Blockchain & Digital Currencies: Basics & Future

2026 Winter High School Students Online Research

1 Background

Digital currencies exist solely in electronic form and work via innovative technologies such as blockchain; a public ledger that records transactions securely with cryptography [1, 2, 5]. Popular cryptocurrencies like Bitcoin and Ethereum rely on this blockchain system to ensure transparency and prevent tampering, all without needing banks or middlemen [2, 5]. This opens up exciting possibilities for new ideas in areas such as financial services, product tracking, and even digital art, which matches government encouragement to build software, validate transactions, and safely manage digital assets using open blockchain networks [3]. Beyond payments, digital currencies play a key role in decentralized finance (DeFi), improving supply chain transparency, introducing nonfungible tokens (NFTs), and supporting new fields like digital identity and charity [5]. Even though digital currencies offer these benefits, there are challenges to solve, including making fair rules, handling price changes, and ensuring these systems can grow as more people use them [1, 4, 5].

2 Description

In this project, students explore blockchain and digital currencies through simulations, real-world examples, and a hands-on capstone project on applications such as finance, healthcare, or government.
If you join this project, you will

- dive into blockchain and cryptography with hands-on projects and real-world applications!
- learn how digital currencies work and create your own blockchain capstone project.
- explore Bitcoin, NFTs, and CBDCs while tackling real-world blockchain challenges.

Figure 1: blockchain: The secure network behind digital currencies

3 Prerequisites

- **Grade Level**: 10th grade and above
- **Interest**: Strong curiosity about technology, economics, and society
- **Skills**: basic comfort with Python coding, research and presentations
- **Technology**: Computer with Internet access (for blockchain simulator, mild Python coding, and research).

4 Project Outcome

By the end of the project, students will be able to:

1. Explain the fundamental concepts of blockchain and digital currencies.
2. Demonstrate blockchain primitives using the blockchain simulator.
3. Describe the main applications of blockchain in finance, government, and other industries.
4. Evaluate opportunities and challenges, including regulation, security, and ethics.
5. Conduct independent research on a blockchain application or digital currency.

6. Communicate the findings effectively through written reports and presentations.

5 Project Structure

The project will run for 4 weeks in an online format, combining live sessions, independent work, and hands-on activities.

- **Week 1: Foundations (Introduction to Digital Currencies and Blockchain)**
  - Introduction to blockchain and digital currencies.
  - Hands-on with Blockchain Demo: Blockchain simulator: exploring blocks, hashes.
  - Case studies of adoption and usage.
  - Assignment: Reflection on how blockchain ensures trust.
- **Week 2: Blockchain Mechanics**
  - Concepts: decentralization, consensus, mining, smart contracts.
  - Interactive exploration with blockchain simulator.
  - Classroom discussion: Why blockchain is secure?
  - Activity: Blockchain Demo advanced features; transactions, distributed ledgers.
  - Assignment: Short write-up on why consensus is critical.
- **Week 3: (Applications & Challenges)**
- Blockchain applications:
  - Finance (cryptocurrencies, DeFi, remittances)
  - Supply chains (provenance and transparency)
  - Government and policy (CBDCs, identity verification)
  - Emerging applications: NFTs, tokenization
- Activity: students select one area (Mini Capstone)
- Assignment: Prepare project outline.
- **Week 4: Project Development and Presentation**
- Activity:
  - Students choose a case study.
  - Conduct guided research
  - Write a research report and create a presentation
  - Final presentations and peer review

6 Deliverables

- Research Report: A structured paper including background, chosen use case, analysis, and future outlook
- Capstone Project: A focused study on one blockchain application or digital currency
- Presentation: A 10–15 minute PowerPoint summarizing the research
- Optional Mini Capstones (for coding-interested students): Python notebook or small blockchain demo

7 Hands-On Projects

1. **Exploring Cryptocurrency Price Trends with Python (Coding)**
   - **Objective**: Analyze historical cryptocurrency data (e.g., Bitcoin) to visualize price changes and volatility.
   - **Tools**: Python, Pandas, Matplotlib
   - **Deliverable**: Python notebook with graphs and a summary linking findings to adoption trends
2. **Building a Simple Blockchain in Python (Coding)**
   - **Objective**: Create a basic blockchain structure in Python with blocks, hashes, and validation.
   - **Tools**: Python (hashlib)
   - **Deliverable**: A short report explaining how block hashes prevent tampering
3. **Case Study on Central Bank Digital Currencies (CBDCs) (Non-Coding)**
   - **Objective**: Research how a country (e.g., China with e-CNY, Nigeria with e-Naira, or the U.S. exploring a digital dollar) is developing or piloting a Central Bank Digital Currency.
   - **Guiding Questions**: Why is the country pursuing a CBDC?
     What problems is it trying to solve (e.g., financial inclusion, reducing cash, global competitiveness)?
     What are the risks and concerns (e.g., privacy, surveillance, cybersecurity)?
   - **Deliverable**: A short policy brief (2–3 pages) or a presentation slide deck summarizing the findings and offering recommendations

References

[1] Investopedia. Cryptocurrency definition. `https://www.investopedia.com/terms/c/cryptocurrency.asp`, 2024. Accessed: September 2025.

[2] Satoshi Nakamoto. Bitcoin: A peer-to-peer electronic cash system, 2008.

[3] United States. Strengthening american leadership in digital financial technology. Executive Order No. 14178, 90 Fed. Reg. 8647, January 2025. Signed Jan. 23, 2025; published Jan. 31, 2025.

[4] Montclair State University. 2022 annual report, 2022. Accessed: September 2025.

[5] J. Yli-Huumo and D. Ko et al. Where is current research on blockchain technology?—a systematic review. *PLoS ONE*, 11(10):1–27, 2016.

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