GENERATION BLOCKCHAIN

Facilitator's Guide

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Generation Blockchain Facilitator's Guide

By
Frankfurt School of Finance & Management

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01

Introduction

01 | INTRODUCTION TO THE ERASMUS+ PROJECT

The ERASMUS+ PROJECT GENERATION BLOCKCHAIN

The ERASMUS+ project "Generation Blockchain" aims at contributing to the enhancement of digital learning and teaching in higher education institutions and the development of advanced student skills such that they are better prepared to contribute to the digital transformation of society. This project is a collaboration between University of Szczecin in Poland, Frankfurt School Blockchain Center in Germany, Momentum Educate+Innovate in Ireland, Amsterdam University of Applied Sciences in the Netherlands, European E-Learning Institute in Denmark and University of Porto in Portugal.

This project has been funded with support from the European Commission. However, the views and opinions expressed are solely those of the author(s) and do not necessarily reflect those of the European Union or the National Agency. Neither the European Union nor the National Agency can be held responsible for the content. In compliance with the new GDPR framework, please note that the partnership will only process your personal data for the sole interest and purpose of the project and without any prejudice to your rights.

New training materials will be developed during the project. Firstly, the Generation Blockchain Audit & Framework showcases the applications of Blockchain education in practice across Europe within HEIs, highlighting areas where blockchain education could be easily utilized. It outlines a framework on how lecturers can best engage blockchain education in a meaningful way. Secondly, the Inverted Learning Open Education Resources (OERs) are designed for use by HEI business educators in small groups or seminar style classes. These resources will empower educators in their application of blockchain education. Finally, the generation Blockchain online course will be a multilingual, interactive learning course in which business, economics, management, and other interested students can access blockchain training directly in a flexible, autonomous manner.

The materials provided are rolled out across several HEIs worldwide and can be adapted as needed to inform, update and bolster the existing syllabus.

Preface and Purpose of the Guide

This facilitators' guide is designed to help you as the facilitator and course organizer to plan and conduct the course. It is not meant to be a "training of trainers" manual, although it covers the basics and essentials of suitable training practice.

This guide is for the Inverted Learning Approach course add-on called "Blockchain Technology & Cryptocurrencies". It covers how to teach blockchain technology to students, acquire the qualification to teach blockchain technology and includes dedicate learning activities for each of the seven modules. Depending on your own level of experience in organizing and conducting courses on blockchain technology, you may want to refer to sections of this guide but not read through its entirety. Please feel free to use these guidelines as you see fit. It can either be read in a linear way from cover to cover, or separate sessions depending on the task you are given and what you are looking for. Courses planning and delivery follow a logical sequence of a set of activities. However, some of these are iterative, and cyclical as will be clear from this guide. Therefore, this guide is not written or presented in a linear fashion but is to be seen as a menu of sections.

02

Manual For The Inverted Learning Approach Add-On

01 | INVERTED LEARNING APPROACH KEY INFORMATION

1.1 Relevance of the Topic Blockchain Technology in HEIs

Blockchain technology is arriving at the core of how businesses operate and are set up. Blockchain technology and crypto assets approach reality and more and more companies plan and implement first blockchain projects. While crypto assets such as Bitcoin and Ethereum are on the rise and blockchain technology is increasingly used by companies in the financial sector and in other sectors, an almost endless plethora of blockchain-based innovations are gaining in importance, such as decentralized finance (DeFi) applications, non-fungible tokens (NFTs), metaverse, web3, or potentially also central bank digital currencies (CBDCs). Therefore, it is important for students in the EU to have a basic understanding of Bitcoin, Ethereum, other crypto assets, and blockchain technology. Blockchain technology will be a core technology for the next decades and will disrupt the finance industry — and possibly also further industries. Blockchain technology not only enables radically new business models but also enhances legacy systems by reducing downtime, increased security, amongst others. While the momentum at which this technology, and its use cases, have come to be adopted is unparalleled, there is still much to do. We are moving toward a phase of widespread institutional integration and it is becoming clear that blockchain will be the foundational infrastructure for finance and capital markets in the future. This includes crypto assets and enterprise distributed ledger technology (DLT) solutions. With this, a transformation of operating cycles, design and development of products and organizational structures can be expected in any business sector and regardless of country borders.

This course provides management and business students in their bachelor's or master's study cycle with a comprehensive overview of blockchain technology and cryptocurrencies. Topics covered include the history of blockchain technology and digital money with a focus on Bitcoin and Ethereum. Different application areas of blockchain as a technology such as financial and industrial use cases will be covered. The legal and regulatory landscape will be examined, and students will be introduced to the fundamentals of programming smart contracts. As blockchain solutions differ greatly from previous means of data storage and transaction processing, it is crucial for students in the 21st century to understand how this new technology works in comparison with technologies of the past. This course gets learners started with blockchain technology on a solid foundation by providing a 360-degree overview of its evolutionary journey, key concepts, standards, technological building blocks, use cases, and real-world examples.

1.2 Prerequisites

Neither the students nor the facilitators require specific prerequisites for this course. Basic knowledge about coding helps but is not a requirement. Sufficient English language proficiency is required to be able to access sources of knowledge that are most often only available in English despite the core curriculum being translated into several languages (i.e., Polish, German, Dutch, Danish, Portuguese). Module five is an exception since it can only be taught in English.

1.3 Course Length

The Bachelor's course curriculum takes approximately 30 hours to complete (counting only the required materials). This includes the highly suggested study activity materials in chapter five of the Facilitator's Guide marked as mandatory) and the Bachelor's curriculum including the videos and podcasts referred to in the curriculum itself as the foundation of the course. The Master's course curriculum takes approximately 35 hours to complete (counting only the required materials). This also includes the highly suggested study

activity materials in chapter five of the Facilitator's Guide marked as mandatory) and the Master's curriculum including videos and podcasts referred to in the curriculum itself.

All other suggested learning activities and voluntary studies are to be seen as voluntary add on as chosen by the facilitator or the students and are not specific to the Master's or Bachelor's curriculum.

1.4 Audience

This course is geared toward higher education providers to add to their pedagogic approach to the implementation of blockchain technology. It is especially designed for study paths in the realms of business, management and economics to become cognizant of how blockchain technology and its applications in business work today. The program is for those seeking a high-level overview of blockchain and cryptocurrencies and guidance on where to look for more information, and people who want to understand how digital currencies and emerging decentralized technologies are making a difference in financial markets and the establishment of trust. Lecturers are advised to use the course add-on for the following student bodies:

- Students of economics, financial systems and monetary policy
- Students of (digital) business, business development, management and strategy
- Students of innovative technologies and engineering
- Students of entrepreneurship
- Students of computer sciences
- Students of procurement
- Other students relating to these fields of study

1.5 Learning Goals for Students

By the end of this course, students should be able to:

- Explain the concept of blockchain and which benefits and drawbacks it has
- Think strategically about and discuss how blockchain and cryptocurrencies could help solve real-world/business problems
- Conduct further research on and identify cutting-edge blockchain initiatives by yourselves
- Avoid common misconceptions about blockchain technology and cryptocurrencies
- Find the right places to pursue further knowledge if desired

Learning Objectives for Module 1
Introduction to Blockchain Technology (Bachelor & Master)

After the first module, students should be able to:

- Explain the difference between blockchain technology and distributed ledger technology (DLT).
- Discuss blockchain technologies and early money.
- Explain the difference between blockchain and the cryptocurrency Bitcoin.
- Explain how the Bitcoin blockchain works.
- Discuss blockchain characteristics.
- Explain blockchain components such as mining and consensus.
- Explain what a block in a blockchain is composed of.
- Explain how transactions on a blockchain work.
- Discuss the advantages and disadvantages of the consensus mechanisms Proof-of-Work and Proof-of-Stake.
- Explain the three main functions of money.

Learning Objectives for Module 2
Trust in Business (Bachelor & Master)

After the second module, students should be able to:

- Argue the importance and prevalence of trust in business.
- Understand the different dimensions of trust.
- Explain how blockchain technology can enhance trust in certain business processes and fields.
- Understand the prerequisites to place trust in cryptocurrencies and factors influencing this trust.
- Explain which group(s) of people trust cryptocurrencies.
- Reiterate various financial use cases for blockchain technology and their benefits and pitfalls.
- Reiterate various industry use cases for blockchain technology and their benefits and pitfalls.

Learning Objectives for Module 3
Cryptocurrencies (Bachelor & Master)

After the third module, students should be able to:

- Reiterate how a Bitcoin transaction works.
- Discuss scalability issues of Bitcoin.
- Have an understanding for the profitability of Bitcoin mining and the hardware and software requirements for miners.
- Understand what Ethereum is and what the differences between Ethereum and Bitcoin are.
- Assess the role of the Ethereum gas fee in transactions.
- Reiterate how an Ethereum transaction works.
- Understand the concept and use cases of smart contracts.
- Understand the different application layers of decentralized finance.
- Name and analyze the parallels and differences between decentralized finance & traditional finance.
- Identify current drawbacks with decentralized finance & traditional finance.

Learning Objectives for Module 4
Regulation & Policy (Bachelor & Master)

After the fourth module, students should be able to:

- Explain the different types of risks in blockchain and crypto asset regulation.
- Reiterate how Liechtenstein's Token Container Model works.
- Understand the complexity of crypto regulation on a national and international level as well as the interests and rights of the stakeholders involved.
- Gain an overview of the current developmental phase of MiCAR in the EU.
- Understand how national and international law interoperates.
- Understand the importance of regulation as an innovation fostering or hindering factor.
- Explain the intricacies of tokenization right.
- Understand the three dimensions (financial regulatory treatment of cryptocurrencies, governance, and regulatory requirements for crypto service providers) of crypto asset regulation.
- Discuss the importance of collaboration and transparency in regulatory advancements.

Learning Objectives for Module 5
Fundamentals of Coding & Programming (Master)

After the fifth module, students should be able to:

- Learn how to program a game on Ethereum.
- Learn and use basic solidity concepts.
- Understand and deploy ERC721 & crypto collectibles.
- Understand and be able to program app front ends & web3.js.
- Understand how data feeds and computations work theoretically and in practice.
- Learn how to deploy dApps with Truffle.
- Learn how to build an Oracle.
- Test smart contracts with Truffle (e.g., using Chai to write more expressive assertions, testing against Loom).
- Learn how to deploy on TRON, one of the fastest-growing public blockchains.
- Understand the basics of zkSync.

Learning Objectives for Module 6
Financial Service Applications (Bachelor & Master)

After the sixth module, students should be able to:

- Explain the concept of borrowing, lending, and tokenizing, staking and flash loans.
- Understand the differences between traditional lending and borrowing and decentralized lending and borrowing.
- Understand the concept of tokenization and their real-life applications and their use in the crypto ecosystem.
- Discuss the history of exchanges and understand their position in the crypto ecosystem.
- Understand web3 and their real-life applications and their use and role in the crypto ecosystem.
- Understand the potentials and risks in regards with web3 as compared to previous iterations of the internet.

Learning Objectives for Module 7
Industry Applications (Bachelor & Master)

After the seventh module, students should be able to:

- Explain how blockchain technology can be used in synergy with other technologies for data management (i.e., IoT, AI).
- Understand how blockchain technology can enable resource responsibility through tokenization.
- Argue concrete ways in which blockchain can improve the energy-sharing economy.
- Explain exemplarily how the roles of stakeholders involved in the energy-sharing economy will change from a legal and task-distribution standpoint with blockchain-based systems.
- Detect potential risks regarding the introduction of blockchain technology in industry applications.
- Reiterate one specific use case for a blockchain industry application in the energy sector.
- Gain a critical view of the Bitcoin energy consumption.

02 | THE COURSE OUTLINE

The course is designed in a linear fashion, skipping modules cannot be recommended. Each module is followed by a dedicated Learning Assessment made up of multiple-choice questions covering the learned materials. Which specific learning activities are used in class is decided by the facilitator. The seven modules serve as the basic framework that can be molded and adjusted as needed based on the learning goals, group size, time availability, and setting of the class as well as the curriculum's significance towards the final grade of students in a Bachelor's or Master's cycle level study path at an HEI.

2.1 Welcome

This section includes important information on how to take the course and provides a broad context of what is happening in the world of blockchain technology.

2.2 Module 1 – Introduction to Blockchain Technology

In this module, students will learn about the history of distributed ledger technologies and, in particular, about blockchain technology itself (e.g., cryptography, block structure, mining and consensus), as well as about the history of digital money and especially Bitcoin.

2.3 Module 2 – Trust in Business

In this module, the role and means for trust in business (i.e., measurement & processes for trust establishment) and how blockchain technology can redress the establishment thereof are discussed. Further, the module presents different application areas of blockchain technology such as financial and industrial use cases.

2.4 Module 3 – Cryptocurrencies

In this module, the Bitcoin basics, its mining mechanism and network will be in focus. Additionally, students will be introduced to the basics of Ethereum, transactions and smart contracts. Finally, the principles of decentralized finance (DeFi) will be covered by drawing comparisons to the traditional financial system.

2.5 Module 4 – Regulation & Policy

In this module, blockchain and crypto asset regulation (i.e., EU and non-EU regulation and law) will be examined.

2.6 Module 5 – Fundamentals of Coding & Programming

In this module, students will be introduced to the programming language Solidity and the concept of building smart contracts and decentralized Apps. This module is only part of the Master's curriculum as it provides advanced knowledge on a technical level.

2.7 Module 6 – Financial Service Applications

In this module, the topics of crypto products and services (i.e., lending and borrowing, trading and crypto exchanges) will be covered. Moreover, the tokenization of assets such as real estate, NFTs and items in the Web3 space will be covered.

2.8 Module 7 – Industry Applications

In this module, blockchain technology in the context of manufacturing (i.e., supply chain management and resource responsibility) will be examined. Furthermore, blockchain technology in the energy sector (i.e., the energy-sharing economy and exemplary use cases) will be subject of this module.

03 | BUILDING BLOCKS FOR THE COURSE

The main building block of the course is the Bachelor's or Master's Curriculum and the recommended learning activities in chapter five of the Facilitator's Guide. It can be expanded by adding some of the other recommended learning activities listed in the following.

3.1 Group Projects

Group assignments or projects play a crucial role in self-study courses. They help to keep the course cohesive, provide continuity, and reinforce learning through practical application of knowledge. Courses that do not include group projects or assignments tend to be less effective as they rely on passive rather than active learning, resulting in lower retention rates among participants. Thus, it is recommended to include group projects such as those recommended in the suggested learning activity section of this learning guide. Additionally, incorporating a problem-solving approach by basing the exercise on real-world situations rather than hypothetical or fictional scenarios can enhance the learning experience. It is essential for facilitators to be thoroughly familiar with the exercise and to have participated in it themselves at least once. They should also agree on a consistent approach and methodology to avoid conflicting instructions for the groups they mentor.

3.2 Mode of Examination

For each of the modules, there is one respective Learning Assessment of approximately 30 minutes that corresponds with the contents learned by the students during the module. It is recommended to use the proposed examination questions to test students' knowledge about the modules. Using a time limit to complete the Learning Assessment lowers the likelihood of students using extensive sources outside of their acquired knowledge.

The Generation Blockchain curriculum is broken down in a way that lets you pick and choose the topics that you want to cover. Depending on the choice of topics that you have made beforehand the content of the examination might has to be altered according to the topics covered in your course. Accredited student Learning Assessments and their evaluation that decide on the passing of the course are the tasks of the facilitator.

3.3 Choosing a more Technical Angel

Though the target group is business and economy students, it is generally recommended to include module 5 in the course since basic knowledge of smart contracts and coding is shown to be a crucial skill in a business context regardless of whether the students is a Bachelor or Master graduate. The need to understand a simple smart contract (i.e., 5–10 lines of code) is important not only for employees in the field of information systems, but also in the fields of business, economics, and law. Deeper technological knowledge about how to configure nodes, however, is mostly not urgently necessary but could be acquired later on. Through the instructive nature of module 5, even students that typically do not have computer sciences or programming in their path of study will be adequately lead through the module.

04 | COURSE PREPARATION

Preparation is crucial for courses, and it is essential for course organizers and facilitators to familiarize themselves with the material they designed or will be delivering. They should also ensure they have enough time to tailor the content to the specific audience. The following are steps and principles all course organizers should follow.

4.1 Establish Course Needs and Context

There are four main critical steps you need to go through in the stage of preparation:
To effectively plan a course, it is important to clarify the following:

a) The purpose, need and expected outcomes of the course, as well as the expectations for attendees.
b) In the course planning process, it is recommended to use a small working group or committee approach to promote ownership and ensure the design meets the needs of the target audience.

Once these have been clarified, decisions should be made regarding:

a) The amount of lead time required to organize the course, it is better to overestimate the amount of time needed.
b) The methods of promoting the course and making it attractive to attend.
c) Whether follow-up after the course is necessary and how it will be undertaken.
d) If support is needed to document the course process, content, and outcomes.

It is also important to identify:

- The profile of the participants, to ensure appropriate individuals attend the course and facilitators can adapt the content and design. Pay attention to age and gender differences, levels of education and experience, and what you are seeking to achieve with the group: influence, raise awareness, orient or sensitize, generate support or engagement.
- The personnel requirements and criteria, roles, and responsibilities.
- The venue, equipment requirements and sources, formal opening, etc.
- The required budget, funding source, and methods of payment.

Lastly, set a deadline for receiving responses for attendance for the course if the course is not used as part of an already existing course and participation is mandatory per default.

4.2 Organize Course Sessions, Material and Presentations

To ensure the course is successful, it is important to:

- Review each block in detail, including the facilitator outline, powerpoints and exercises.
- Decide what needs to be adapted and changed and what should remain as-is.
- Determine if there is a need for translation of materials or translation services during the course.
- Evaluate venue options and suitability, taking into consideration the location, room size, layout, and space for break-out working groups, acoustics, external distractions, and safety. Ideally, try to find a venue with good natural lighting. This has a big impact on group dynamics, particularly for large groups, and on the overall learning experience.

4.3 Your Role as the Facilitator

What is a facilitator?

A facilitator is a person who helps a group of people to work together effectively, efficiently and productively. They help to guide the group's discussion, decision-making, and problem-solving process. They are responsible for creating an environment that encourages participation, open communication and active engagement. They also help to keep the group focused on its goals and objectives, and to manage any conflicts that may arise. Additionally, they may provide guidance and support to individual members of the group and help to ensure that the group's processes are inclusive and equitable. The role of a facilitator is to make the process of collaboration easy and efficient, by keeping the group on track and ensuring that everyone can contribute. Note that it is not necessary to hold a degree or be a lecturer to be an effective facilitator for the generation blockchain curriculum (previous experience as a lecturer helps however).

The facilitator's role

When taking on the role of a facilitator, the trainer should:

1. Encourage active participation from all members of the group, particularly from those who may be less confident.
2. Handle difficult participants in a non-confrontational and friendly manner, for example, those who are overly talkative, argumentative, disengaged, or frequently absent.
3. Manage conflicts by intervening if necessary to teach positive conflict resolution skills or to help the group find common ground.
4. Periodically have the group summarize the discussion and pose questions or make suggestions to move the conversation forward.
5. Assist less assertive participants by clarifying their ideas so they are not overlooked.
6. Provide positive feedback to individuals and the group as a whole.
7. Provide necessary resources and information for the group to function effectively.
8. Use silence strategically to allow for participation.
9. Conclude the discussion when the intended learning outcomes have been met or when the allotted time is up.
10. Ensure the group works towards common goals and feels a sense of accomplishment from working together.

4.4 Important Consideration for the Course

Audience

To ensure that a course is relevant to the attendees, it is important to tailor the content to their specific needs, priorities, and realities. This includes gathering information on their membership, roles, current priorities, and needs related to the topic of the course. Keep in mind that participants often come from diverse backgrounds and have different levels of experience and knowledge. Therefore, it is essential to prepare the course in a way that is useful for a diverse group of learners and that sets an appropriate level of complexity. During the course, it is essential to be aware of group dynamics, signs of engagement or disengagement and adapt accordingly. It is also important to follow the principles of adult education, by starting with a stimulus presentation or exercise, followed by opportunities to apply and analyze the new

ideas considering the participants' own situation and developing an application plan, taking into account possible barriers and impediments that could arise.

Monitoring Groups

Facilitators can either monitor group progress or empower the group to self-monitor. This approach allows for a greater sense of ownership of the course and encourages the group to take responsibility for their own learning and development. To achieve this, a rotating group of participants could be selected to monitor one day of the course each. They could then meet at the end of their allocated day to discuss their observations.

Covering Course Contents

Maintaining a schedule is essential to ensure that each session flows logically and to help participants follow the progression of the course.

- In case of any deviation from the main topic, it is a good idea to offer to address them during a break.
- It is also helpful to make a note of any additional topics brought up by participants, and if there is time remaining, to bring them up at the end of the session. Keeping this list visible to participants will remind them of the topics that will be covered.
- Each session's lesson plan should include key summary points, which will help you know if all the main content of your lesson plan has been covered. Reviewing these points at the end of each session will help you ensure that all the important information was covered.

Leadership in Group Discussions

A group discussion is a method that may be used by a facilitator to create a learning situation where attitudes and opinions/arguments are sought and examined. There are three key features:

1. The participative environment encourages the sharing of experiences and the introduction and development of ideas.
2. The fact that all participants are actively involved in thinking, listening and speaking leads to better learning and fuller understanding.
3. For adults, particularly experienced adults ‘social learning’ is one of the most powerful modes of learning.

4.5 Quick Preparation Checklist

Preparation checklist for giving the course:

1. Clarify the purpose, need, and expected outcomes of the course, as well as the expectations for attendees.
2. Identify the target audience and their level of familiarity with blockchain technology.
3. Review and update the course material, including the facilitator outline, powerpoints and exercises.
4. Identify any areas that need to be adapted or changed based on the target audience.
5. Decide if there is a need for translation of materials or translation services during the course.
6. Identify personnel requirements, including facilitators, and their roles and responsibilities.
7. Identify the venue, and evaluate the suitability in terms of location, room size, layout, and space for break-out working groups, acoustics, external distractions, and safety.
8. Identify equipment requirements, such as projectors, audio equipment, and internet access, and arrange for these to be available.
9. Identify the required budget, funding source, and methods of payment.
10. Promote the course and make it attractive to attend.
11. Decide if follow-up after the course is necessary and how it will be undertaken.
12. If support is needed to document the course process, content, and outcomes.
13. Set a deadline for receiving responses for attendance
14. Test the technology before the course to make sure everything works correctly
15. Prepare a backup plan in case of technical issues.

03

Teaching Blockchain Technology to Students

01 | Teaching Blockchain Technology to Students

Teaching blockchain technology to business students presents a unique opportunity to showcase the potential of this technology to disrupt traditional business models and create new opportunities. The task of teaching can be a challenging one, as it is a complex and rapidly evolving field. However, with the right approach and resources, it can be an engaging and rewarding experience for both the students and the instructor.

1. **Start with the basics**
   Begin by introducing students to the fundamental concepts of blockchain technology, such as distributed ledger technology, cryptography, and consensus mechanisms. Make sure to explain these concepts in a way that is easy for students to understand.

2. **Emphasize the business use cases**
   Start by highlighting the various ways in which blockchain technology can be used in different industries such as finance, supply chain management, and healthcare. This will help students understand the potential impact of blockchain on their future careers.

3. **Discuss the impact on traditional business models**
   Highlight how blockchain technology can disrupt traditional business models, such as by reducing intermediaries, increasing transparency, and creating new revenue streams. This will help students understand the potential for blockchain to create new opportunities and challenges for businesses.

4. **Incorporate hands-on experience**
   Assign projects or case studies that involve analyzing the potential impact of blockchain on a specific industry or business. This will help students develop the skills needed to evaluate the potential of blockchain technology for businesses.

5. **Invite guest speakers**
   Invite industry experts to speak to your class about their experiences working with blockchain technology. This will give students an opportunity to learn from professionals and understand the practical applications of blockchain in the business world.

6. **Keep current**
   Keep yourself and your students up to date on the latest developments in blockchain technology by regularly reviewing industry news and research papers. Encourage your students to do the same, and make sure to incorporate these updates into your curriculum.

The pedagogics of teaching blockchain technology

Teaching blockchain technology to business students from a pedagogical standpoint requires a combination of theoretical and practical approaches. The following help to effectively teach blockchain to business students:

1. **Use a problem-based approach**

   Start by presenting business problems that can be solved using blockchain technology. This will help students understand the potential of blockchain to address real-world issues and create new business opportunities.

2. **Incorporate case studies**

   Use case studies to illustrate the application of blockchain technology in different industries. This will help students understand the practical aspects of blockchain and its potential to disrupt traditional business models.

3. **Encourage group work and discussions**

   Organize group discussions and project-based assignments that encourage students to work together and share their ideas. This will foster critical thinking, problem-solving and collaboration skills.

04

Qualifications to Teach Blockchain Technology

01 | Qualifications to Teach Blockchain Technology

As of right now, there is only a handful of blockchain-related and accredited study paths out there that can provide formal evidence for qualification to teach blockchain technology. Everybody who works or intends to work in the field of blockchain should at least be able to understand Bitcoin and Ethereum. Concerning Ethereum, it is essential to understand — and program — a very simple smart contract such as an escrow process implemented with a couple of lines of code in Ethereum's programming language Solidity. This chapter covers some of the current possibilities to acquire accredited proof of eligibility to teach blockchain technology, though this is not a requirement to teach at most universities.

Different Kinds of Accreditation

There are several forms of accreditation for blockchain technology knowledge, each with its own unique focus and level of rigor. Some of the most common forms of accreditation include:

1. **Certifications**
   Certifications are typically offered by industry organizations or companies and are designed to demonstrate a basic level of knowledge and understanding of blockchain technology. Examples include the Certified Blockchain Professional (CBP) from the Blockchain Council and the Blockchain Professional (BCP) from the International Association of Blockchain Professionals (IABP).

2. **Diplomas**
   Diplomas are typically offered by educational institutions and are designed to demonstrate a more advanced level of knowledge and understanding of blockchain technology. These programs often include coursework and hands-on experience and may be focused on specific areas of blockchain technology such as smart contracts or decentralized finance.

3. **Degrees**
   Degrees are typically offered by universities and are designed to demonstrate a comprehensive level of knowledge and understanding of blockchain technology. These programs often include coursework, research, and hands-on experience, and may be focused on specific areas of blockchain technology such as blockchain governance or blockchain security.

4. **Professional Development**
   Professional Development courses are designed to provide professionals with the knowledge and skills to work in a specific field, in this case blockchain technology. These courses are typically focused on specific areas of blockchain technology such as blockchain development, blockchain security, and blockchain governance.

It is worth noting that each accreditation form has its own requirements and standards, and the level of rigor and credibility will vary depending on the provider. It's important to research the options available and choose the one that best aligns with your goals and interests.

Executive Education

Executive education on blockchain technology is a form of professional development that is specifically designed for executives and managers. The goal of this type of education is to provide leaders with the knowledge and skills they need to understand and effectively leverage blockchain technology in their organizations. Executive education programs on blockchain technology are typically designed for busy

professionals who are looking to quickly gain a comprehensive understanding of the technology, its use cases and potential impact on business and the economy. These programs can be delivered in a variety of formats, such as online, in-person or in a hybrid mode, and they usually last from a few days to a few weeks. They also provide an opportunity to network with peers and industry experts.

Studying blockchain-related subjects

There are a growing number of universities around the world that offer programs specifically focused on blockchain technology. These programs can range from undergraduate and graduate degrees to specialized certifications and executive education programs. Some examples of universities that offer programs in blockchain technology include:

- The Massachusetts Institute of Technology (MIT): MIT offers a graduate level course in blockchain technology called "Blockchain Technologies: Business Innovation and Application" which is part of their Media, Economics, and Entrepreneurship program.

- University of Nicosia: The University of Nicosia in Cyprus offers an MSc in Digital Currency, which covers blockchain technology and other digital currencies.

- Frankfurt School of Finance & Management: The Frankfurt School of Finance & Management offers an MSc in Blockchain Technology & Digital Assets which covers blockchain and crypto assets from a financial industry angle.

- Imperial College London: Imperial College London offers a Master's degree in "Distributed Ledger Technology" which focuses on the technical and business aspects of blockchain technology.

- New York University (NYU): NYU offers a course called "The Law and Business of Bitcoin and Other Cryptocurrencies" which covers the legal and business aspects of blockchain technology.

- University College London (UCL): UCL offers a course called "Cryptocurrency, Blockchain and Smart Contracts" which covers the technical and business aspects of blockchain technology.

- The University of California, Berkeley: Berkeley offers a course called "Blockchain, Cryptoeconomics, and the Future of Technology, Business and Law" which covers the technical and business aspects of blockchain technology.

- The University of Illinois at Urbana-Champaign: The university offers a Master of Computer Science in Blockchain which is focused on the technical aspects of blockchain technology.

These are just a few examples of universities that offer blockchain technology programs, there are many more universities and educational institutions that offer similar programs in different locations around the world. It is important to research the options available in your area and choose the program that best aligns with personal goals and interests.

Additional Experience Building Activities for Lecturers

Next to accreditation from official institutes and universities, there are additional expiring building activities that facilitators can accrue to help them become more effective at teaching blockchain technology to students.

Listen to podcasts

Time needed: 1 day for listening to 10–15 episodes

There are very interesting and insightful blockchain and crypto podcasts. They can be very helpful by providing first basic knowledge about blockchain technology and crypto currencies.

Read important white papers

To get a feeling about the origin and the concept of blockchain technology, it is necessary to study the white papers of the two most important crypto assets Bitcoin and Ether. Reading the white papers should rather provide a high-level overview about the intentions of the crypto assets and about the mechanics of the technology.

- **Bitcoin white paper**: Nakamoto, S. (2008): Bitcoin: A Peer-to-Peer Electronic Cash System
- **Ethereum white paper**: Buterin, V. (2013): Ethereum White Paper: A Next Generation Smart Contract and Decentralized Application Platform

Networking and meeting people

It is highly recommended to step into the blockchain community and engage in first discussions with blockchain experts. Regardless of the country of residency, there are both (inter)national and regional blockchain communities. Twitter is an amazing resource for knowledge, but it is important to follow the right users (see below).

- Regional Meetups: They provide an easy way to discuss your thoughts and questions with blockchain enthusiasts nearby. Research on Google here and here.
- Frankfurt School Blockchain Center (FSBC) Events: Attending (online) blockchain events organized by the Frankfurt School Blockchain Center (FSBC) is another possibility to approach blockchain technology. The FSBC organizes various conferences related to blockchain and cryptocurrencies such as the Crypto Assets Conference every year. Furthermore, discussions about current topics such as digital securities, the digital euro, DeFi, and NFT are offered. To be up-to-date about FSBC events see www.fs-blockchain.de — here you can subscribe to the newsletter.
- Twitter: A lot of knowledge is disseminated on Twitter. Sometimes, Twitter users compile lists of other users to follow. It is highly recommended to not just open a Twitter user account but also to follow crypto experts on Twitter — and even network with them.

Online courses e.g. on smart contracts

It is also recommend to participate in an online course about blockchain technology and smart contracts. Theory provides an important perspective, of course. Yet, practical exercises are essential, as well, to gain a deeper understanding of the technology.

- Web3 Talents' programs of the Frankfurt School Blockchain Center: DLT Talents program to empower women in the blockchain space, and the DeFi Talents program for education in the DeFi sector as well as the NFT Talents for leadership in the NFT space.

Books for the wider overview

The following books provide the broader picture why Bitcoin, crypto assets and blockchain, in general, will be important in the future and how it potentially can change business processes, entire organizations or potentially society:

- The Bitcoin Standard: The Decentralized Alternative to Central Banking by Saifedean Ammous
- Mastering Ethereum: Building Smart Contracts and Dapps by Andreas Antonopoulos, Gavin Wood
- Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations by Henning Diedrich
- Layered Money: From Gold and Dollars to Bitcoin and Central Bank Digital Currencies by Nik Bhatia
- Various German Bitcoin Books by Aprycot Media
- Mastering Bitcoin: Unlocking Digital Cryptocurrencies by Andreas Antonopoulos
- Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder

05

Learning Activities

01 | Learning Activities

1.1 Proposed Study Mediums

Generally speaking, all topics touching blockchain technology and cryptocurrencies can be researched online in an autonomous manner. the means of study are manifold and range from purchasing and transferring cryptocurrencies to completing online courses reading books scientific papers watching videos reading crucial white papers networking and meeting people physically and online or listening to podcasts.

The following list of proposed learning activities for each of the seven modules. The purpose of the proposed learning activities is to engage deepen and anchor the students understanding of blockchain technology and cryptocurrencies. The selection of the proposed study materials depends on the designated learning goals and objectives as chosen by the facilitator.

02 | PROPOSED LEARNING ACTIVITIES FOR MODULE 1

Reading Activities (mandatory)

a) Read all chapters of "21 Lessons" and summarize your key learnings from each chapter of "21 Lessons"
b) Read through "Building the Internet of Blockchains" by Outlier Ventures

Practical Experience (mandatory)

a) Explore Goldman Sach's website "Blockchain — The Technology of Trust"
b) Purchasing and transferring crypto assets

It is very important for understanding this technology that facilitators and students operatively "get their hands dirty". This works as follows and provides interested persons with the most important learning about what blockchain technology actually is.

Step-by-step guide:

i) Open an account e.g. on Coinbase or Bison; further alternatives: Bitstamp, Bitrex, Binance, Bitfinex, etc.
ii) Buy Ether and Bitcoin for 10 Euro. Please be aware that in case of making mistakes with public or private keys, this money can be lost irreversibly. So, following these steps is, of course, everybody's own decision.
iii) Open a second account (examples above).
iv) Obtain a wallet address from the second account which looks similar to 0xd42899dcC146d4788649e6aa5B09f129fC269127 for Ethereum.
v) In the first step, transfer a fraction of Ether or Bitcoin you have purchased to this address. Note that addresses for Ether and Bitcoin are different, so be cautious and do not mix them up.
vi) Now, you can see that value can be sent around the world just within a couple of seconds (Ether) or minutes (Bitcoin).
vii) A more advanced step but extremely helpful to understand blockchain: Add the plug-in MetaMask to the Google Chrome internet browser to access the Ethereum network directly and to store your Ether in your own wallet. Thereafter, open an account and generate your own wallet address. Then, transfer some of your Ether from the earlier steps to this newly generated wallet.
viii) Inspect what you have done on the Ethereum block explorer or the Bitcoin block explorer.

This is not financial advice and students are not encouraged to open an account themselves in class. It is recommended to go through this process with the facilitator screen sharing while presenting this process to the students. For data privacy reasons, it is recommended to set up an (institutional) account previous to the start of the screen-sharing activity.

Open Discussion Questions (mandatory)

a) How can blockchain technology be applied to the future of finance? Think of trading, securitization, payments, financial services, cross-border payments, etc.
b) Some people claim that Bitcoin is mainly used in the shadow economy for large-scale illicit payments due to its privacy features/anonymity. Discuss if you agree with the statement. Include in your answer a concrete example for a Bitcoin transaction and how it relates to anti-money laundering efforts from regulatory agencies.

Others (voluntarily)

a) Explain how lending in decentralized finance (DeFi) differs from lending provided by commercial banks today. Think of a) processes, b) intermediation, c) leverage.

03 | PROPOSED LEARNING ACTIVITIES FOR MODULE 2

Reading Activities (mandatory)

a) Read through "Bitcoin: Economics, Technology, and Governance"
   Boehme, R., Christin, N., Edelman, B. & Moore, T. (2015).
   Bitcoin: Economics, Technology, and Governance. The Journal of Economic Perspectives, vol. 29, no. 2, pp. 213–238
b) Read through "Where does money come from?"
   Greenham, T., Jackson, A, Ryan-Collins, J., Greenham, T., & Werner, R., & Jackson, A. (2012). Where does money come from? London: New Economics Foundation. p. 7.
c) Read through „Money creation in the modern economy"
   McLeay, M., Radia, A., & Thomas, R. (2014). Money creation in the modern economy. Bank of England Quarterly Bulletin, Q1.

Practical Experience (voluntarily)

a) Work through the "Evolution of Trust" by Nick Case
b) Group work and in class learning game "The Blockchain Game"by J Scott Christianson

Open Discussion Questions (mandatory)

a) Which problems can and can't DeFi resolve that TradFi has?
b) Is DeFi reinventing the wheel or are there tangible benefits to be gained?
c) Discuss the likelihood of an overhaul of the financial system by the introduction of blockchain as the backbone of the financial industry

04 | PROPOSED LEARNING ACTIVITIES FOR MODULE 3

Reading Activities (mandatory)

a) Read through DeFi-ning DeFi: Challenges & Pathway
   Amler H., L. Eckey, S. Faust, M. Kaiser, P. Sandner (2021). DeFi-ning DeFi: Challenges & Pathway.
b) Read through SoK: Decentralized Finance (DeFi)
   S. Werner, D. Perez, L. Gudgeon, A. Klages-Mundt, D. Harz, W. J., Knottenbelt (2022). SoK: Decentralized Finance (DeFi).
c) Read through CeFi vs. DeFi — Comparing Centralized to Decentralized Finance
   K. Qin, L. Zhou, Y. Afonin, L. Lazzaretti, A. Gervais (2021). DeFi vs. DeFi – Comparing Centralized to Decentralized Finance.
d) Read through Systematic Literature Overview and Research Directions
   E. Meyer, I. M. Welpe, P. Sandner (2022). Systematic Literature Review and Research Directions.

Practical Experience (voluntarily)

a) Play the "Bitcoin Rollercoaster" game by ngpf

Open Discussion Questions (mandatory)

a) What are the advantages/disadvantages of using the Lightning Network instead of a traditional Bitcoin on-chain transaction regarding a commercial agreement, e.g. coffee purchase?
b) How does Ethereum's "monetary policy" differ from Bitcoin's "monetary policy", and its effects on miner/validator incentivization. Think of the current policy since the merge took place in September of 2022 as part of the Serenity Update.
c) Discuss the role of gas (fees) in the Ethereum network and how it relates to the execution of smart contracts.

Others (voluntarily)

a) Do research by (i) reading on Medium, (ii) watching on Youtube, (iii) listening to podcasts on these topics:
   i) Top entrepreneurs in the blockchain area, top startups in the blockchain area. What do these people have in common? What makes them outstanding?
   ii) Five startups in Germany, in which would you invest, in which would you not invest? Five worldwide startups, in which would you invest, in which would you not invest?
   iii) Smart contracts and Smart contract templates
   iv) Ethereum standards (e.g. ERC20, ERC721)
   v) DeFi projects
   vi) Alternative smart contract platforms

b) What were the top 5 biggest DeFi exploits?
   i) Explain what vulnerabilities were exploited
   ii) Blame game: Do you blame the "hackers" or do you blame the project (developers)?

c) Describe the different forms of digital fiat-money and include relevant characteristics that explain how they differ from each other.

d) Alice pays for her coffee with Bitcoin at Bob's place. Since it is the year 2014, and Lightning has not been implemented yet, she does it via an on-chain transaction. List the steps for achieving the payment, until it is completely irreversible.

05 | PROPOSED LEARNING ACTIVITIES FOR MODULE 4

Reading Activities (voluntarily)

a) Read through "Stablecoins: Risks, potential and regulation"

D. Arner (2020). Stablecoins: Risks, potential and regulation. [Basel] : Bank for International Settlements, Monetary and Economic Department.

b) Read through "The Markets in Crypto-Assets Regulation(MICA) and the EU Digital Finance Strategy"

D. Zetzsche; F. Annunziata; D. Arner; R. Buckley (2021): The Markets in Crypto-Assets regulation (MiCA) and the EU digital finance strategy, Oxford University Press, vol. 16 (2), pp. 203-225.

c) Read through "Legal Aspects of Blockchain Technology for Industrial Use Cases"

M. Kaulartz; J. Gross; C. Lichti; P. Sandner. (2022): Legal Aspects of Blockchain Technology for Industrial Use Cases, KOSMoS.

Open Discussion Questions (mandatory)

b) How can crypto prices be protected from social media hype?

c) Should developing countries adopt cryptocurrency as legal tender?

d) Research the Crypto Travel Rule and discuss the practical implications of the introduction thereof and how it compared to equivalent regulation around fiat money today.

06 | PROPOSED LEARNING ACTIVITIES FOR MODULE 5

Open Discussion Questions (mandatory)

a) How does the concept of "code is law" apply to smart contract development?
b) What are the security risks associated with smart contract development and how can they be mitigated?

Others (voluntarily)

a) Analyze the provided code snippet of a Solidity contract and address the following points:
   i) Briefly explain the main purpose of the function present in the contract, including its input and any other relevant details.
   ii) Elaborate on the fundamental concepts of functions and state variables in Solidity, and how they are employed in this contract to achieve specific results.

```
1  // SPDX-License-Identifier: MIT
2  pragma solidity ≥0.4.0 <0.7.0;
3  contract SimpleStorage {
4    uint storedData;
5    function set(uint x) public {
6        storedData = x;
7    }
8    function get() public view returns (uint) {
9        return storedData;
10   }
11 }
```

Explanation of Code
Line 1: Specifying SPDX license type, which is an addition after Solidity ^0.6.8; whenever the source code of a smart contract is made available to the public, these licenses can help resolve/avoid copyright issues.

Line 2: On the first line we are declaring which Solidity compiler we want to use. For instance, we are targeting any version between ≥ 0.4.0 and <0.7.0 .

Line 3: We are declaring our contract here and naming it as Simplestorage. It is normal practice to use the same filename as the contract name. For example - this contract will be saved in the file name SimpleStorage.sol (.sol is the file extension for solidity smart contracts).

Line 4: We are declaring a uint (Unsigned Integer) variable named storedData, this variable will be used to store data.

Line 5-7: Next, we will add a set function, using which we will change the value of our variable storeData. Here set function is accepting a parameter x whose value, we are storing into storeData. In addition, the function is marked as public which means that the function can be called by anyone.

Line 8-10: We will add a get function to retrieve the value of storeData variable. This function is marked as view which tells Solidity compiler that this is a read-only function.

Other than that, the “get” function also has returns (uint), which means that the function will return a uint.

07 | PROPOSED LEARNING ACTIVITIES FOR MODULE 6

Practical Experience (mandatory)

a) Explore Nifty Erdstall testsuite by PolyCrypt
   i) Get familiar with Metamask and the Goerli test network (get free GöETH here: https://goerli-faucet.mudit.blog/, you can delete the post right after receiving your GöETH)
   ii) Mint your own NFT and cNFT on https://nifty.erdstall.dev (Note: please do not start before June 8th)
   iii) Buy / sell / offer a NFT / cNFT.
   iv) Withdraw an NFT and take a screenshot of the transaction on https://goerli.etherscan.io/, you can also check it on OpenSea.

Open Discussion Questions (mandatory)

a) What is the significance of NFTs? Use-cases beyond art?
b) What are the key differences between Web 2.0 and Web3? How does the decentralization aspect of Web3 change the way we interact and use the internet?
c) How Web3 technology can change the way we handle identity on the internet? How can it enable a decentralized and more secure approach to identity management?

Others (voluntarily)

a) Get familiar with the core concepts of NFTs
   i) Define nonfungibility in a broader sense
   ii) Research on base functionality (minting, token burn, buy, sell, deposit, withdraw, royalties)
   iii) Visualize the "NFT stack" in a nice slide: What are the elements and layers of NFT and how are they related to each other?

b) Which NFT collections are you following and what's special about them?
   i) What are the top 5 collections by market capitalization (sales volume)?
   ii) What are the most relevant Marketplaces for NFTs?
   iii) What are the most relevant Blockchains for NFTs and why?
   iv) Summarize utilities that NFTs can provide.

08 | PROPOSED LEARNING ACTIVITIES FOR MODULE 7

Reading Activities (voluntary)

a) Read through "Blockchain Platforms in Energy Markets—A Critical Assessment."
   Burger, Christoph & Weinmann, Jens. (2022). Blockchain Platforms in Energy Markets—A Critical Assessment. Journal of Risk and Financial Management. 15. 10.3390/jrfm15110516.

b) Read through "How Blockchain Technologies Impact Your Business Model"
   Morkunas, V. J., Paschen, J., and Boon, E. 2019. "How Blockchain Technologies Impact Your Business Model," Business Horizons, 62(3), 295–306.

c) Read through "The impact of blockchain on business models in banking. Information Systems and e-Business Management"
   Rajnak, V., & Puschmann, T. (2021). The impact of blockchain on business models in banking. Information Systems and e-Business Management, 19(3), 809-861.

Open Discussion Questions (mandatory)

a) Why does Bitcoin mining consume energy?
b) How do you evaluate the energy consumption and CO2 footprint of Bitcoin mining? Consider in your answer benefits and drawbacks of Bitcoin's energy consumption
c) How can blockchain technology be used to enable peer-to-peer energy sharing? What are the benefits of using blockchain in this context?
d) How can smart contracts be used to facilitate energy trading and transactions in a decentralized energy sharing economy?

Others (voluntarily)

a) Do research by (i) reading on Medium, (ii) watching on Youtube, (iii) listening to podcasts on these topics:
   i) Enterprise use cases
   ii) Identity management
   iii) Hyperledger
   iv) Corda
   v) Supply chain use cases

b) Conduct an Interview
   i) Get in contact with an expert within your chosen domain and prepare and conduct a 15-minute interview. No recording required.
   ii) Reflect on the interview you did. Recapitulate on it. How can the outcomes of the interview be matched with your learnings so far and the current situation in the blockchain ecosystem?

1.9 Further Study Directions

Here are a few additional learning activities that you can use to teach students about blockchain technology:

1. **Blockchain simulation**
   Create a simulation of a blockchain network using a tool like Ethereum or Hyperledger. Assign students to different roles, such as miners, validators, or users, and have them work together to create and maintain the blockchain network.

2. **Smart contract development**
   Assign students to groups and have them develop a smart contract using a programming language like Solidity. Have them present their contracts to the class and discuss the potential use cases for their contracts.

3. **Blockchain case study**
   Provide students with a case study of a company or organization that is using blockchain technology. Have them research and analyze the use case, and then present their findings to the class.

4. **Blockchain hackathon**
   Organize a hackathon where students can compete to develop the best blockchain-based solution to a problem or challenge. Provide prizes for the winning team and have them present their solution to the class.

5. **Blockchain game**
   Create a game that teaches students about the different components of a blockchain network, such as nodes, consensus mechanisms, and smart contracts. Have students play the game in small groups and discuss what they learned afterward.

6. **Debate**
   Divide the class into two groups, one group representing the proponents of blockchain technology and the other representing the critics of it. Each group should research and prepare arguments for their respective side, and then have a debate on the potential benefits and drawbacks of blockchain technology.