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Comparing Learning Platforms for Cybersecurity Education: Learners' Engagement Insights from Moodle and TryHackMe

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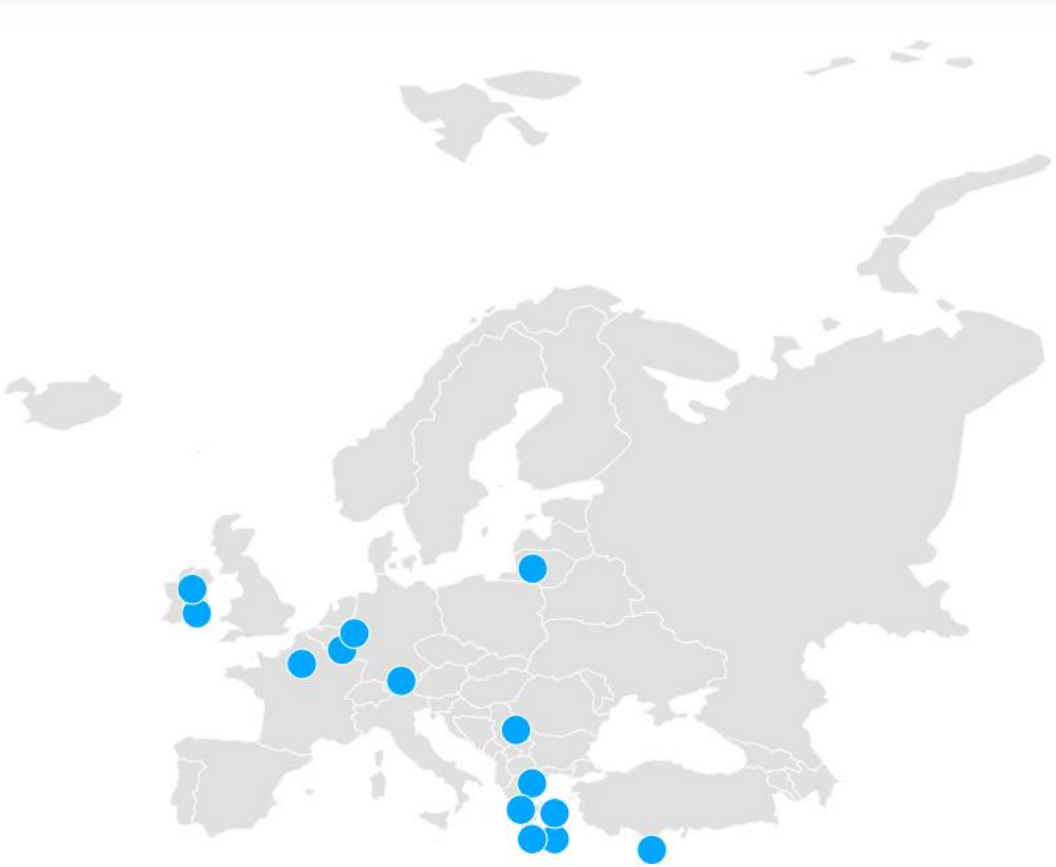
augMENTOR

Augmented Intelligence for Pedagogically Sustained Training and Education (augMENTOR)



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augMENTOR vision

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aug MENTOR aims to develop a **novel pedagogical framework** that promotes both **basic skills** and **21st century competencies** by integrating emerging technologies. This framework will be supported by an open access **AI-boosted toolkit** that builds on the strengths of big data and learning analytics to provide different types of stakeholders with explainable recommendations for smart search and identification of educational resources, as well as for designing **personalized learning profiles** that take into account individual actors' characteristics, needs, and preferences.

aug MENTOR will leverage advancements in the fields of Pedagogical Design, Creative Pedagogy, Explainable Artificial Intelligence, and Knowledge Representation and Reasoning for instructional purposes. We will meaningfully integrate **pedagogical approaches** with **AI-based software solutions** to enable a rich collaboration among all chain's actors from **students** to **teachers** and **policy makers**. Our goal is to provide guidelines to stakeholders on how to address potential underlying educational difficulties and disabilities, shape individual learning paths, or identify cases of gifted and talented students, so as to enable them to reach their full potential.

aug MENTOR will enhance trust and transparency - and trigger constructive reflection - in both tutoring and **pedagogical policy making**. The overall solution will be deployed and thoroughly tested in **four real-life pilots** representing diverse educational and training settings.

Project architecture

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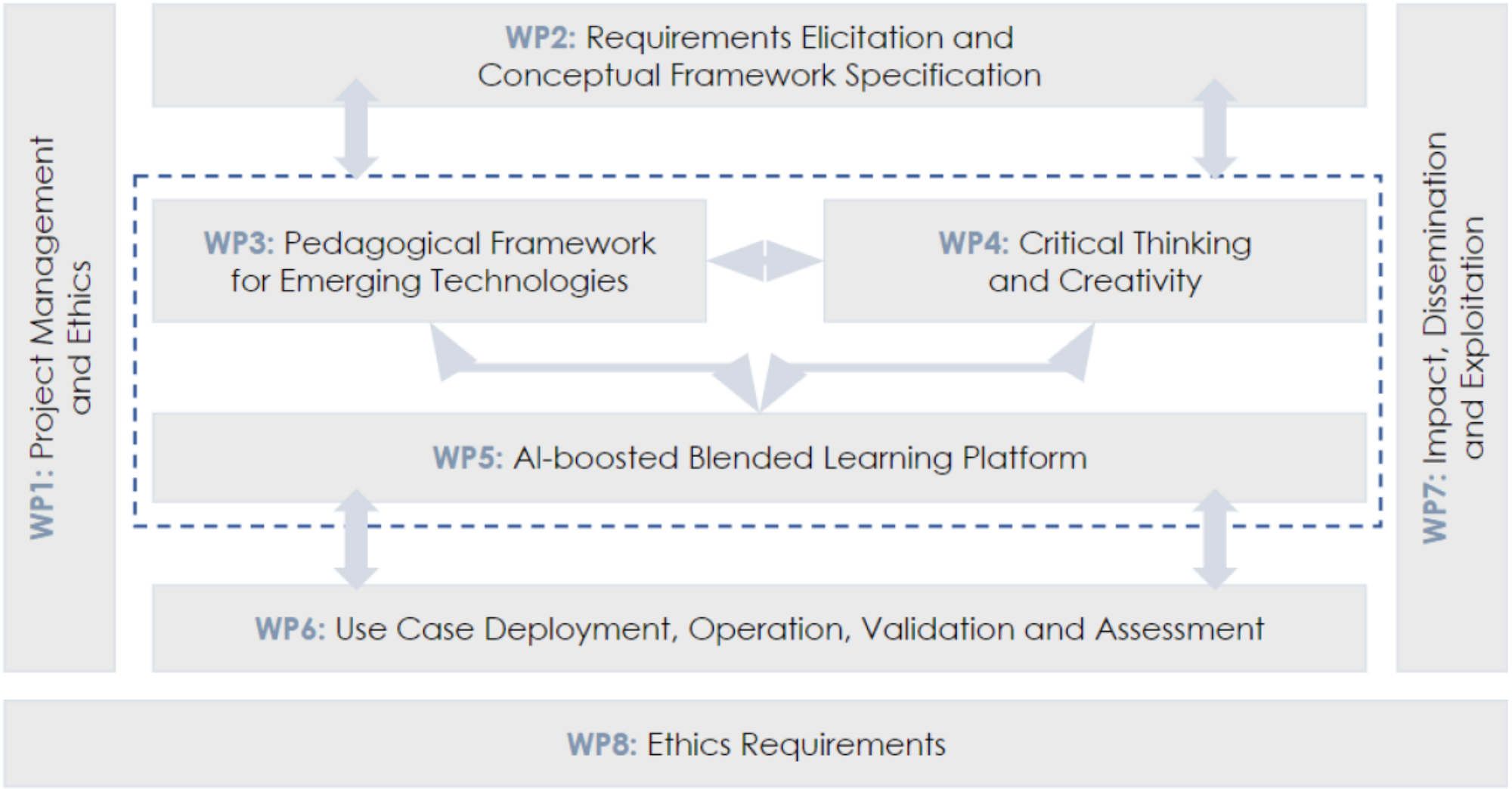

The components of the augMENTOR solution

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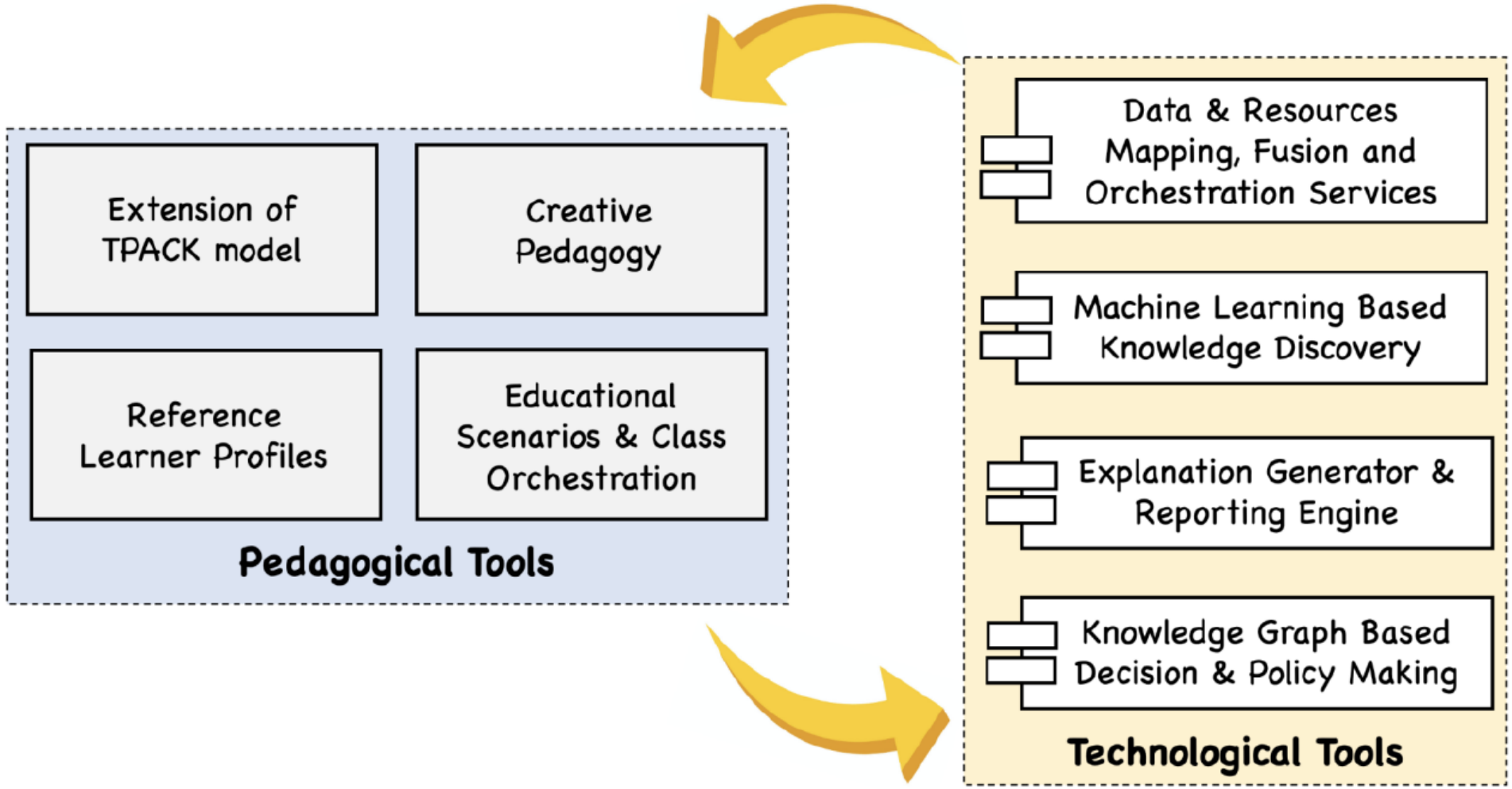


The augMENTOR Pedagogical Framework

Educational/Training Data & Resources

Semantically-rich Knowledge Graph

Trustworthy AI & ML pipelines

Methods for assessing basic & 21st century skills and competencies

Dynamic Learner Profiles

Augmented personalised learning through appropriate shaping and sequencing of **educational activities and supporting material**

Purposeful and pedagogical **integration of emerging technologies** in educational practices

Co-creation of education and training material and curricula for both **basic skills and skills of the 21st century**

Easy monitoring of **dynamic learner profiles**

Personalized and flexible ways of learning, based on advanced learning analytics and explainable recommendations

Informed decision/policy making on diverse education and training issues

Learners

Teachers

Parents

Policy Makers

Educational Leaders

Pilot #1: Emerging technologies in Adult Education and Life-Long Learning settings (IASIS)

+ This pilot aims to address major problems encountered in the field of **Adult Education** and **Life-Long Learning**, such as the inexperience of adult educators in Greece with **emerging technologies** as well as **diverse cultural barriers**, and meet the priorities mentioned in the EU agenda for Adult Education.
+ IASIS will approach and pilot a training methodology on adult **educators who work with vulnerable populations.**
+ The pilot addresses development of **basic skills** as well as diverse **policy making issues** towards promoting and ensuring inclusion and equity in education and training.

Pilot #2: Innovative Training Programmes for Pre-service Teachers (UPAT)

+ The aim of the pilot is to deploy the augMENTOR solution to develop and thoroughly **assess innovative training programmes** that augment the digital competence and confidence of **pre-service teachers**.
+ The pilot concerns development of both **basic skills** and **21st century skills**, such as communication, collaboration, digital literacy, critical as well as design thinking and creativity.
+ augMENTOR solution will be incorporated to offer **individualised learning**, supported with information in visualised form (e.g. graphs) to facilitate students' better understanding and support tutors to give appropriate assistance to the learner.

Pilot #3: STEAM-based Programs for Environmental Education in a Network of Eco-schools (EASD)

+ This pilot deploys and evaluates the proposed solution in **STEAM-based programs** run in the Eco-Schools network in Serbia.
+ The purpose of this pilot is to improve the quality of education in **STEAM education** by employing **young students** to get familiarized with **emerging technologies**.
+ The pilot will enable a **dynamic classroom environment** where the **instructor** is enabled to interact with group process and behaviour to thoroughly augment learning outcomes.

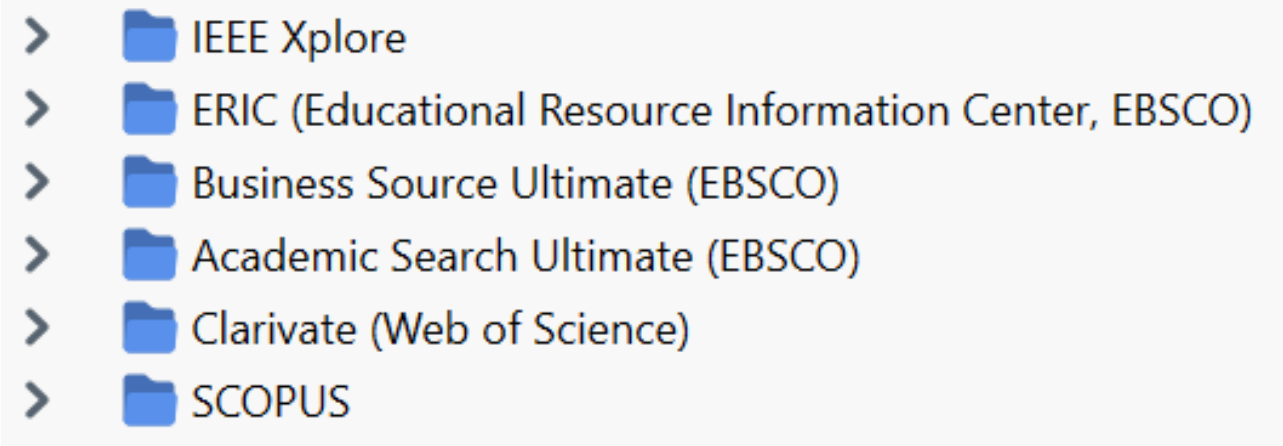
Pilot #4: Leapfrogging Industry 4.0 technologies for Civic Society watchdogs and EU Civilian Missions (KTU)

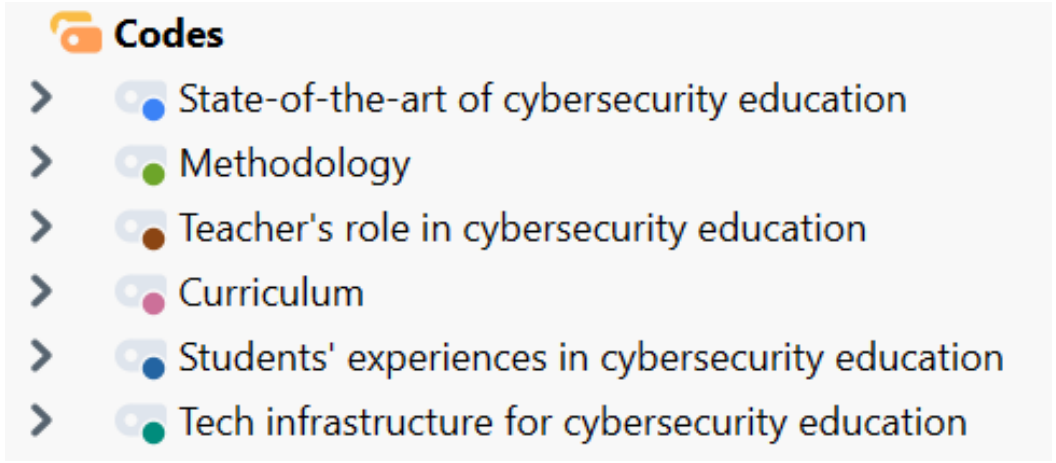
+ The aim of the pilot is to examine the most effective methods for triggering a **leapfrogging effect** when learning Industry 4.0 enabled technologies such as AI, ML, which can boost the efficiency of **non-technical experts.**

+ The pilot will develop appropriate **pedagogical methods** that foster non-linear progress for **civil servants, NGOs** and **CSOs** involved in **watchdog** and **governmental oversight roles.**

+ The purpose of the pilot is to **enhance novel technology uptake** of EU Civilian CSDP Mission members and offer them a repository of **ICTs** and **relevant skills** needed in different watchdog and government oversight roles.

On our way to build a research-informed course on cybersecurity and ethical hacking…





A systematic literature review on cybersecurity education

COMING SOON…

What have other course designers done before?

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1. **Incentivized Mentorship**
- Mentors are incentivized with rewards for their group's performance
- Rewards encourage mentors to provide effective guidance and support to their groups

2. **Storytelling-based Pedagogy**
- Storytelling case studies that parallel real-world situations
- Creative storylines focus on teaching specific principles, concepts, and challenges

3. **Gamified Learning Approach**
- Integration of gamification, collaborative learning, and interactive elements
- Enhances knowledge and skill acquisition through engaging learning experiences

4. **Capture the Flag (CTF) Challenges**
- Utilization of CTF platforms like CTFd and FBCTF
- Challenges include step-by-step scenarios, storytelling elements, and teamwork

5. **Problem-based and Case-based Learning**
- PBL and CBL approaches embedded in CTF challenges
- Engaging learning experiences and gamification elements like rewarding systems

6**. Phased Instructional Approach**
- Phase 1: Basic instructions and setup for virtual lab and CTF challenges
- Phase 2: Learning phase with observational research and student feedback
- Phase 3: Assignments for self-directed learning and knowledge construction
- Phase 4: Black-box CTF event and assessment

7. **Adaptive Pedagogical Model**
- Considers player's skill level and Bloom's Taxonomy mastery levels
- Provides personalized learning experiences with appropriate challenges and instruction

8. **Comprehensive Evaluation Framework**
- Preparation, introduction, interactions, and conclusion stages
- Pre-game, in-game, and post-game assessments

What activities are included in cybersecurity curriculum?

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1. **Hands-on Cybersecurity Exercises**
- Responding to programming code, firewall, and open port issues
- Working with intrusion detection systems, threat modeling tools, network analyzers, and other cybersecurity tools
- Conducting static and dynamic code analysis

2. **Simulation-based Cybersecurity Training**
- Scenario-based simulations to identify and remediate vulnerabilities
- Guided cybersecurity games with attacker and defender roles
- Competitive activities involving OWASP Mutillidae and network attack/defense

3. **Interactive Cybersecurity Skill Development**
- Creating custom cyber ranges to practice vulnerability identification and remediation
- Requesting and analyzing attacks on self-created cyber ranges
- Designing and implementing defense mechanisms against specific attacks
- Enumerating target systems to gather detailed information for vulnerability analysis and exploitation

4. **Ethical Hacking and Penetration Testing Techniques**
- Reconnaissance and intelligence gathering through network scanning, mapping, and enumeration
- Network infiltration and exploitation using available exploits and rootkits
- Password attacks using tools like John the Ripper and RockYou.txt

5. **Capture the Flag (CTF) Competitions**
- Jeopardy-style CTF challenges involving web technology, digital forensics, decompilation, and packet analysis
- Attack and defense-style CTF scenarios where teams defend their own systems and attack others
- Participation in prestigious CTF events like DEFCON

6. **Contextual Cybersecurity Assessments**
- Non-intrusive information gathering about the target organization's network structure and services
- Identifying open ports and associated services to detect potential vulnerabilities

What platforms have been used?

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- **CTFd**: A platform used to host Capture the Flag (CTF) challenges for cybersecurity education.
- **Emulab**: A testing platform that provides a controllable environment for conducting cybersecurity experiments.
- **Testbed@TWISC**: A test platform that integrates the Emulab system and customized software kits and firmware.
- **Unity 3D**: A game development engine used to implement the HackLearn COFELET game.
- **Flask**: A Python web framework used to build the web platform for the proposed cybersecurity education platform.
- **Docker**: A platform used to host and deploy challenges, such as web applications, binary services, programming challenges, and interactive games, in the proposed cybersecurity education platform.
- **SEP-CyLE**: A platform that contains cybersecurity learning content in the form of digital learning objects and tool tutorials.
- **CHEESEHub**: An open web platform that hosts community-contributed containerized demonstrations of cybersecurity concepts, deployed on a Kubernetes cluster.

Our course content

Week 1: Introduction to Try Hack Me Platform

Week 2: Introduction to Antivirus and Security Awareness

Week 3: Phishing Emails and Common Attacks

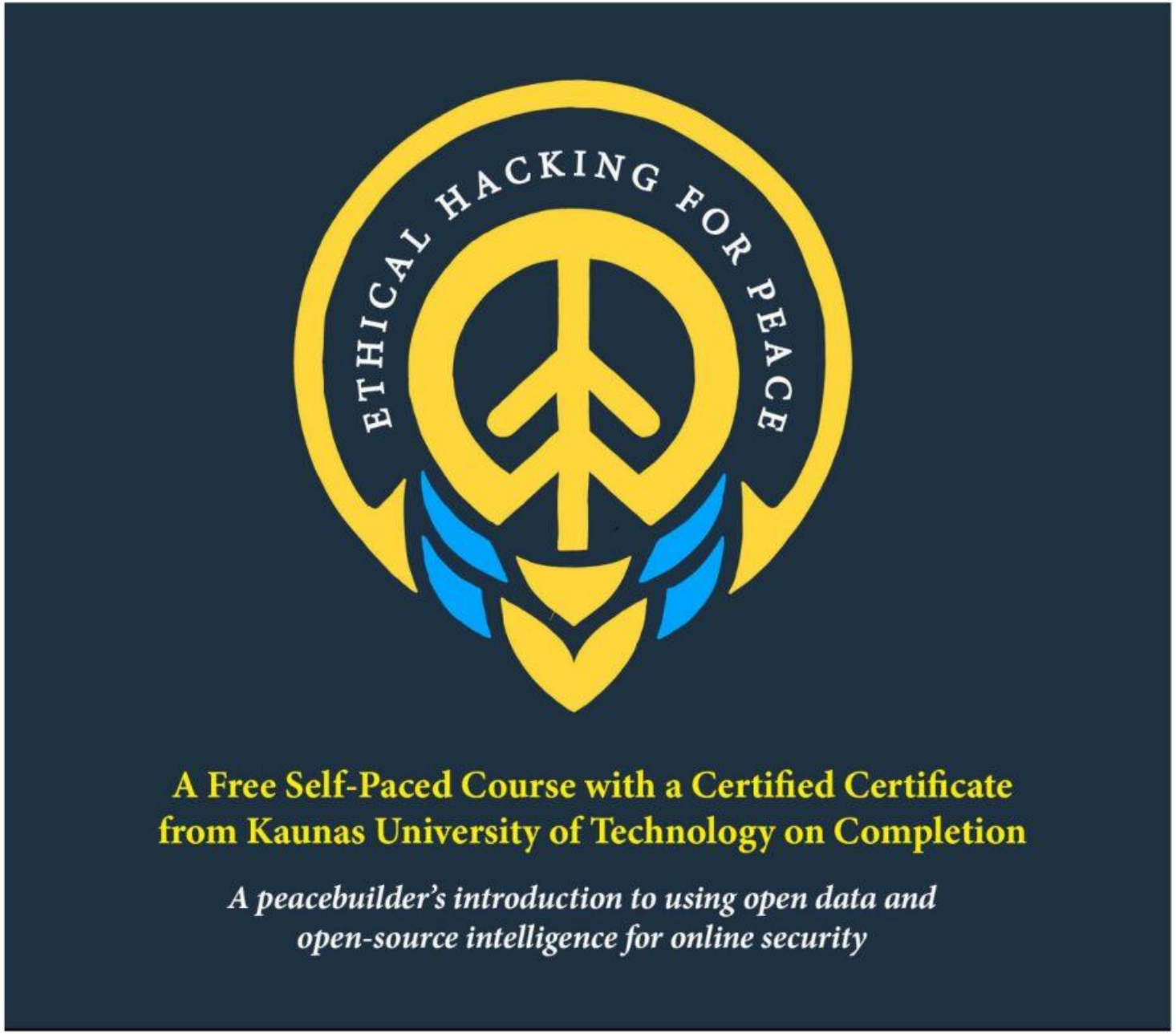
Week 4: Networking Fundamentals

Week 5: Browsing for Security: OSINT & Web App Hacking

Week 6: Web Fundamentals & Security

Week 7: Advanced OSINT Techniques & Tools

Week 8: Python Essentials for OSINT



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Advent of Cyber 2024
Solve daily beginner-friendly challenges with over $100,000 worth of prizes up for grabs!
Join for FREE
Try Hack Me
Learn
Compete
For Education
For Business
Pricing
Login
Join for FREE
Anyone can learn cyber security with TryHackMe
Hands-on cyber security training through real-world scenarios
Email
Join for FREE

TryHackMe

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Byte-sized gamified lessons

Learning cyber security on TryHackMe is fun and addictive. Earn points by answering questions, taking on challenges and maintain your hacking streak through short lessons.

Learn and Practice

Learn by following a structured paths and reinforce your skills in a real-world environment by completing guided, objective-based tasks and challenges.

What is available to augMENTOR learners (fee of charge)?

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Premium monthly

Best for those who want flexibility while staying on track with their goals.

€11.20 per month

Billed monthly

Subscribe now

- Full access to learning paths
- Unlimited web-based Attack Box & Kali
- Faster Machines
- Private OpenVPN Servers
- Private King of the Hill games
- Access to networks

Premium yearly

Best for individuals who want to hit their goals faster.

€8.40 per month

Billed annually

Subscribe now

- Full access to learning paths
- Unlimited web-based Attack Box & Kali
- Faster Machines
- Private OpenVPN Servers
- Private King of the Hill games
- Access to networks

Business

Best for teams that want to upskill effectively.

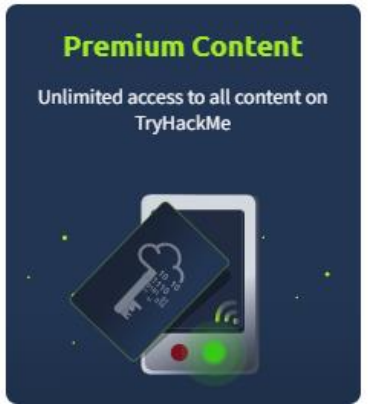
Pricing on request

Billed annually (min 5 seats required)

Contact sales

All Premium features plus

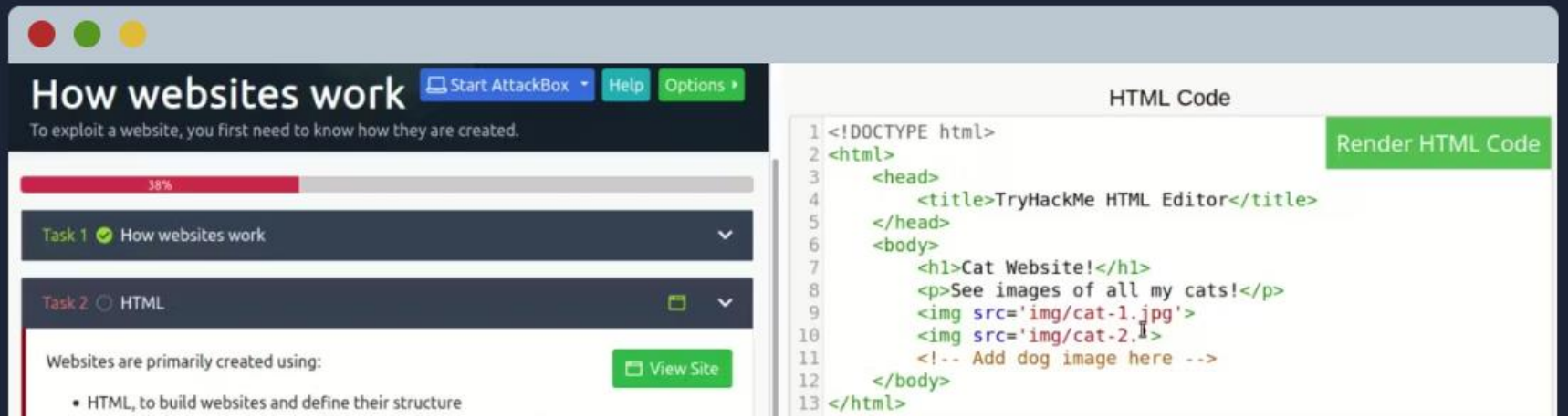
- Custom learning/career paths
- Business reporting
- Create labs with your custom machines
- Transferable licenses
- Customer success manager



Hands-on hacking for all skill levels

Learn cyber security with fun gamified labs and challenges

- Exercises in every lesson
- Beginner Friendly
- Start Hacking Instantly
- Real-world Networks



Welcome to TryHackMe!

Complete these first steps to kickstart your cyber learning

2/4

- ✓ Enroll in a path
- ✓ Answer a question
- ○ Complete a room
- ○ Get a 2-day streak

Your Stats

Go to profile

VilSu

Level 1 [0x1]

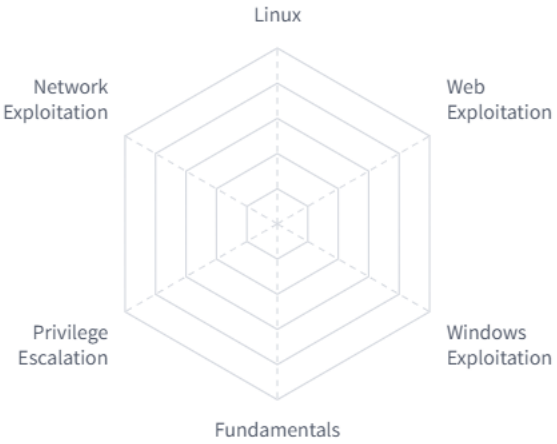
0	1251321	8	0	0

Friends

Add friends

You don't have any friends on TryHackMe :(
Click the **Add friends** button to start hacking with your friends. It's way more fun this way!

Skills Matrix Beta



TryHackMe rooms and paths in our course

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Introduction into Terminal

In this room you will learn Kali Linux terminal basics, will understand how to install git repositories and using Python script start using some awesome OSIN…

Medium

Free | Walkthrough

Introduction into OSINT

Dive into the dynamic world of Open Source Intelligence with our comprehensive OSINT room. This room offers a theoretical knowledge making …

Medium

Free | Walkthrough

Chrome Developer Tools & OSINT

You will learn how to use the Chrome developer tools and with the help of it extract the necessary data

Medium

Free | Walkthrough

Searchlight - IMINT

OSINT challenges in the imagery intelligence category

Easy

Free | Challenge

Past on Web: Wayback Machine

Web Archive Retrieval and Analysis Course

Easy

Free | Walkthrough

Dark Web and TOR network

Introduction to Dark Web and TOR network

Easy

Free | Walkthrough

Welcome to AugMENTOR project

On this room you will know more about AugMENTOR project and find the necessary information

Easy

Free | Walkthrough

KaffeeSec - SoMeSINT

An intro to SOCMINT (Social Media Intelligence/Investigation) techniques and tooling. Use your awesome OSINT skills to perform an online investigatio…

Medium

Free | Walkthrough

Introduction to Antivirus

Understand how antivirus software works and what detection techniques are used to bypass malicious file checks.

Geolocating Images

Room to understand how to geolocate images

Phishing Emails in Action

Learn the different indicators of phishing attempts by examining actual phishing emails.

Python Basics

Using a web-based code editor, learn the basics of Python and put your knowledge into practice by eventually coding a short Bitcoin investment…

Inside the rooms (course manager view)

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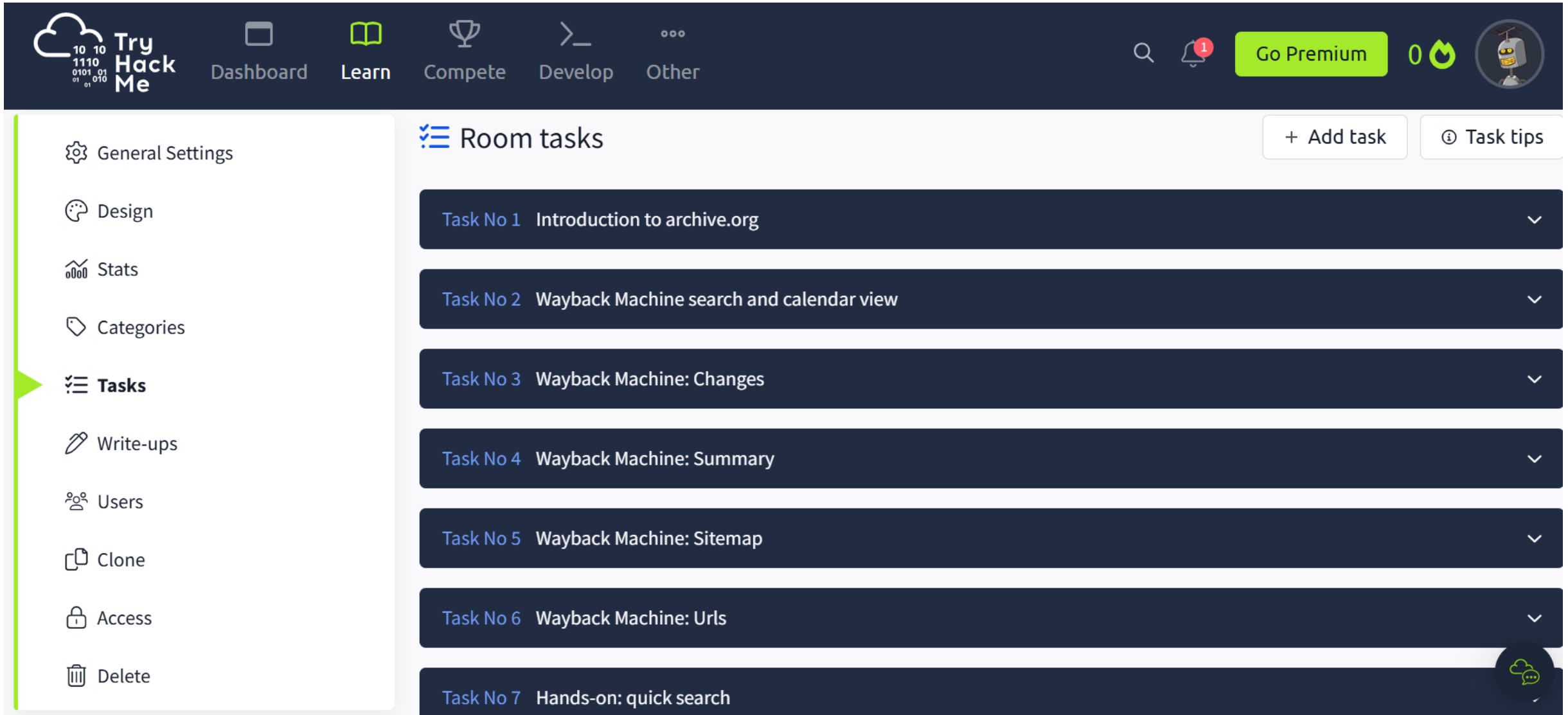

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Code

🔍 Efficient Techniques for Web Research Using the Wayback Machine

In this task, you will learn **quick tricks** and **strategies** for efficiently conducting web research and historical analysis using the **Wayback Machine**. By mastering specific URL formats, you can quickly access all the files and archives of a website, significantly streamlining your research process. These methods will enhance your ability to **navigate**, **retrieve**, and **analyze archived web content** for research purposes.

⚙️ Quick Tricks for Accessing Archived Web Content:

1. Viewing All Files Archived on a Specific Website

To quickly see all the files archived on a particular website, use the following URL format:

- **URL Format**:
  `https://web.archive.org/*/www.example.com`
  - Replace `www.example.com` with the website of interest.

  Example:
  If you want to view all archived files of **example.com**, visit:
  `https://web.archive.org/*/www.example.com`

Learner’s view

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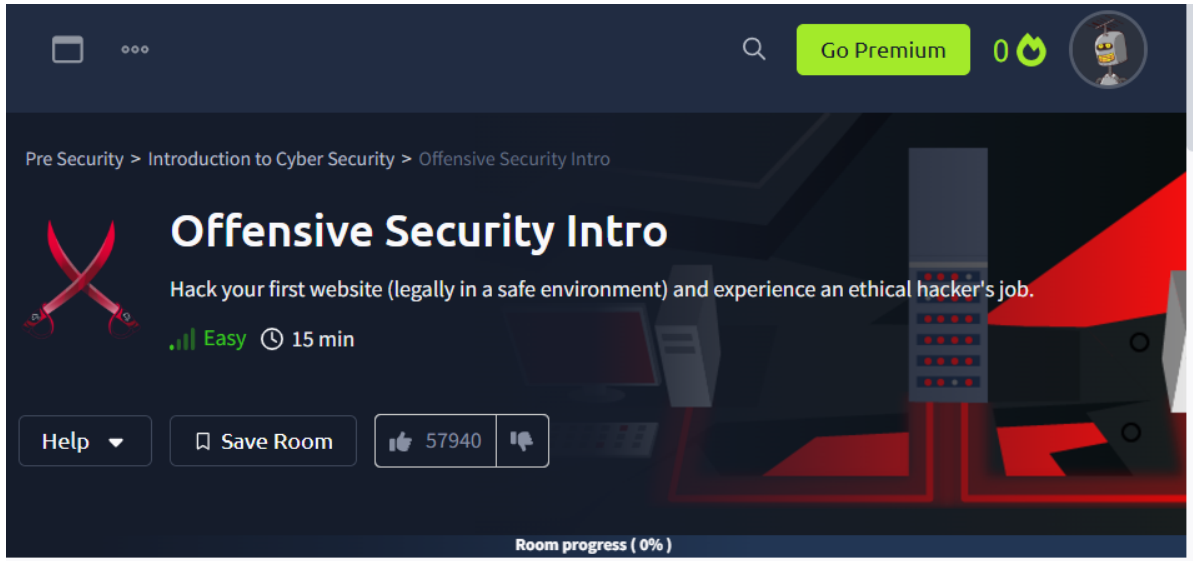

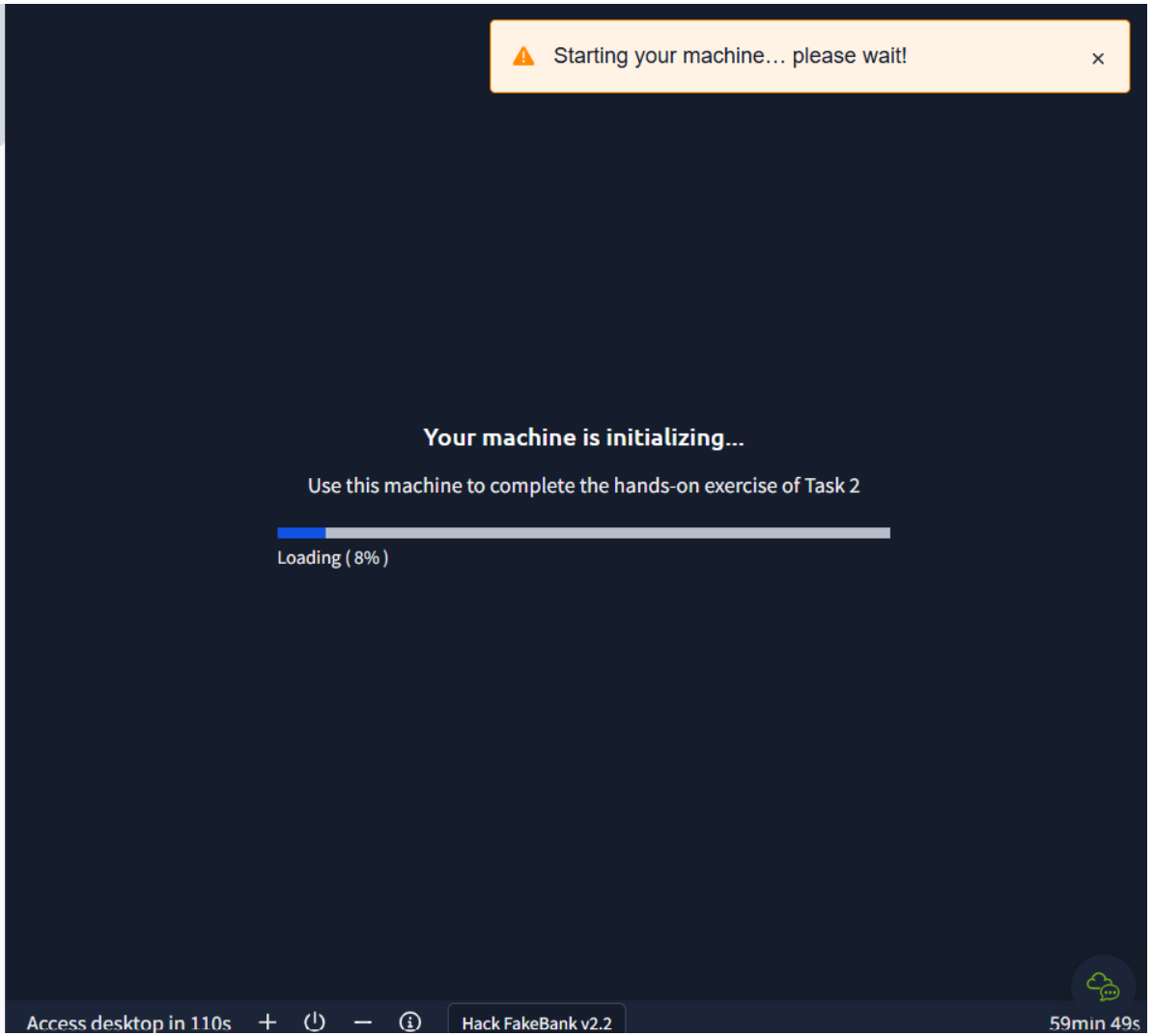

And then… Moodle

Welcome

Activities: 3

Week 1: Antivirus and Security Awareness

Activities: 6

Week 2: Phishing and Common Attacks

Activities: 14

Week 3: Common Attacks

Activities: 10 Progress: 0 / 1

Week 4: Networking, Websites, HTTP, and DNS

Activities: 13

Week 5: Content Discovery, Chrome Developer Tools, and WebOSINT

Activities: 10

🌐 Gaining an Understanding of the Internet Archive and the Wayback Machine

In this task, you will explore the **Internet Archive** and its renowned tool, the **Wayback Machine**. You will learn how to use the Wayback Machine for **historical research**, track **web content changes** over time, and access **archived versions of websites**. Through **hands-on exploration**, you will delve into features like **sitemaps**, **URLs**, **CDX**, and **timestamps**, enabling you to recover lost content and understand the evolution of websites. 🚀

💻 What You'll Learn:

- **How to Search**: Learn to search for archived versions of websites using the Wayback Machine's intuitive interface.
- **Track Changes**: Use features like **timestamps** and **CDX** to track changes to a website over time.
- **Sitemaps and URLs**: Explore the structure of websites using **sitemaps** and learn to navigate archived URLs.
- **Domain/Subdomain Searches**: Perform searches across specific domains or subdomains to gather data on a website's entire structure.
- **Summarizing Data**: Gain insights by summarizing data from archived snapshots of websites to see how they evolved.

⚠️ Important Reminder:

Before starting your exploration, you may need to create a **new Google account** for certain tasks. For **security reasons**, use the VM to create a new Google account, specifically for learning purposes, and avoid using your personal accounts during this task.

🔐 Understanding Digital Preservation and Open Knowledge

WHAT IS THE BACKGROUND OF OUR LEARNERS?
WE ASKED THEM IN A FORM OF ONLINE SURVEYS.

How much time did learners spend on THM vs Moodle?

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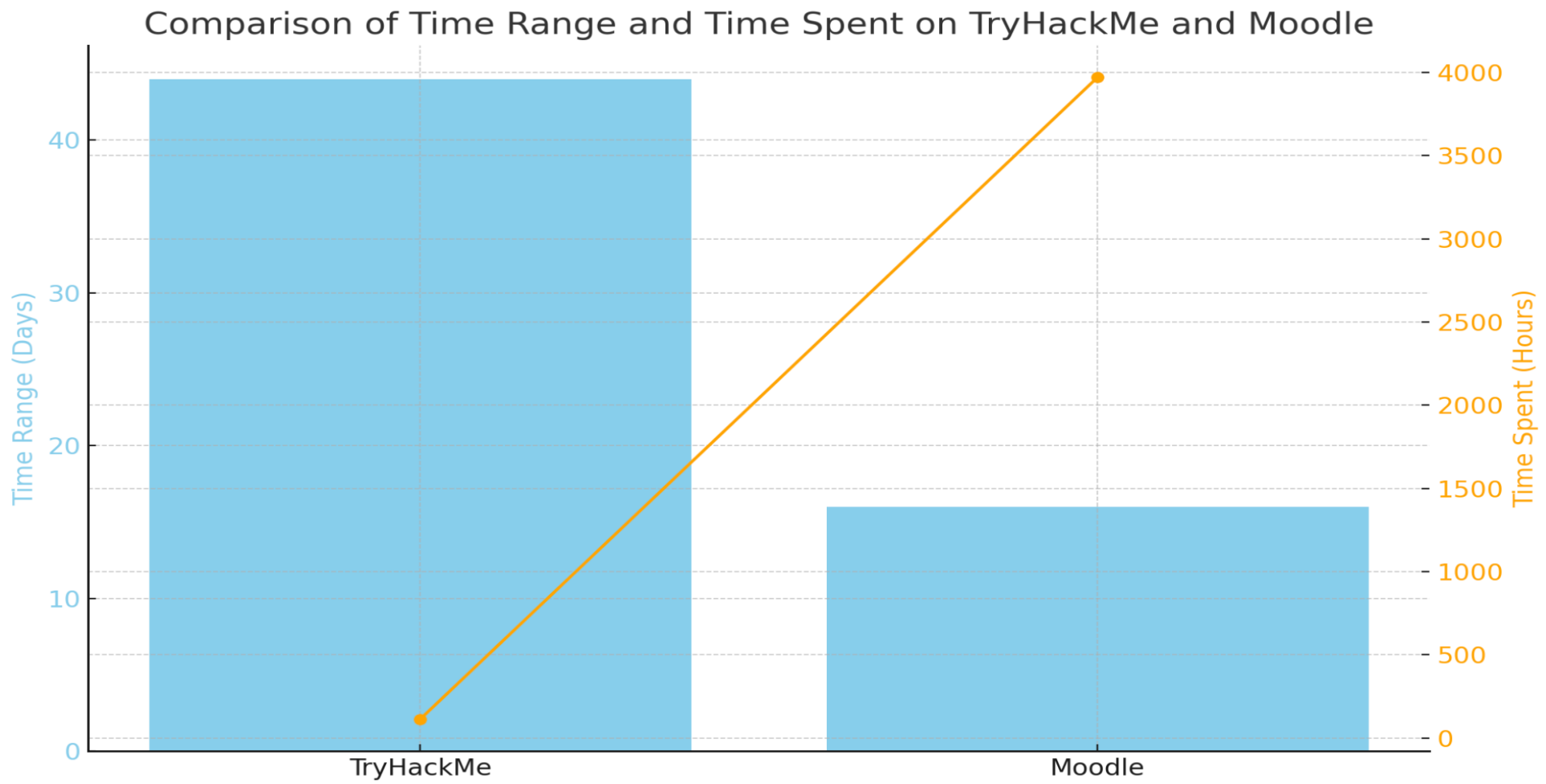

Where do the differences come from?

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Category	TryHackMe	Moodle
Task complexity	• Designed for shorter bursts of activity	• Involves tasks that require longer, sustained engagement
Platform design	• Fewer users and shorter sessions, leading to lower cumulative time	• A higher number of users participating in the dataset contributes to the overall time spent
User behavior and attitude	• TryHackMe is more self-paced, allowing users to engage voluntarily; • Users might disengage after completing a single challenge; • The hands-on, gamified format may encourage shorter, more frequent sessions rather than prolonged periods of activity	• Moodle is often used for formal education; • Users might spend several hours completing tasks in one sitting
Recording mechanism	• Time recording focuses on specific task completion rather than overall session duration.	• Time spent may include periods of inactivity (e.g., a user leaves a page open while working offline or multitasking)

User Drop Out Analysis

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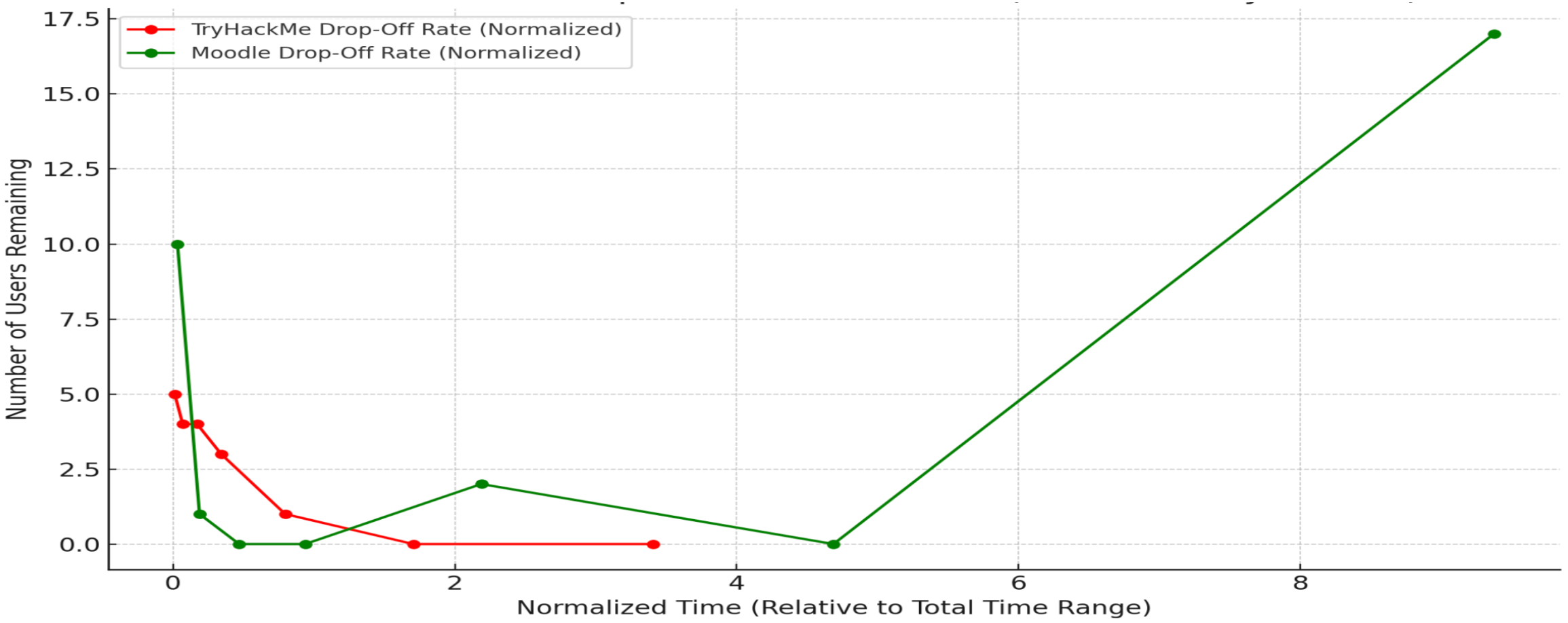

TryHackMe

SLOWER, GRADUAL DROP OUT

- TryHackMe has a more gradual decline in user activity. Users tend to remain active over a longer period compared to Moodle, as the drop-oout rate is less steep in the early normalized time.
- TryHackMe offers a more engaging or sustained experience for its users, with more users continuing to engage over a prolonged period.

Moodle

FASTER DROP OUT

- Moodle shows a steeper drop-out early in the normalized time range, indicating that users tend to disengage more quickly on this platform.
- After a short period of activity, many Moodle users either complete their tasks or lose interest, leading to a rapid decline in active users.

Long-term engagement

By the later stages of the normalized time range, TryHackMe retains a greater proportion of its users compared to Moodle.

- This suggests that a subset of users remains highly engaged on TryHackMe, participating regularly even after numerous users have dropped out.

In contrast, Moodle sees a more significant decrease, indicating that few users continue with prolonged activity.

Return patterns

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TryHackMe encourages users to return frequently for shorter bursts of engagement, while Moodle's tasks may demand longer, more sustained effort in each session.

- **Moodle’s higher time per module** results from Moodle being more complex, involving more content, using additional software, and requiring more time to complete.
- **TryHackMe’s lower time per room** suggests users can complete rooms quickly, potentially because TryHackMe's rooms might be shorter, more task-oriented, or designed for rapid progression.

Our Takeaways and Recommendations

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Moodle:
•Enhance post-initial engagement features.
•Introduce dynamic challenges to extend user activity duration.
•Introduce more gamification elements (esp. related to competing against and collaborating with other learners).

•**TryHackMe:**
•Maintain challenge-based approach.
•Have a plan B in case your learner wanders off too far from your course.
•Explore beginner-friendly onboarding strategies and provide support to new users (esp. through faster and less formal means of communication).

Cross-Platform Opportunities:
•Integrate Moodle-style quizzes into TryHackMe.
•Offer TryHackMe-style gamified tasks on Moodle.

WHAT AWAITS IN THE FUTURE?

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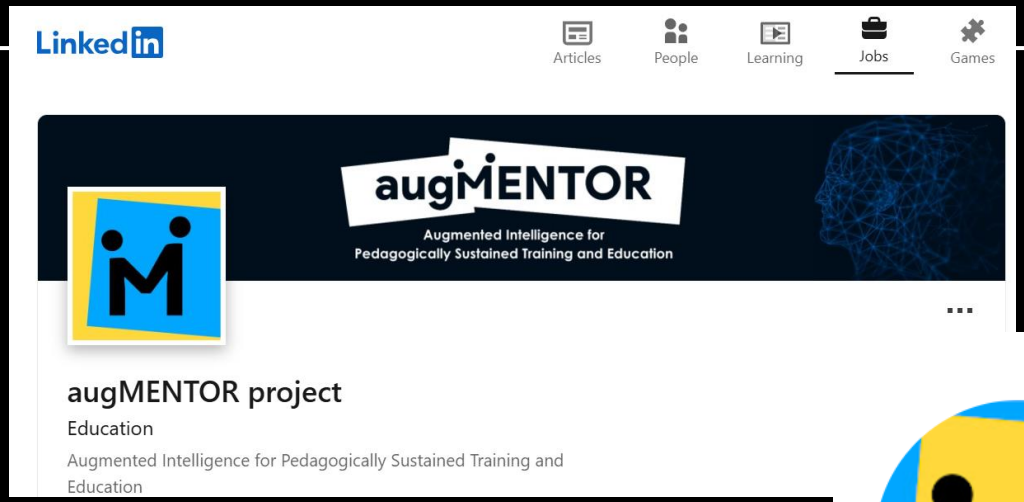
Follow us!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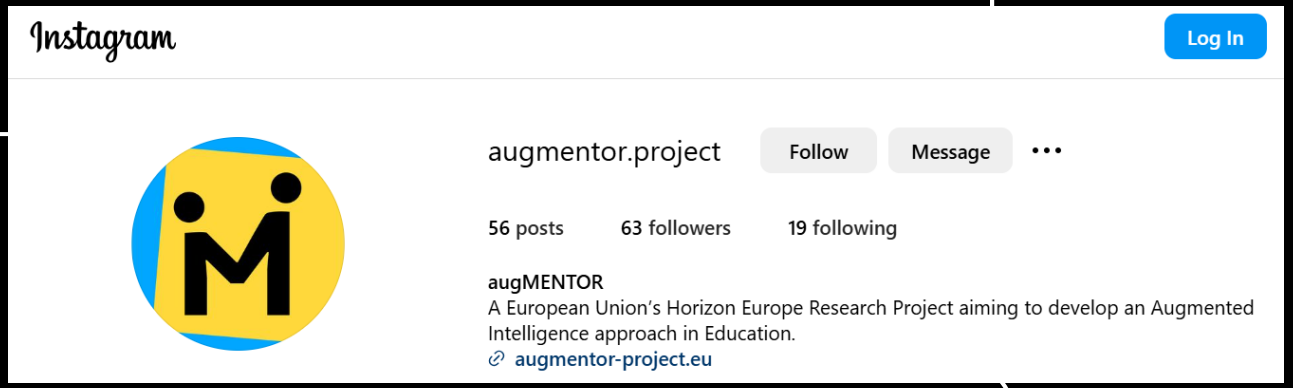
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63 followers
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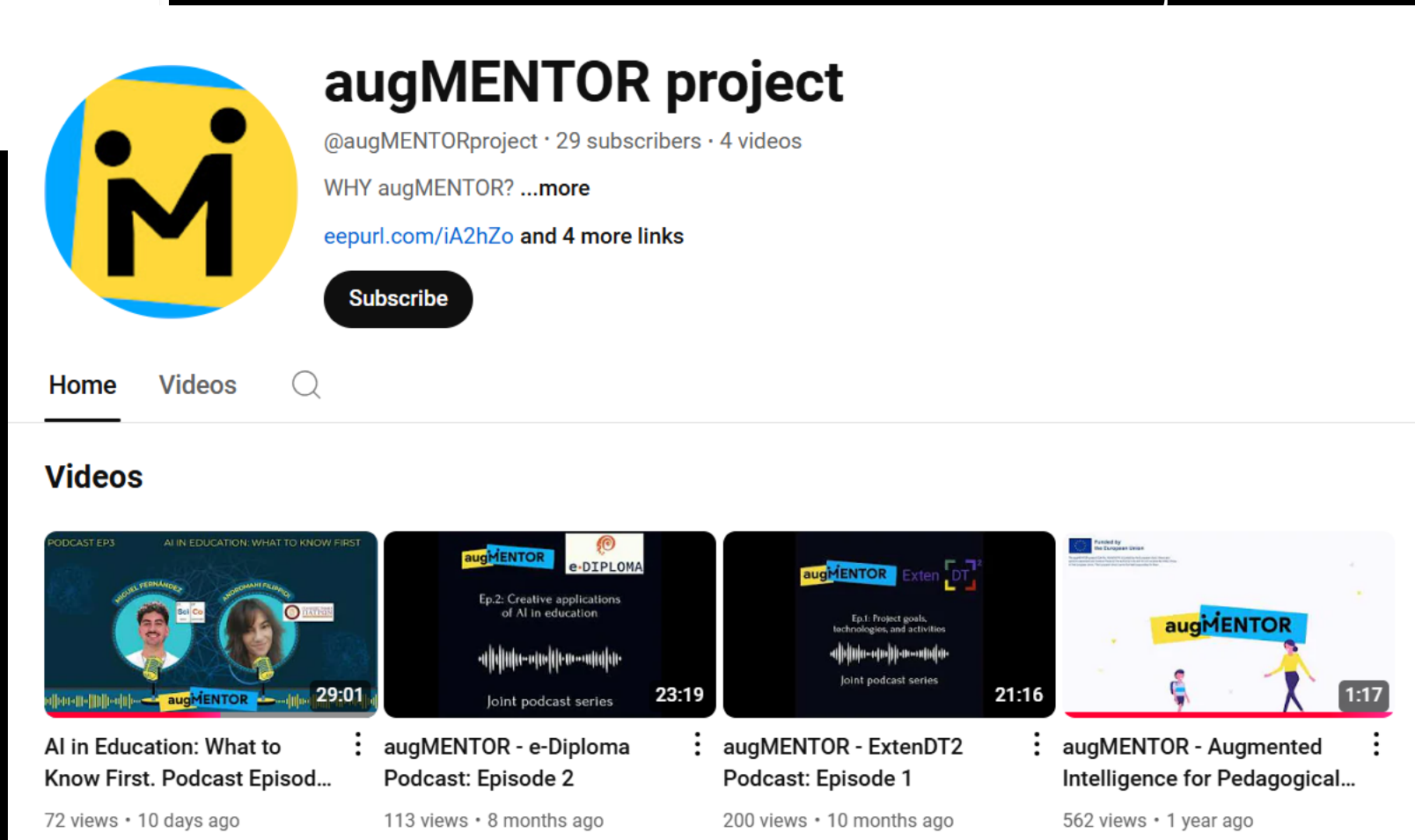
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