



From MOOCs to Microcredentials

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MOOCs



- Time frame:
 - 2010s
- Innovation of the time:
 - Digital technologies: online videos, quizzes, forum
- Format:
 - Modality: online
 - Duration: (15-) ~4-week courses, (60'-) ~5' videos
 - Level: from undergrad to lifelong learning courses
- Certificates:
 - None or PDF with image of signature



Microcredentials

- Time frame:
 - 2020s
- Innovation of the time:
 - Artificial Intelligence
- Format:
 - Modality: onsite, online, or mixed
 - Duration: short, local regulations (eg. Spain <15 ECTS)
 - Level: mainly up/re-skilling, stackability
- Certificates:
 - Digital (authoritative, interoperable)



What is a Microcredential?

Technical (digital) format for certificates

- "The **record** of the **learning outcomes** that a learner has **acquired** following a **small** volume of learning. These learning outcomes have been **assessed** against transparent and clearly defined **standards**"

Educational (packaging) format for courses



Framework for Microcredentials

Creation of
Educational
Material

Framework for Microcredentials

Creation of
Educational
Material



Enactment

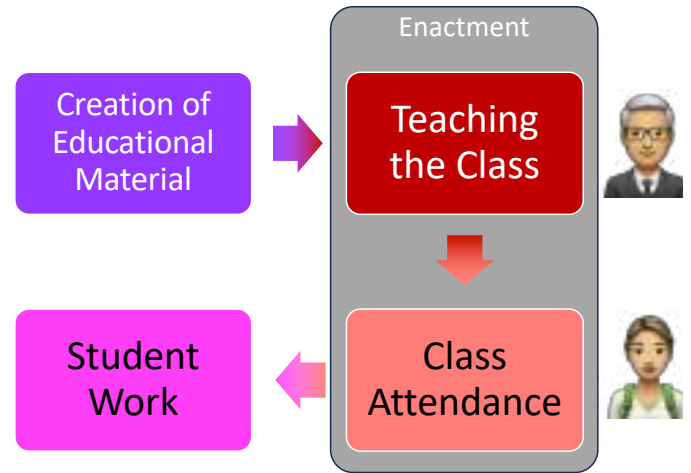
Teaching
the Class



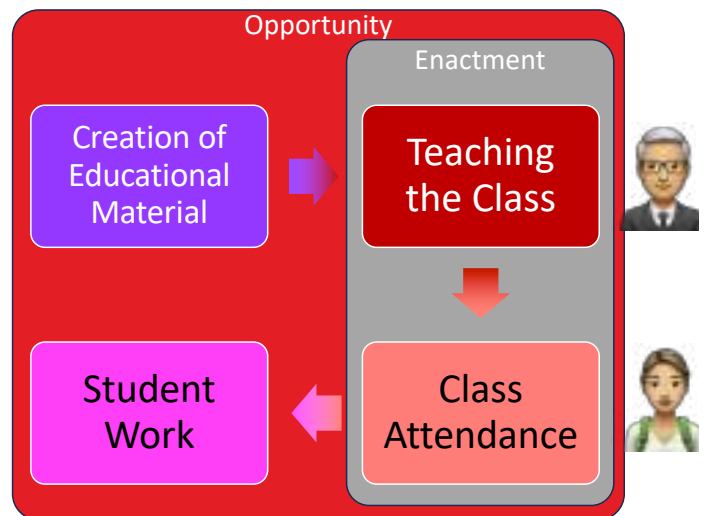
Class
Attendance



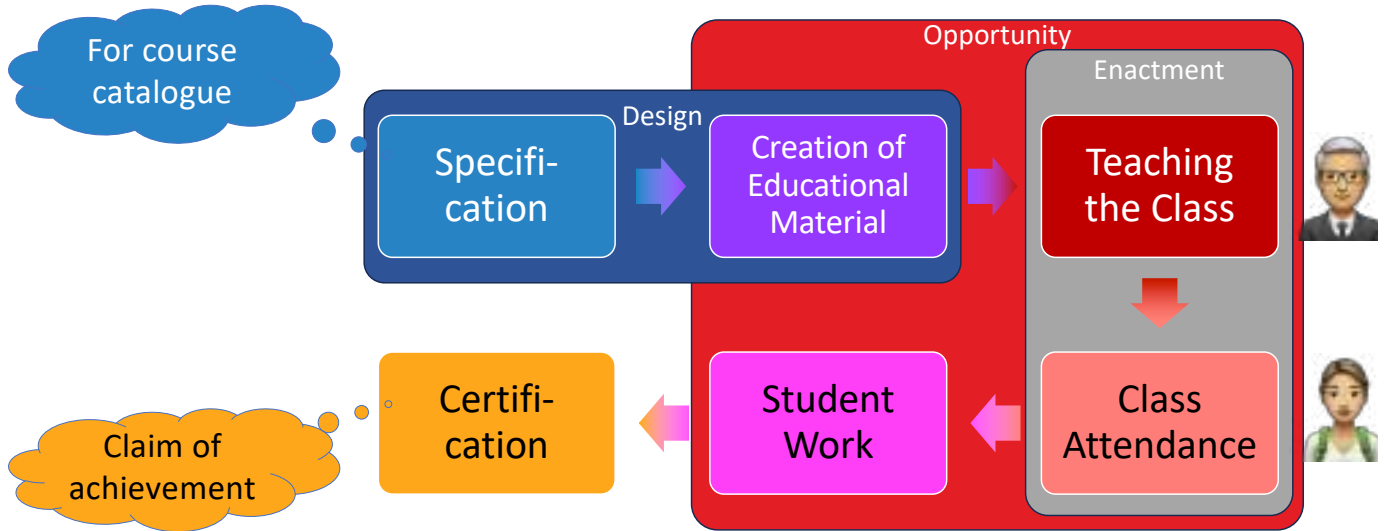
Framework for Microcredentials



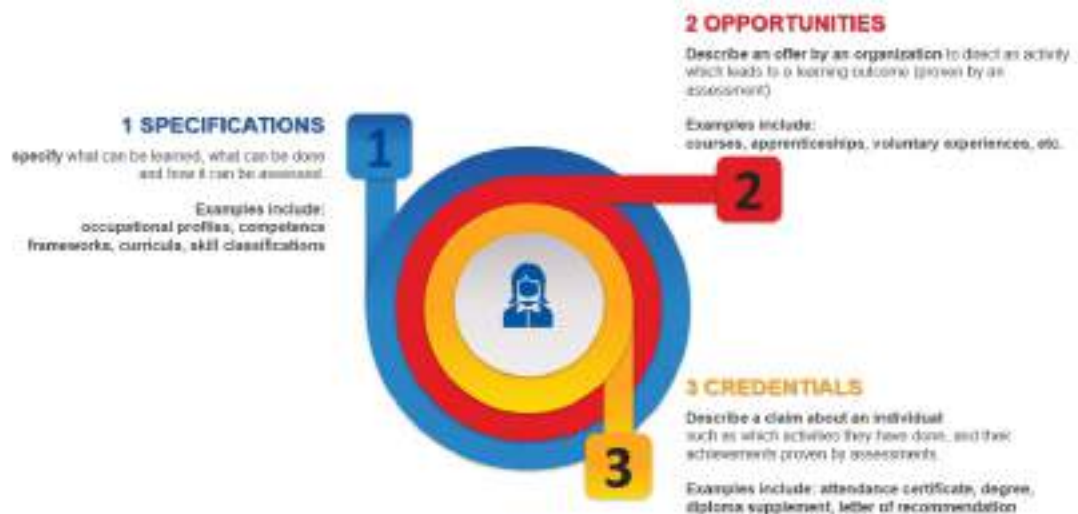
Framework for Microcredentials



Framework for Microcredentials



Specifications, Opportunities, Credentials





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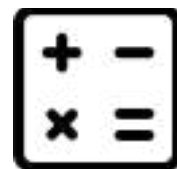
11

- To understand a particular field, one must master the vocabulary associated with it
- Domain-specific vocabularies, languages, formats



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Vocabulary of Math

- **Variable:** A symbol that represents a value that can change or be unknown.
- **Constant:** A value that does not change.
- **Scientific Notation:** A way of expressing numbers using powers of 10.
- **Exponent:** A number indicating how many times a base number is multiplied by itself.
- **Formula:** A mathematical expression that defines a relationship between variables.
- **Equation:** A mathematical statement that two expressions are equal.
- **Unit Conversion:** Process of converting measurements from one unit to another.
- **Function:** A relationship between two sets of values, where each input value corresponds to a unique output value.



Vocabulary of Chemistry

- **Formula:** A symbolic representation of a compound's composition.
- **Molecule:** The smallest unit of a substance that retains the chemical properties of it.
- **Atom:** The smallest unit of an element.
- **Enzyme:** A protein that acts as a catalyst, speeding up chemical reactions.
- **Substrate:** The substance on which an enzyme acts.
- **Reaction:** A process where one or more substances are converted into one or more different substances.
- **pH:** A measure of acidity or alkalinity, ranging from 0 to 14, with 7 being neutral.
- **Acid:** A substance that releases hydrogen ions (H⁺) in water, typically with a sour taste and pH less than 7
- **Base:** A substance that accepts hydrogen ions (H⁺) or releases hydroxide ions (OH⁻) in water, typically with a pH greater than 7



Vocabulary of Law

- **Defendant:** The person accused of a crime or sued in a civil case.
- **Plaintiff:** The person who initiates a lawsuit.
- **Damages:** Money awarded to a person who has been wronged.
- **Evidence:** Information presented in court to prove a point.
- **Default:** Failing to fulfill a legal obligation.
- **Abate:** To reduce or cancel something, such as a legal proceeding.
- **Good faith:** Acting honestly and with integrity.
- **Complaint:** A written statement by the plaintiff outlining the defendant's wrongdoing.
- **Conviction:** A judgment of guilt against a criminal defendant.

Quote



*The limits of my language
are the limits of my world.*

-- Ludwig Wittgenstein (1889-1951)



Learning Goals vs. Learning Outcomes

- Learning goals (or intended learning outcomes):
 - Directly related to the **intentions of the teacher**
 - **Not necessarily measurable**
- Learning outcomes:
 - Declarations of what a student has been able to **know, understand, and do** at the end of the teaching period
 - Must be **measurable**

Specifi-
cation

Certifi-
cation

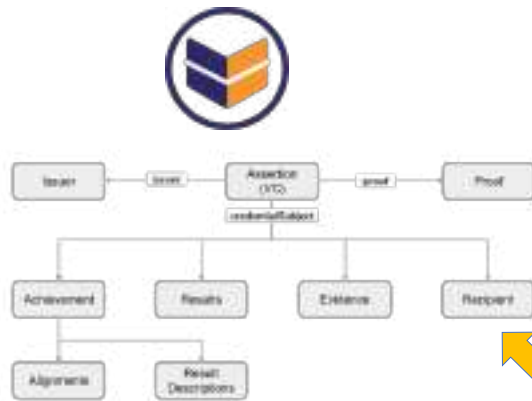
Certification

Certifi-
cation

Formats for Digital Credentials

Certification

OpenBadges (1EdTech)



ELM (European Commission)



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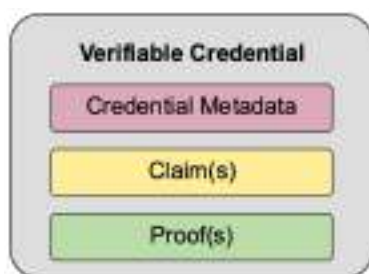
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W3C Verifiable Credentials



Certification

- Data Model v1.1 (3 Mar 2022)
 - Data Model v2.0 (15 May 2025)
- W3C Recommendation
[w3.org/TR/vc-data-model-2.0](https://www.w3.org/TR/vc-data-model-2.0)



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European Learning Model

Certification

/ HOW CAN DIGITAL SOLUTIONS SUPPORT THE PORTABILITY OF MICRO-CREDENTIALS?

*"In terms of platforms for credential sharing, the **European Learning Model** aims to establish a unified **vocabulary for learning** in Europe to enhance recognition and trust in qualifications and digital credentials."*



European Learning Model

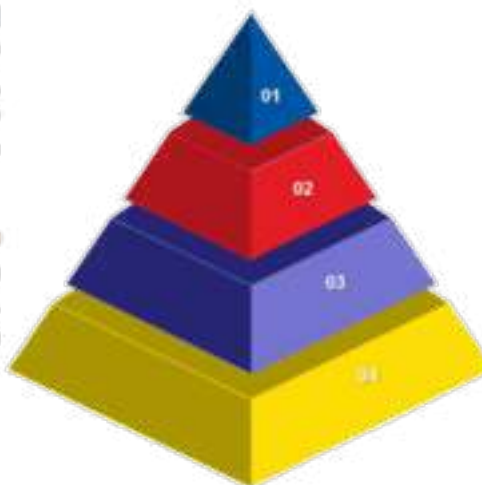
Certification

01 European Information Model

Definitions and Standards in EGF Recommendation, Diploma Supplement, Europass Decision, etc. supplemented by glossaries for additional terms

03 Application Profiles

Specific sets of rules for publishing learning opportunities, qualifications, accreditations and credentials in Europass



02 European Learning Model

A Linked Open Data publication of concepts to be used in educational and employment use cases throughout Europe

04 Extensions

National, Regional or Sectoral extensions of the data model & application profiles to deal with specific use cases

European Learning Model

Certification

- Available in 30 languages

- | | | |
|--------------|------------------------|----------------|
| 1. Bulgarian | 11. Greek | 21. Polish |
| 2. Croatian | 12. Hungarian | 22. Portuguese |
| 3. Czech | 13. Icelandic | 23. Romanian |
| 4. Danish | 14. Irish | 24. Serbian |
| 5. Dutch | 15. Italian | 25. Slovak |
| 6. English | 16. Latvian | 26. Slovenian |
| 7. Estonian | 17. Lithuanian | 27. Spanish |
| 8. Finnish | 18. Macedonian | 28. Swedish |
| 9. French | 19. Maltese | 29. Turkish |
| 10. German | 20. Norwegian (Bokmål) | 30. Ukrainian |

24 EU languages



+ 6 languages of EEA/candidate countries

European Learning Model

Certification

- 480 fields

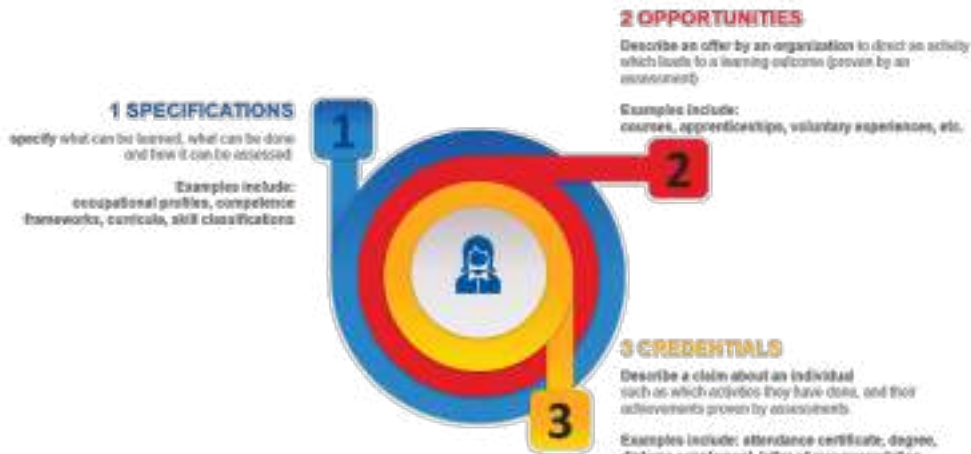
- Core ontology and 4 application profiles:

1. Learning Opportunities & Qualifications (LOQ)
 - “what can be studied and what it leads to”
2. Accreditation Metadata Schema (AMS)
 - “who authorised what”
3. Person Identity (PID)
 - “who the learner or staff member is”
4. European Digital Credential for Learning (EDC)
 - “what the learner has achieved”



European Learning Model

Certification



1. Learning Opportunities & Qualifications (LOQ)

- “what can be studied and what it leads to”



Certification



1. Learning Opportunities & Qualifications (LOQ)



Certification

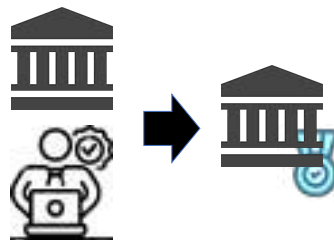
Scenario	What LOQ delivers
Course catalogues / training marketplaces	Standard description of a course (Learning Opportunity Specification) and upcoming runs (Learning Opportunity Instance)—including provider, language, start/end dates, workload, fees, delivery mode, etc.
National qualification registers	Machine-readable facts about a Qualification (title, level, field of study, awarding body, learning outcomes, credit, EQF link, NQF link).
Micro-credential ecosystems	Same pattern works for short, modular offerings; micro-credentials can reuse ECTS/ECVET credit, workload, outcome and level elements already present in LOQ.
Mobility & recognition tools	Because every LOQ entity carries multilingual titles/descriptions and controlled-vocabulary links (ISCED-F, EQF, Country, Language), information can be surfaced on the Europass portal in 31 languages without extra mapping.

2. Accreditation Metadata Schema (AMS)



Certification

- “who authorised what”

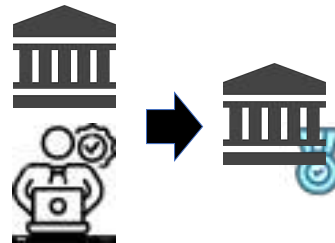


2. Accreditation Metadata Schema (AMS): Concepts



Certification

- Organization: the educational provider
- Accrediting agent: QA body or ministry
- Accreditation: the decision



- Identifier/LegalIdentifier: Decision number, DEQAR IDs, etc.
- Concept: EQF level, credential type, etc.
- WebResource/Report: public reference

2. Accreditation Metadata Schema (AMS): Min. Example



Certification

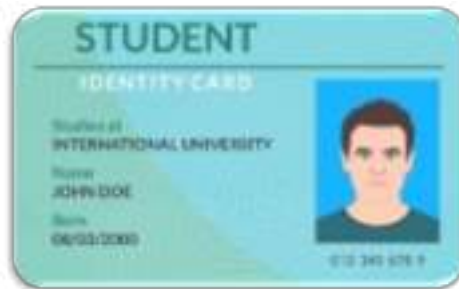
```
{ "@context": [ "https://www.w3.org/2018/credentials/v1",
  "http://data.europa.eu/snb/model/context/ams" ],
  "id": "https://qdr.europa.eu/accreditation/DEQAR-123456",
  "type": "Accreditation",
  "accreditingAgent": { "id": "https://eqar.eu/agency/EQAR-ASIIN",
    "type": "Organisation",
    "preferredName": { "en": "ASIIN e.V." } },
  "organisation": [ "https://hei.example.edu/institution/0713" ],
  "dc:issued": "2024-04-17T00:00:00Z",
  "expiryDate": "2030-03-31T23:59:59Z",
  "limitEQFLevel": "http://data.europa.eu/snb/eqf/level6",
  "report": "https://backend.deqar.eu/reports/ASIIN/2024-0713-report.pdf",
  "status": "valid" }
```


3. Person Identity (PID)

- “who the learner or staff member is”



Certification



Student ID card

3. Person Identity (PID)



Certification



3. Person Identity (PID)



Certifi-
cation

- First and last name: **Carlos Delgado Kloos**

Good,
but not
enough

3. Person Identity (PID)



Certifi-
cation

- E-mail: **cdk@it.uc3m.es**

Limited to
HEI during
studies

3. Person Identity (PID)

- **eduID** (in NL)



eduid.nl



Certification

Limited to NL



3. Person and Org. Identity (PID)

- **eIDAS**: electronic IDentification, Authentication and trust Services

- EU Regulation that introduces a voluntary digital wallet (European Digital Identity) that member states must issue at the request of EU citizens

- eur-lex.europa.eu/eli/reg/2018/3045/oj

- **myAcademicID**

- myacademic-id.eu

- **ESI**: European Student Identifier

- wiki.geant.org/display/SM/Eu+Student+Identifier:
urn:schac:personalUniqueCode:int:esi:<country>:<code>

Centralized European system



eIDAS Regulation

- **electronic Identification, Authentication and Trust Services**
- Trusted electronic interactions for businesses in EU
- Services
 - eSignature: electronic signature (for persons)
 - eSeal: electronic seal (for organizations)
 - eTimestamp: electronic timestamp (for time)
 - WAC: website authentication certificate (for websites)
 - eDelivery: electronic registered delivery service (for docs)



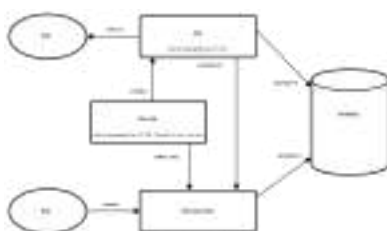
- digital-strategy.ec.europa.eu/es/policies/eidas-regulation

3. Person Identity (PID)



Certification

- An entity (person, org, etc.) about which a claim is made
- How is this subject identified?
 - OpenBadges 1.0 and 2.0: E-mail
 - OpenBadges 3.0 and ELM v3: DID (decentralized identifier) or e-mail



Scheme
did:example:123456789abcdefghi
DID Method DID Method-Specific Identifier

3. Person Identity (PID): Minimal Example



Certification

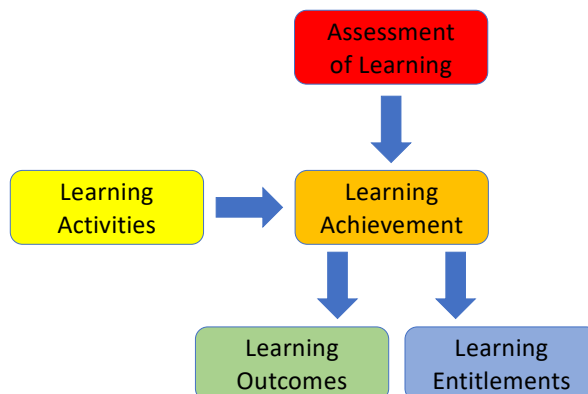
```
{ "@context": [ "https://www.w3.org/2018/credentials/v1",
  "http://data.europa.eu/snb/model/context/pid" ],
  "type": "Person",
  "givenName": { "en": "Maria" },
  "familyName": { "en": "Németh" },
  "birthDate": "1990-05-03",
  "nationality": { "id": "http://publications.europa.eu/resource/authority/country/HUN",
    "type": "Concept" },
  "identifier": { "id": "urn:example:nin:123456789",
    "type": "LegalIdentifier",
    "notation": "123456789",
    "spatial": "http://publications.europa.eu/resource/authority/country/HUN"
  }
}
```

4. European Digital Credential for Learning (EDC)



Certification

- “what the learner has achieved”



4. European Digital Credential for Learning (EDC)



Certification



4. European Digital Credential for Learning (EDC)



Certification



4. European Digital Credential for Learning (EDC)



Certification

```
{
  "@context": "https://europa.eu/elm/v3/context.jsonld",
  "type": "DigitalCredential",
  "id": "urn:uuid:...",
  "issuer": { "id": "https://example.edu/org#id" },
  "issuanceDate": "2025-06-01",
  "credentialSubject": {
    "id": "did:key:z...",
    "hasAchievement": {
      "type": "LearningAchievement",
      "title": { "en": "Post-Graduate Micro-credential in Data Ethics" },
      "eqfLevel": "6"
    }
  },
  "proof": { "type": "EidasSeal2019", "created": "2025-06-01T10:30:00Z", ... }
}
```

4. EDC Life Cycle



Certification

- **Authoring**
Issuer uses the Online Credential Builder UI or REST API, selecting fields defined by ELM v3
- **Sealing**
Credential is e-sealed with the organisation's qualified certificate (eIDAS compliant)
- **Delivery & Storage**
JSON-LD file is pushed to the learner's *Europass wallet* (or downloaded as a standalone .edc file)
- **Presentation**
Learner shares a verifiable presentation (PDF/JSON-LD) or "EDC link" with employers, HEIs, etc.
- **Validation**
Relying parties send the file/link to the EDCI validation service;
checks performed: e-seal validity, hash integrity, schema compliance with ELM v3, issuer accreditation (via QDR/DEQAR), and revocation status

Recommendations in Spain

Certification



Identificación de la persona que recibe la certificación
Supervisión y verificación de la identidad durante la formación y la evaluación
Determinación de la microcredencial universitaria
Universidad que imparte la microcredencial universitaria (pueden ser varias)
Universidad, sociedad, institución, organismo, empresa, en la que se realiza el aprendizaje (si es distinto de la universidad que imparte la formación)
Fecha de inicio y fin de la actividad formativa
Idioma
Requisitos previos de acceso y criterios de admisión (nivel de acceso y/o descripción de conocimientos previos)
Objetivos, destrezas de forma clara en función de las personas destinatarias y la finalidad de la formación
Descripción de los contenidos de la formación
Modalidad de enseñanza (presencial, virtual, híbrida)
Resultados del aprendizaje y tipo de logro

Nivel de la experiencia de aprendizaje (marco de cualificaciones)
Marco competencial: ESCO / DACCOMP / Ocas
Actividades de aprendizaje (teóricas y prácticas)
Volumen de trabajo teórico necesario para obtener los resultados del aprendizaje (en créditos ECTS y horas, cuando sea posible)
Volumen de trabajo práctico necesario para obtener los resultados de aprendizaje (en créditos ECTS y horas, cuando sea posible)
Tipo de pruebas de evaluación que validen los resultados de aprendizaje (aplicación de una habilidad, presentación de un vídeo, portfolio, etc.)
Lista de formadores (cualificación y experiencia profesional)
Disponer de integración o aplicabilidad (independientemente, integradas, asociadas con otras microcredenciales)
Resultado o dominio para el estudiante
Tipo de garantía o procedimiento de aseguramiento de la calidad utilizado
Universidad que emite la certificación (autoridad, acreditación legal otorgada, país o región de expedición)
Fecha de expedición

Specification

Specifi-
cation

Specification

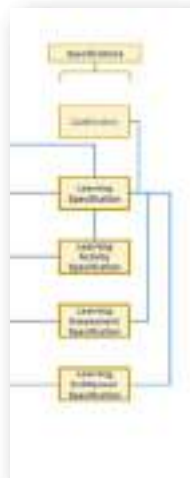
Specifi-
cation



Specification

Specifi-
cation

- Learning Goals
 - Knowledge
 - Competences
 - Skills
- Learning Activity Spec
- Learning Assessment Spec
- Learning Entitlement Spec
- Organizational info



ESCO

Specifi-
cation

- European multilingual classification of skills, competences, qualifications and occupations
- Descriptions of 3.039 occupations and 13.939 skills related to these occupations, translated to 28 languages



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Occupations

Specifi-
cation

- 3.039 occupations

3039

Occupations

0 - Ocupaciones militares	+
1 - Directores y gerentes	+
2 - Profesionales científicos e intelectuales	+
3 - Técnicos y profesionales de nivel medio	+
4 - Personal de apoyo administrativo	+
5 - Trabajadores de los servicios y vendedores de comercios y mercados	+
6 - Agricultores y trabajadores calificados agropecuarios, forestales y pesqueros	+
7 - Oficiales, operarios y artesanos de artes mecánicas y de otros oficios	+
8 - Operadores de instalaciones y máquinas y ensambladores	+
9 - Ocupaciones elementales	+

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Skills

- 13.939 skills

13939
Skills

T - competencias transversales	+
S - competencias	-
S1 - comunicación, colaboración y creatividad	+
S2 - competencias en materia de información	+
S3 - prestar asistencia y cuidados	+
S4 - competencias de gestión	+
S5 - trabajar con ordenadores	+
S6 - manipular y mover	+
S7 - construir	+
S8 - trabajar con maquinaria y equipo especializado	+
K - conocimientos	+
L - competencias lingüísticas y conocimiento de lenguas	+

Specifi-
cation



Qualifications

- Qualifications are the formal result of an **evaluation and validation** process, obtained when a competent **authority** establishes that a person has obtained the **learning outcomes** corresponding to a given **norm**

Specifi-
cation



Example

I want to design a course of Introduction to Programming with Java. I want you to help me design the learning goals for this 14 week course. Use ESCO for the specification of skills and competences.

Por supuesto, aquí tienes solo las competencias según ESCO para cada sección del curso:

1. Fundamentos de Programación y Java (Semanas 1-3)

- Comprender la lógica de programación.
- Aplicar estructuras de control básicas.

2. Estructuras de Datos y Algoritmos Básicos (Semanas 4-6)

- Diseñar clases y objetos.
- Diseñar algoritmos para la manipulación de datos y objetos.

4. Manejo de Excepciones y Depuración (Semanas 10-11)

- Manejar errores y excepciones.
- Realizar pruebas de software.

5. Introducción a APIs y Colecciones en Java (Semanas 12-13)

- Utilizar bibliotecas y APIs.
- Gestionar colecciones de datos.

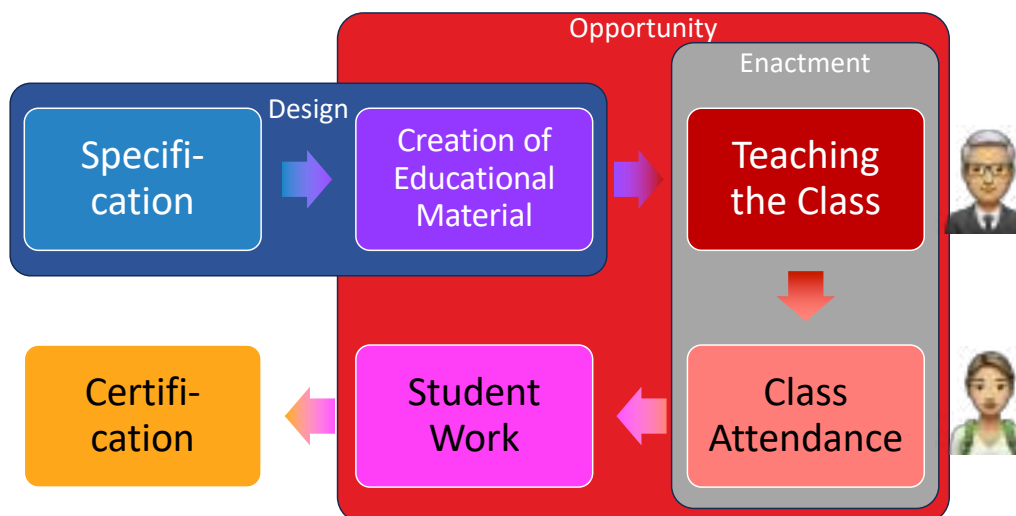
6. Proyecto Final y Documentación (Semana 14)

- Documentar el software.
- Desarrollar una aplicación simple.

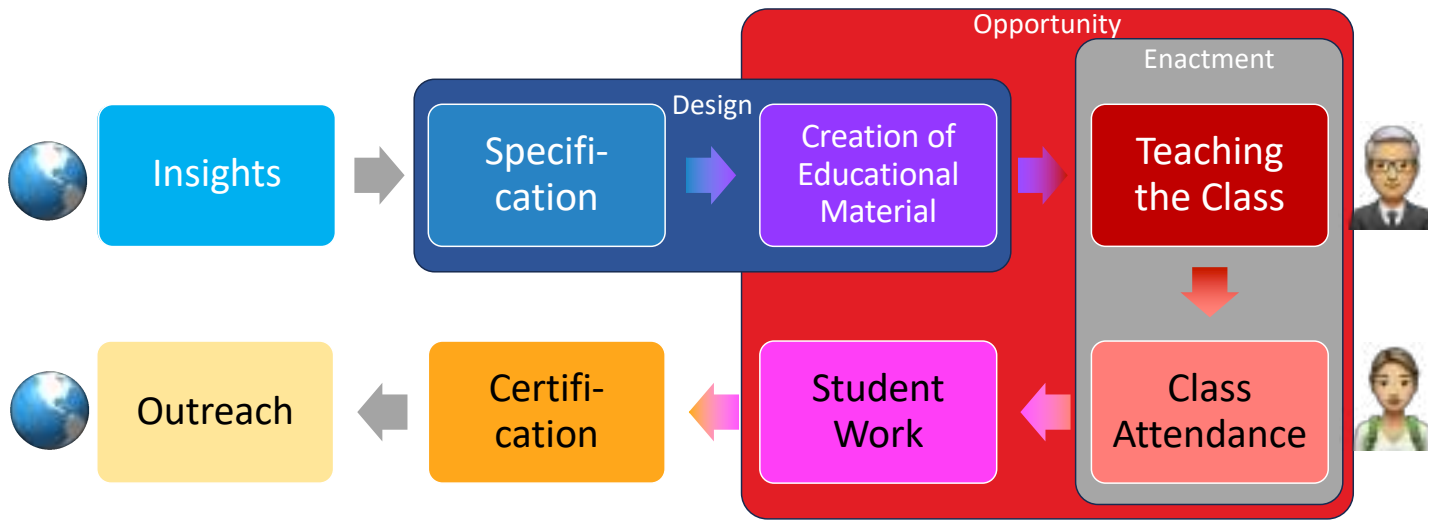
Si necesitas alguna adaptación o especificación adicional, ¡me dices!

Specifi-
cation

Framework for Microcredentials



Framework for Microcredentials



Insights

- Observatory

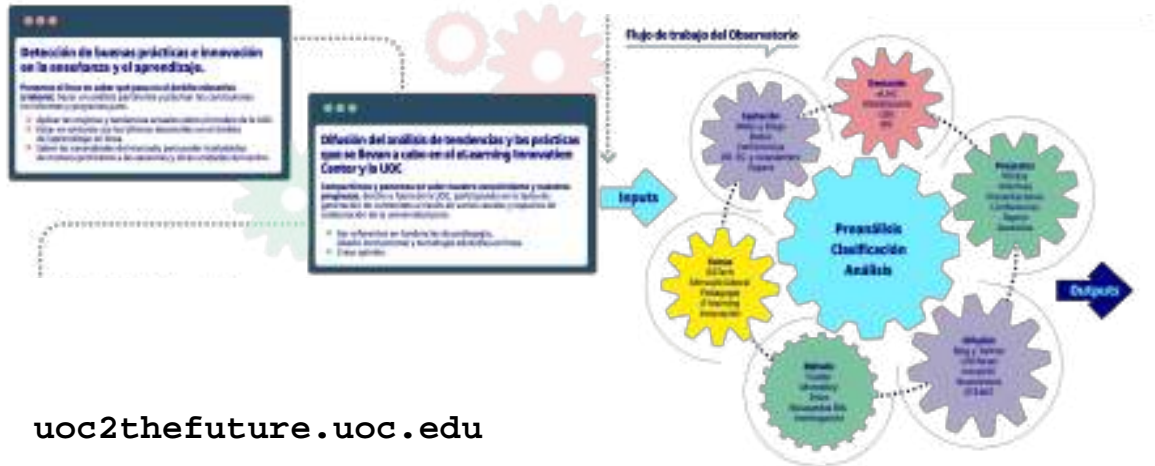


- Specialized company



UOC Observatory

Insights



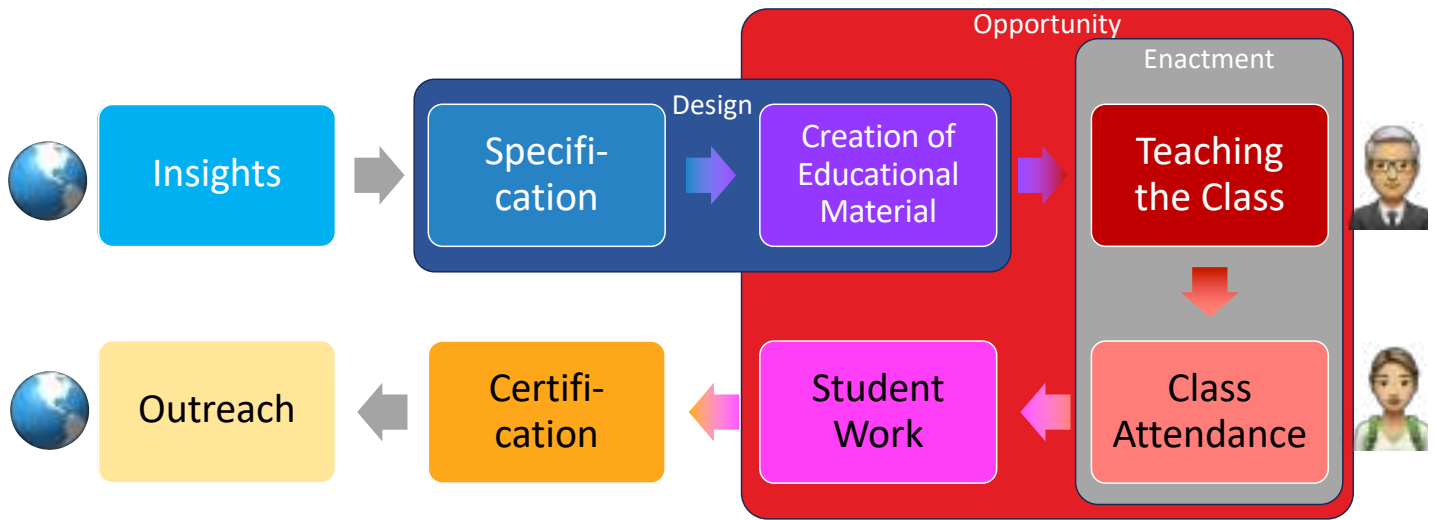
Specialized company

Insights

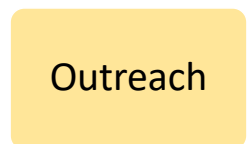
$$\text{Emsi} + \text{burning glass} = \text{Lightcast}$$



Framework for Microcredentials



Outreach



- Simple
 - File
 - Europass
 - Blockchain
- Broad
 - LinkedIn
 - Other social media



File

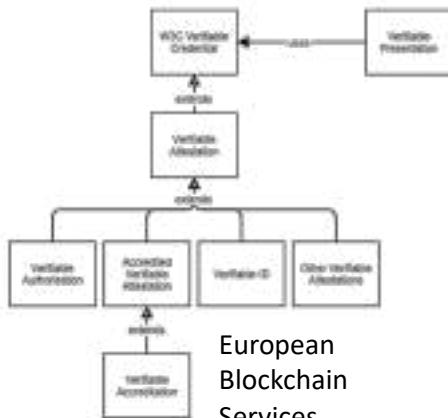


Europass Library (or Wallet)



europa.eu/europass/eportfolio/screen/my-library

Blockchain

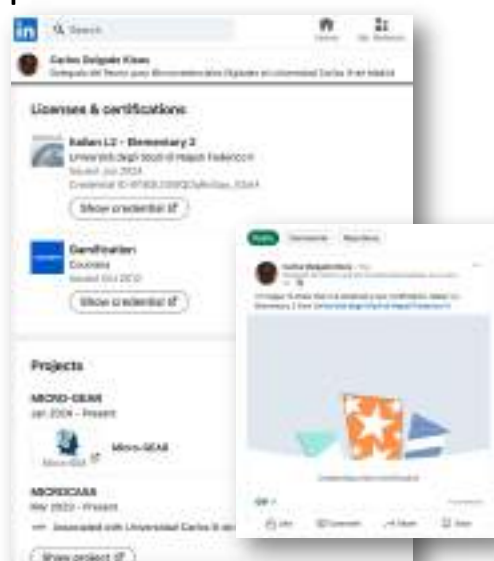


European Blockchain Services Infrastructure



Diplomechain

LinkedIn



Post analysis

1,000

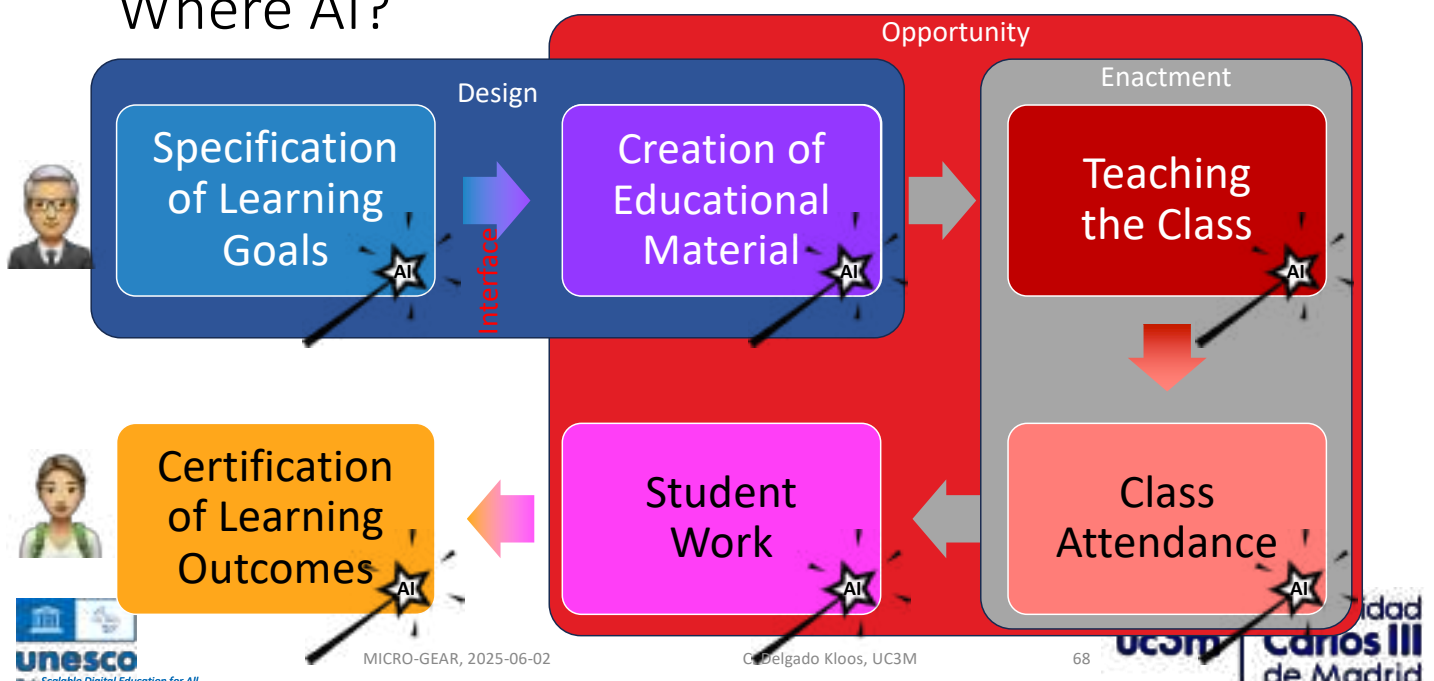
Category	Value	%
Company size	1 001-5 000 employees	20%
Company size	13 001+ employees	15%
Company size	11-50 employees	12%
Company size	51-200 employees	10%
Company size	5001+ 10,000 employees	1%
Job titles	Professor	12%
Job titles	Teacher	3%
Job titles	Executive	3%
Job titles	Software Engineer	2%
Job titles	Co-Founder	2%
Locations	Greater Madrid Metropolitan Area	35%
Locations	Greater Boston	5%
Locations	Greater Barcelona Metropolitan Area	3%
Locations	Berlin Metropolitan Area	2%
Locations	New York City Metropolitan Area	2%
Locations	Universidad Carlos III de Madrid	8%
Companies	UNESCO	1%
Industries	Higher Education	20%
Industries	Software Development	11%
Industries	IT Services and IT Consulting	30%
Industries	Research Services	6%
Industries	Telecommunications	4%

The Role of AI

- **Digital technologies** were key to promote **MOOCs** a decade ago
- **AI** can play a key for designing and enacting **microcredentials**



Where AI?



Creation of Educational Material



Creation of Educational Material



bit.ly/edu-ai-it



bit.ly/edu-ai-es

federica.eu/esplorare-ia

coursera.org/learn/ensear-con-ia-herramientas

Teaching the Class



You

Please generate a script to orchestrate a 50 minute class session to teach recursion in a Java programming class. Include collaborative tasks.

Teaching the Class

OBJECT
Class Session Plan: Teaching Recursion in Java (50 minutes)

Notes: Adjust the time allocation on the basis of your class and the level of familiarity your students have with recursion.

Objectives:

- Understand the concept of recursion in Java.
- Learn to design and implement recursive algorithms.
- Apply recursion to solve programming problems.

Materials:

- Whiteboard or screen.
- Projector for code demonstrations.
- Laptop or computer for students.
- Collaborative problem-solving handouts.

Class Structure:

- Introduction (5 minutes)**
 - Briefly review the concept of recursive problems in Java.
 - Introduce the concept of recursion and its relevance in programming.
 - Explain the lesson's structure using handouts, code, and exercises.
- Visualizing Recursion (10 minutes)**
 - Use a whiteboard or projector to draw a simple recursive tree diagram for a common problem (e.g., factorial/fibonacci).
 - Discuss the tree structure and how it relates to recursive calls.
 - Introduce the concept of base cases and how they prevent infinite recursion.
- Live Coding Session (15 minutes)**
 - Perform a live coding session to implement a simple recursive algorithm (e.g., factorial or fibonacci) on the projector.
 - Explain each step, emphasizing the recursive calls and how they relate to the problem.
 - Encourage students to ask questions during the coding session.

- Interactive Example and Practice (10 minutes)**
 - Provide a handout with a partially completed recursive code and a small task.
 - In pairs, students complete the code and solve the problem on the slide.
 - Discuss the solutions in pairs, focusing on understanding the recursive flow.
- Collaborative Problem Solving (5 minutes)**
 - Divide the class into small groups.
 - Assign a more challenging recursive problem to each group (e.g., recursive tree traversal).
 - Each group collaboratively designs and implements a recursive solution.
 - Encourage groups to discuss and solve challenges together.
- Group Presentations and Discussion (5 minutes)**
 - Each group presents its solution to the class.
 - Discuss different approaches, optimizations, and potential pitfalls.
 - Encourage questions and feedback from the class.
- Conclusion and Homework (5 minutes)**
 - Summarize key concepts about recursion in Java.
 - Assign a homework exercise involving recursion for further practice.
 - Emphasize the importance of applying recursion to solve real-world programming problems.

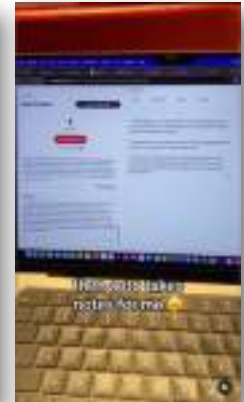
Closing Note:

Encourage students to practice recursion outside of the classroom and explore its applications in programming. Emphasize that mastering recursion requires regular practice and exposure to diverse problem-solving scenarios.

Class Attendance

- Record the professor presenting
 - Transcribe the talk into text
 - Translate to another language
 - Simplify, explain, illustrate, give examples
 - Check for correctness?

• **studfetch.com**



Class Attendance

AI

Student Work



slides

problem sets & exams

videos from edX MOOC



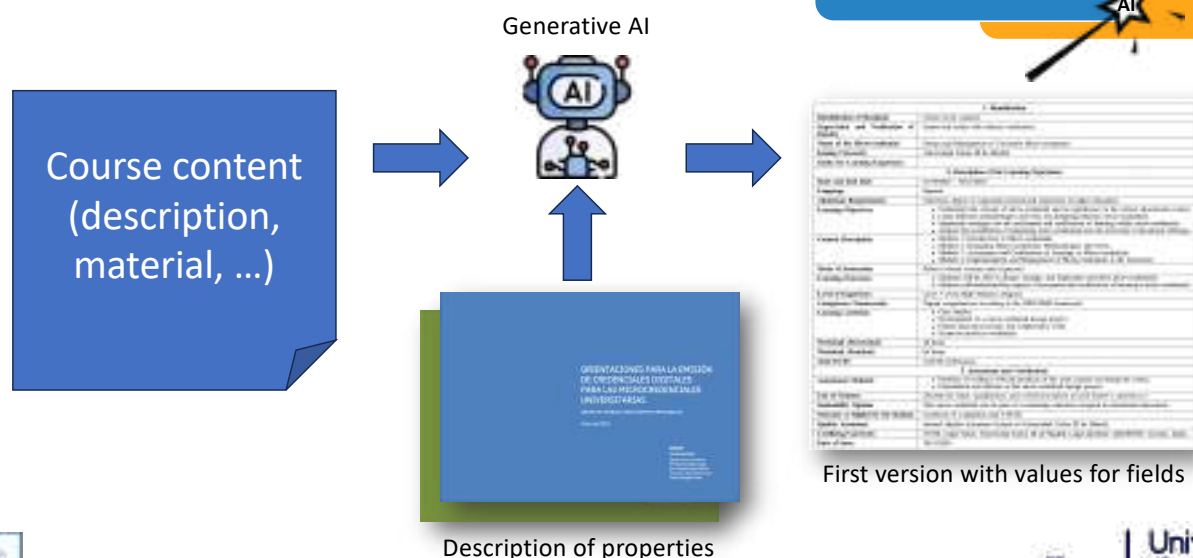
Student Work

AI



CharlieBOT

Specification and Certification



Summary



- Framework for Microcredentials
- Vocabularies (main concepts) for Specification and Certification
 - W3C, OpenBadges, ELM
 1. Learning Opportunities & Qualifications (LOQ)
 2. Accreditation Metadata Schema (AMS)
 3. Person Identity (PID)
 4. European Digital Credential for Learning (EDC)
- AI can be applied everywhere

Thank you!

Շնորհակալություն!



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Technologies for the Specification and Certification of Microcredentials

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