

AI-Assisted Micro-Course Development

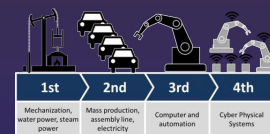
Carlos Delgado Kloos
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 @cdk100s



Outline

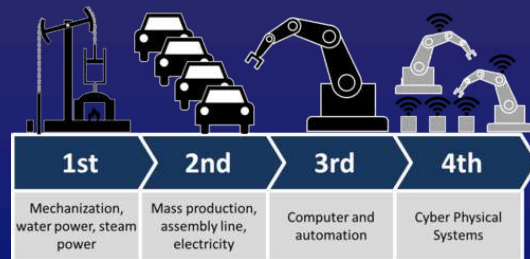
- 1. Context: Industry 4.0, Education 4.0
- 2. Microcourse production
- 3. Concluding remarks





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1. Industry 4.0, Education 4.0

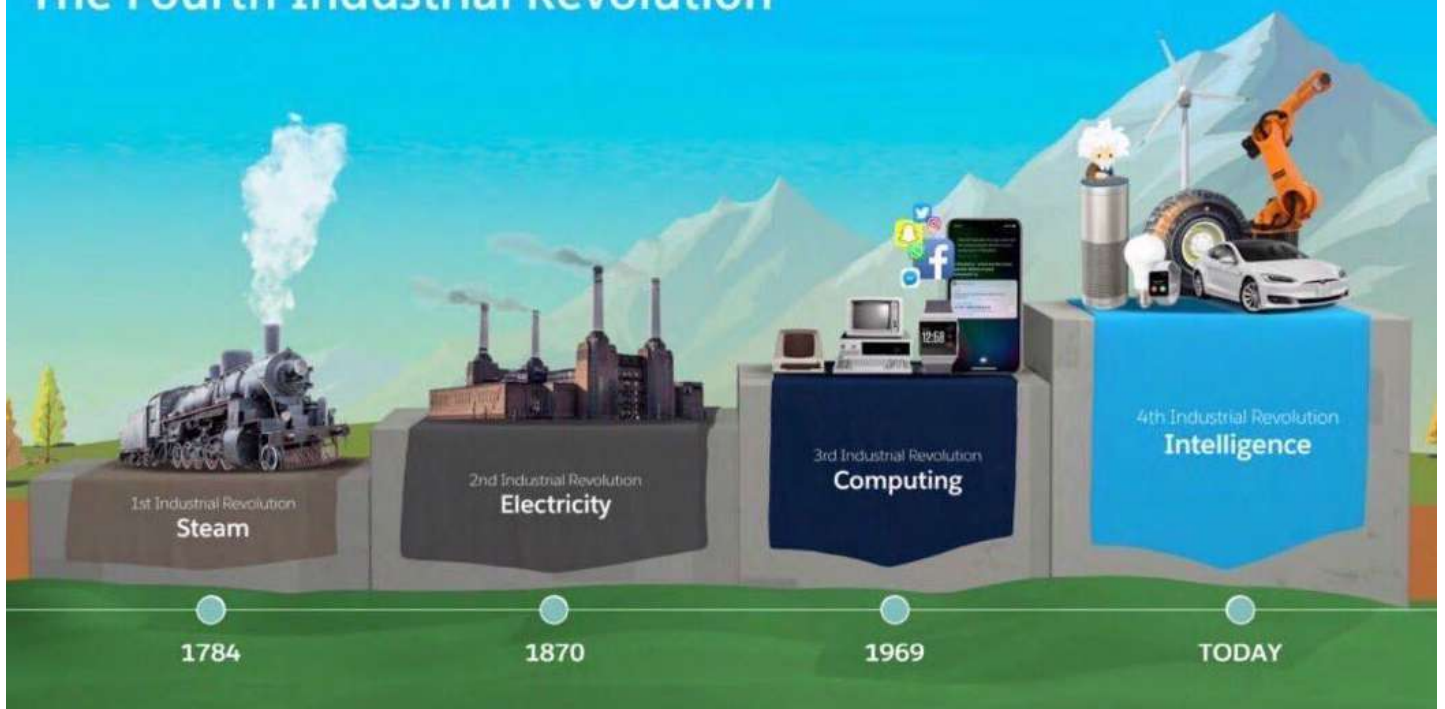


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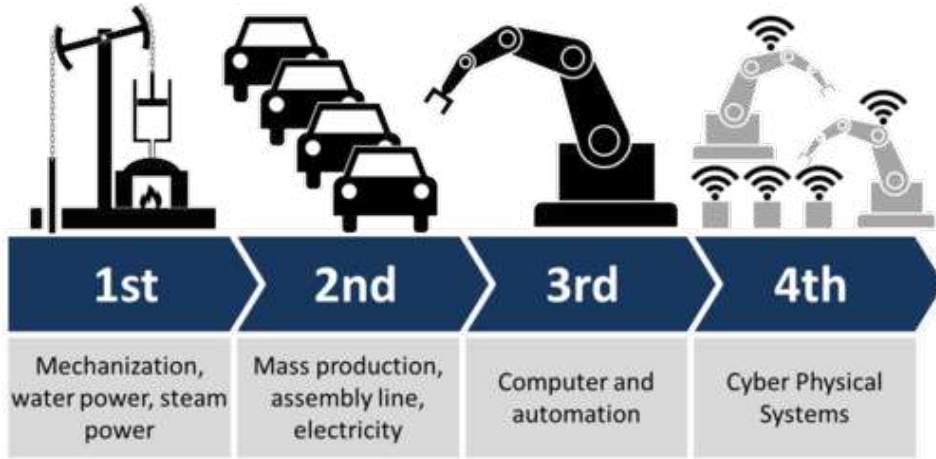
The Fourth Industrial Revolution





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Industry 1.0-4.0



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Education 0.0



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Education 1.0



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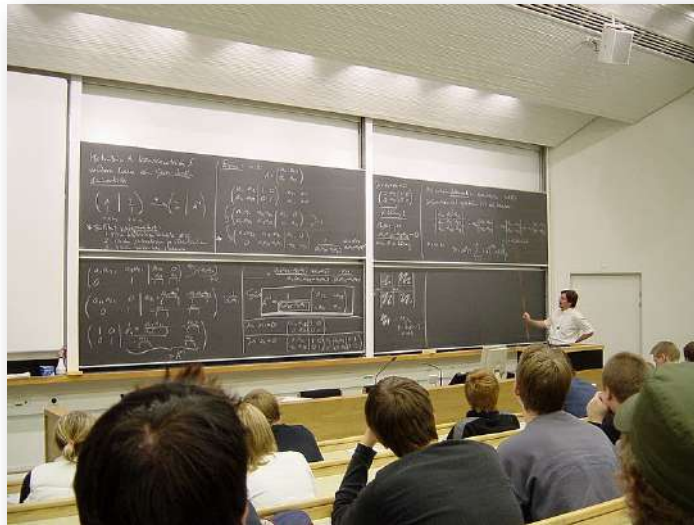
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Education 1.0



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Education 1.0



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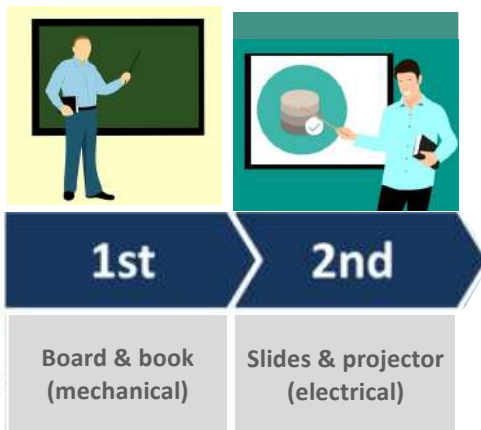
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Education 2.0



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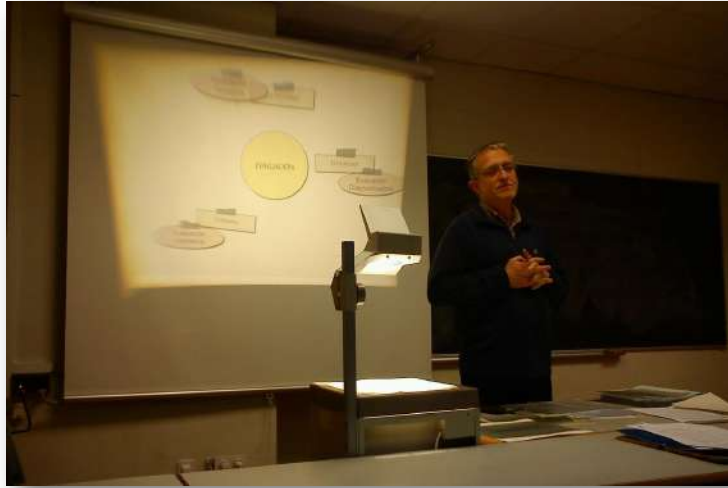
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Education 2.0



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Education 2.0



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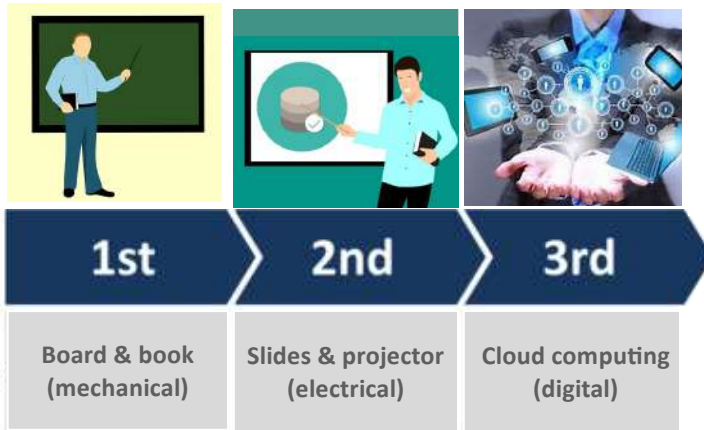
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Education 3.0



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Education 3.0: Learning Management Systems



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Education 3.0: Engagement Apps



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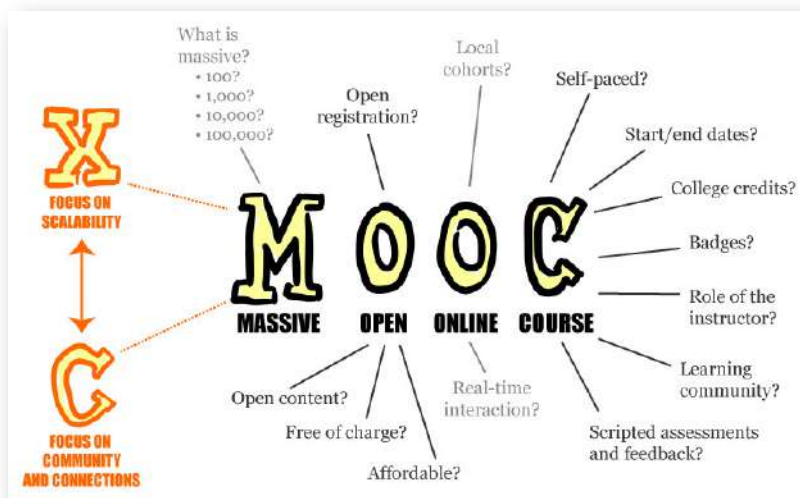
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Education 3.0: MOOCs



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Video production and distribution



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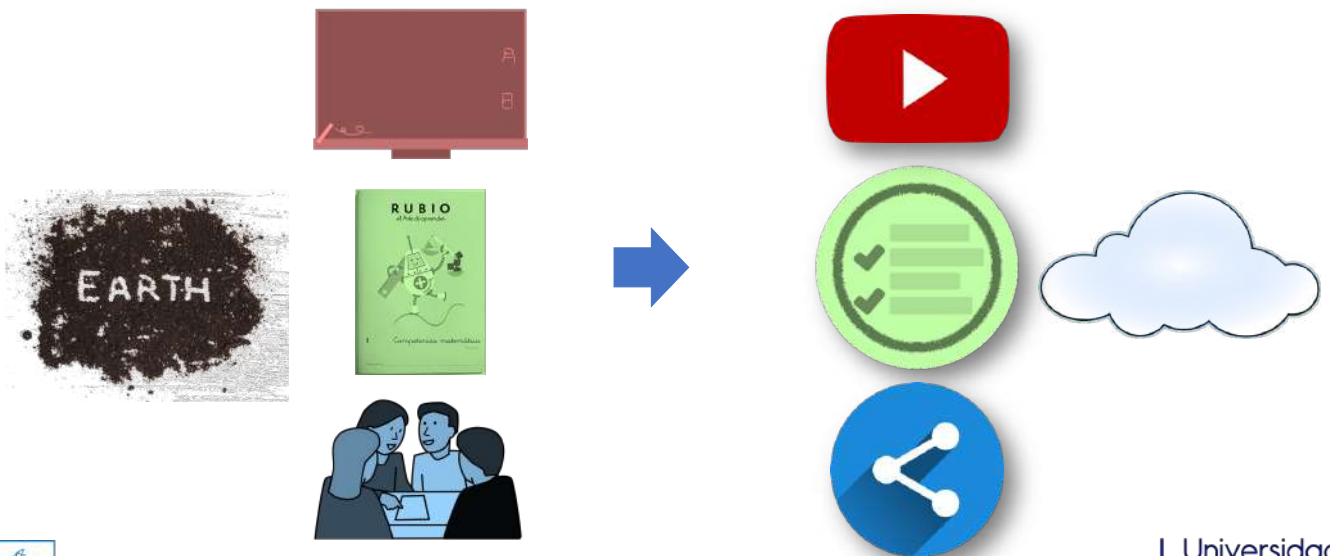
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Education 1.0 to 3.0



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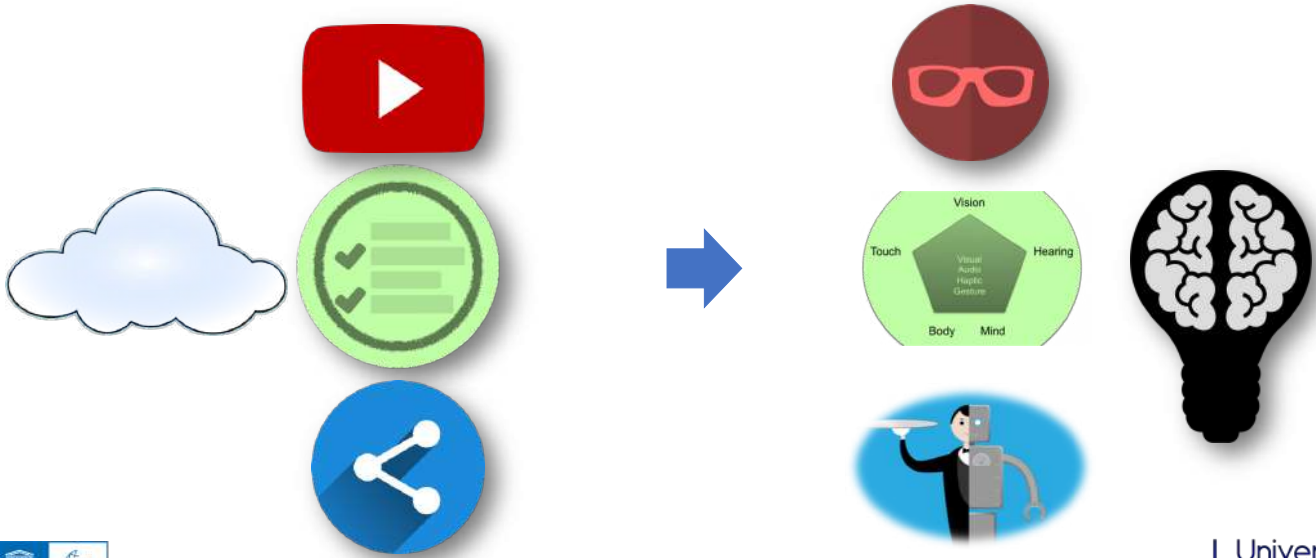
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Education 3.0 to 4.0



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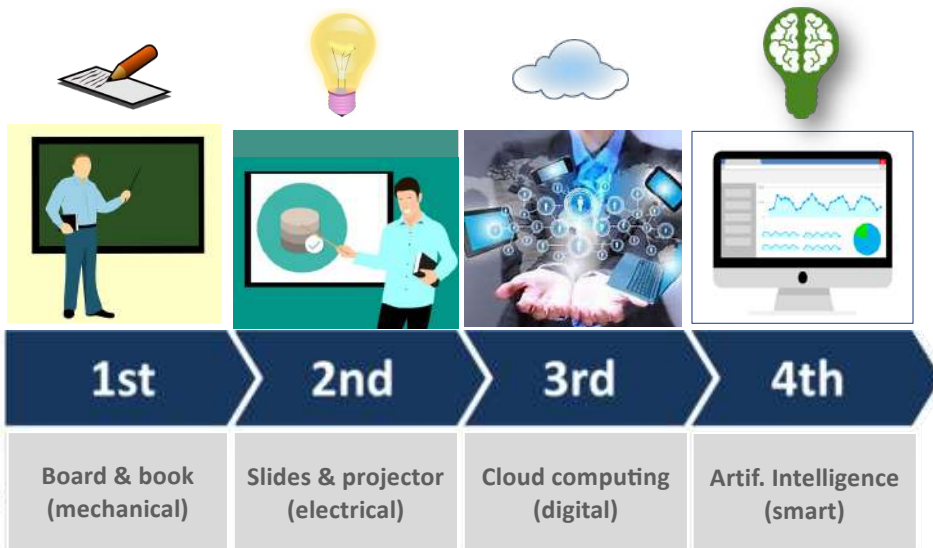
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Education 1.0-4.0



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2. Microcourse Production



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Production of Online Material

- Videos



- Quizzes



- Forums



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Videos: Production 3.0

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



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



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



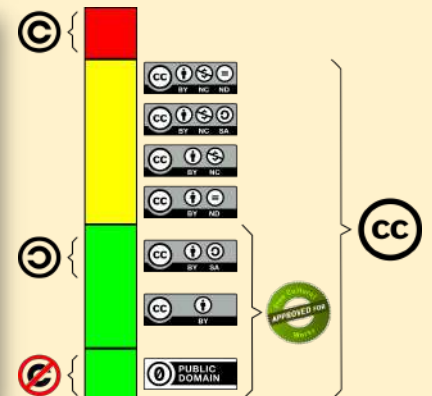
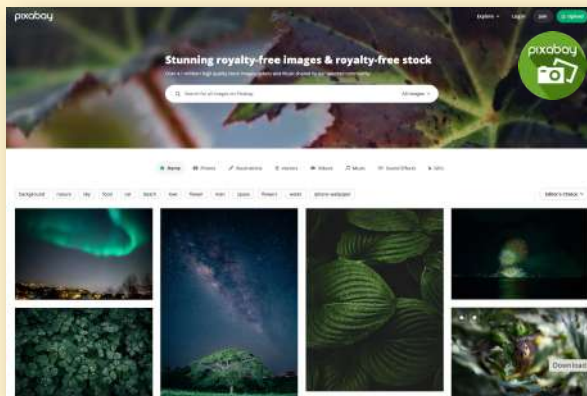
	Visual	Audio
1	Spokesperson speaking to camera Image next to speaker: Sales graph	"This graph shows us that there was a sharp increase in sales in Q3..."
2	Spokesperson speaking to camera Image next to speaker: Pie chart	"...and this pie chart may hold the key to understanding why."
3	Spokesperson speaking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



Video Production 3.0

Pre-Production: Resources

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





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Video Production 3.0

Production: Shooting

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



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Video Production 3.0

Post-Production: Edition



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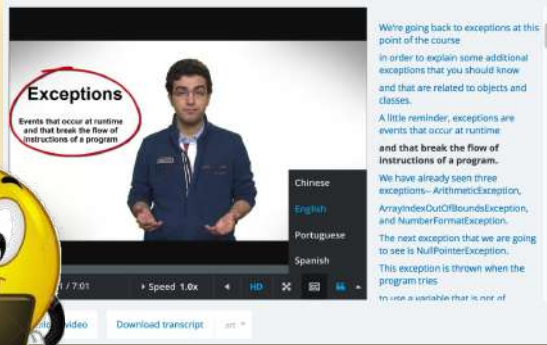


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Video Production 3.0 Post-Production: Subtitles



- Convert from script
- Generate (semi-)manually

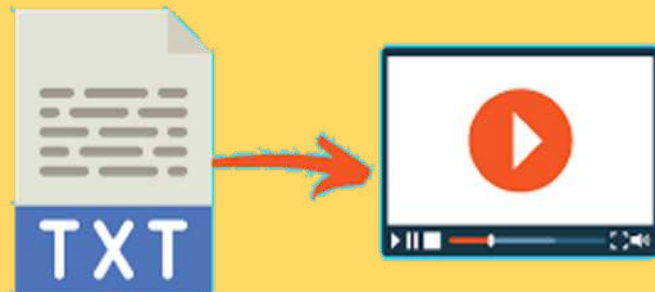


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Videos: Production 4.0



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





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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.

Certainly! Introducing the topic of recursion in Java programming requires engaging and effective approaches to help learners grasp the concept. Here are three possible ideas:

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 dominos set up on a table.

Professor: "Recursion is like setting up a line of dominos. You push the first domino, which then knocks down 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 relatable 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 infinite 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.



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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.]

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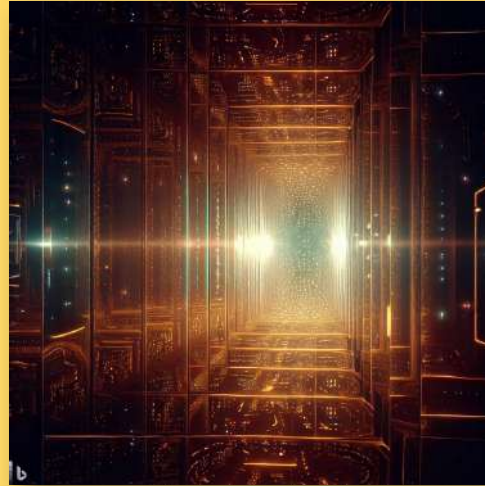


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Video Production 4.0 Pre-Production: Resources



- Generate new images with AI



bing.com/
images/create



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DALL-E 1 > 2 > 3



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Video Production 4.0 Pre-Production: Resources



- Improve images with AI



DALL-E 2 extend



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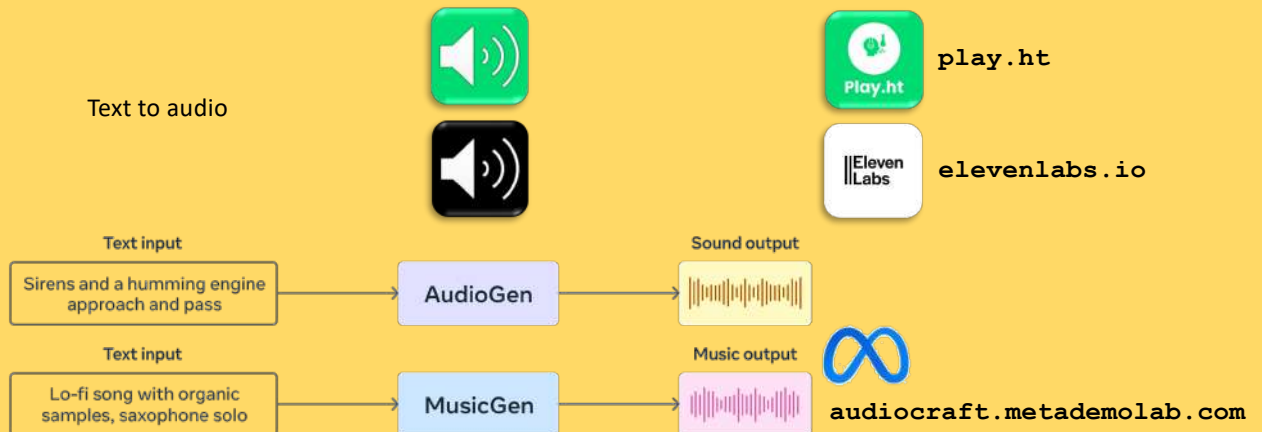


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Video Production 4.0 Pre-Production: Resources



- Generate new sounds with AI



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Video Production 4.0 Production: Shooting Generation

- Generate video with AI



d-id



Runway



Heygen



Invideo



Rask



Collosyan



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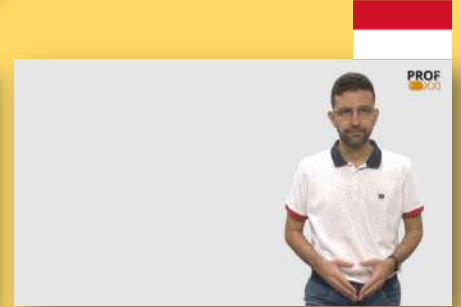
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Dubbing



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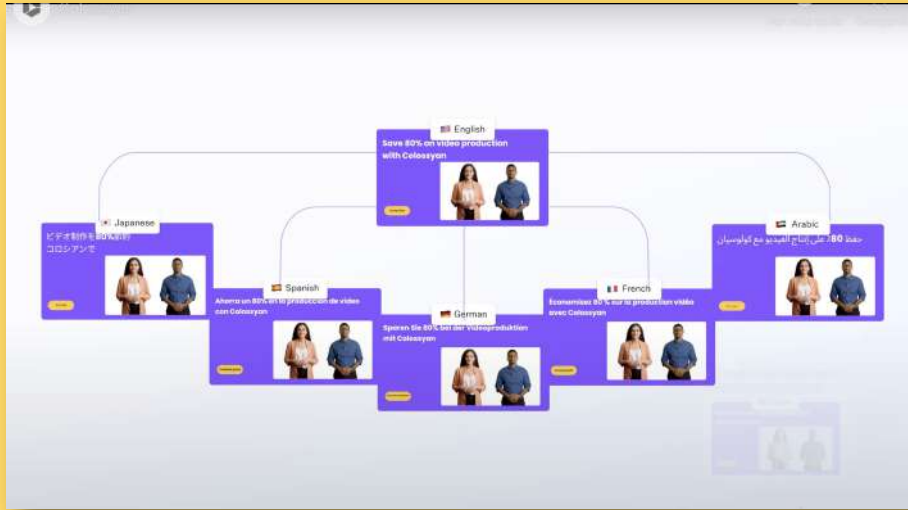
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Dubbing with Lip Sync



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Lip Sync



AI | myGoodTrust.com

mygoodtrust.com/singing-portraits



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Video Personalization

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



Generation of Avatars



youtu.be/auPW_84ZyRY



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Video Production 4.0 Post-Production: Edition



- Edit, if necessary, with the video generating tool



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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.	02:14
• Khanmigo can act as a super tutor and provide guidance counseling to every student	04:15
• Students can talk to historical figures through AI-powered conversation	06:06
• Khanmigo uses generative AI to enhance reading comprehension and writing skills	08:00
• AI-powered writing coach and teacher's guide on steroids	09:53
• GPT-4's ability in math and tutoring improved dramatically by allowing AI to think before speaking.	11:47
• Active participation is key in deciding the future of AI	13:38

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

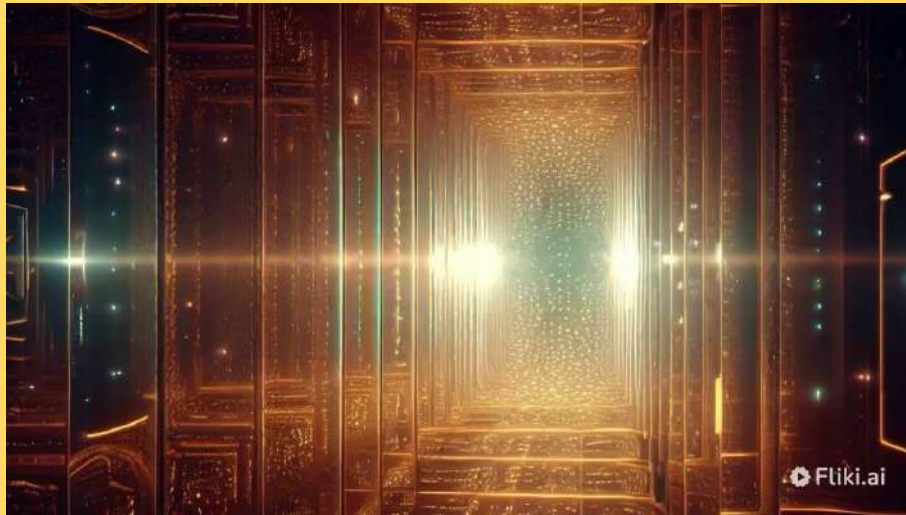
- [00:05] There are concerns that students will use AI to cheat and not learn, which will undermine education
- [00:25] AI can be used positively to transform education by providing every student with a personal tutor
- [01:17] The 2 sigma problem shows that 1-to-1 tutoring can improve student performance 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 science
- [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 better
- [03:48] Khanmigo can provide personalized feedback and support in computer programming even when they are stuck
- [04:25] AI can be a super tutor and improve learning outcomes for all students. In the video, Sal Khan talks about how AI can help students understand complex concepts
- 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 their argument
- 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].



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Videos: Example



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Production

• Videos



• Quizzes



• Forums



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Quizzes 3.0



Different kinds of variables (non graded activity)
1/0/1.0 point (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 solo-preneur, are:

```

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

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

Question
20/20 points (graded)

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

Math Expression Input
1/1 point (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 like this. Example: To test this example, the correct answer is $R_1 * R_2 / R_3$

Correct (1/1 point)



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

Enter the final value of x :



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





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.



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 n. 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.

3. 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("n 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.

2. 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.





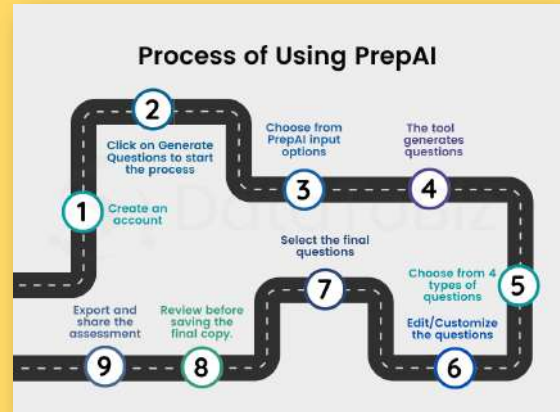
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PrepAI

PrepAI



• prepai.io



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Quillionz

Quillionz



• quillionz.com



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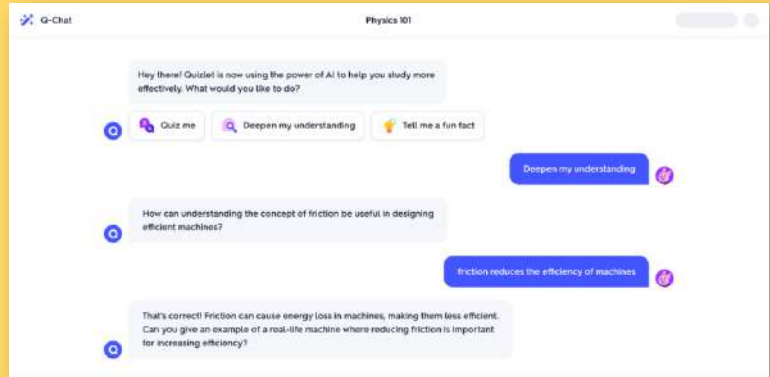
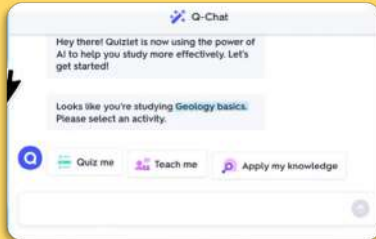


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Quizlet



- quizlet.com



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Production

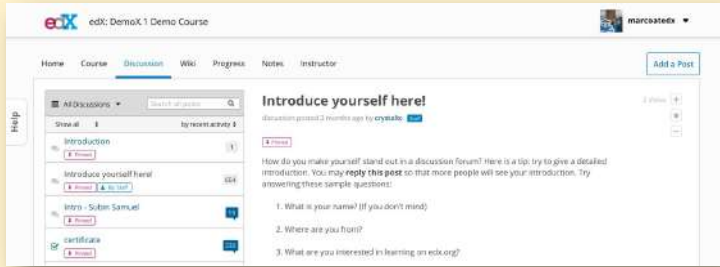
- Videos
- Quizzes
- Forums





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Forums 3.0



edx.org



edstem.org



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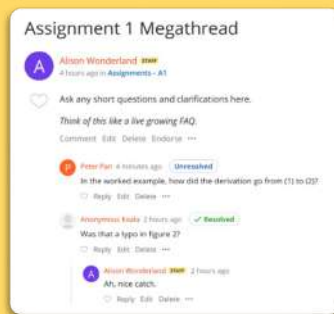
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Forums 4.0



edstem.org



David Malan
Harvard U



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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



Evolution

From personal interaction



to online forums

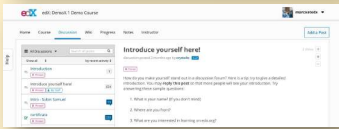
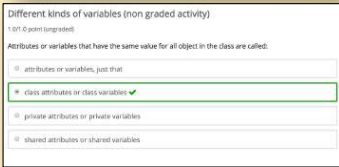


to mixed human-bot forums





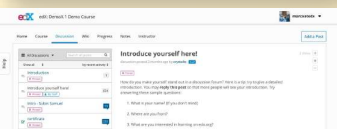
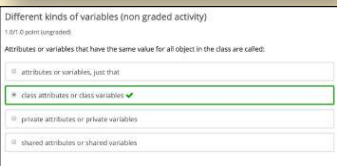
Production: Digital (3.0) vs AI Era (4.0)



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



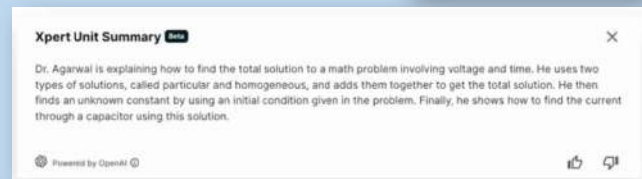
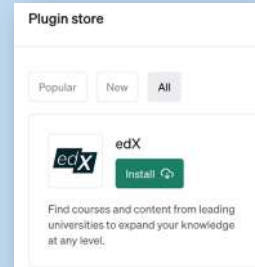
- The appearance of new possibilities does not mean replacement, but additional options available.
- The field is advancing very fast. Be prepared to see improvements.
- You have to be in control, beware of hallucinations and nuances. Always be critical!





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



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

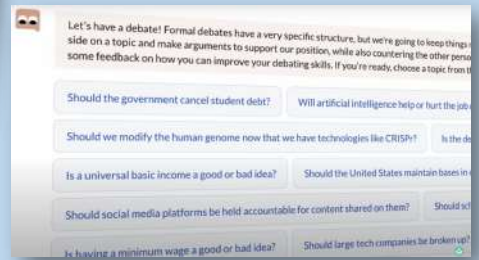


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Platforms are Evolving: Khanmigo by Khan Academy



Tutoring for all
Empowering educators
Unlocking creativity
Reimagining computer science



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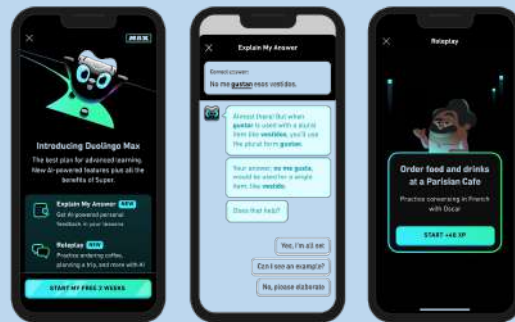
Platforms are Evolving: Max by Duolingo



Explain my answer



Roleplay



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New Platforms Coming Out

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

Learning Studio AI
by SCORMHERO

NOLEJ

mini-course GENERATOR



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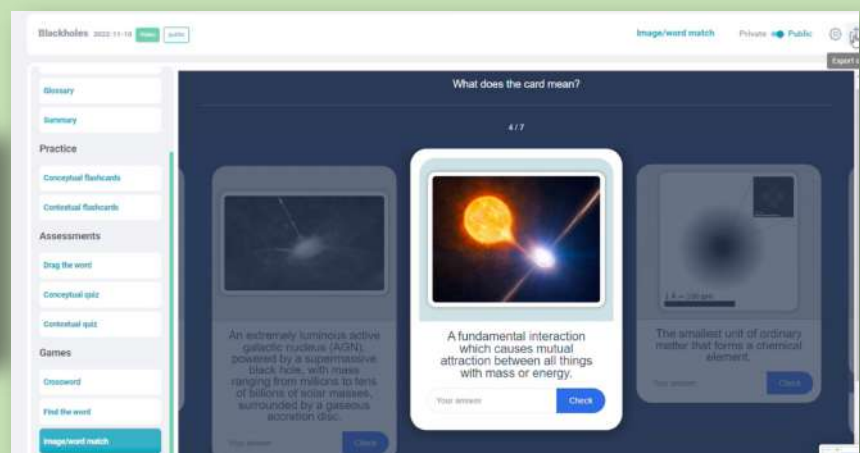


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Nolej

- nolej.io

NOLEJ



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Nolej

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



3. Concluding Remarks

The End





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Production More Efficient

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



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Advances in AI Video Generation in 100 Days

April 2023

Source: Reddit



August 2023

Source: @CuriousRefuge



via minchoi, via Generative AI



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Platforms Evolving, Others Appearing

Video Personalization

gan.ai

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

Platforms are Evolving: Khanmigo by Khan Academy

Tutoring for all
Empowering educators
Unlocking creativity
Reimagining computer science

Nolej

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



Conclusion

- Renaissance of course production and deployment
- Production
 - Teacher copilot
 - More efficient
 - More options (adaption)
- Deployment
 - AI as Socratic tutor
 - AI as participant in forums and debates
 - Personalized reinforcement learning





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Conclusion

- Still many open issues
 - Intellectual property
 - Quality of results
 - Biases
 - Impact
 - Regulation needed



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Conclusion

- Don't judge GenAI by its affordances today



- Many initiatives not directed to the general public



Vertex.ai



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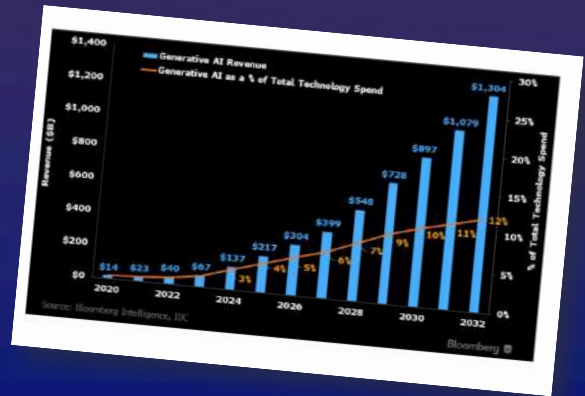
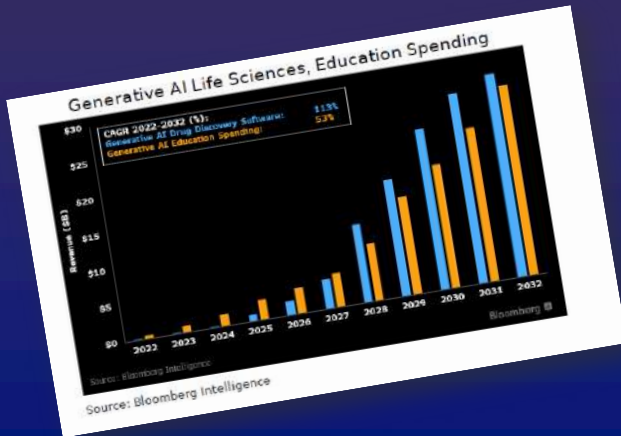
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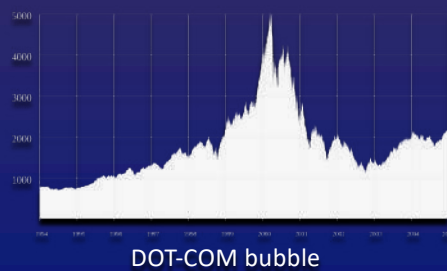
Conclusion

- The investment is going to be huge



Conclusion

- DOT-COM bubble -> DOT-AI bubble?





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Conclusion

- Incredible activity around Gen AI
 - Gen AI tools appearing at a fast rate
 - Exponential improvement



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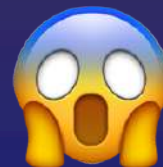
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Remember!

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



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Thank you!

Terima Kasih



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