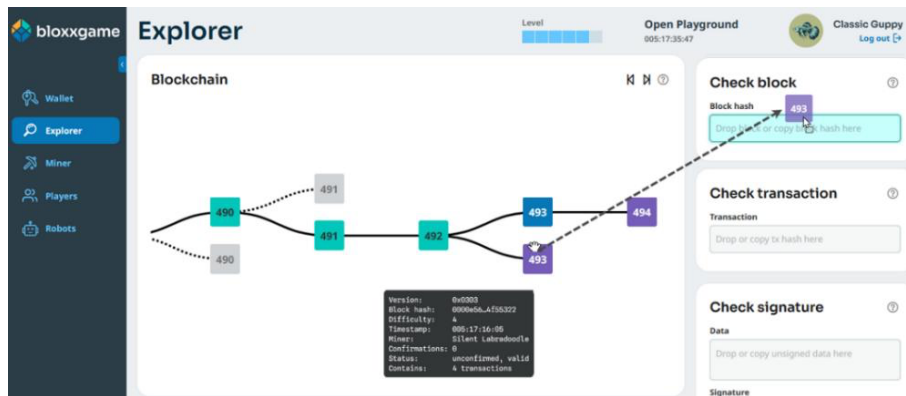


Fig. 1. The blockchain explorer is one of three user views (wallet, explorer, miner) and shows the diagram of the blockchain with information to better understand the underlying mechanism.

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