

# Impact of generative AI on teaching



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***Michaël Lobet***

# Content

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## Questions

*“How do you see the impact of generative AI such as ChatGPT on your institutions?”*

*“Can you discuss about your experiences with generative AI?”*

## Challenge

Make a presentation in 5 to 7 minutes



# Impact of generative AI on institutions

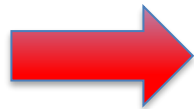


I see impact on the *three missions* of universities

→ *Research*

→ *Education*

→ *Services*



*How can generative AI be a tool for*

→ Teachers preparing a lecture

→ Students ... supervised by teachers

With a balance between *evolution* and *revolution*

# Impact on teaching



Question that should **guide** us when designing a class activity

*What can my students do, that generative AI can't?*



We must **change** our **learning goals**.

Instead of asking:

*“Write a text about this writer’s life”*

We should ask

*“Ask ChatGPT to write a text about this writer’s life and **double check the veracity** of the generated text”*

# *Examples of teaching activities*

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## *Creative writing*

ChatGPT is revolutionizing creativity.

It can write:

- Poems
- Story plotlines
- Music and lyrics
- Scripts for movies, youtube, Tiktok, etc.

Adapted from a tweet of Joe  
Speiser  
@jspeiser [3:00 PM · 2 janv. 2023](#)

# Examples of teaching activities

## §: “An explanation of Hegel's philosophy of the dialectic via an episode of the Simpsons”



Here's the revised version with the additional text included:

The episode starts with Homer, Marge, and the kids at a buffet restaurant. Homer is trying to decide what to eat, but he can't seem to make up his mind. He goes back and forth between the roast beef and the chicken, unable to decide which one he wants.

Marge: "Homer, just pick one already. We've been standing here for 20 minutes."

Homer: "I can't decide! The roast beef looks so juicy and delicious, but I'm worried about the fat content. And the chicken is probably healthier, but it's not as tasty."

Marge: "Homer, we're at a buffet. You're not exactly known for being health-conscious when it comes to food."

Homer: "That's true, but I've been trying to watch my cholesterol lately. It's hard to resist all this delicious food, though."

Meanwhile, Lisa is reading a book on Hegel's philosophy. She looks up from her book and says, "Hey guys, did you know that according to Hegel, the universe is constantly in a state of change and this change occurs through a process called the dialectic?"

Homer: "The what-now?"

Lisa: "The dialectic. It's a kind of debate or argument between two opposing ideas, and through this debate, a new synthesis is reached."

As Homer continues to struggle with his decision, Lisa observes that he has become the embodiment of the dialectic. On one hand, he wants the roast beef because it looks juicy and delicious. On the other hand, he's worried about the fat content and thinks the chicken might be a healthier option. These two opposing ideas are like the thesis and antithesis in the dialectic.

Bart: "Oh man, I can't believe we're talking about cholesterol while there's all this food in front of us. My arteries are starting to dialectically debate whether they should clog up now or later."

As the debate goes on, Homer realizes that he can have both the roast beef and the chicken by ordering a small portion of each. This new synthesis, where he gets to enjoy both options, is the resolution of the dialectic.

Homer: "So Lisa, you're saying I should just go for the roast beef and chicken and worry about the cholesterol later?"

Lisa: "Well, I wouldn't go that far. But the dialectic can help us find new solutions to problems and move forward."

Marge: "See, Homer? The dialectic can even help us solve our dinner time problems."

Homer: "Thanks, Lisa. You're a genius. Now if you'll excuse me, I'm going to go get some more roast beef."

The episode ends with the family happily enjoying their meal, having learned a little bit about philosophy thanks to Lisa.

Tweet from Daniel Hutchinson  
@D\_\_Hutchinson [8:09 PM · 3 janv. 2023](#)

# Examples of teaching activities

## Creative writing

It can even write your wedding vows.

Write my wedding vows in the style of Snoop Dogg

Sure, here are wedding vows in the style of Snoop Dogg:

Yo, [BRIDE/GROOM], I ain't never met nobody like you before. You bring the sunshine into my life and make everything feel right.

I promise to always be there for you, to support you and love you no matter what. I promise to keep it real with you, to be honest and true, and to always put our love first.

You're my everything, [BRIDE/GROOM]. I can't wait to spend the rest of my days with you, building a future filled with love and good vibes.

I love you now and forever, [BRIDE/GROOM]. Let's make it official and ride off into the sunset together.

(raises hand for a fist bump)



**Use it to compare different writing styles/writing forms with a similar theme!**

Adapted from a tweet of Joe Speiser  
@jspeiser [3:00 PM · 2 janv. 2023](#)



# Examples of teaching activities

## Study partner

Type “**learn**”. Then paste a link to your online textbook (or individual chapters). Ask Chatbot to provide questions based on your textbook.

Ask me 10 questions about the chapter I just provided.

Sure, here are 10 questions based on the chapter summary of Chapter 3 of the "Introduction to Psychology" textbook you provided:

1. What is the difference between sensation and perception?
2. How do the sensory systems work, and what are some examples of stimuli they detect?
3. What is sensory adaptation, and how does it affect our perception of stimuli?
4. What is signal detection theory, and how does it explain how we perceive stimuli?
5. What is attention, and how does it affect our perception of stimuli?
6. How do past experiences, expectations, and cultural context influence our perception?

**Generate personalized exercises for your students about your chapter**

Tweet from Joe Speiser  
@jspeiser [3:00 PM · 2 janv. 2023](#)



# Examples of teaching activities

## Code

It can provide code & it can de-bug your existing code for you

code me a computer game of tic-tac-toe in python

Sure! Here is a Python code snippet that implements a simple tic-tac-toe game:

Copy code

```
# define the board as a list of strings
board = [" " for i in range(9)]
```

```
def print_board():
    row1 = "|".join(board[0:3])
    row2 = "|".join(board[3:6])
    row3 = "|".join(board[6:9])
    print()
    print(row1)
    print("-----")
    print(row2)
    print("-----")
    print(row3)
    print()
```

```
def player_move(icon):
    if icon == "X":
        number = 1
```



**You can ask ChatGPT to explain  
what an existing code does**

**Ask to code with 5 mistakes**

+

**ask your students to spot them**

**(using chatGPT or not, they will  
have to learn to find them, by  
comparing with the right code)**

*Find mistakes*

Tweet from Joe Speiser  
@jspeiser [3:00 PM · 2 janv. 2023](#)

# Examples of teaching activities

## Writing assistant

It provides students with feedback on their writing. It can provide suggestions for revisions, such as grammar and style corrections



Proofread this text

Mobile developpt is the process of creating software for small,, devices such as smartphones and tablets. these devices have become increasiny popular in recent years, and as a result, mbile development has become a rapidly growing field. Mobile developers are responsible for creating apps and other software for these devices, And they use a variety of tools and programg languages to do s.



Mobile development is the process of creating software for small, portable devices such as smartphones and tablets. These devices have become increasingly popular in recent years, and as a result, mobile development has become a rapidly growing field. Mobile developers are responsible for creating apps and other software for these devices, and they use a variety of tools and programming languages to do so.



*Find mistakes, help to improve writing*

Wowtechy.com + Times Higher  
education

# In my class?

## Design of activities

- + 300 students in biology and veterinary sciences – first bachelor

- |             |   |
|-------------|---|
| ✓ Chapter 1 | → Ask ChatGPT to <i>summarize</i>           |
| ✓ Chapter 2 | → Ask ChatGPT to <i>exemplify</i>           |
| ✓ Chapter 3 | → Ask ChatGPT to <i>suggest experiments</i> |
| ✓ Chapter 4 | → Ask ChatGPT to <i>define</i>              |
| ✓ Chapter 5 | → Ask ChatGPT to <i>solve an exercise</i>   |

*Different levels in  
Bloom's taxonomy*

# In my class?

## Design of activities

- + 300 students in biology and veterinary sciences – first bachelor



120 students motivated at first lecture



25 students showed up at first meeting



6 students registered and performed the activity



# *In my class?*

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## *Multiple reasons for failure*

- first bachelor → They have to discover this new life (and if they made the right choice)
- It was not rewarded in any way (points at exams, bonus,...) (not good alignment with goals, only extra work, not enough time)
- ***Students does not know AI!***

# Study at UNamur (SPU)

- ✓ Study led by Marie Lobet, Valérie Wathelet & Antoine Honet, Service de pédagogie universitaire, UNamur
- ✓ 1233 students – first bachelor – all faculty (sciences, med, economy, law...) – anonymous survey
- ✓ Only **13% of the UNamur students** used Chat GPT as a help for their lecture
- ✓ Consistent with Pew Research survey in the US

*“Just **14% of all U.S. adults** say they have used it **for entertainment, to learn something new, or for their work**”*



5 students out of 6 does not know about Chat GPT

We must **TEACH** them how to use it properly!



# References

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## *More examples of how to use AI in teaching*

<https://www.unamur.be/punch/midis/axe5/SessionPUNChMichalLobetChatGPTAnopportunityforteaching.pdf>

## *Survey SPU*

<https://newsroom.unamur.be/en/news/chatgpt-by-students-ai-all-rage>

## *Best practice for using AI when writing*

<https://pubs.acs.org/doi/10.1021/acsnano.3c01544>

## *Survey Pew Research center*

<https://www.pewresearch.org/short-reads/2023/05/24/a-majority-of-americans-have-heard-of-chatgpt-but-few-have-tried-it-themselves/>

## *Other examples how to use ChatGPT in class at UNamur*

<https://newsroom.unamur.be/en/news/chatgpt-opportunity-education>



# Acknowledgments

- Marie Lobet
- Valérie Wathelet
- Antoine Honet
- UNamur & Harvard colleagues



**HARVARD**  
John A. Paulson  
School of Engineering  
and Applied Sciences



**UNIVERSITÉ  
DE NAMUR**



*Thanks for your  
attention*

# Procedure for using ChatGPT with students

1. Warn the *teaching community* about the risks (aim of this conference)
2. Tell the students *«Hey kids, we know!»*  
Show the limits of using ChatGPT, « plagiarism cases », the risk of having all the same copy (which is indistinguishable from cheating from a professor point of view)
3. Show them *how to use properly the tool* to build their learning in a critical way, to foster their understanding of a subject

→ Learn how to use the tool!

## Use of a jigsaw

Simply wood cutting



Make *art* out of it



# A new tool for teachers

## Provide the outline of a lecture



What would be an outline for a lecture on plasmonics ?

### I. Introduction

- Definition of plasmonics
- Historical background and current state of the field
- Overview of applications and potential future uses

### II. Basic Principles

- Electromagnetic waves and the behavior of metals
- Surface plasmon polaritons and their properties
- Dispersion relations and wave equations

### III. Plasmonic Materials

- Metals and alloys commonly used in plasmonics
- Synthesis and characterization methods
- Comparison of different types of materials and their properties

### IV. Plasmonic Devices

- Surface plasmon resonance sensors
- Plasmonic waveguides and nanolasers
- Plasmonic nanoantennas and their applications
- Plasmonic metamaterials

### V. Challenges and Limitations

- Losses in plasmonic systems
- Temperature effects
- Interaction with the environment

### VI. Conclusion

- Summary of key points
- Future directions and ongoing research in the field

*Not happy with this one?*

Luc Henrard, 13 Janvier 2023

# A new tool for teachers

## Provide the outline of a lecture



What would be an outline for a lecture on plasmonics ?

### I. Introduction

- Definition of plasmonics and its importance in modern technology
- Brief overview of the history of plasmonics research

### II. Fundamentals of Plasmonics

- Explanation of the physics of plasmons
- Description of the different types of plasmonic systems (metals, metal-dielectric interfaces, etc.)
- Overview of the different plasmonic phenomena (surface plasmon resonance, localized surface plasmon resonance, etc.)

### III. Plasmonic Applications

- Discussion of plasmonic applications in sensing, imaging, and photonics
- Description of plasmonic nanostructures and their properties
- Explanation of plasmon-enhanced spectroscopies
- Discussion of plasmonic solar cells, energy harvesting and conversion.

**Generate a new one in 2 seconds!**

### IV. Challenges and future directions

- Overview of current challenges in the field of plasmonics
- Discussion of future research directions in plasmonics
- Explanation of potential new applications for plasmonics.

### V. Conclusion

- Summary of the key points covered in the lecture
- Discussion of how plasmonics is expected to play a key role in future technologies
- Encourage for further research and development in this area.

# A new tool for teachers

## Design a course



Design a syllabus for a class on plasmonics

**Course Title:** Plasmonics

### **Course Description:**

*Plasmonics is an interdisciplinary field that studies the interaction of light with metal nanostructures. This class will introduce students to the fundamental concepts of plasmonics, including the properties of metal nanostructures, the physics of plasmonic resonances, and the applications of plasmonics in areas such as sensing, imaging, and energy harvesting. Students will also learn about the latest research in the field and will have the opportunity to work on a project related to plasmonics.*

### **Course Objectives:**

- Understand the basic concepts of plasmonics and the properties of metal nanostructures
- Learn about the physics of plasmonic resonances and the different types of plasmonic modes
- Understand the various applications of plasmonics in areas such as sensing, imaging, and energy harvesting
- Learn about the latest research in the field of plasmonics
- Develop the skills to work on a project related to plasmonics

# A new tool for teachers

## Design a course



Design a syllabus for a class on plasmonics

**Course Outline:** *see before*

### Project work

- Selection of a topic
- Literature review
- Data analysis and interpretation
- Presentation and report

### Assessment:

- Quizzes (30%)
- Midterm exam (30%)
- Final exam (30%)
- Project work (10%)

### Prerequisites:

- Basic understanding of optics and electromagnetic waves
- Familiarity with the mathematical concepts of vector calculus and complex numbers

### Textbook:

"Introduction to Plasmonics" by Thomas P. Graham and Mark L. Brongersma

### References:

"Plasmonics: Fundamentals and Applications" by Stefan A. Maier  
"Nanoplasmonics" by K. John Geddes



# A new tool for teachers

## Prepare an in-class activity

"Plan three lessons to explain how volcanoes are formed. Each lesson needs an introductory activity, information input, a student task and a plenary."

### Lesson 1: Introduction to Volcanoes

Introductory activity: Show students a picture of a volcano and ask them to describe what they see. Discuss their observations as a class.

Information input: Explain that a volcano is a mountain with a hole at the top (the crater) from which magma (molten rock), ash, and gas can erupt. Volcanoes are formed when molten rock (magma) from deep within the Earth rises up and collects in magma chambers near the surface. When the pressure in the magma chamber becomes too great, the magma is forced up and out through the crater, creating an eruption.

Student task: Have students work in small groups to create a diagram showing the different parts of a volcano (e.g., magma chamber, crater, lava flow) and the process of an eruption.

Plenary: As a class, discuss the different parts of a volcano and the process of an eruption. Ask students to share their diagrams and explain their understanding of how volcanoes are formed.

Tweet from Stephen Lockyer  
@mrlockyer [12:51 PM · 31 déc. 2022](#)

# A new tool for teachers

## Prepare an in-class activity

"Plan three lessons to explain how volcanoes are formed. Each lesson needs an introductory activity, information input, a student task and a plenary."

### Lesson 2: Types of Volcanoes

Introductory activity: Show students pictures of different types of volcanoes (e.g., stratovolcano, shield volcano, cinder cone volcano) and ask them to describe the differences they see.

Information input: Explain that there are three main types of volcanoes: stratovolcanoes, shield volcanoes, and cinder cone volcanoes. Stratovolcanoes are tall, conical volcanoes made up of layers of ash, lava, and other volcanic debris. Shield volcanoes are broad, flat volcanoes made up of thin layers of lava. Cinder cone volcanoes are small, steep-sided volcanoes made up of loose, volcanic debris.

Student task: Have students research one of the three types of volcanoes and create a presentation to share with the class. The presentation should include information about the characteristics of the volcano, examples of where it is found, and any interesting facts.

Plenary: As a class, have students present their research on different types of volcanoes. Ask students to share what they learned about the characteristics, location, and facts about their chosen volcano.

Tweet from Stephen Lockyer  
@mrlockyer [12:51 PM · 31 déc. 2022](#)

# A new tool for teachers

## Prepare an in-class activity

"Plan three lessons to explain how volcanoes are formed. Each lesson needs an introductory activity, information input, a student task and a plenary."

### Lesson 3: The Effects of Volcanoes

Introductory activity: Show students pictures of volcanoes before and after an eruption and ask them to describe the differences they see.

Information input: Explain that volcanoes can have both positive and negative effects on the environment and people living nearby. Some positive effects include the creation of new land, the fertilization of soil with ash, and the development of geothermal energy sources. Negative effects include destruction of property and loss of life, the release of harmful gases into the atmosphere, and the disruption of air travel.

Student task: Have students work in small groups to research a specific volcano and its effects on the environment and people living nearby. Each group should create a report summarizing their findings and identifying any potential risks or benefits of living near a volcano.

Plenary: As a class, discuss the different effects of volcanoes on the environment and people living nearby. Ask students to share their findings from their group research and discuss the potential risks and benefits of living near a volcano.

Tweet from Stephen Lockyer  
@mrlockyer [12:51 PM · 31 déc. 2022](#)

# A new tool for teachers

## Prepare an in-class activity

"Oh, can we tabulate this? "

Lesson	Introductory Activity	Information Input	Student Task	Plenary
Lesson 1: Introduction to Volcanoes	Show students a picture of a volcano and ask them to describe what they see. Discuss their observations as a class.	Explain that a volcano is a mountain with a hole at the top (the crater) from which magma (molten rock), ash, and gas can erupt. Volcanoes are formed when molten rock (magma) from deep within the Earth rises up and collects in magma chambers near the surface. When the pressure in the magma chamber becomes too great, the magma is	Have students work in small groups to create a diagram showing the different parts of a volcano (e.g., magma chamber, crater, lava flow) and the process of an eruption.	As a class, discuss the different parts of a volcano and the process of an eruption. Ask students to share their diagrams and explain their understanding of how volcanoes are formed.

Tweet from Stephen Lockyer  
@mrlockyer [12:51 PM · 31 déc. 2022](#)

# A new tool for teachers

## Create personalized exercises



Can you generate an exercise on the plural of names in English?



Exercise:

Choose the correct plural form for each of the following words:

1. Child
  - a. Children
  - b. Childs
  - c. Childes
2. Tooth
  - a. Teeth
  - b. Tooths
  - c. Tooths
3. Foot
  - a. Feet
  - b. Foots
  - c. Footh

# A new tool for teachers

## Generate quizzes or tests...



Can you generate 10 multiple choice questions on geometrical optics, with 5 propositions and only one correct?



1. What is the name of the phenomenon where light bends as it passes through a medium with a different refractive index?
  - a) Diffraction
  - b) Refraction
  - c) Dispersion
  - d) Reflection
  - e) None of the above
2. What is the formula used to calculate the focal length of a concave mirror?
  - a.  $f = R / 2$
  - b.  $f = R / (n - 1)$
  - c.  $f = R$
  - d.  $f = 2R$
  - e. None of the above

# A new tool for teachers

*...and get the answers!*



Thanks! Can you highlight the correct answers ?



1. b) Refraction
2. d)  $f = 2R$
3. d) Parabolic mirror
4. b) Incidence angle
5. d)  $M = d / f$
6. c) Dispersion
7. c) Angle of reflection
8. b)  $\sin(c) = n_1 / n_2$
9. a) Convex lens
10. a) Refraction angle



# A new tool for teachers

## Design rubric



Design a rubric to grade a master thesis

Criteria	Excellent (90-100%)	Good (80-89%)	Satisfactory (70-79%)	Poor (0-69%)
<b>Research question and objectives</b>	Clearly defined and well-focused	Adequately defined and mostly focused	Somewhat defined and somewhat focused	Not defined or focused
<b>Methods</b>	Appropriate and well-executed	Appropriate but with some minor flaws	Somewhat appropriate but with major flaws	Inappropriate or poorly executed
<b>Results and Analysis</b>	Clearly presented and thoroughly analyzed	Clearly presented but with some minor flaws in analysis	Somewhat presented and analyzed	Poorly presented and analyzed
<b>Discussion and Implications</b>	Thorough and well-supported by evidence	Adequate and mostly supported by evidence	Somewhat discussed and supported by evidence	Not discussed or supported by evidence
<b>Conclusion</b>	Clear and well-supported by evidence	Adequate and mostly supported by evidence	Somewhat clear and supported by evidence	Not clear or supported by evidence
<b>Writing and Organization</b>	Clear, concise, and well-organized	Adequate but with some minor flaws in organization	Somewhat clear and organized	Poorly written and disorganized
<b>References</b>	Complete and correctly cited	Mostly complete and correctly cited	Somewhat complete and correctly cited	Incomplete and/or incorrectly cited

# *A new tool*

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A tool for

→ Teachers

→ Students ... supervised by teachers

# A new tool for students

## Marketing

It can outline your content marketing strategy to get a roadmap



You can ask ChatGPT to extrapolate on each point until you've got a ***detailed roadmap.***

content marketing strategy for my AI Saas:

Here are a few ideas for a content marketing strategy for your AI SaaS (Software as a Service) business:

1. Blog about the benefits of AI: Write blog posts that demonstrate how your AI SaaS can improve efficiency, productivity, and other business outcomes.
2. Create case studies: Share success stories from businesses that have used your AI SaaS to achieve specific goals.
3. Share industry insights: Share your expertise and insights about the AI industry through articles, podcasts, or webinars.
4. Create educational content: Create content, such as ebooks, webinars, or infographics, that educates your audience about AI and how it can be applied in various industries.
5. Use social media: Use social media platforms, such as LinkedIn and Twitter, to share your content and engage with your audience.

**Ask your students to be**  
**criticizing/commenting/adapting it**

Tweet from Joe Speiser  
@jspeiser [3:00 PM · 2 janv. 2023](#)

# A new tool for students

## Communication/Marketing

### Craft all your marketing materials

Type “learn” and paste any existing copy (landing page, articles, etc). Then ask it to generate:

- Ads
- Blog posts
- Email templates
- Landing page copy
- Social media posts / captions

They’re not perfect, but make **great templates**.

Write me a cold email for prospective Brax customers based on the information I just provided

Here is a draft of a cold email that you could send to prospective Brax customers based on the information you provided:

Dear [Prospective Customer],

I hope this email finds you well. My name is [Your Name] and I am reaching out to you today because I believe that Brax could be a valuable asset for your business.

As you may know, Brax is a native advertising platform that helps brands and agencies create, optimize, and scale their native ads. The platform streamlines content syndication across various sources, such as Yahoo Gemini, Outbrain, Taboola, and Revcontent, and provides tools for goal optimization and budget and bid adjustments based on campaign performance. Brax also allows users to connect multiple accounts and add multiple users with different access permissions.



**Ask your students grade it according a rubric you provide them**

Tweet from Joe Speiser  
@jspeiser [3:00 PM · 2 janv. 2023](#)

# In other words

## Use of a jigsaw

Simply wood cutting



Make **art** out of it



## In terms of Bloom's taxonomy

**Remember**

Copying, defining,  
googling, searching,  
tabulating, bullet pointing,  
quoting, selecting

**Understand**

Summarizing,  
paraphrasing, grouping,  
exemplifying, ...

Comparing, presenting,  
correlating, mind-  
mapping, grading,  
criticizing, commenting,  
reviewing, detecting,  
adapting

# Challenge

Can it help students to reach  
higher levels?



ChatGPT is good at **low levels**  
of Bloom's taxonomy



# Last words

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The **best advice** for teachers just getting started with OpenAI ChatGPT is to

- Familiarize yourself with the basics
- Start with a clear goal in mind
- Be mindful of the tool's limitations
- Use it in combination with other resources
- Don't be afraid to experiment.

Tweet James Brauer  
@JamesBrauer 12:33 AM · 2 janv. 2023



*Plenty of stuff have  
been tried...  
but the best is still  
to come and to  
invent!*

← Tweet

Suggested by  
Pr L. Schumacher



David E. Weekly @david@weekly.org  
@dweekly

ChatGPT bedtime stories, with a prompt of the children's choosing. This is our new nighttime ritual and it's kind of nerdy and adorable.



5:34 AM · Jan 16, 2023 · 11K Views



# Limitations



**Sam Altman** ✓  
@sama

(CEO Open AI)



ChatGPT is incredibly limited, but good enough at some things to create a misleading impression of greatness.







it's a mistake to be relying on it for anything important right now. it's a preview of progress; we have lots of work to do on robustness and truthfulness.

[Traduire le Tweet](#)

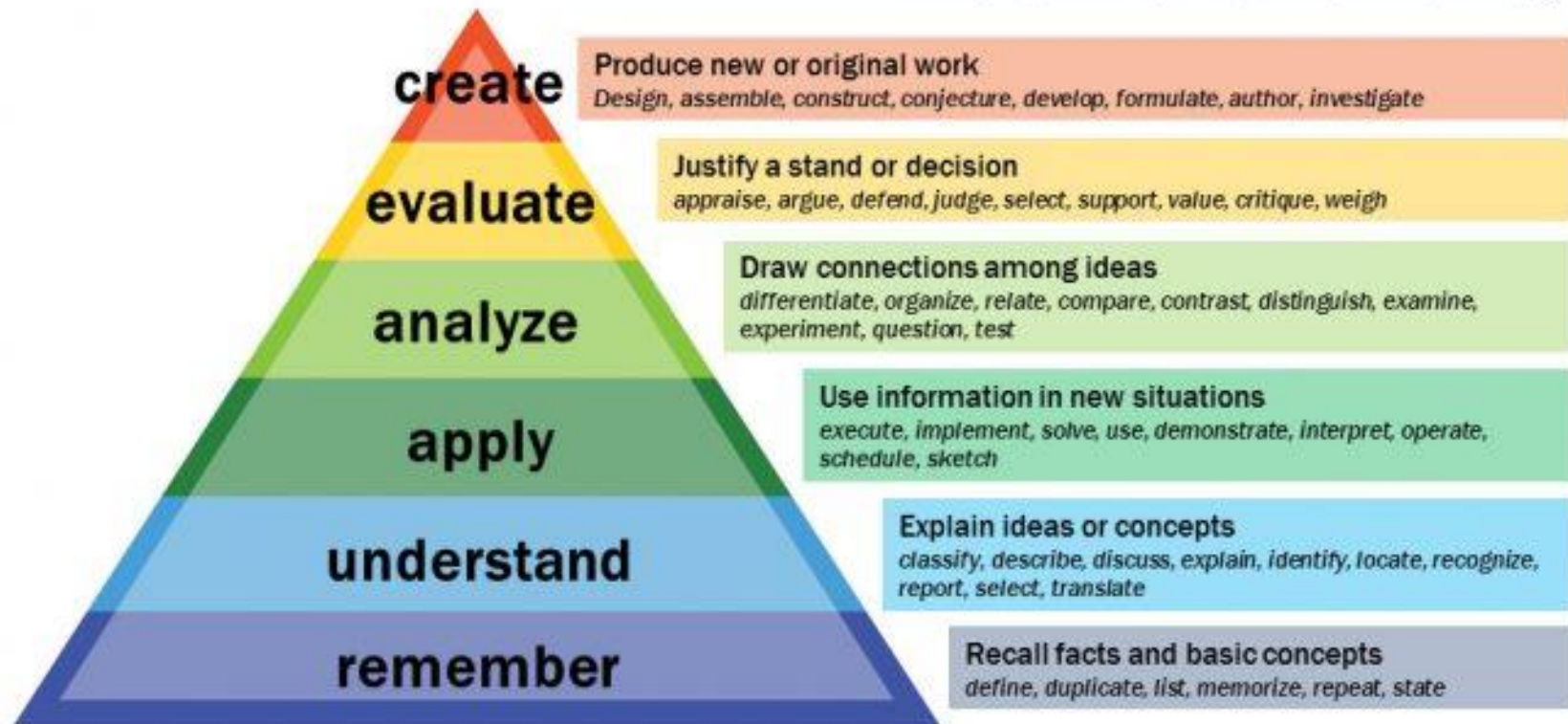
1:11 AM · 11 déc. 2022

**3 459** Retweets   **698** Tweets cités   **28,6 k** J'aime

# Procedure

BLOOM'S TAXONOMY DIGITAL PLANNING VERBS					
REMEMBERING	UNDERSTANDING	APPLYING	ANALYZING	EVALUATING	CREATING
					
Copying Defining Finding Locating Quoting Listening Googling Repeating Retrieving Outlining Highlighting Memorizing Networking Searching Identifying Selecting Tabulating Duplicating Matching Bookmarking Bullet-pointing	Annotating Tweeting Associating Tagging Summarizing Relating Categorizing Paraphrasing Predicting Comparing Contrasting Commenting Journaling Interpreting Grouping Inferring Estimating Extending Gathering Exemplifying Expressing	Acting out Articulate Reenact Loading Choosing Determining Displaying Judging Executing Examining Implementing Sketching Experimenting Hacking Interviewing Painting Preparing Playing Integrating Presenting Charting	Calculating Categorizing Breaking Down Correlating Deconstructing Linking Mashing Mind-Mapping Organizing Appraising Advertising Dividing Deducing Distinguishing Illustrating Questioning Structuring Integrating Attributing Estimating Explaining	Arguing Validating Testing Scoring Assessing Criticizing Commenting Debating Defending Detecting Experimenting Grading Hypothesizing Measuring Moderating Posting Predicting Rating Reflecting Reviewing Editorializing	Blogging Building Animating Adapting Collaborating Composing Directing Devising Podcasting Wiki Building Writing Filming Programming Simulating Role Playing Solving Mixing Facilitating Managing Negotiating Leading

## Bloom's Taxonomy



Vanderbilt University Center for Teaching