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STEAME TEACHER ACADEMY

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STEAME ACADEMY
TEACHING FACILITATION LEARNING & CREATIVITY PLAN (L&C PLAN) - LEVEL 2
STUDENT TEACHERS: Exploring the Technology Behind Bitcoin and Its Distributed Security Potential

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1. Overview

Title	Exploring the Technology Behind Bitcoin and Its Distributed Security Potential
Driving Question or Topic	1. What is blockchain, and how does it work as the technology behind Bitcoin? 2. How does blockchain technology enhance security through decentralization? 3. What are potential applications of blockchain technology beyond cryptocurrency?
Ages, Grades, …	secondary (15-19) 10th to 12th grade
Duration, Timeline, Activities	10 learning hours ten 45 minute class periods At least 10
Curriculum Alignment	Science, Mathematics, Entrepreneurship, Technology
Contributors, Partners	
Abstract - Synopsis	Students will investigate blockchain technology and its function as the foundation for cryptocurrencies like Bitcoin. Through hands-on activities, they'll explore how blockchain uses cryptographic principles and decentralization to secure data. Students will examine real-world applications of blockchain in finance, healthcare, and data management, fostering an understanding of its broader potential. By the end, students will understand blockchain's importance in modern security frameworks and gain insights into its future applications.
References, Acknowledgements	

2. STEAME ACADEMY Framework*

Teachers' Cooperation	Teacher 1 (Computer Science) and Teacher 2 (Mathematics) will collaborate to integrate technical concepts with mathematical foundations. 1. Goal Setting: Teacher 1 and Teacher 2 establish clear learning objectives that connect computer science with mathematical cryptography concepts. 2. Planning and Preparation: They develop a comprehensive work plan outlining specific activities and tasks for both service and student teachers. This includes designing lessons, creating learning materials, and identifying opportunities for interdisciplinary connections. 3. Collaboration Meetings: Regular collaboration meetings are scheduled to discuss progress, share ideas, and troubleshoot any challenges that arise. Teacher 1 provides guidance and mentorship to the student teacher, offering insights and feedback based on their experience and expertise.

	4. Co-Teaching and Observation: Teachers will co-lead sessions demonstrating cryptographic methods, guiding students through practical applications. Service teachers observe and provide feedback to student teachers, offering guidance on lesson delivery and classroom management. 5. Reflection and Feedback: Throughout the collaboration, service teachers and student teachers engage in reflective practices to evaluate their progress and identify areas for growth. Teacher 1 provides constructive feedback and support to help student teachers develop their teaching skills and confidence. By following this collaborative approach, Teacher 1 and Teacher 2 create a supportive environment where service teachers mentor student teachers effectively, promoting professional growth and enhancing the learning experience for all involved.
STEAME in Life (SiL) Organization	Invite guest speakers from local businesses in fintech or data security to discuss real-world blockchain applications.
Action Plan Formulation	STAGE I. Preparatory Work of the Teacher: a. Research and Planning: - Study foundational blockchain principles, cryptographic methods, and applications in Bitcoin and beyond.. b. Gather Resources: - Assemble resources including videos, articles, and case studies on blockchain; secure access to computers with internet for simulation activities. c. Design Activities: - Develop simulations and hands-on activities to demonstrate blockchain processes such as hashing, block formation, and transaction validation. STAGE II. Workshop Activities: a. Introduction to Blockchain**:** - Overview of blockchain technology, focusing on its role in Bitcoin and other cryptocurrencies. Explain decentralization and cryptographic concepts through multimedia. b. Mathematical Exploration: - Use mathematical concepts like hashing, public-key cryptography, and consensus algorithms to introduce students to the security mechanisms behind blockchain. c. Technological Integration: - Facilitate exercises on creating simple blockchain structures, validating transactions, and understanding hash functions through online tools. d. Real-World Applications: - Case studies on how blockchain is used in various industries, such as finance (smart contracts), healthcare (secure patient data), and supply chain management. STAGE III. Reflection and Wrap-Up: - Encourage students to discuss their learning, reflecting on how blockchain's decentralized nature enhances security. Future Exploration**:** - Offer resources on advanced blockchain topics and encourage students to explore further applications of blockchain technology.

[*] *under development the final elements of the framework*

3. Objectives and Methodologies

Learning Goals and Objectives	Learning Goals: 1. Understand blockchain as a decentralized, cryptographic data structure. 2. Explore mathematical principles in blockchain security.

	3. Investigate blockchain's practical applications in various sectors. Learning Objectives: 1. **Define and Explain Core Blockchain Concepts** Students will be able to explain what blockchain is, describe how it functions as a decentralized ledger, and identify its role in cryptocurrencies like Bitcoin. 2. **Analyze Cryptographic Principles in Blockchain** Students will understand and apply cryptographic principles, such as hashing and digital signatures, to explain how blockchain ensures data security and integrity. 3. **Illustrate the Process of Transaction Validation** Students will outline the steps involved in transaction validation within a blockchain network, including the role of consensus mechanisms (e.g., proof of work, proof of stake). 4. **Investigate Real-World Applications of Blockchain Technology** Students will explore and assess applications of blockchain beyond cryptocurrency, including its uses in fields like finance, supply chain management, healthcare, and data privacy. 5. **Evaluate the Strengths and Limitations of Blockchain Systems** Students will critically examine the advantages of blockchain, such as transparency and security, as well as its limitations, including scalability issues and energy consumption. 6. **Demonstrate Technological Proficiency Using Blockchain Simulators** Students will gain hands-on experience by simulating blockchain transactions, understanding block creation, and testing data integrity within a blockchain environment. 7. **Collaborate on Problem-Solving Challenges Related to Blockchain** Students will work in teams to solve challenges, such as designing a blockchain application prototype or proposing solutions for blockchain scalability, fostering teamwork and critical thinking. 8. **Reflect on the Ethical and Social Implications of Blockchain** Students will engage in discussions about the ethical concerns and social impacts of blockchain technology, such as data privacy, security, and the potential for decentralization in various industries. 9. **Synthesize Learning through a Capstone Project or Presentation** Students will create a final project or presentation, demonstrating their understanding of blockchain, its applications, and its potential future developments
Learning Outcomes and expected Results	Learning Outcomes: 1. Students will demonstrate an understanding of blockchain fundamentals. 2. Students will be able to apply cryptographic principles, such as hashing and digital signatures, to secure and validate data within a blockchain structure. 3. Students will evaluate the consensus mechanisms in blockchain, such as proof of work and proof of stake, and understand their roles in transaction validation. 4. Students will recognize and describe real-world applications of blockchain technology across various industries, including finance, healthcare, and supply chain management. 5. Students will demonstrate proficiency in using blockchain simulation tools to create blocks, validate transactions, and explore the ledger's structure.

	6. Students will showcase their creativity by designing or proposing a unique blockchain application or improvement, incorporating elements of data security, decentralization, or transparency. 7. Students will engage in collaborative discussions to deepen their understanding of blockchain's ethical, social, and economic implications. 8. Students will critically assess both the strengths and limitations of blockchain technology, considering factors such as scalability, energy consumption, and privacy. 9. Students will develop and present a final project or report demonstrating their comprehensive knowledge of blockchain technology and its potential future impact. Expected Results: 1. Increased appreciation for the role of blockchain technology in enhancing data security, transparency, and decentralization across various industries. 2. Improved critical thinking skills demonstrated through the analysis and evaluation of blockchain's technical mechanisms and real-world applications. 3. Enhanced understanding of the ethical and social implications associated with blockchain, including issues related to privacy, scalability, and energy consumption. 4. Development of digital literacy and technological skills through the hands-on use of blockchain simulators and exploration of cryptographic principles. 5. Strengthened creativity and innovation as students propose original applications or improvements to blockchain technology. 6. Strengthened communication and collaboration skills through group discussions and team-based problem-solving activities. 7. Increased motivation and interest in further exploration of technology and data security fields, with potential career paths in blockchain, cryptography, and cybersecurity.
Prior Knowledge and Prerequisites	Prior Knowledge and Prerequisites: 1. Basic understanding of mathematics: Students should have a foundational understanding of mathematical concepts, particularly in areas such as numbers, basic algebra, and logic, which are essential for understanding cryptography. 2. Familiarity with computer science fundamentals: Students should have some experience with basic computer science concepts or digital literacy, including an understanding of how computers process and store data. 3. Basic comprehension of technology: Students should be comfortable using digital tools and software for educational purposes, such as computers, tablets, or smartphones, as they will interact with blockchain simulators. 4. Awareness of data security concepts: Students should be aware of basic data security principles, such as data privacy and encryption, to grasp how blockchain enhances security. 5. Critical thinking skills: Students should possess the ability to analyze and evaluate information, make connections between concepts, and engage in problem-solving activities. 6. Interest in technology and innovation: Students should have a curiosity about emerging technologies and an interest in exploring how these innovations can impact various industries. 7. Openness to interdisciplinary learning: Students should be open-minded and willing to explore connections between computer science, mathematics, and social studies, understanding that this lesson integrates concepts from multiple fields.
Motivation, Methodology, Strategies, Scaffolds	1. Project-Based Inquiry: Introduce the lesson by presenting an overarching question about blockchain's role in secure data management and its potential

	beyond cryptocurrency. This inquiry-based approach encourages students to actively engage in solving real-world problems. 2. Collaborative Learning: Facilitate collaborative learning experiences where students work in groups to analyze blockchain applications in various fields, like finance and healthcare. Encourage students to share findings, discuss challenges, and brainstorm solutions, fostering teamwork and communication. 3. Hands-On Activities: Integrate hands-on activities where students simulate the processes of blockchain, such as block creation, transaction validation, and consensus mechanisms. These tangible experiences deepen understanding and reinforce technical concepts. 4. Technology Integration: Use blockchain simulators and cryptographic tools to enable students to visualize and interact with blockchain processes. Access to these digital tools enhances learning by allowing students to experiment with concepts like hashing and data immutability. 5. Authentic Assessments: Design assessments that connect learning with real-world scenarios. For example, students could work in teams to develop a proposal for a blockchain-based solution to a societal problem, demonstrating their understanding of security, transparency, and decentralization. 6. Reflection and Feedback: Build in regular opportunities for students to reflect on their learning journey and receive feedback. Encourage self-assessment and peer assessment, guiding students to critically evaluate their understanding and contributions. 7. Scaffolded Support: Provide support through structured steps, guiding students from foundational blockchain concepts to more advanced applications. Break down complex topics, offer guiding questions, and support learning with resources and examples to ensure all students can successfully engage with the material.

4. Preparation and Means

Preparation, Space Setting, *Troubleshooting Tips*	Procedures: Rotate between interactive presentations, hands-on activities, and group discussions. Utilize a classroom setting for presentations and group discussions, and a computer lab for blockchain simulations and hands-on activities. Prepare digital devices, access to blockchain simulators, cryptography tools, and relevant reference materials. Space Setting: Arrange the classroom to facilitate group work and discussions. Set up computer stations with access to necessary software and blockchain simulation tools. If possible, allocate separate areas for group projects and individual reflection activities. Troubleshooting Tips: Ensure all devices are compatible with blockchain simulators and cryptographic tools, and test them prior to the session. Prepare technical guides or troubleshooting instructions for common issues in using simulation software. Arrange for additional support if students encounter difficulties with the digital tools or cryptographic concepts.
Resources, Tools, Material, Attachments, Equipment	1. Blockchain Fundamentals - Khan Academy, "Introduction to Blockchain" - IBM Blockchain Basics, free resources on blockchain technology and its applications - Book: "Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher 2. Cryptography and Security Principles

	- YouTube Channel: Computerphile, "Introduction to Cryptographic Hash Functions" and related videos - MIT OpenCourseWare, "Introduction to Cryptography" - Online Tool: CyberChef, for hands-on practice with encryption and hashing functions 3. Blockchain Simulators and Interactive Tools - Block Explorer: Blockchain.com for real-world blockchain data exploration - SimBlock: A blockchain simulator for educational use - CryptoZombies: Interactive coding game that teaches students to build simple blockchain applications 4. Case Studies on Blockchain Applications - Harvard Business Review articles on real-world blockchain applications in finance, supply chains, and healthcare - Case study articles from Deloitte and PwC on blockchain use cases and industry impacts 5. Ethics and Social Implications of Blockchain - Article: "Blockchain and the Ethics of Decentralization" (available on JSTOR or ResearchGate) - TED Talk: Bettina Warburg, "How the Blockchain Will Radically Transform the Economy" - European Union Blockchain Observatory, reports on blockchain's impact on privacy and data rights 6. Additional Digital Resources - Interactive Infographic: Visualizing key blockchain concepts at VisualCapitalist.com - GitHub, for open-source blockchain projects and examples that students can explore - Library resources for academic papers on blockchain advancements and trends.
Health and Safety	

5. Implementation

Instructional Activities, Procedures, Reflections	1. Creative Activities and Tasks - Individual: Students create a simplified model of a blockchain, explaining key elements such as blocks, transactions, and hashing. - Team: In groups, students collaborate to propose a blockchain application in a field of their choice, focusing on security and transparency. 2. Engagement and Active Participation - Hands-On Practices: Students participate in hands-on blockchain simulations, experiencing block creation, transaction validation, and consensus mechanisms. - Interactive Discussions: Students explore real-world blockchain applications in finance, healthcare, and data management, engaging in discussions on benefits and limitations. 3. Feedback and Reflection - Peer Review: Students provide feedback to peers on their blockchain models and application proposals, focusing on clarity, feasibility, and creativity. - Self-Reflection: Students document their learning experiences and challenges in a reflection journal, considering how blockchain could impact various sectors.

	- Rubrics and Checklists: Rubrics and checklists are used to assess students' creativity, critical thinking, collaboration, and mastery of learning objectives, providing clear criteria for evaluation.
Assessment - Evaluation	**Formative Assessment** - Conduct ongoing checks for understanding through class discussions, hands-on blockchain simulations, and group activities. - Provide regular feedback to guide students' learning and clarify any misunderstandings. - Use quick quizzes or exit tickets to assess comprehension of key blockchain concepts and processes. - Include peer and self-assessment, where students reflect on their progress and offer feedback to classmates. **Summative Assessment** - Culminating project where students design and present a proposed blockchain application, explaining its potential benefits, security features, and practical applications. - Written reflections or essays analyzing the role of blockchain in data security and the social implications of decentralization. - Presentations or digital showcases where students explain their blockchain models, including the technical and ethical considerations involved.
Presentation - Reporting - Sharing	1. PowerPoint Presentation: Develop a PowerPoint presentation that clearly explains blockchain concepts, using visuals to illustrate complex ideas like decentralization, cryptography, and consensus mechanisms. Share the file with the audience via email or a file-sharing platform after the presentation. 2. Written Report: Prepare a structured written report that covers the basics of blockchain, its applications, and social implications. Include sections with headings, subheadings, and supported analysis, then share it electronically or in print format with stakeholders. 3. Virtual Meeting: Organize a virtual meeting using video conferencing software to present blockchain concepts or student projects in real-time. Share the meeting link in advance and encourage Q&A sessions to foster engagement and discussion. 4. Team Collaboration Platform: Use a collaboration platform like Microsoft Teams or Google Workspace to share documents, reports, and presentations. Enable team members to contribute, review, and provide real-time feedback, promoting collaborative learning and efficient communication.
Extensions - Other Information	

Resources for the development of the STEAME ACADEMY Learning and Creativity Plan Template
In the case of learning through project-based activity

STEAME ACADEMY Prototype/Guide for Learning & Creativity Approach

Action Plan Formulation

Major steps in the STEAME learning approach:

STAGE I: Preparation by one or more teachers

1. Formulating initial thoughts on the thematic sectors or areas to be covered
2. Engaging with the wider environment, including work, business, parents, society, ethics, and environmental factors
3. Determining the target age group of students, aligning with the official curriculum, and setting clear goals and objectives
4. Organizing tasks and responsibilities, including the designation of a coordinator and establishing workspace.

STAGE II: Action Plan Formulation (Steps 1-18)

Preparation (by teachers)

1. Relation to the Real World – Reflection
2. Incentive – Motivation
3. Formulation of a problem (possibly in stages or phases) resulting from the above

Development (by students) – Guidance & Evaluation (in 9-11, by teachers)

4. Background Creation - Search / Gather Information
5. Simplify the issue - Configure the problem with a limited number of requirements
6. Case Making - Designing - identifying materials for building / development / creation
7. Construction - Workflow - Implementation of projects
8. Observation-Experimentation - Initial Conclusions
9. Documentation - Searching Thematic Areas (AI fields) related to the subject under study – Explanation based on Existing Theories and / or Empirical Results
10. Gathering of results / information based on points 7, 8, 9
11. First group presentation by students

Configuration & Results (by students) – Guidance & Evaluation (by teachers)

12. Configure STEAME models to describe / represent / illustrate the results
13. Studying the results in 9 and drawing conclusions, using 12
14. Applications in Everyday Life - Suggestions for Developing 9 (Entrepreneurship - SIL Days)

Review (by teachers)

15. Review the problem and review it under more demanding conditions

Project Completion (by students) – Guidance & Evaluation (by teachers)

16. Repeat steps 5 through 11 with additional or new requirements as formulated in 15
17. Investigation - Case Studies - Expansion - New Theories - Testing New Conclusions
18. Presentation of Conclusions - Communication Tactics.

STAGE III: STEAME ACADEMY Actions and Cooperation in Creative Projects for school students

Title of Project: _____
Brief Description/Outline of Organizational Arrangements / Responsibilities for Action

STAGE	**Activities/Steps** Teacher 1(T1) Cooperation with T2 and student guidance	**Activities /Steps** **By Students** Age Group: ____	**Activities /Steps** Teacher 2 (T2) Cooperation with T1 and student guidance
A	Preparation of steps 1,2,3		Cooperation in step 3
B	Guidance in step 9	4,5,6,7,8,9,10	Support guidance in step 9
C	Creative Evaluation	11	Creative Evaluation
D	Guidance	12	Guidance
E	Guidance	13 (9+12)	Guidance
F	Organization (SIL) STEAME in Life	14 Meeting with Business representatives	Organization (SIL) STEAME in Life
G	Preparation of step 15		Cooperation in step 15
H	Guidance	16 (repetition 5-11)	Support Guidance
I	Guidance	17	Support Guidance
K	Creative Evaluation	18	Creative Evaluation