



# From MOOCs to Microcredentials

**Carlos Delgado Kloos**

Universidad Carlos III de Madrid

@cdk1oos



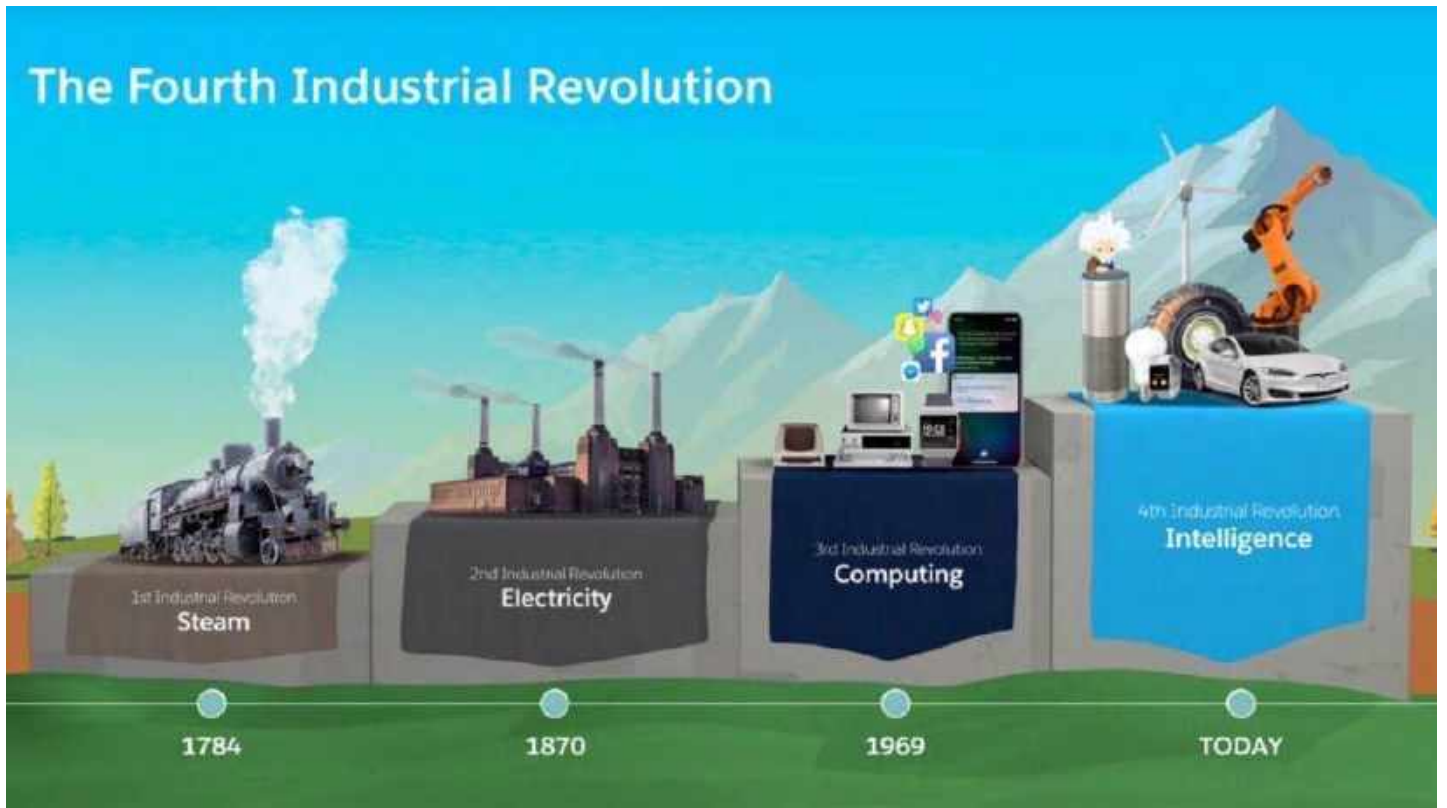
# From MOOCs to Microcredentials: Smaller 🐭 and Smarter 💡 Education

**Carlos Delgado Kloos**

Universidad Carlos III de Madrid

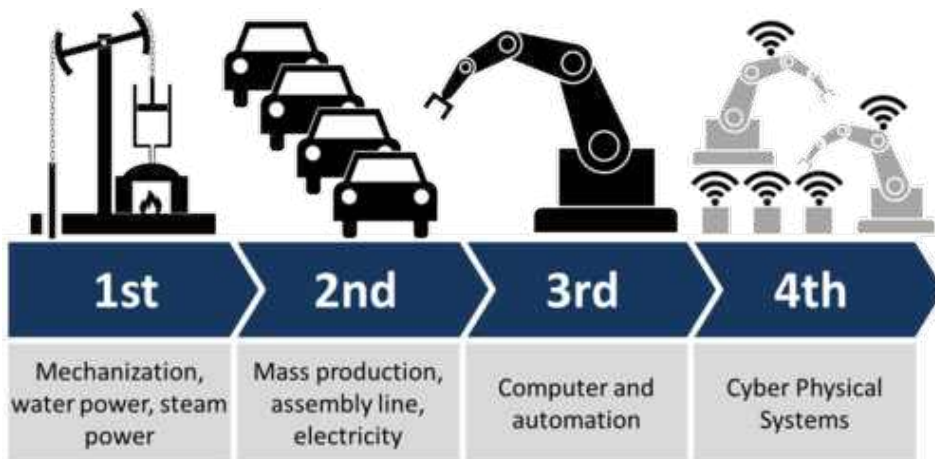
@cdk1oos





Co-funded by the European Union

## Industry 1.0-4.0





Co-funded by the European Union

# Education 0.0



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

5

uc3m | Universidad Carlos III de Madrid



Co-funded by the European Union

# Education 1.0



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

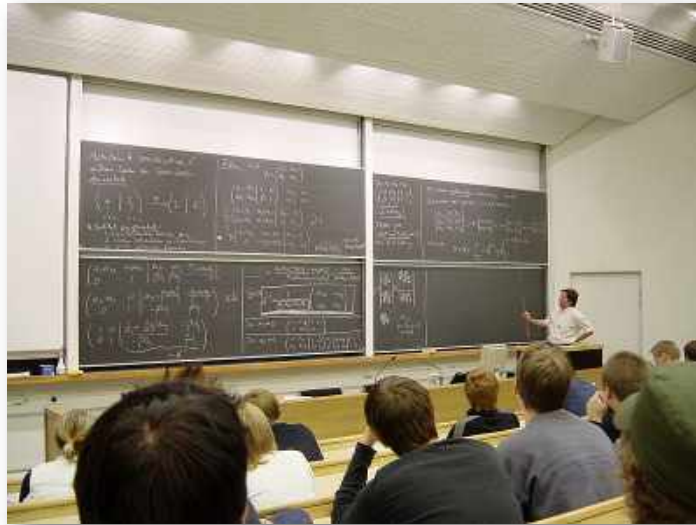
6

uc3m | Universidad Carlos III de Madrid



Co-funded by the European Union

# Education 1.0



UNESCO  
Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

7

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union

# Education 1.0



UNESCO  
Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

8

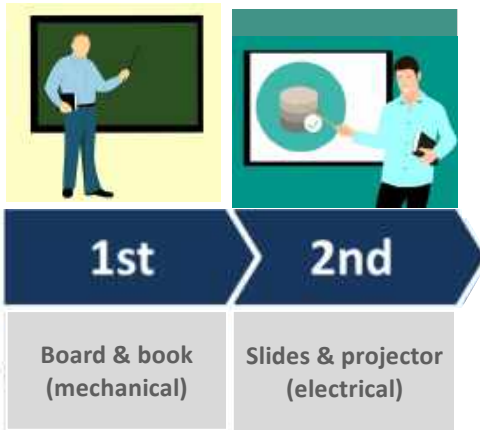
uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union

# Education 2.0



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

9



Co-funded by the European Union

# Education 2.0



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

10





Co-funded by the European Union

# Education 2.0



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

11



Universidad Carlos III de Madrid



Co-funded by the European Union

# Education 2.0



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

12

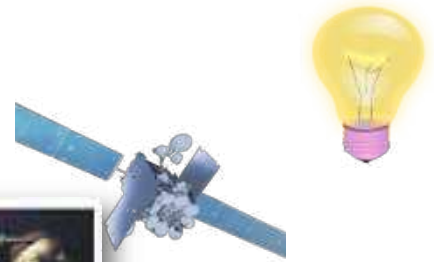


Universidad Carlos III de Madrid



Co-funded by the European Union

# Education 2.0



MICROCASA, Penang, 2023-10-05

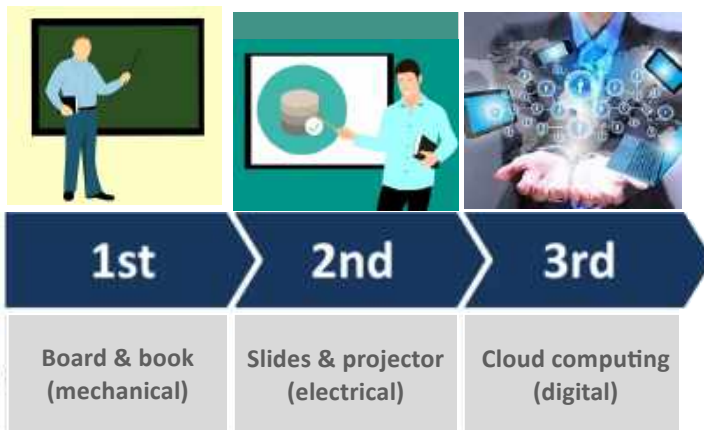
C. Delgado Kloos, UC3M

13



Co-funded by the European Union

# Education 3.0



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

14





Co-funded by the European Union



# Education 3.0: Learning Management Systems



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

15

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union



# Education 3.0: Engagement Apps



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

16

uc3m

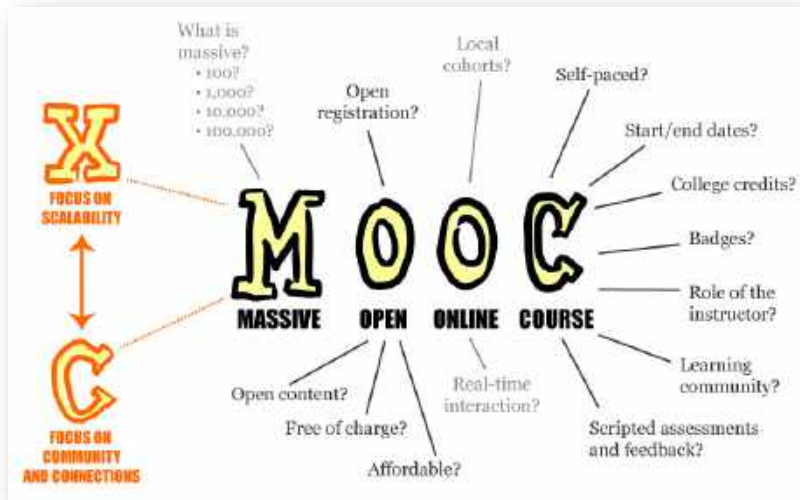
Universidad Carlos III de Madrid





Co-funded by the European Union

# Education 3.0: MOOCs



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

17



Co-funded by the European Union

## Video production and distribution



Interactive web technologies

Social networks



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

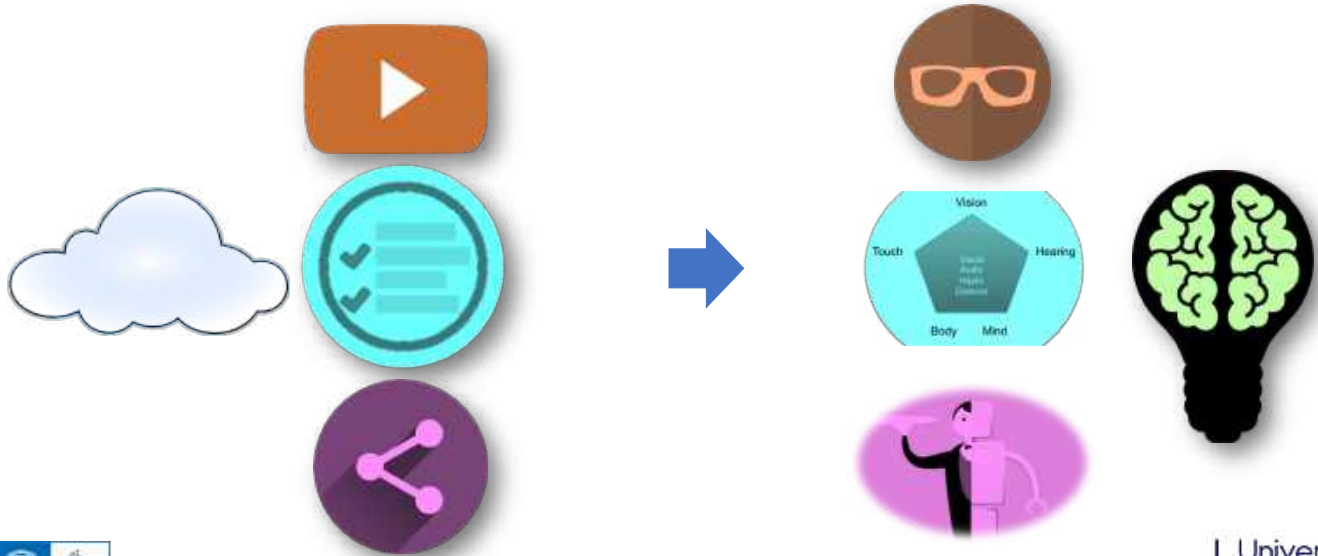
C. Delgado Kloos, UC3M

18



Co-funded by the European Union

# Education 3.0 to 4.0



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

19



Co-funded by the European Union

# Education 1.0-4.0



MICROCASA, Penang, 2023-10-05

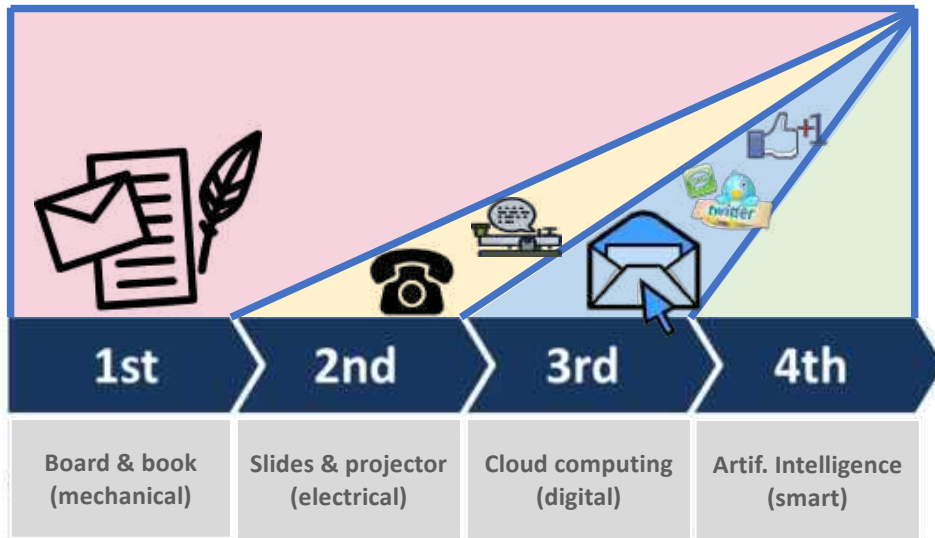
C. Delgado Kloos, UC3M

20

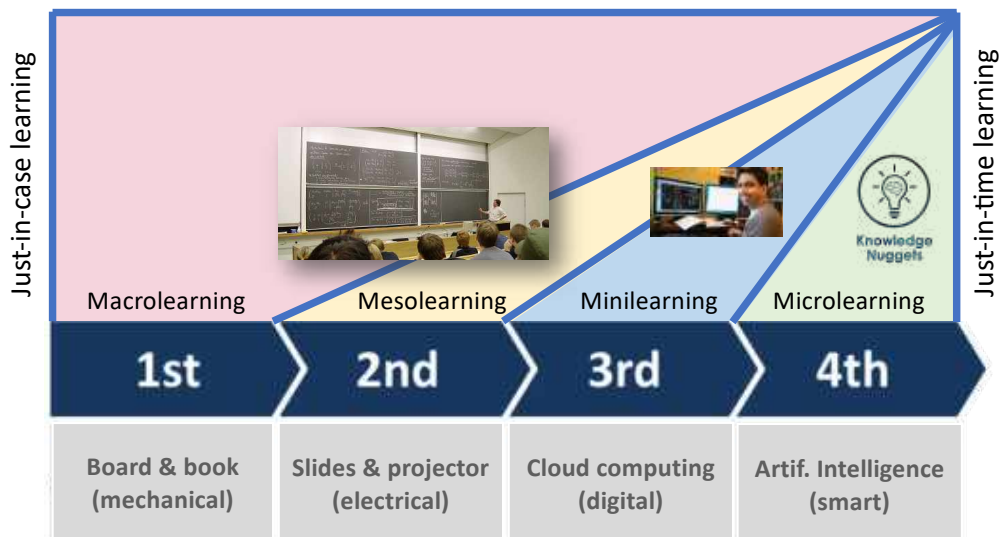




# Size of Human Communication: Smaller

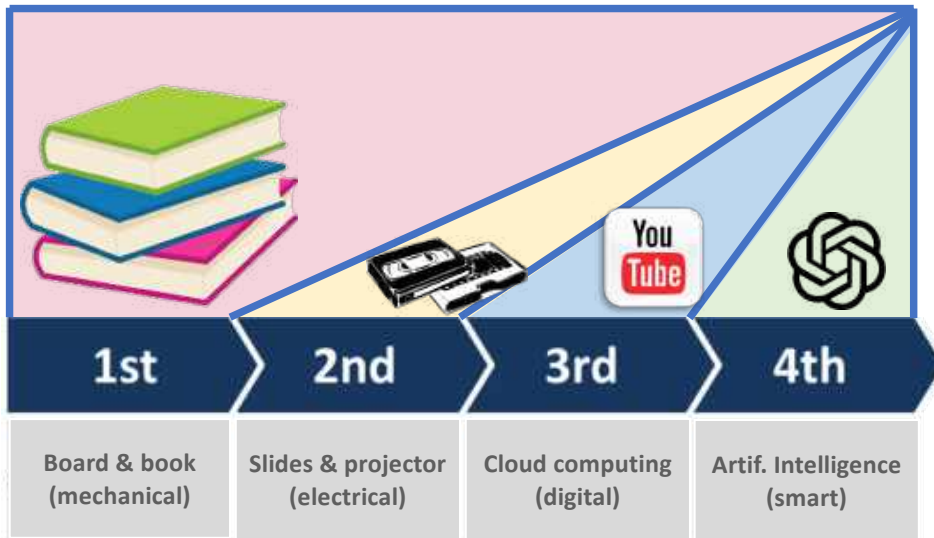


# Size of Learning Packages: Smaller





# Modern Way of Learning: Smarter



# Smaller and Smarter

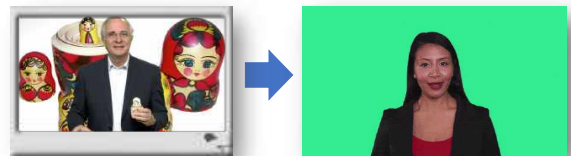
## 1. Package size

- Smaller
- Microcredentials



## 2. Support technology

- Smarter
- Artificial Intelligence





Co-funded by the European Union

# 1. SMALLER



Chair Scalable Digital Education for All



Universidad Carlos III de Madrid

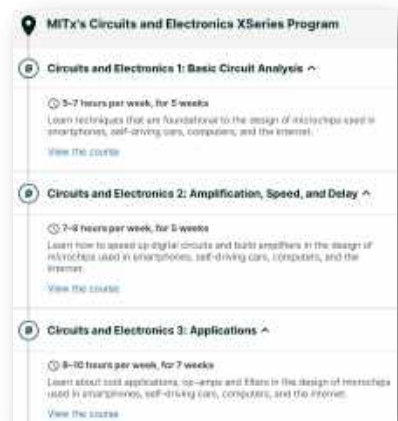


Co-funded by the European Union

## Evolution of Course Length



From semester-long (14-15 weeks)



to ~5 weeks long



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

26

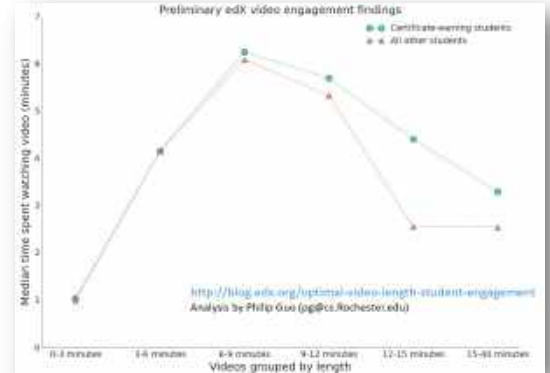


Universidad Carlos III de Madrid



# Evolution of Video Length in MOOCs

- 45-60 min (Lecture length)
- 10 min (initial Youtube max length, Khan)
- 6-7 min (edX)
- 3 min (Coursera)



# Program Length Evolution



From year-long programs

to week-long programs



Co-funded by the European Union

# Program Length Evolution



From year-long programs

to micro-credentials



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

29



Co-funded by the European Union

# What is a Microcredential?!



Most definitions of micro-credentials denote **an organised learning activity with an associated credential** – the credential recognises a skill or competency that has been acquired through an organised learning process and validated through an assessment. Consequently, the term “micro-credential” is commonly understood to refer to both **the credential** itself and **the education or training programme** which leads to the credential award.

OECD EDUCATION POLICY PERSPECTIVES © OECD 2021

[doi.org/10.1787/f14ef041-en](https://doi.org/10.1787/f14ef041-en)



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

30





Co-funded by the European Union

# What is a Microcredential?



- "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**".



MICROCASA, Penang, 2023-10-05

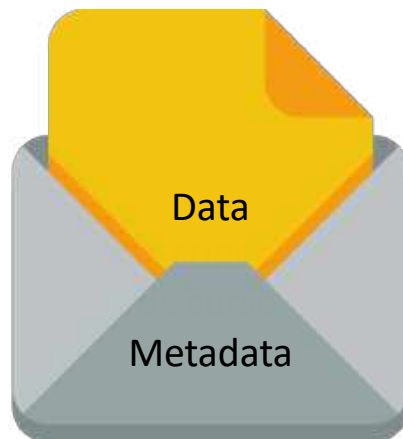
C. Delgado Kloos, UC3M

31



Co-funded by the European Union

# Content and Envelope



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

32

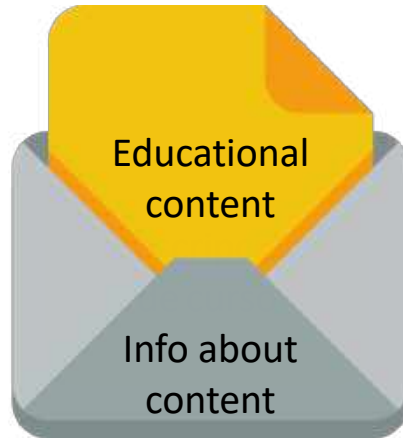






Co-funded by the European Union

# Content and Envelope



MICROCASA, Penang, 2023-10-05

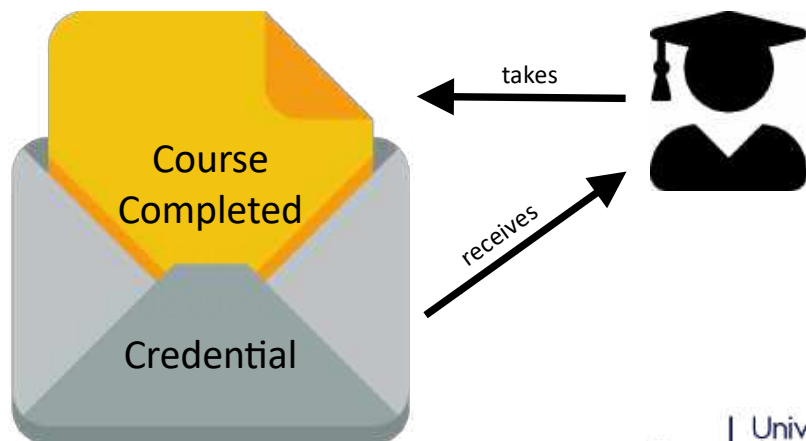
C. Delgado Kloos, UC3M

33



Co-funded by the European Union

# Content and Envelope



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

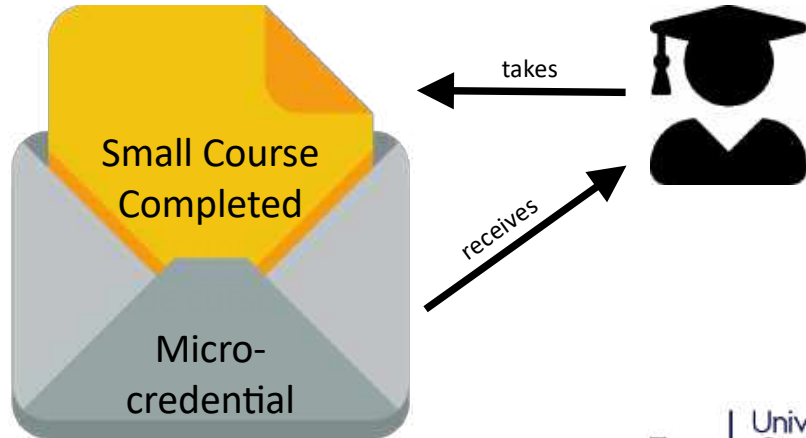
34





Co-funded by the European Union

# Content and Envelope



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

35



Co-funded by the European Union

# Reskilling/Up-skilling



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

36





Co-funded by the European Union

# Many Providers



Co-funded by the European Union

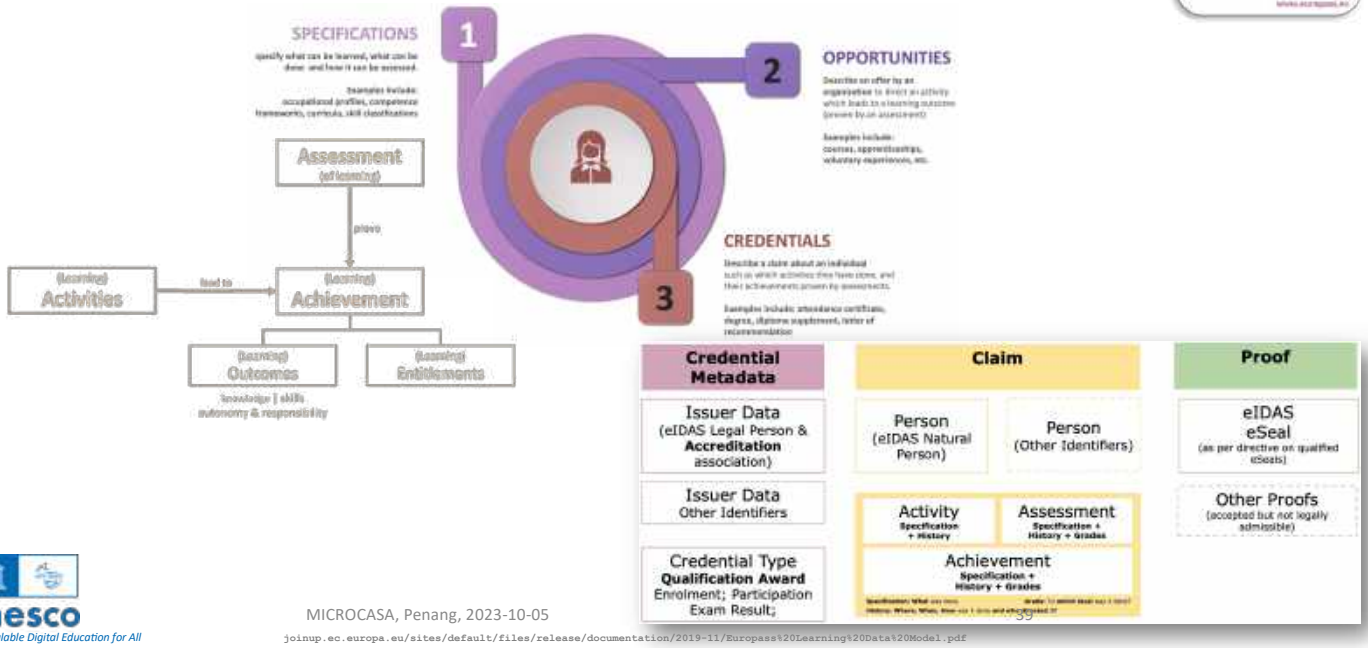
# The European Way





Co-funded by the European Union

# 1. European Digital Credentials



MICROCASA, Penang, 2023-10-05  
joinup.ec.europa.eu/sites/default/files/release/documentation/2019-11/Europass%20Learning%20Data%20Model.pdf



Co-funded by the European Union

# Example



MICROCASA, Penang, 2023-10-05 C. Delgado Kloos, UC3M



Co-funded by the European Union



## 2. European Blockchain Services Infrastructure



2018: Establishment of the *European Blockchain Partnership*



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

41



Co-funded by the European Union

## Urgent Action Required



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

42





# Alternative Education Providers



# Urgent Action Required

- Recognition that a profound change is needed for the universities to become educational institutions of reference for the whole life
  - Agile identification of educational offer
  - Adaptation of teaching formats
  - Collaboration with industry (PPP: *public-private partnerships*)
  - Internal organization (FFF: *form follows function*)
  - Incentives
  - Digital certification
  - External support





Co-funded by  
the European Union

# 2. SMARTER



Chair Scalable Digital Education for All

uc3m | Universidad  
Carlos III  
de Madrid



Co-funded by  
the European Union

## Production of Online Material

- Videos



- Quizzes



- Forums



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

46

uc3m | Universidad  
Carlos III  
de Madrid



Co-funded by  
the European Union



## Videos: Production 3.0

- Pre-production
  - Video concept
  - Script
  - Supporting resources
- Production
  - Shooting
- Post-production
  - Edition
  - Subtitles



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

47

uc3m

Universidad  
Carlos III  
de Madrid



Co-funded by  
the European Union



## Videos: Production 4.0

- Pre-production
  - Video concept
  - Script
  - Supporting resources
- Production
  - "Shooting": text2video
- Post-production
  - Edition
  - Subtitles



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

48

uc3m

Universidad  
Carlos III  
de Madrid





Co-funded by the European Union



# Video Production 3.0

## Pre-Production: Video Concept

- Video type
- Basic ideas
- Setting
- Resources needed



Always with sound	With person	With hand	Without person or hand
Writing	Person writing on blackboard	Hand writing	Writing
Images	Person with images	Writing & images	Images
Powerpoint	Person with ppt	Hand with ppt	Writing with ppt
Web page or app	Person with web page		App on screen
Experiments	Person with experiments	Hands & experim.	Animation
Other	Several persons		All



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

49



Universidad Carlos III de Madrid



Co-funded by the European Union



# Video Production 4.0

## Pre-Production: Video Concept

- Get ideas from AI



You have been producing MOOCs for many years now and are experienced in conveying complex information to learners. You are specialized in Java programming. Give me 3 possible ideas to introduce the topic of recursion in Java programming.

**Idea 1: The Story of Matryoshka Dolls**

Opening Scene: The professor holding a set of Matryoshka dolls.

Professor: "Imagine you have a set of Matryoshka dolls, those Russian nesting dolls. Each doll contains a smaller doll inside, and you can keep opening them up until you reach the smallest one. This concept is quite similar to recursion in Java programming."

**Advantages:**

- Uses a relatable real-world analogy to simplify the concept.
- Creates a visual representation of the "nested" nature of recursion.
- Helps learners understand the progressive breakdown of a problem.

**Idea 2: The Domino Effect**

Opening Scene: A line of dominoes set up on a table.

Professor: "Recursion is like setting up a line of dominoes. You push the first domino, which then knocks over the second one, and the process continues until the last domino falls. In Java, you start with a base case, and each step triggers a recursive call until you reach the final outcome."

**Advantages:**

- Uses a simple and reliable analogy to demonstrate the sequence of recursive calls.
- Helps learners visualize how one step leads to another in a cascading manner.
- Highlights the importance of base cases in stopping the recursive process.

**Idea 3: The Mirror Reflection**

Opening Scene: The professor standing between two mirrors facing each other.

Professor: "Recursion is like looking into two mirrors facing each other. Each mirror reflects an image of the other mirror, creating an infinite set of images. Similarly, in programming, a method can call itself to solve a problem, creating a chain of calls until a base case is met."

**Advantages:**

- Uses a thought-provoking visual analogy to convey the self-replicating nature of recursion.
- Draws parallels between mirror reflections and recursive calls.
- Encourages learners to consider the iterative nature of recursion and its controlled termination.

Each of these approaches has its unique strengths in introducing the concept of recursion. Depending on the audience's familiarity with programming concepts and their preferred learning style, you can choose the approach that resonates the most and effectively conveys the essence of recursion in Java programming.



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

50



Universidad Carlos III de Madrid



Co-funded by the European Union



# Video Production 3.0

## Pre-Production: Script

1. Define your Goals
2. Create an Engaging Narrative
3. Make the Best Call to Action
4. Cut, Cut, Cut
5. Think Like your Audience
6. Read it Out Loud
7. Ask for Feedback



	Visual	Audio
1	Spokesperson speaking to camera Image next to speaker: Sales graph	"This graph shows us that there was a sharp increase in sales in Q3..."
2	Spokesperson speaking to camera Image next to speaker: Pie chart	"...and this pie chart may hold the key to understanding why."
3	Spokesperson speaking to camera Text above image of pie chart: VIDEO MARKETING	"As it turns out our video marketing efforts in Q2 made a big difference."



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

51

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union



# Video Production 4.0

## Pre-Production: Script

- Generate a script with AI



You are an experienced computer science professor who has taught Java programming for over 25 years. Generate a script for a 10 minute video introducing the concept of recursion in Java. Introduce the concepts step by step.

**Title: Exploring Recursion in Java - A Comprehensive Introduction**

[Opening Scene: Professor standing in front of a whiteboard with "Recursion in Java" written on it.]

Professor: "Hello, everyone! Welcome to today's Java programming lesson. I'm Professor [Your Name], and today we're going to dive into a fascinating topic: recursion in Java."

**Scene Transition: Whiteboard with "What is Recursion?"**

Professor: "Let's start with the fundamental question: What is recursion? In programming, recursion occurs when a method calls itself to solve a problem. Think of it as a problem-solving technique that breaks down complex problems into simpler sub-problems. Each of these sub-problems is solved in a similar way until we reach a base case, which is the simplest form of the problem that can be directly solved."

**Scene Transition: Whiteboard with "Key Elements of Recursion"**

Professor: "Now, let's understand the key elements of recursion."

**Step 1: Base Case**

Professor: "Every recursive algorithm needs a base case. This is the condition that specifies when the recursion should stop. Without a base case, your program could end up in an infinite loop."

**Step 2: Recursive Case**

Professor: "The recursive case defines how the problem is broken down into smaller sub-problems. In each recursive call, the problem size should be reduced, bringing us closer to the base case."

**Scene Transition: Whiteboard with "Factorial Example"**

Professor: "To illustrate recursion, let's consider a classic example: calculating the factorial of a number."

**Step 3: Factorial Example**

Professor: "The factorial of a non-negative integer  $n$ , denoted as  $n!$ , is the product of all positive integers from 1 to  $n$ ."

**Step 4: Recursive Solution**

Professor: "To compute the factorial of  $n$  using recursion, we can define a method like this:"

```

public static int factorial(int n) {
    // Base case
    if (n == 0 || n == 1) {
        return 1;
    }
    // Recursive case
    return n * factorial(n - 1);
}

```

**Scene Transition: Whiteboard with "Recursion Stack"**

Professor: "Now, let's talk about the recursion stack."

**Step 5: Recursion Stack**

Professor: "When a method is called, a new frame is added to the stack, containing its local variables and execution context. In recursion, each recursive call adds a new frame to the stack."

**Scene Transition: Whiteboard with "Pros and Cons of Recursion"**

Professor: "Before we conclude, let's discuss the advantages and disadvantages of using recursion."

**Step 6: Pros and Cons**

Professor: "Recursion can lead to elegant and concise code, making complex problems easier to solve. However, it can also consume more memory due to the recursion stack and might be less efficient than iterative solutions for some problems."

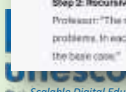
**Closing Scene: Professor in front of whiteboard**

Professor: "And that wraps up our introduction to recursion in Java. We've covered the basics, including what recursion is, its key elements, a factorial example, the recursion stack, and the pros and cons of using recursion."

Professor: "Recursion is a powerful concept in programming, and understanding it will open doors to solving various types of problems more elegantly. As you explore this topic further, remember to always define your base case, ensure your recursive calls reduce the problem size, and be mindful of potential performance concerns."

Professor: "Thank you for joining me today. If you have any questions, feel free to leave them in the comments below. Happy coding, and I'll see you in the next lesson!"

[Video fades out with the professor waving goodbye.]



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

52

uc3m

Universidad Carlos III de Madrid



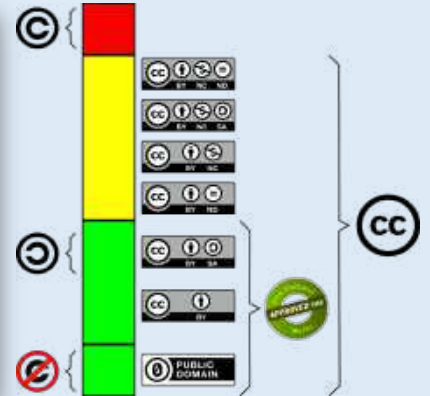
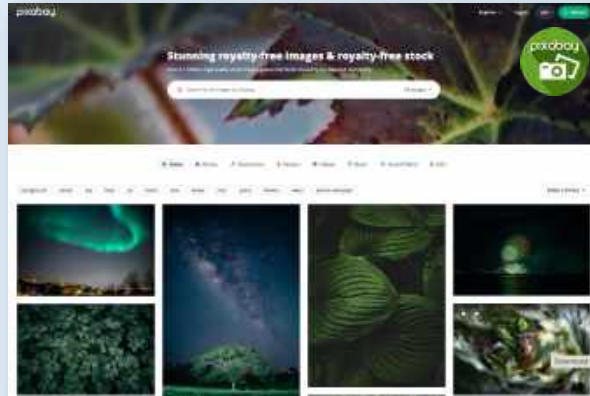
Co-funded by the European Union

# Video Production 3.0

## Pre-Production: Resources



- Search for images, sounds, ... with appropriate license



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

53



Co-funded by the European Union

# Video Production 4.0

## Pre-Production: Resources



- Generate new images with AI



bing.com/  
images/create



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

54





Co-funded by the European Union

# DALL-E 1 > 2 > 3



MICROCASA, Penang, 2023-10-05



C. Delgado Kloos, UC3M



Chair Scalable Digital Education for All

55

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union

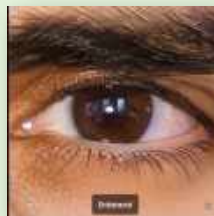
# Video Production 4.0 Pre-Production: Resources



- Improve images with AI



improve resolution



extend



DALL-E 2

extend



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

56

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union

# Video Production 4.0

## Pre-Production: Resources



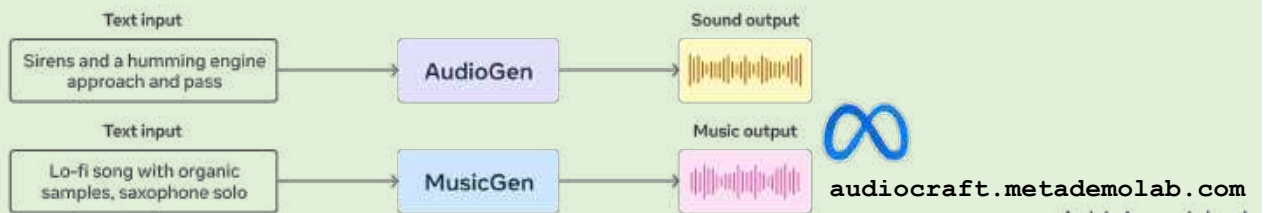
- Generate new sounds with AI

Text to audio



play.ht

elevenlabs.io



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

57

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union

# Video Production 3.0

## Production: Shooting



- Studio with personnel, microphone, green screen, tele-prompter, ...
- Equipment to screencast



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

58

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union



# Video Production 4.0 Production: Shooting Generation

- Generate video with AI



D-ID



Runway



Heygen



Invideo



Rask



Collosyan



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

59

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union



# Languages



heygen.com



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

60

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union

# Voice Cloning



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

61



Universidad Carlos III de Madrid



Co-funded by the European Union

# Lip Sync



[mygoodtrust.com/singing-portraits](https://mygoodtrust.com/singing-portraits)



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

62



Universidad Carlos III de Madrid



Co-funded by the European Union



# Generation of Avatars



Synthesia Avatars



HeyGEN Avatar 2.0

[youtu.be/auPW\\_84ZyRY](https://youtu.be/auPW_84ZyRY)



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

63



Universidad Carlos III de Madrid



Co-funded by the European Union



# Dubbing with Lip Sync



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

64



Universidad Carlos III de Madrid





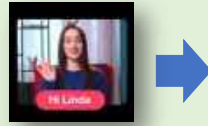
Co-funded by  
the European Union

GAN.ai



# Deep Personalization

- gan.ai
- Personalized videos
  - from one video
  - get many personalized by name, location, etc. with voice and lip sync



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

65

uc3m

Universidad  
Carlos III  
de Madrid



Co-funded by  
the European Union

# Video Production 3.0 Post-Production: Edition



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

66

uc3m

Universidad  
Carlos III  
de Madrid



Co-funded by the European Union

# Video Production 4.0 Post-Production: Edition



- Edit, if necessary, with the video generating tool



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

67



Universidad Carlos III de Madrid



Co-funded by the European Union

# Video Production 3.0 Post-Production: Subtitles



- Convert from script
- Generate (semi-)manually



Administrar Recursos

Uso de disco global

Disco Local	Usado (%)	Disponible	Reservado	Reservado (%)
Disco Local	1,43 TB	74,27 TB	5,51 TB	76,7%

Espacio de Snapper

Grupo	Reservado	Usado
Autosistemas	4,09 TB	3,14 TB
Area de los datos	626,94 GB	23,96 GB
SV-Asistencia	74,86 GB	197,23 GB
Monitoria	326,89 GB	5,10 GB
Reportes de Seguridad	674,86 GB	694,8
Trabajo de Localiza	14,91 GB	700,84 MB
SV - Comunicacion	326,89 GB	174,23 GB
OTRO	626,94 GB	2,84 B
Total	4,17 TB	3,24 TB



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

68



Universidad Carlos III de Madrid



Co-funded by the European Union



# Video Production 4.0 Post-Production: Subtitles

- Get the transcription from an AI-based tool



## Merlin

## Rio

AI in education can be positive, with personal AI tutors and teaching assistants. It can improve student performance significantly.

- AI could be the biggest positive transformation in education. [00:04]
- Khanmigo AI tutors students in math and coding exercises, identifying mistakes and misconceptions. [01:15]
- Khanmigo can act as a super tutor and provide guidance counseling to every student. [01:15]
- Students can talk to historical figures through AI-powered conversation. [02:04]
- Khanmigo uses generative AI to enhance reading comprehension and writing skills. [03:31]
- AI-powered writing coach and teacher's guide on steroids. [03:31]
- GPT-4's ability in math and tutoring improved dramatically by allowing AI to think before speaking. [11:47]
- Active participation is key in shaping the future of AI. [13:18]

The video transcript is about using AI in education to improve learning outcomes. Here are some key points

- [00:05] There are concerns that students will use AI to cheat and not learn, which will undermine education
- [00:25] AI can be used positively to transform education by providing every student with a personal tutor
- [01:17] The 2 sigma problem shows that 1-to-1 tutoring can improve student performance by two standard deviations
- [01:51] Scaling 1-to-1 tutoring is an economic challenge that AI can help overcome.
- [02:14] Khan Academy's AI, called Khanmigo, can provide personalized tutoring and support in subjects like math and coding
- [02:36] Khanmigo's safeguards prevent cheating by recording conversations and involving teachers in the process
- [03:11] Khanmigo can detect and correct misconceptions and provide explanations to help students understand
- [03:48] Khanmigo can provide personalized feedback and support in computer programming even when students are stuck
- [04:25] AI can be a super tutor and improve learning outcomes for all students. In the video, Sal Khan talks about using AI to ask students questions about a passage and highlight parts of it to help them understand it better
- Allowing students to ask for feedback on their writing and highlighting parts of the passage that don't support the main idea
- Using AI to make personalized education and save time for both teachers and students [10:38].
- Enabling teachers to create lesson plans, prepare materials, and grade students using AI [10:59].
- Discussing the power of large language models and how they can be made more magical by making them think before speaking [11:48-13:18].



Chair Scalable Digital Education for All

MICROCASA, Penang.

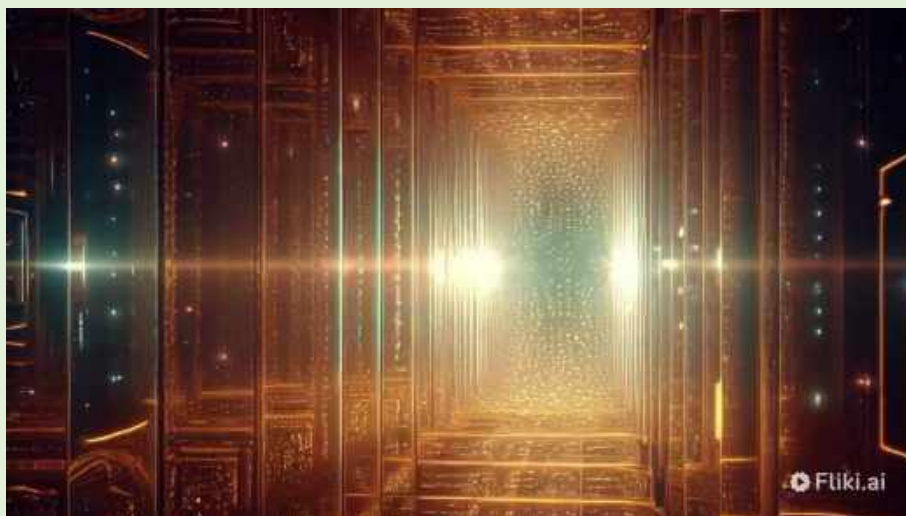
Universidad Carlos III de Madrid



Co-funded by the European Union



# Videos: Example



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

70

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union

# Production

- Videos
- Quizzes
- Forums



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

71



Universidad Carlos III de Madrid



Co-funded by the European Union

# Quizzes 3.0



Different kinds of variables (non graded activity)  
1/1/0 points (ungraded)

Attributes or variables that have the same value for all object in the class are called:

- attributes or variables, just that
- class attributes or class variables
- private attributes or private variables
- shared attributes or shared variables

The business processes developed for John Doe, a entrepreneur, are:

```

graph LR
    A[Contacting customers] --> B[Consulting activities]
    B --> C[Invoicing]
  
```

The entrepreneur is considering installing an ERP. Which of the following statements are correct?  
(SELECT all items that apply)

Question  
1/0/0 points (graded)

- If an ERP is installed, each module might use a different DBMS.
- The "Consulting activities" business process might encompass several ERP.
- A consulting project could go through all three business processes.
- Even only three business processes are involved, an ERP could not be installed.

Math Expression input  
1/1 points (ungraded)

Write an expression for the product of  $R_1$ ,  $R_2$ , and the inverse of  $R_3$ .  
You can add an optional tip or note related to the prompt. We'll use, for example, the correct answer is  $R_1 \cdot R_2 \cdot R_3^{-1}$ .

Correct (1/1 point)

$x=2;$   
 $y=x+1;$   
 $x=x+y;$

Enter the final value of  $x$ :



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

72



Universidad Carlos III de Madrid



Co-funded by the European Union

# Quizzes 4.0



## • Generate quiz questions

- with general purpose AIs, like ChatGPT or Bard



- with AI-based applications specialized on the task, like PrepAI or Quillionz



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

73




Universidad Carlos III de Madrid



Co-funded by the European Union

# Quizzes 4.0



 You are an experienced professor of Java Programming. Create a quiz with 4 multiple-choice questions, each with 4 responses, of which one shall be the correct one. The topic is recursion in Java. Be creative.

**Recursion in Java Quiz**

Question 1: What is recursion in Java programming?

A) A technique to optimize loops.  
 B) A method that always returns the same value.  
 C) A programming concept where a method calls itself to solve a problem.  
 D) A way to create random numbers in Java.

**Correct Answer: C) A programming concept where a method calls itself to solve a problem.**

Question 3: What is a "base case" in recursive algorithms?

A) The first case in a switch statement.  
 B) A case where the program exits without any output.  
 C) The condition that specifies when recursion should stop.  
 D) A case where the program enters an infinite loop.

**Correct Answer: C) The condition that specifies when recursion should stop.**

Question 2: Which of the following is NOT a key element of recursion?

A) Base Case  
 B) Recursive Case  
 C) Looping Statement  
 D) Reduction of Problem Size

**Correct Answer: C) Looping Statement**

Question 4: Which real-world analogy can help understand recursion better?

A) Baking a cake.  
 B) Solving a Rubik's Cube.  
 C) Setting up dominoes.  
 D) Building a skyscraper.

**Correct Answer: C) Setting up dominoes.**



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

74



Universidad Carlos III de Madrid



Co-funded by the European Union

# Quizzes 4.0



You are an experienced professor of Java Programming. Create a quiz with 4 multiple-choice questions, each with 4 responses, of which one shall be the correct one. The topic is recursion in Java. Be creative.



Sure, here are 4 multiple-choice questions on recursion in Java:

1. Which of the following is a correct recursive definition of the factorial function?

- A. `factorial(n) = n!`
- B. `factorial(n) = n * factorial(n - 1)`
- C. `factorial(n) = n * (n - 1)`
- D. `factorial(n) = n * (n - 1) * (n - 2)`

The correct answer is (B). The factorial function is defined as the product of all positive integers less than or equal to a number. The recursive definition of the factorial function uses the fact that the factorial of a number is equal to the number and the factorial of the number minus 1.

2. Which of the following is a recursive function in Java?

- A. `public int factorial(int n) { if (n <= 0) { return 1; } else { return n * factorial(n - 1); }`
- B. `public int factorial(int n) { return n; }`
- C. `public int factorial(int n) { if (n <= 0) { throw new IllegalArgumentException("must be non-negative"); } else { return n * factorial(n - 1); }`
- D. `public int factorial(int n) { if (n <= 0) { return 0; } else { return n; }`

The correct answer is (A). The function `factorial(n)` in this code is recursive because it calls itself to calculate the factorial of a smaller number.

3. Which of the following statements is true about recursion?

- A. Recursion is a process of defining something in terms of itself.
- B. Recursion can be used to solve problems that are difficult or impossible to solve iteratively.
- C. Recursion can lead to infinite loops if it is not used carefully.
- D. All of the above

The correct answer is (D). Recursion is a process of defining something in terms of itself. It can be used to solve problems that are difficult or impossible to solve iteratively. However, recursion can also lead to infinite loops if it is not used carefully.

4. Which of the following is a way to break an infinite recursion?

- A. Use a base case.
- B. Use a condition to stop the recursion.
- C. Use a loop to prevent the recursion from calling itself.
- D. All of the above

The correct answer is (D). An infinite recursion can be broken by using a base case, a condition to stop the recursion, or a loop to prevent the recursion from calling itself.

I hope these questions are creative and challenging. Let me know if you have any other questions.



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

75



Universidad Carlos III de Madrid



Co-funded by the European Union

# PrepAI

• [prepai.io](https://prepai.io)

PrepAI



## Process of Using PrepAI



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

76



Universidad Carlos III de Madrid



Co-funded by the European Union

# Quillionz

Quillionz?



- [quillionz.com](https://quillionz.com)

**Using Quillionz is as easy as this.**

- 1 Submit Content**  
Copy your content into Quillionz.
- 2 Choose Keywords**  
Tell Quillionz which keywords are important for question creation.
- 3 Review Content**  
Review and edit your content to get it ready for the Quillionz AI engine.
- 4 Get Question Ideas**  
Get quality question ideas within seconds, and tweak them as you wish.



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

77

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union

# Quizlet



- [quizlet.com](https://quizlet.com)

**Q-Chat**

Hey there! Quizlet is now using the power of AI to help you study more effectively. Let's get started!

Looks like you're studying **Geology** basics. Please select an activity.

Quiz me
  Teach me
  Apply my knowledge

**Q-Chat** Physics III

Hey there! Quizlet is now using the power of AI to help you study more effectively. What would you like to do?

Quiz me
  Deepen my understanding
  Tell me a fun fact

**Deepen my understanding**

How can understanding the concept of friction be useful in designing efficient machines?

**Friction reduces the efficiency of machines.**

That's correct! Friction can cause energy loss in machines, making them less efficient. Can you give an example of a real-life machine where reducing friction is important for increasing efficiency?



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

78

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union

# Production

• Videos



• Quizzes



• Forums



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

79

uc3m

Universidad Carlos III de Madrid

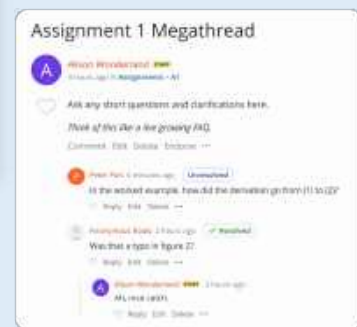


Co-funded by the European Union

# Forums 3.0



edx.org



edstem.org



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

80

uc3m

Universidad Carlos III de Madrid





Co-funded by  
the European Union

## Forums 4.0



edstem.org



David Malan  
Harvard U



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

81

uc3m

Universidad  
Carlos III  
de Madrid



Co-funded by  
the European Union

## Forums 4.0



- CS50: The AI can
  - explain highlighted lines of code
  - improve the code
  - explain arcane error messages (to be read by advanced programmers)
  - help students find bugs in their code via rhetorical questions of the kind that a human might pose (“you might want to take a look at lines 11 and 12”)
  - assess the design of student programs
  - provide feedback
  - help measure student understanding by administering oral exams, which can be then evaluated by the course staff reviewing transcripts of the interaction



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

82

uc3m

Universidad  
Carlos III  
de Madrid



Co-funded by the European Union



# Code Explanation

Explicame el siguiente código en Java

```
public static int factorial(int n) {
    if (n == 0) return 1;
    else return n * factorial(n - 1);
}
```

El código que has compartido es una versión más compacta y simplificada de la implementación recursiva de la función factorial en Java. La función "factorial" toma un número entero "n" como argumento y devuelve el factorial de ese número.

Aquí está el desglose del código:

```
public static int factorial(int n) {
    if (n == 0) {
        return 1;
    } else {
        return n * factorial(n - 1);
    }
}
```

En este caso, el código utiliza una estructura de control "if-else" para verificar si el caso base se cumple o no.

1. Caso base:  
El caso base es la condición que detiene la recursión. En este caso, el caso base es cuando "n" es igual a 0. Si esta condición se cumple, se devuelve el valor 1, ya que el factorial de 0 es 1. Esto evita que la recursión continúe y proporciona un punto de salida para la función.

2. Caso recursivo:  
Si el caso base no se cumple, es decir, "n" es diferente de 0, el programa ejecuta la línea siguiente:

```
return n * factorial(n - 1);
```

En esta línea, se realiza una llamada recursiva al método "factorial" con el argumento "n - 1". Esto significa que se está calculando el factorial de un número más pequeño y se multiplica por "n" para obtener el factorial total. Este proceso se repite hasta que se alcanza el caso base.

La estructura "if-else" en una línea permite una implementación más compacta y legible para el cálculo del factorial recursivo.

Al igual que en la explicación anterior, cuando se llama a "factorial(5)", usando este código, se realizarán llamadas recursivas de la siguiente manera:

- "factorial(5)" llama a "factorial(4)".
- "factorial(4)" llama a "factorial(3)".
- "factorial(3)" llama a "factorial(2)".
- "factorial(2)" llama a "factorial(1)".
- "factorial(1)" llama a "factorial(0)".

Finalmente, "factorial(0)" se evalúa y devuelve el valor 1. A medida que las llamadas recursivas se desdraman, los resultados parciales se multiplican para obtener el resultado final del factorial.

Espero que esta explicación te ayude a comprender cómo funciona este código. Si tienes más preguntas, no dudes en hacerlas.



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

83



Universidad Carlos III de Madrid



Co-funded by the European Union



# Debugging

Buscamos los errores en el siguiente método:

```
public static int factorial(int n) {
    return n * factorial(n - 1);
}
```

El código que has compartido tiene un error que puede causar un error de tiempo de ejecución y un posible desbordamiento de pila (stack overflow).

Aquí está el problema en el código:

```
public static int factorial(int n) {
    return n * factorial(n - 1);
}
```

El error se produce cuando la función "factorial" se llama con un valor de "n" que es menor o igual a 0. En ese caso, la recursión nunca alcanza el caso base y se producen llamadas recursivas infinitas, lo que eventualmente llevará a un desbordamiento de pila.

Para solucionar este problema, necesitas agregar una condición para manejar el caso base, es decir, cuando "n" es menor o igual a 0. Además, es importante verificar si "n" es igual a 0 antes de realizar la multiplicación. Aquí tienes la corrección del código:

```
public static int factorial(int n) {
    if (n <= 0) {
        return 1;
    } else {
        return n * factorial(n - 1);
    }
}
```

En esta corrección, se agrega la condición "if (n <= 0)" para manejar los casos en los que "n" es menor o igual a 0. Si se cumple esta condición, el método devuelve 1 como caso base. Esto detendrá la recursión y evitará el desbordamiento de pila.

Recuerda que al utilizar la recursión, siempre debes tener un caso base y asegurarte de que cada llamada recursiva se acerque al caso base. Además, debes tener en cuenta las condiciones límite y manejarlas adecuadamente en tu implementación.



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

84



Universidad Carlos III de Madrid



Co-funded by the European Union

# Explanation of Diagrams



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

85

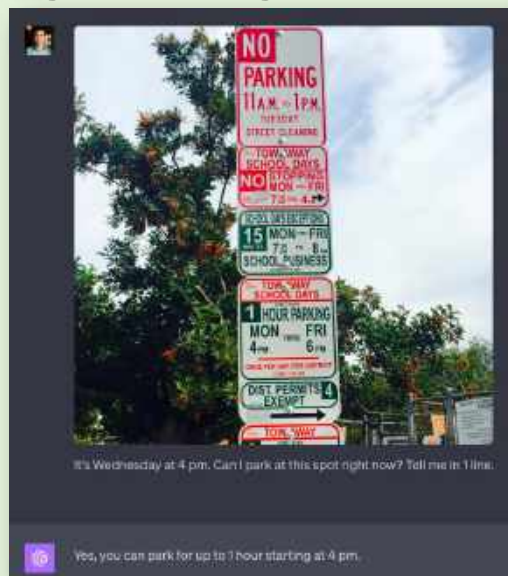


Universidad Carlos III de Madrid



Co-funded by the European Union

# Understanding of Images



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

86



Universidad Carlos III de Madrid



Co-funded by  
the European Union

# Evolution

From personal interaction



to online forums



to mixed human-bot forums



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

87

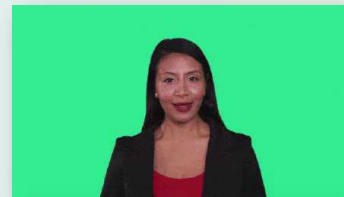
uc3m

Universidad  
Carlos III  
de Madrid



Co-funded by  
the European Union

# Production: Digital (3.0) vs AI Era (4.0)



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

88

uc3m

Universidad  
Carlos III  
de Madrid



Co-funded by the European Union

# Production: Digital (3.0) vs AI Era (4.0)



Chair Scalable Digital Education for All

- The appearance of new possibilities does not mean replacement, but additional options available.
- The field is advancing very fast. Be prepared to see improvements.
- You have to be in control, beware of hallucinations and nuances. Always be critical!



89

uc3m

Universidad Carlos III de Madrid

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

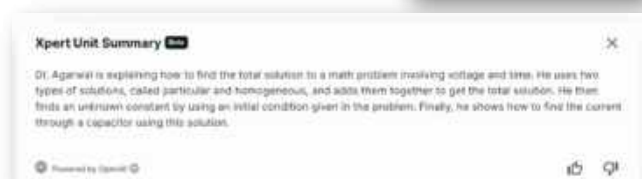
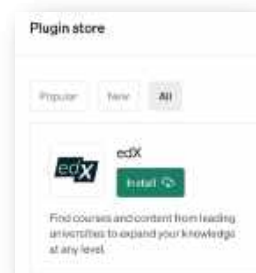


Co-funded by the European Union

# Platforms are Evolving: 2U/edX



- **Content discovery**
  - ChatGPT plugin for edX course discovery
  - Viral sharing
- **Learner experience**
  - Unit summary
  - Translations
  - Learner help center
  - Career coach
  - Learning assistant
- **Teacher experience**
  - Copilot for authors and instructors



Chair Scalable Digital Education for All

[press.edx.org/edx-debuts-two-ai-powered-learning-assistants-built-on-chatgpt](https://press.edx.org/edx-debuts-two-ai-powered-learning-assistants-built-on-chatgpt)

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

90

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union



# Platforms are Evolving: Coursera

- **In-course search:** Search in videos, readings, and other resources
- **Subtitle translations:** Machine-generated translations
- **Accessibility support:** Support for screen readers, keyboard navigation, etc.
- **Real-time personalization:** Personalized recommendations for courses
- **Personalized learner digest:** Weekly email digest (based on reinforcement learning) for self-reflection, goal-setting, and planning for the week ahead
- **Forum recommendations:** Driven by AI models, relevant forum thread recommendations will be visible on programming assignments

[blog.coursera.org/announcing-new-products-tools-and-features-to-support-learners-educators-and-institutions-with-their-rapidly-evolving-teaching-and-learning-needs](https://blog.coursera.org/announcing-new-products-tools-and-features-to-support-learners-educators-and-institutions-with-their-rapidly-evolving-teaching-and-learning-needs)



MICROCASA, Penang, 2023-10-05

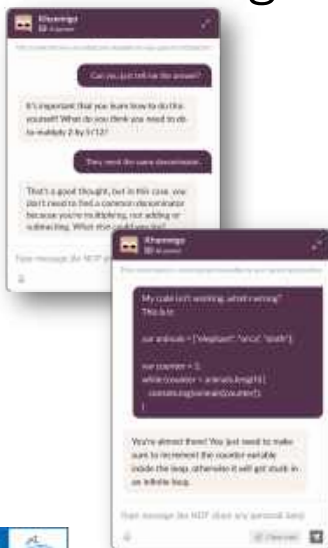
C. Delgado Kloos, UC3M

91



Co-funded by the European Union

# Platforms are Evolving: Khanmigo by Khan Academy



Tutoring for all  
Empowering educators  
Unlocking creativity  
Reimagining computer science



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

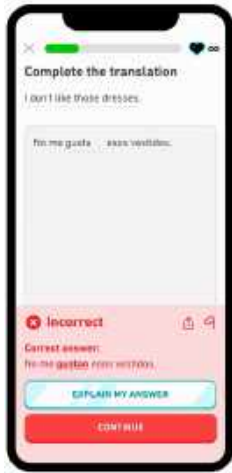
92





Co-funded by the European Union

# Platforms are Evolving: Max by Duolingo



Explain my answer



Roleplay



C. Delgado Kloos, UC3M

93

uc3m | Universidad Carlos III de Madrid



MICROCASA, Penang, 2023-10-05



Co-funded by the European Union

# New Platforms Coming Out

- Automatic course creation from a video or blog
- Video transcription
- Flashcards
- Quizzes
- Games



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

94

uc3m | Universidad Carlos III de Madrid

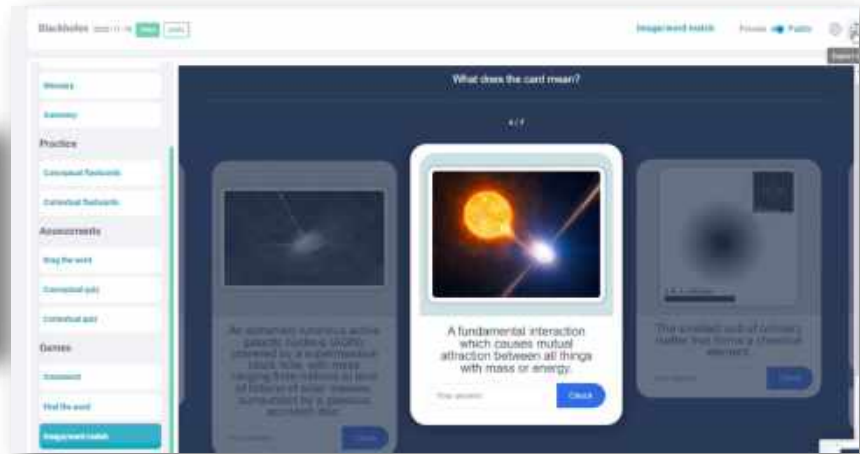


Co-funded by the European Union

# Nolej



• [nolej.io](https://nolej.io)



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

95



Co-funded by the European Union

# Nolej



- Packages
  - Interactive video
  - Interactive book
- Assessments
  - Flashcards
  - Quizzes
- Games
  - Crosswords
  - Drag the word
- Wrapping up
  - Summaries
  - Glossaries



MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

96







Co-funded by the European Union

# Final Remarks



Chair Scalable Digital Education for All

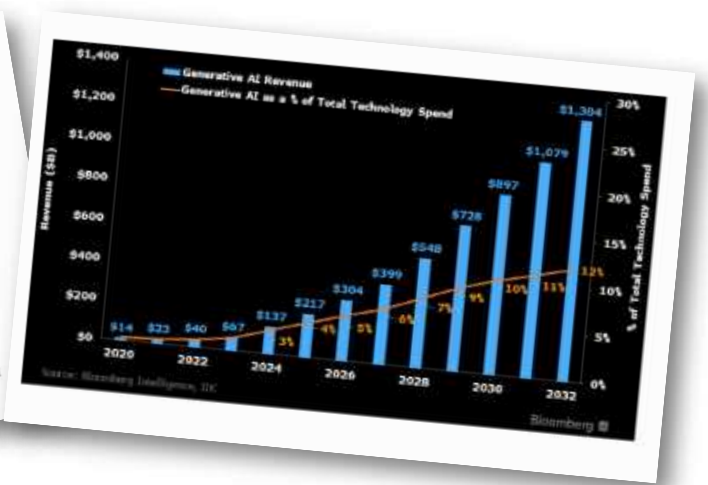
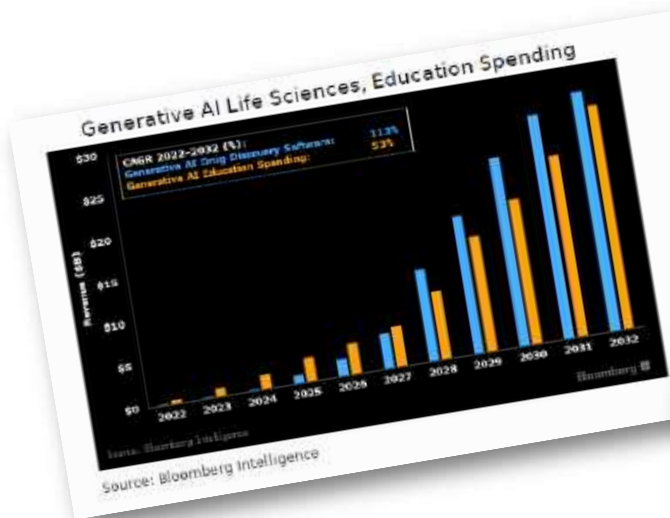


Universidad Carlos III de Madrid



Co-funded by the European Union

## Huge Investment Expected



Chair Scalable Digital Education for All



Universidad Carlos III de Madrid



Co-funded by the European Union

# Still Many Open Issues

- Intellectual property
- Quality of results
- Biases
- Impact
- Regulation needed



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

99

uc3m

Universidad Carlos III de Madrid



Co-funded by the European Union

# Technological Advance and Dependency



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

100

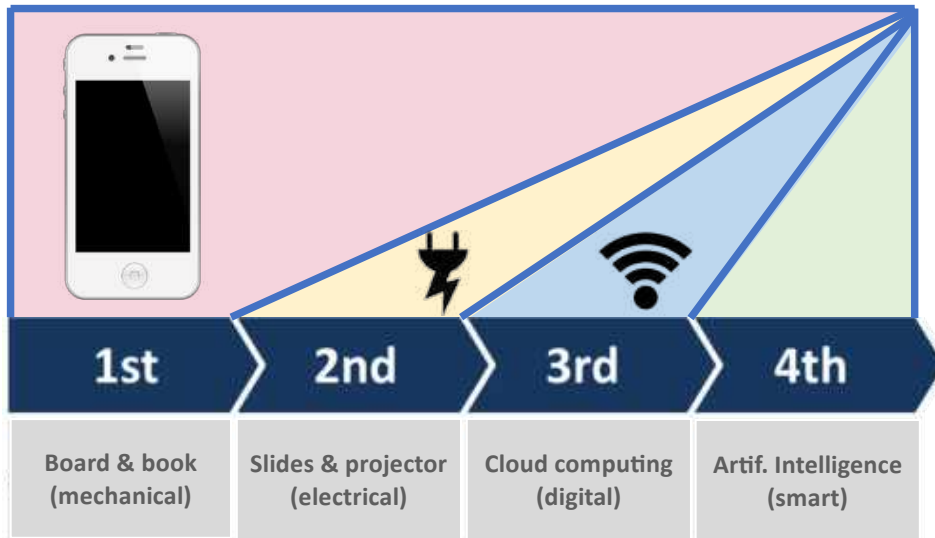
uc3m

Universidad Carlos III de Madrid



Co-funded by  
the European Union

## What You Need Today



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

101

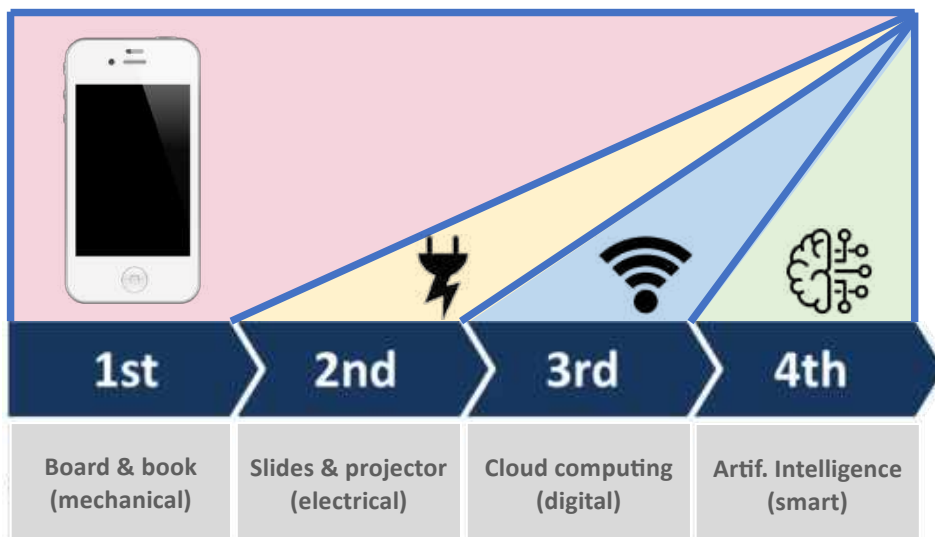
uc3m

Universidad  
Carlos III  
de Madrid



Co-funded by  
the European Union

## What You Need Tomorrow



Chair Scalable Digital Education for All

MICROCASA, Penang, 2023-10-05

C. Delgado Kloos, UC3M

102

uc3m

Universidad  
Carlos III  
de Madrid



Co-funded by  
the European Union

# Be in Control!

- AI may help you extraordinarily!
- But it might also hallucinate!
- So, always be in control!



Thank you!

Terima Kasih

