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From MOOCs to Microcredentials

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www.it.uc3m.es/cdk www **www.it.uc3m.es/calario**

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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

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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

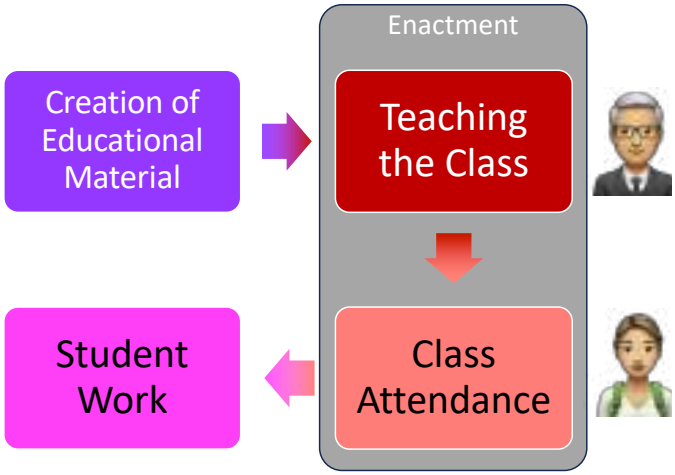
Creation of Educational Material

Enactment

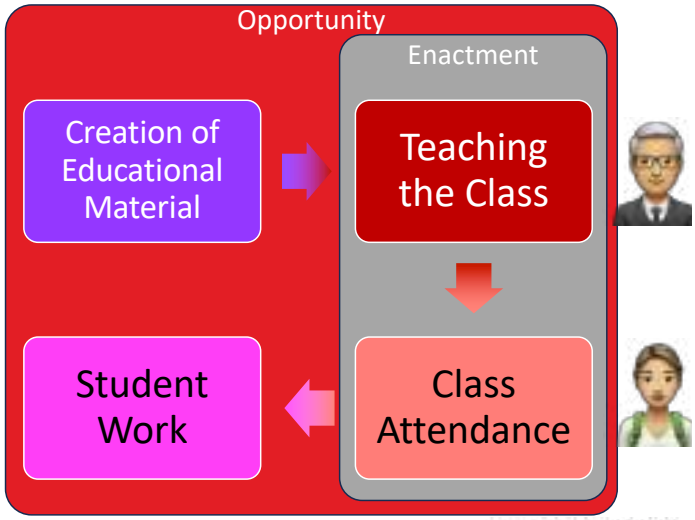
Teaching the Class

Class Attendance

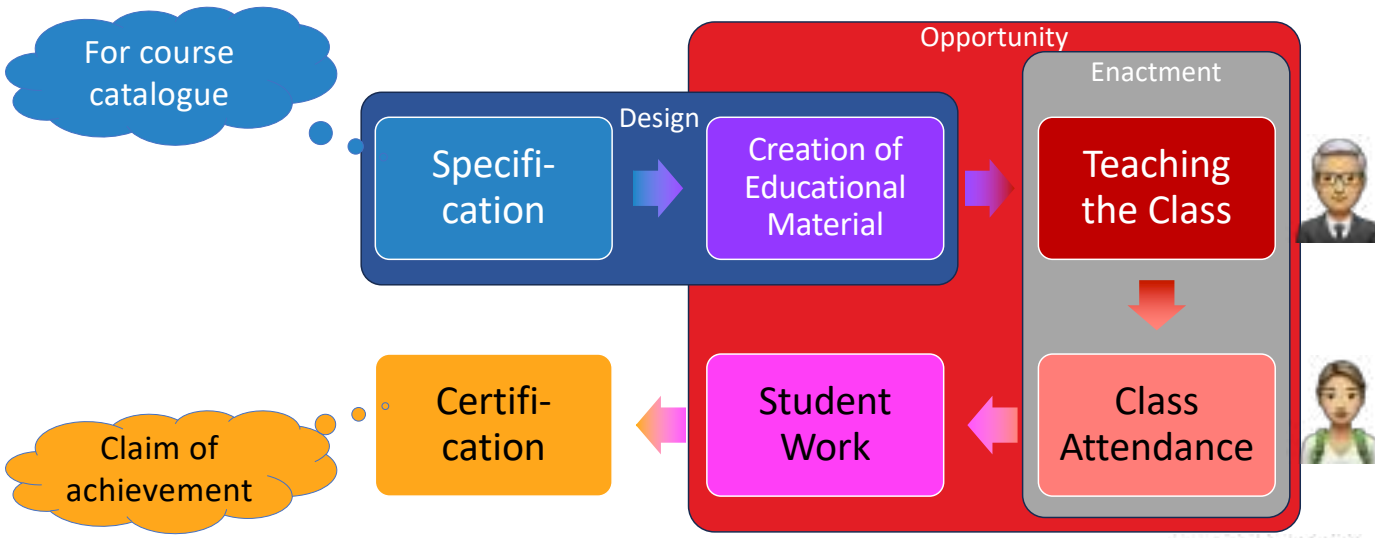
Framework for Microcredentials



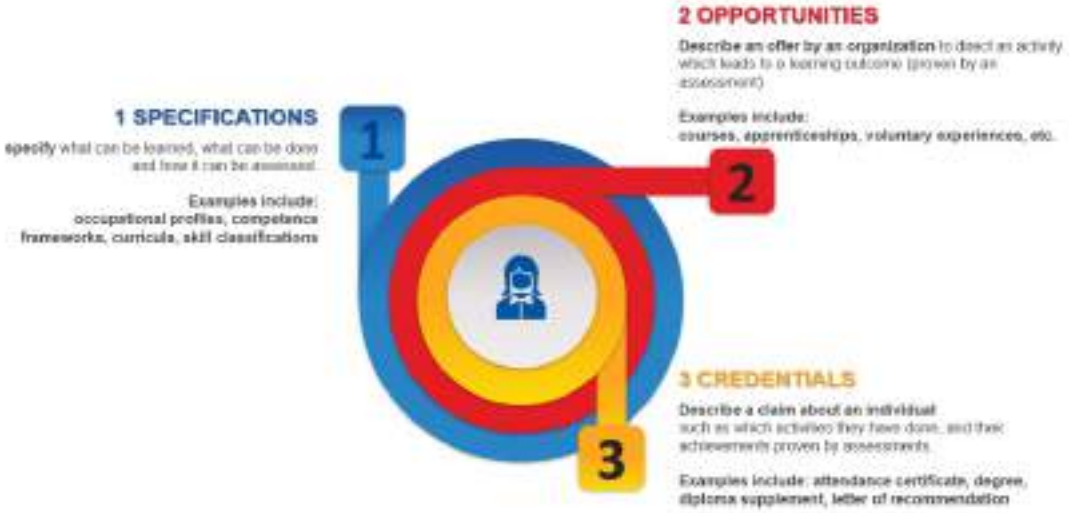
Framework for Microcredentials



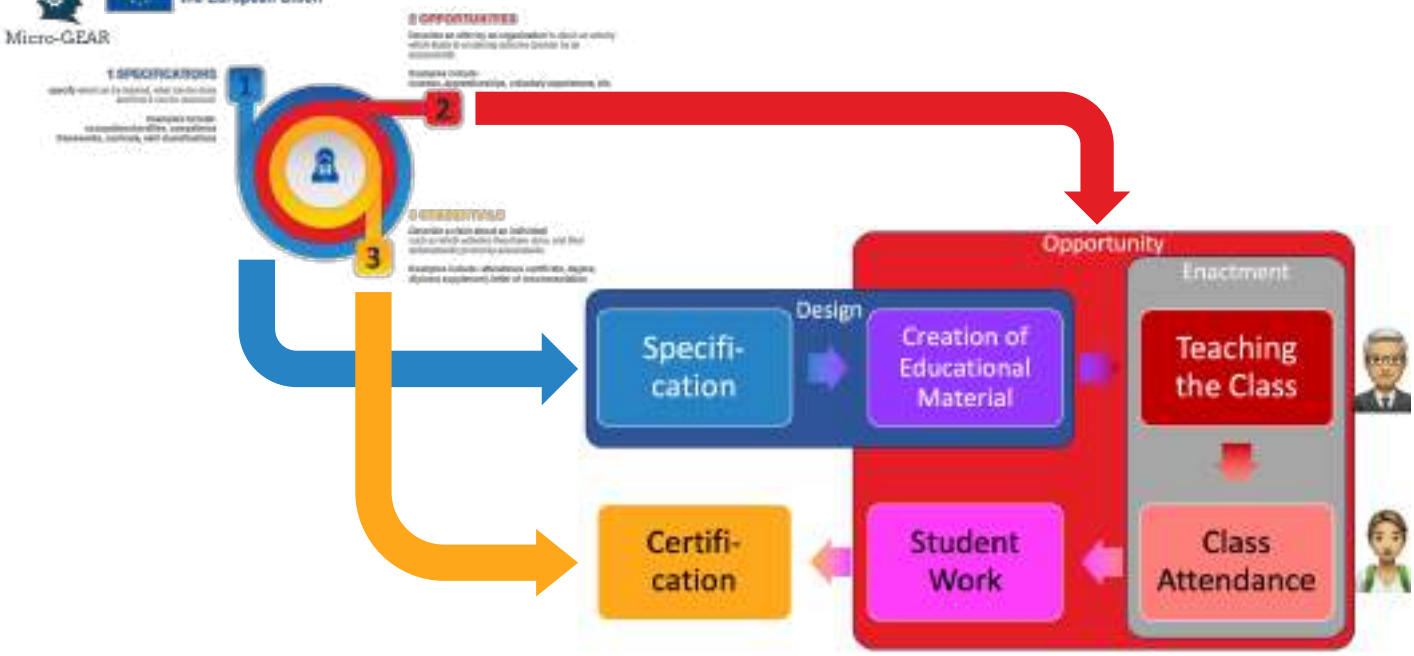
Framework for Microcredentials



Specifications, Opportunities, Credentials



europass.europa.eu/en/node/2128



Vocabularies

- 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.

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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

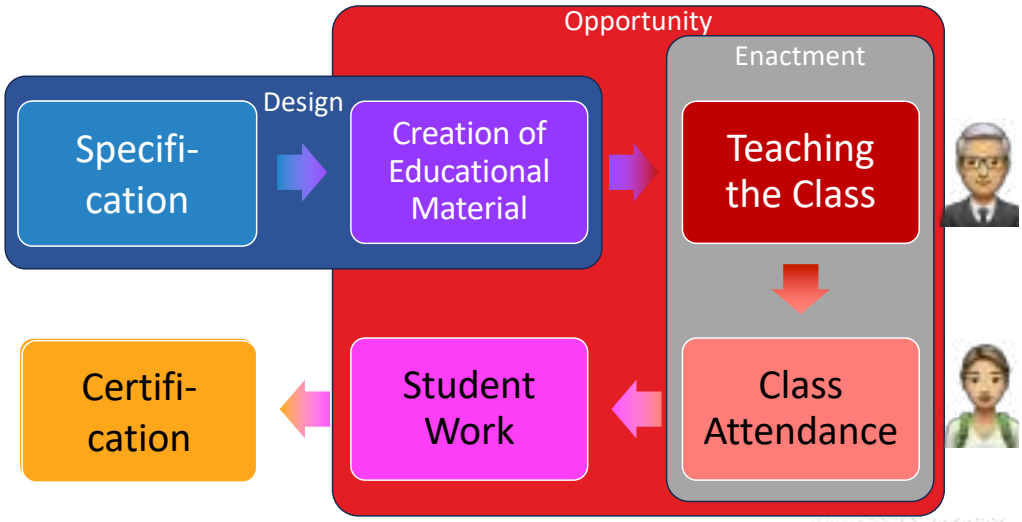
- **Defendant:** The person accused of a crime or sued in a civil case.
- **Plaintiff:** The person who initiates a lawsuit.
- **Damages:** Money awarded to a person who has been wronged.
- **Evidence:** Information presented in court to prove a point.
- **Default:** Failing to fulfill a legal obligation.
- **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.

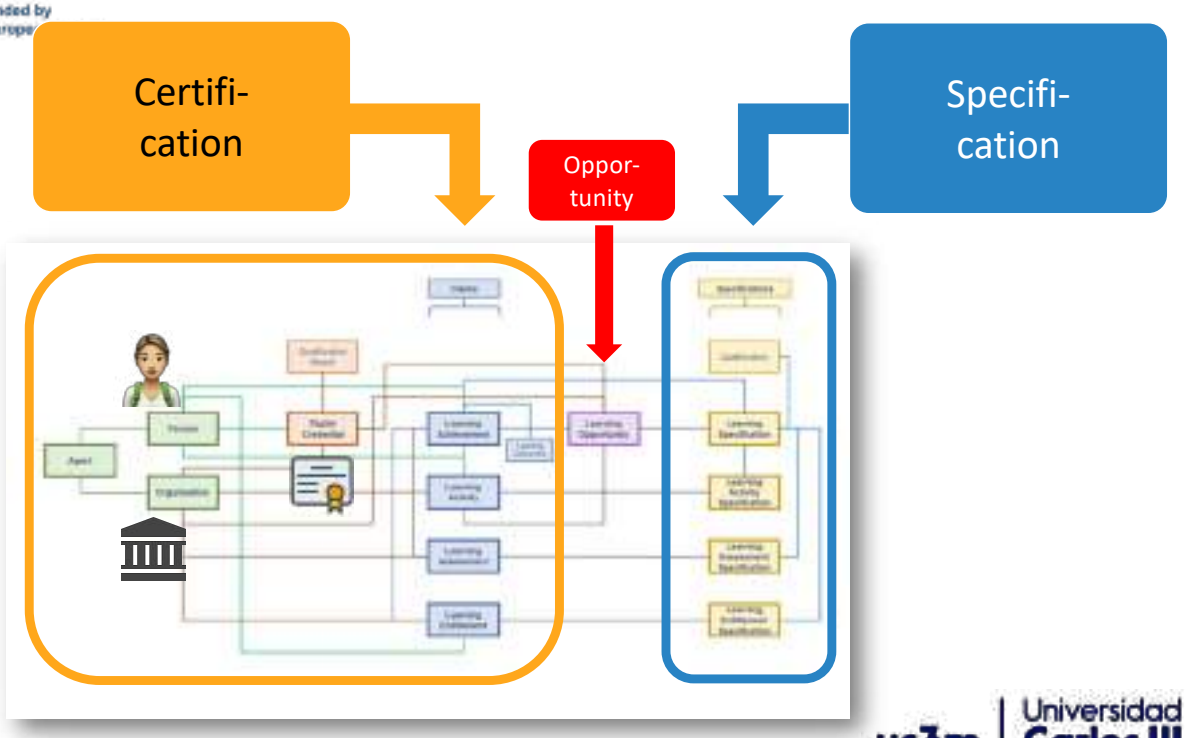
Quote

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

-- Ludwig Wittgenstein (1889-1951)

Framework for Microcredentials





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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

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Certification

Certifi-cation

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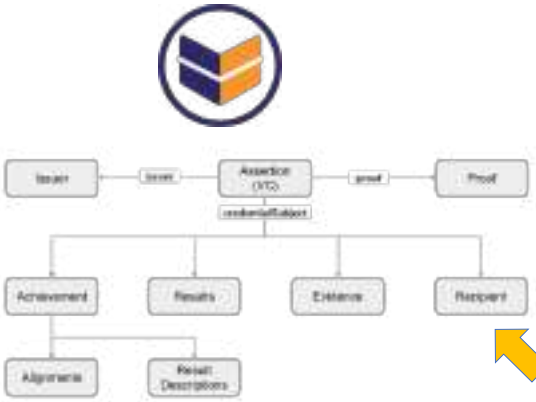
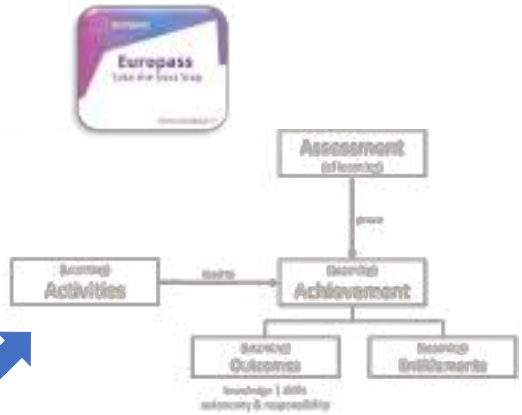
Formats for Digital Credentials

Certifi-cation

OpenBadges (1EdTech)



ELM (European Commission)



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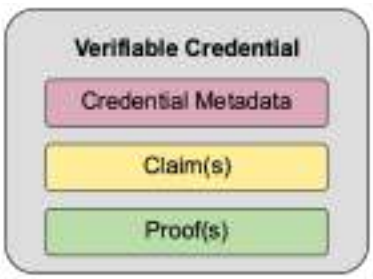
W3C Verifiable Credentials

Certifi-cation

- Data Model v1.1 (3 Mar 2022)
- Data Model v2.0 (15 May 2025) W3C Recommendation **`w3.org/TR/vc-data-model-2.0`**



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European Learning Model

Certifi-cation

/ 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."*

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European Learning Model

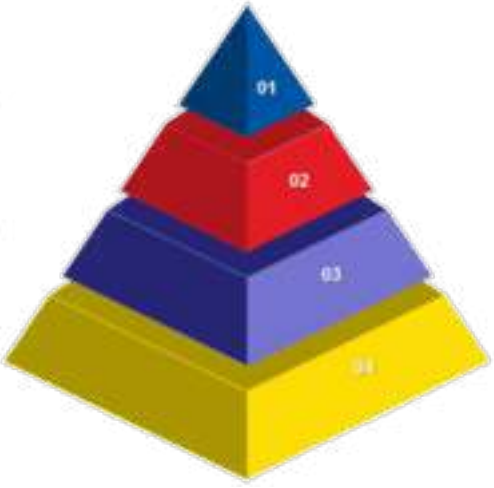
Certifi-cation

01 European Information Model

Definitions and Standards in EQF 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

Certifi-cation

- Available in 30 languages

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

24 EU languages

+ 6 languages of EEA/candidate countries

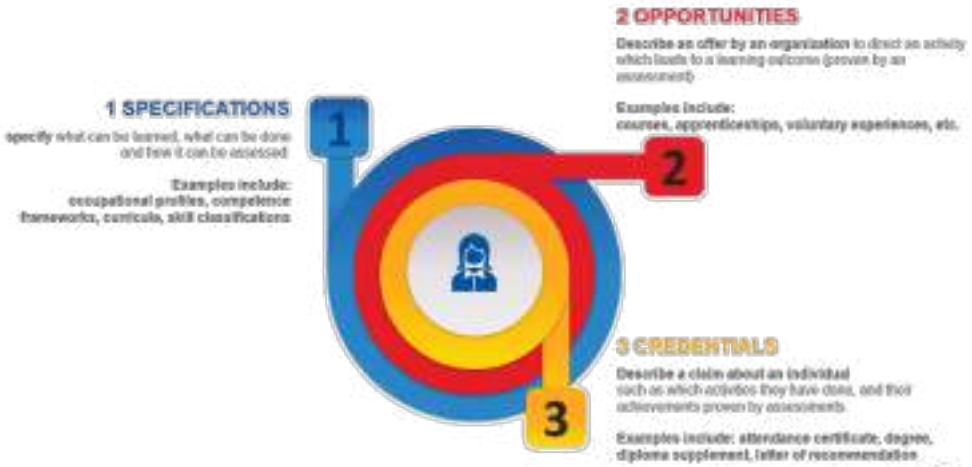
European Learning Model

Certifi-cation

- 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

Certifi-cation



1. Learning Opportunities & Qualifications (LOQ)

Certifi-cation

- *"what can be studied and what it leads to"*

1. Learning Opportunities & Qualifications (LOQ)

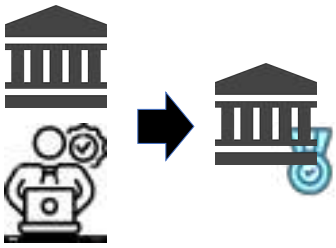
Certifi-cation

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)

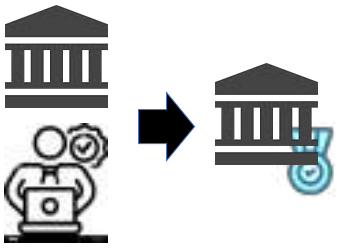
Certifi-cation

- *“who authorised what”*



2.Accreditation Metadata Schema (AMS): Concepts

Certifi-cation



- 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

Certifi-cation

```
{"@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)

Certifi-cation

- *"who the learner or staff member is"*

Student ID card

3. Person Identity (PID)

Certifi-cation

Name → E-mail → National identity → European identity

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)

Certifi-cation

- **eduID** (in NL)

`eduid.nl`

Limited to NL

3. Person and Org. Identity (PID)

Certifi-cation

- **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/2`** **`/oj`**
- **myAcademicID**
  - **`myacademic-id.eu`**
- **ESI**: European Student Identifier
  - **`wiki.geant.org/display/SM/Eu`** **`udent+Identifier`**): **`urn:schac:personalUniqueCode:int:esi:<country>:<code>`**

Centra-lized European system

eIDAS Regulation

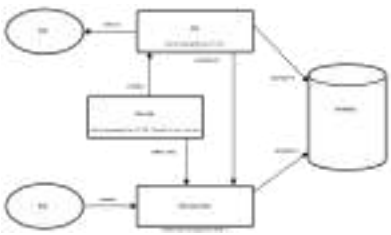
- **e**lectronic **Id**entification, **A**uthentication and Trust **S**ervices
- Trusted electronic interactions for businesses in EU
- Services
  - eSignature: electronic signature (for persons)
  - eSeal: electronic seal (for organizations)
  - eTimestamp: electronic timestamp (for time)
  - WAC: website authentication certificate (for websites)
  - eDelivery: electronic registered delivery service (for docs)

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

3. Person Identity (PID)

Certifi-cation

- 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



3. Person Identity (PID): Minimal Example

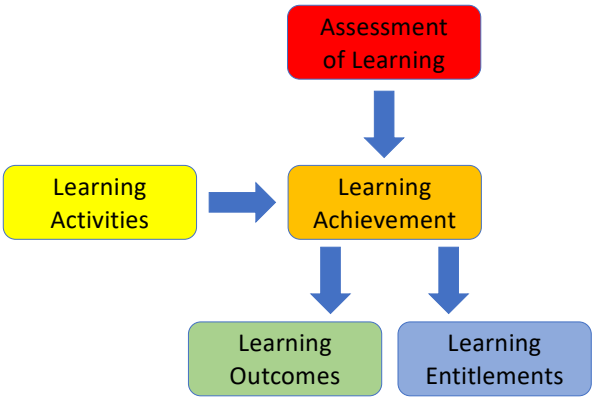
Certifi-cation

```
{"@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)

Certifi-cation

- *"what the learner has achieved"*



4. European Digital Credential for Learning (EDC)

Certifi-cation

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4. European Digital Credential for Learning (EDC)

Certifi-cation

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4. European Digital Credential for Learning (EDC)

Certifi-cation

```
{ "@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

Certifi-cation

- **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

Certifi-
cation

Specification

Specifi-
cation

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Specification

Specifi-cation

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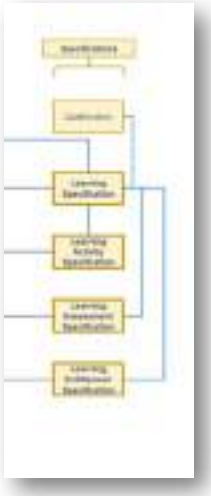
Specification

Specifi-cation

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



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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

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Skills

- 13.939 skills

Specifi-cation

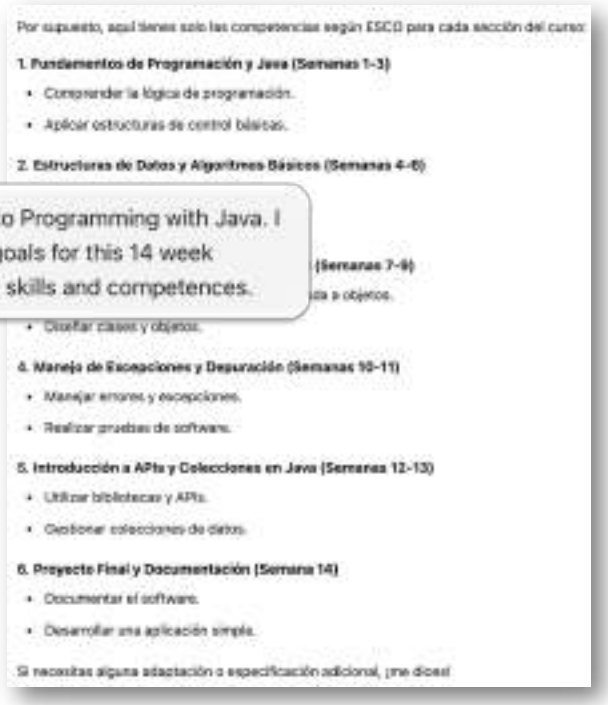
Qualifications

- 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.

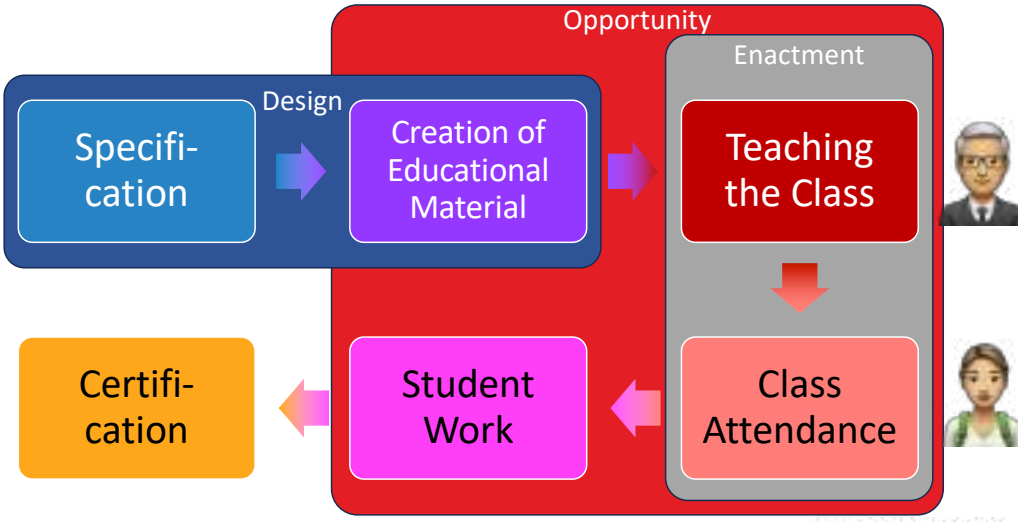

Por supuesto, aquí tienes solo las competencias según ESCO para cada sección del curso:

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)
3. (Semanas 7-9)
   - Diseñar clases 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.

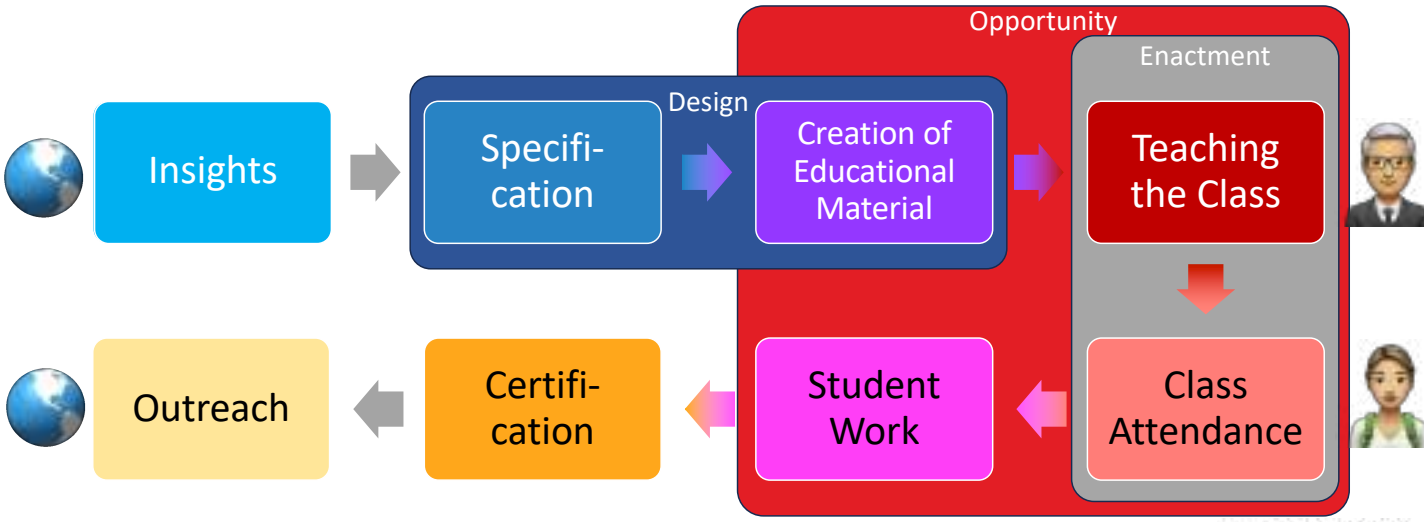
Si necesitas alguna adaptación o especificación adicional, ¡me dices!

Specifi-cation

Framework for Microcredentials



Framework for Microcredentials



Insights

Insights

- Observatory

- Specialized company

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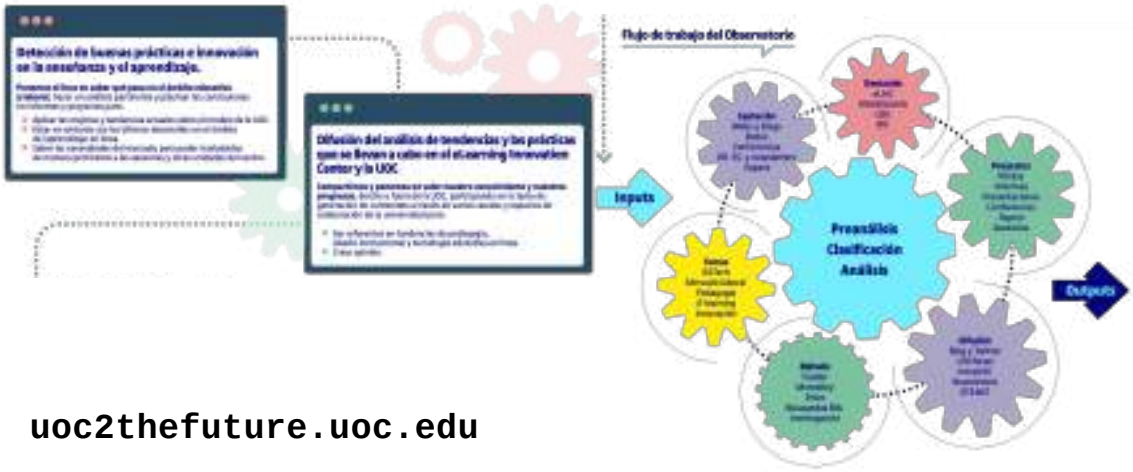
Micro-GEAR

UOC Observatory

Insights



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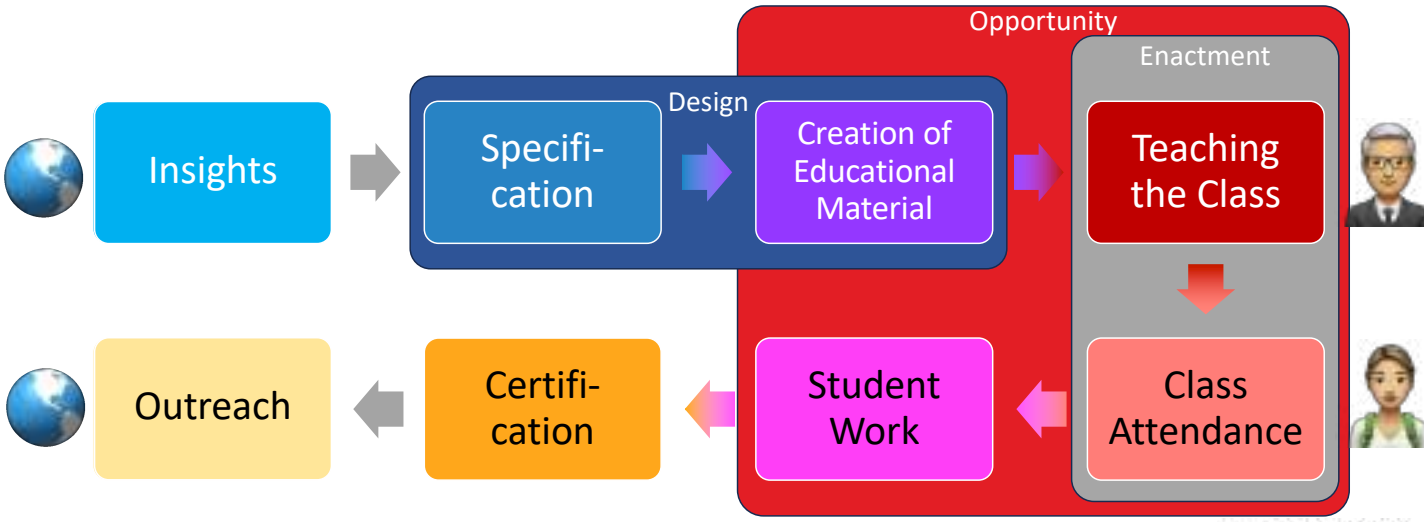
Micro-GEAR

Specialized company

Insights

Emsi + burning glass = Lightcast

Framework for Microcredentials



Outreach

Outreach

- Simple
  - File
  - Europass
  - Blockchain


- Broad
  - LinkedIn
  - Other social media


File

Europass Library (or Wallet)

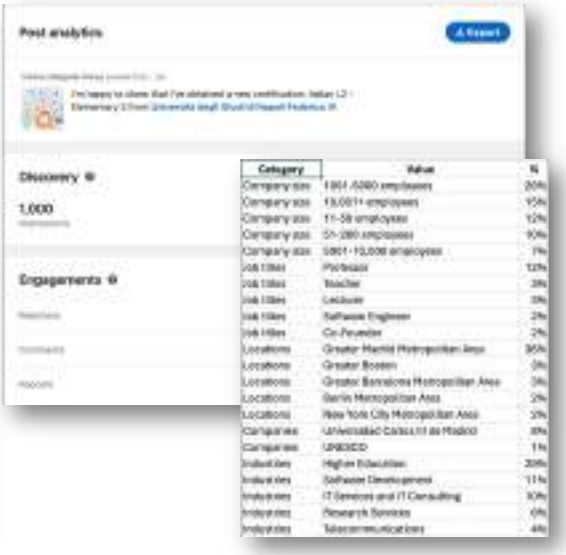
europa.eu/europass/eportfolio/screen/my-library

Blockchain

European Blockchain Services Infrastructure

Diplomechain

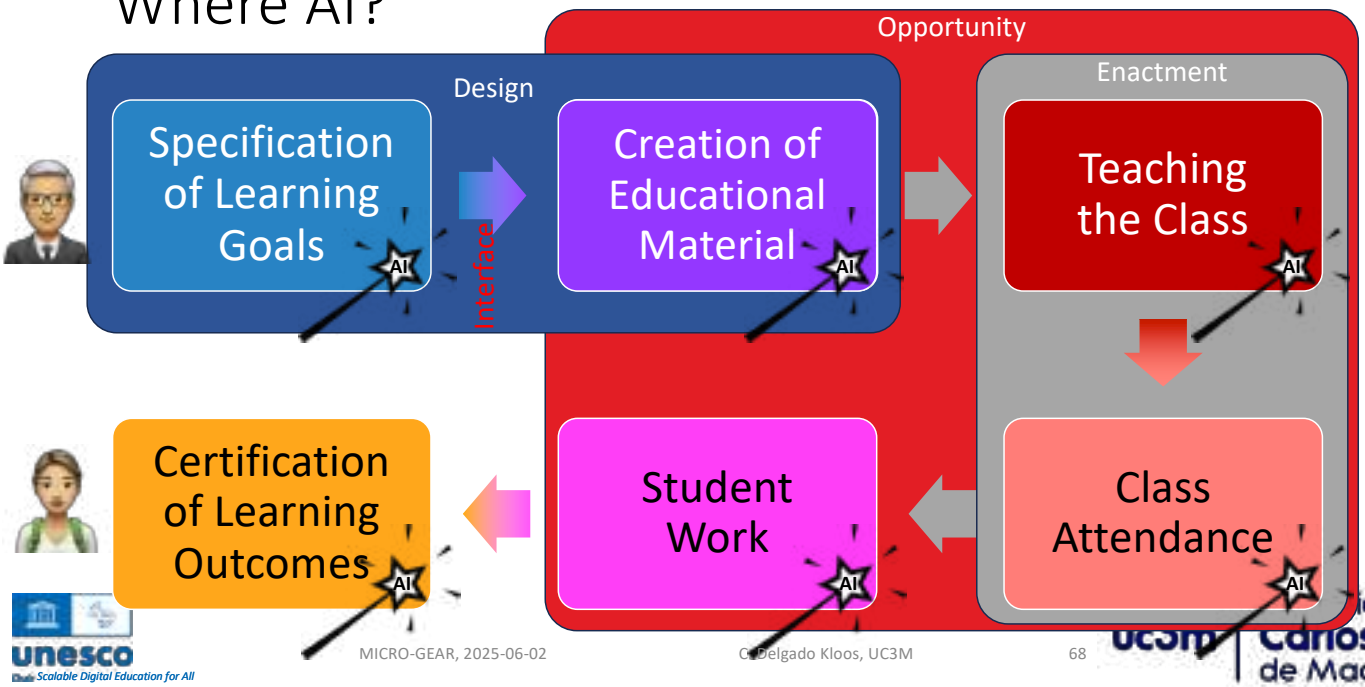
LinkedIn



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?



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Creation of Educational Material

Creation of Educational Material AI

bit.ly/edu-ai-it

bit.ly/edu-ai-es

federica.eu/esplorare-ia

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

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Micro-GEAR

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Teaching the Class

Teaching the Class AI

You

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

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.

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Class Attendance

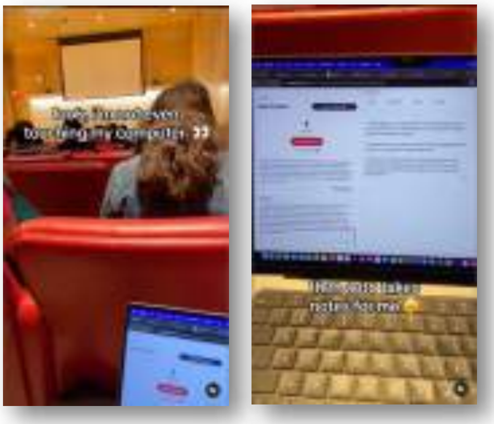
Class Attendance

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

STUDY FETCH


Lecture Summary, Interactive Quizzes, and Flashcards

Our AI will generate, focused study tools for you from your lectures and course material, in seconds.



Student Work

Student Work

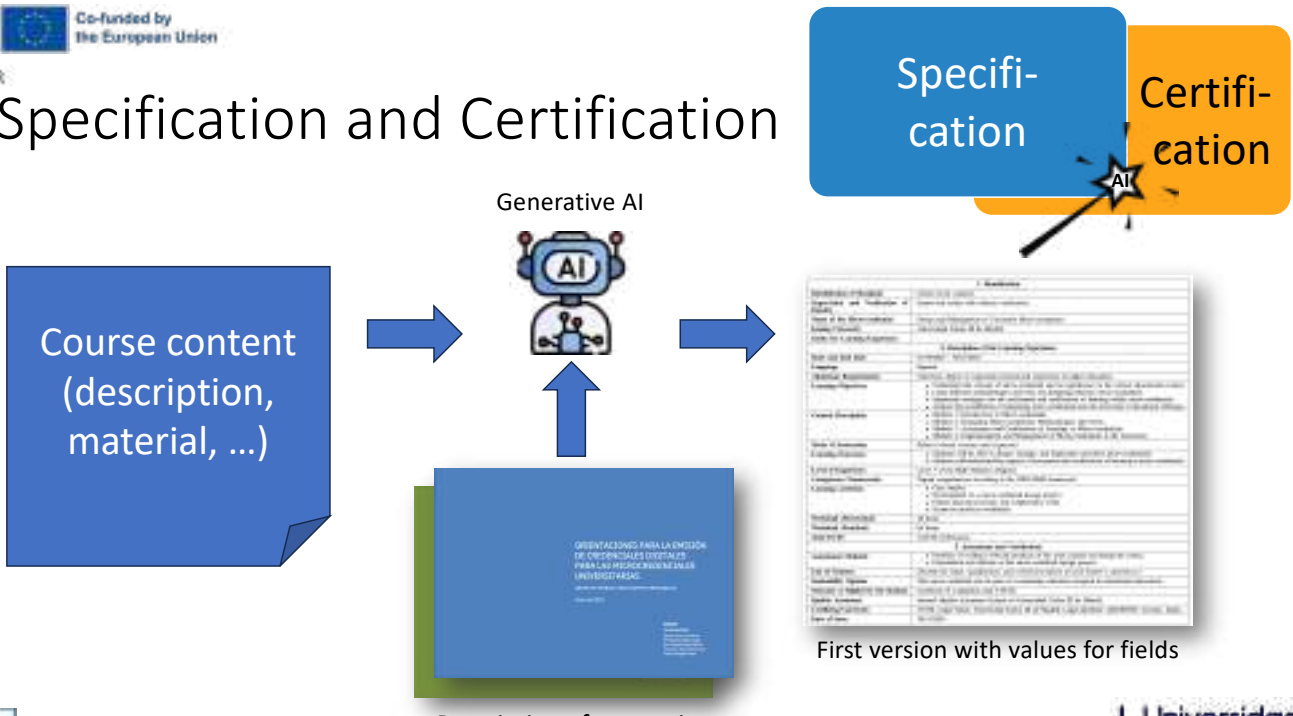

slides


problem sets & exams


videos from edX MOOC


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

Micro-GCAS

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Technologies for the Specification and Certification of Microcredentials

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