

# Navigating the Intersection of **Generative** Artificial Intelligence and Dental Education: Opportunities, challenges, and perspectives

**Mustafa Radif, BDS, MA, EdD (C)**  
Assistant Professor  
Department of Periodontics  
Arthur A. Dugoni School of Dentistry  
University of the Pacific, San Francisco

**Meixun Sinky Zheng, PhD, MA, MS (C)**  
Director, Educational Innovation & Assessment  
Associate Professor  
Office of Academic Affairs  
Arthur A. Dugoni School of Dentistry  
University of the Pacific, San Francisco

# Disclaimer

The presenters do not have any financial or personal relationships with artificial intelligence companies that could inappropriately influence or bias the content of this presentation. All the views and opinions expressed are solely those of the presenters and do not reflect the views or policies of any AI companies.

# Learning objectives

- Explore the **role** of generative AI, such as ChatGPT, in dental education.
- Evaluate the **benefits and drawbacks** of generative AI tools.
- Reflect on the **ethical and legal** considerations in generative AI for dental education.
- Identify ways to **embrace** generative AI in teaching and learning.
- Describe the future of generative AI and emerging **trends**.
- Compare and contrast the **perceptions** of faculty and students towards the use of generative AI in dental education based on **survey** findings.

# Generative AI

Computer algorithms (Large Language Models) can create content, including text, images, audio, videos, and other artifacts, in response to users' prompts

(McKinsey, 2023).

- Deep learning
- Reinforcement learning
- Ongoing

## Examples

- ChatGPT (OpenAI)
  - text / coding/data analysis
- Bard (Google) - text
- Bing (MicroSoft) -text
  
- Midjourney - Image
- DALL-E 2 - Image
- Stable Diffusion - Image
- ....

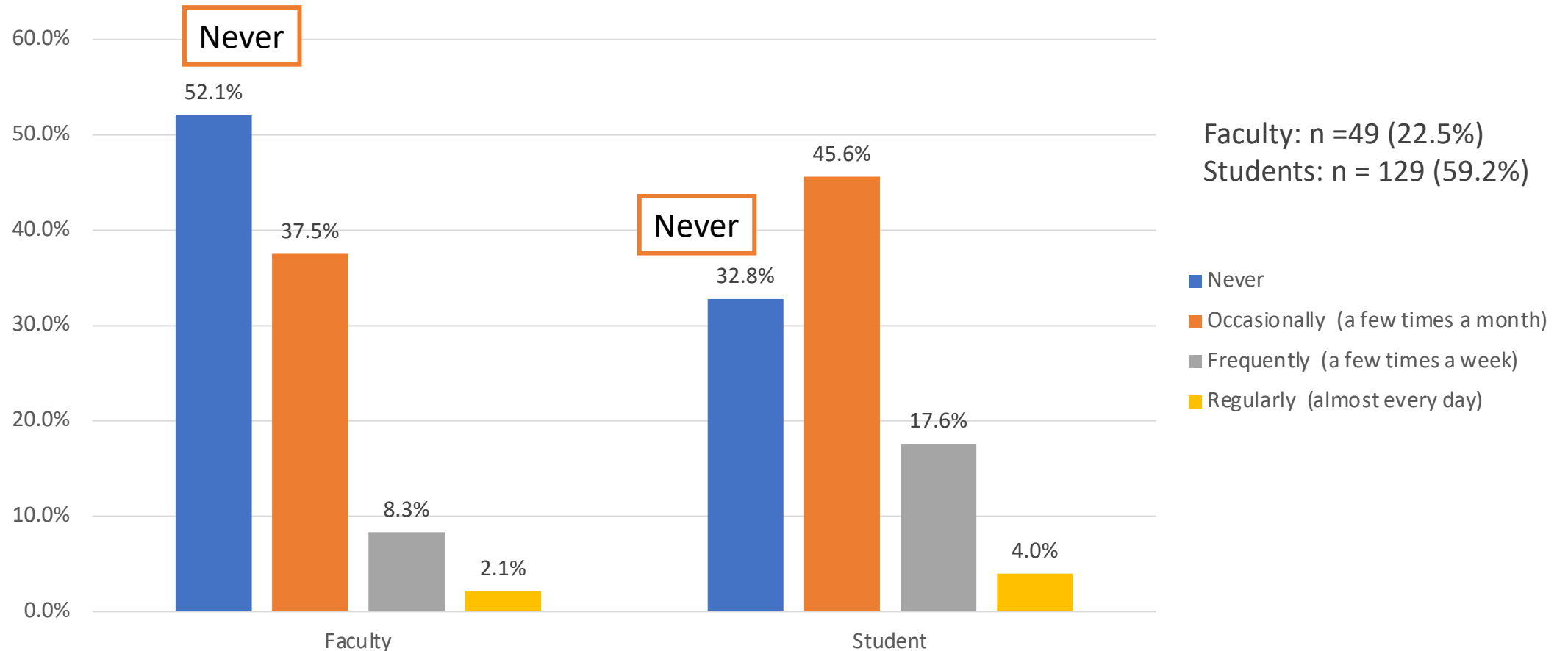
# Polling #1

How often have you used generative AI tools such as ChatGPT for **personal** purposes?

- Never
- Occasionally (a few times a month)
- Frequently (a few times a week)
- Regularly (almost every day)



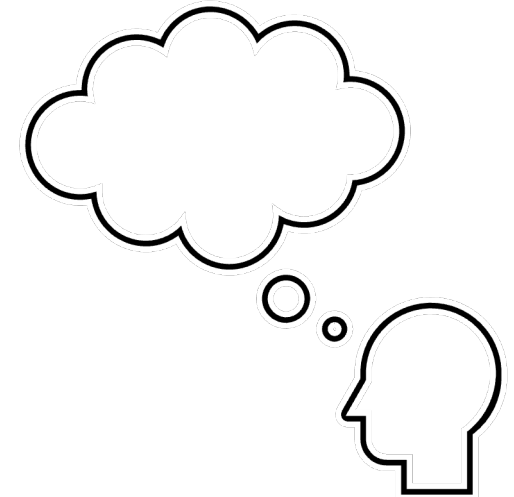
# Pacific survey: How often have you used generative AI tools such as ChatGPT for **personal** purposes?



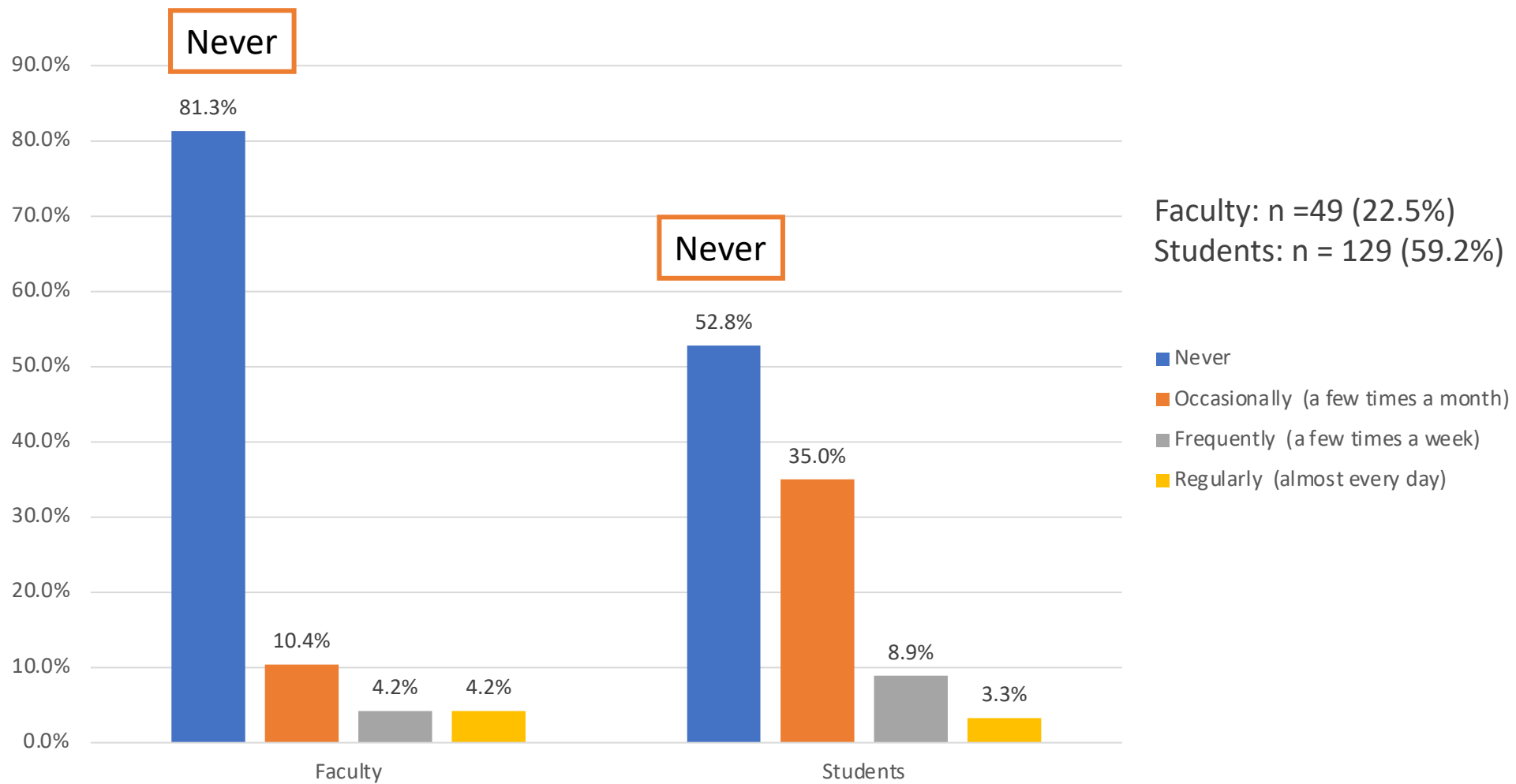
# Polling #2

How often have you used generative AI tools such as ChatGPT for **work** purposes?

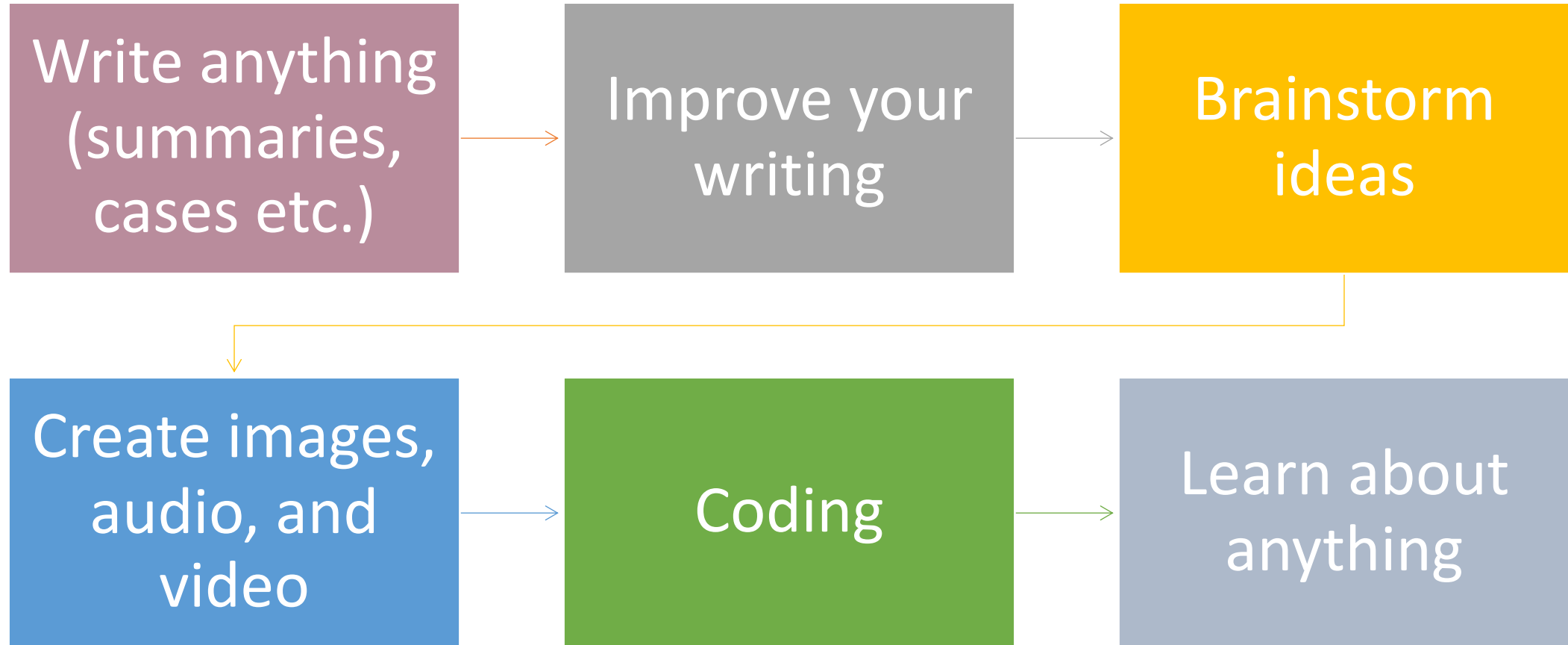
- Never
- Occasionally (a few times a month)
- Frequently (a few times a week)
- Regularly (almost every day)



# Pacific survey: How often have you used generative AI tools such as ChatGPT for **work (academic)** purposes?



# Generative AI capabilities



# ChatGPT capabilities



ChatGPT passed USMLE.



ChatGPT passed a UPenn Wharton Business School final exam.





ChatGPT went from a D grade on a George Mason University's economics test to an A in 3 months.

# Medical school example





[BROWSE](#) [PUBLISH](#) [ABOUT](#)

# PLOS MEDICINE

 OPEN ACCESS  PEER-REVIEWED

RESEARCH ARTICLE

## Deep learning for chest radiograph diagnosis: A retrospective comparison of the CheXNeXt algorithm to practicing radiologists

Pranav Rajpurkar  , Jeremy Irvin , Robyn L. Ball, Kaylie Zhu, Brandon Yang, Hershel Mehta, Tony Duan, Daisy Ding, Aarti Bagul, Curtis P. Langlotz, Bhavik N. Patel, Kristen W. Yeom, Katie Shpanskaya, [ ... ], Matthew P. Lungren  [ view all ]

Published: November 20, 2018 • <https://doi.org/10.1371/journal.pmed.1002686>

# ChatGPT capabilities

---

**Prompt :** I am a 65-year-old woman with a history of high blood pressure and have had leg pain and swelling for the past 5 days in one of my legs. I was recently hospitalized for pneumonia and had been recuperating at home. After I started walking, my right leg became red, painful, tender, and swollen. **What is likely causing my symptoms?**

---

**ChatGPT response:** Your symptoms of leg pain, swelling, redness, and tenderness after a recent hospitalization for pneumonia could be indicative of a DVT (Deep Vein Thrombosis) or a blood clot.

It's important that you seek medical attention as soon as possible, as DVT can be serious and potentially lead to other complications, such as pulmonary embolism. Other possible causes of leg swelling and pain include an injury, cellulitis (a skin infection), or Lymphedema (an accumulation of lymphatic fluid). Your doctor can perform a physical examination and imaging tests to determine the cause of your symptoms.

# Demo: ChatGPT is a chat

<https://chat.openai.com>

Original prompt:

- Write a patient case with type II diabetes for 3rd year dental students.

Follow-up prompts:

- Adding more radiograph description and focus on restorative options.
- Include biomedical science in the case.
- Create 5 multiple choice questions for the case.

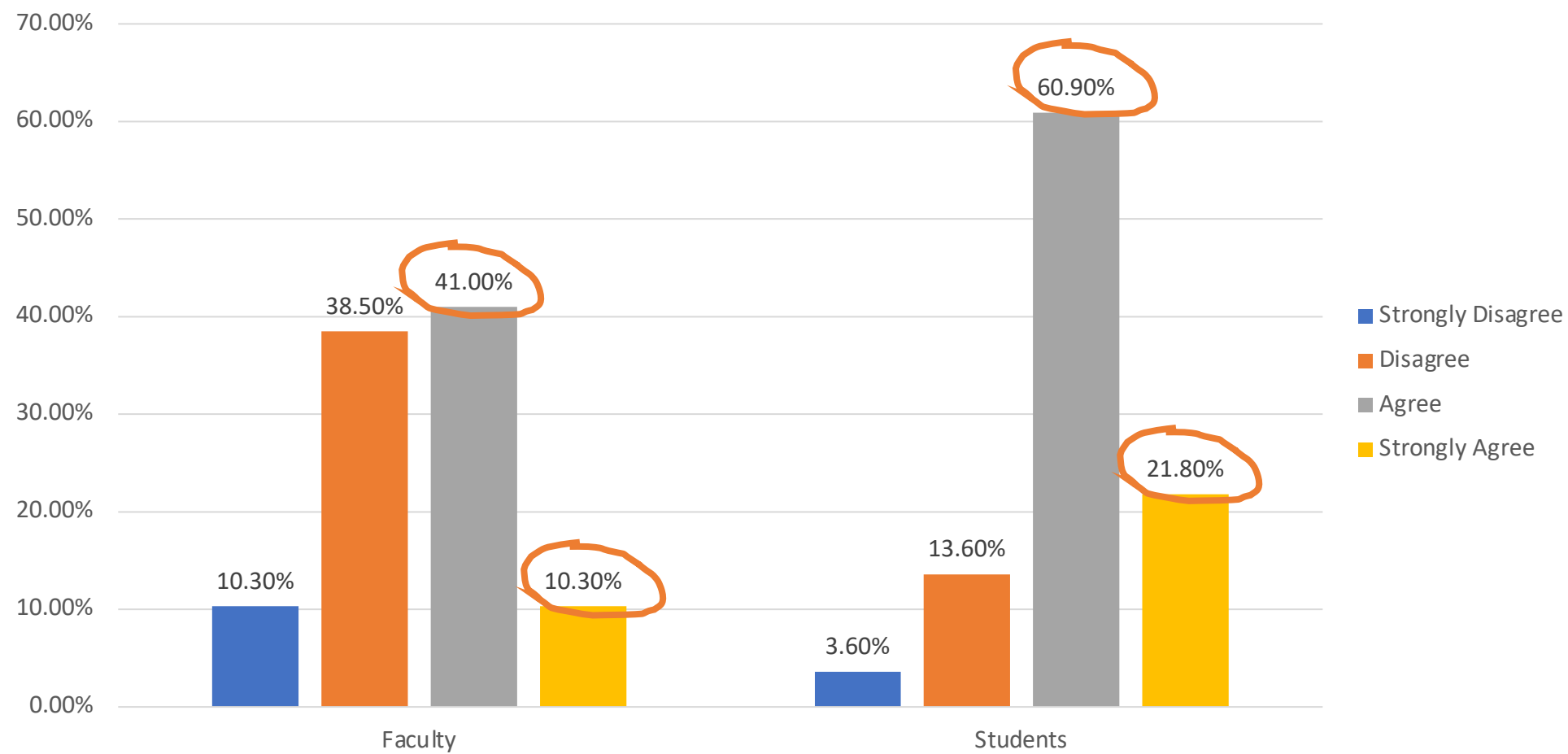
# Discussion #1

In 2 or 3 words, what do you think are the **benefits** of generative AI technology such as ChatGPT?

Type in the chat area.



The use of generative AI tools such as ChatGPT will improve my work productivity (learning effectiveness).



# Pacific survey: Benefits

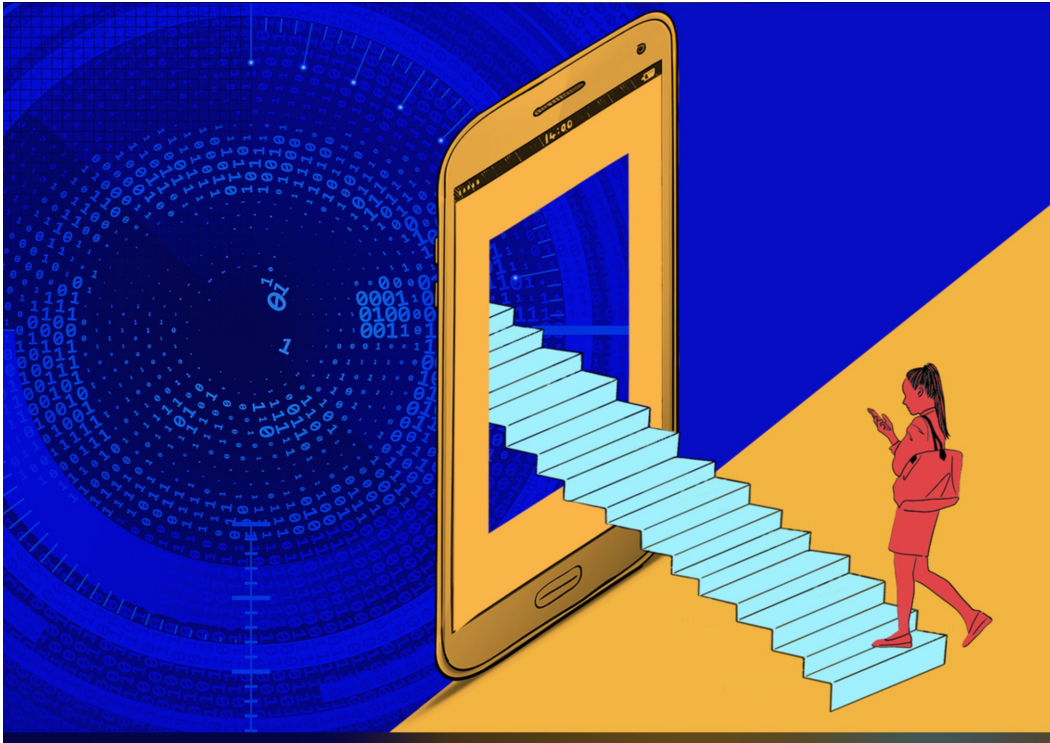
## Faculty

- “AI tools provide a great *starting point* that many educators can use when designing instructional materials.”
- “We need to *embrace* Chatgpt and similar tools as it is not going away. We need to develop assignments and projects where these types of tools are not heavily relied on but use as *supportive* or additional resources.”

## Student

- “Great tool for students whose first *language* is not English.”
- “Benefits may be creating more *access to resources*.”

## Discussion #2

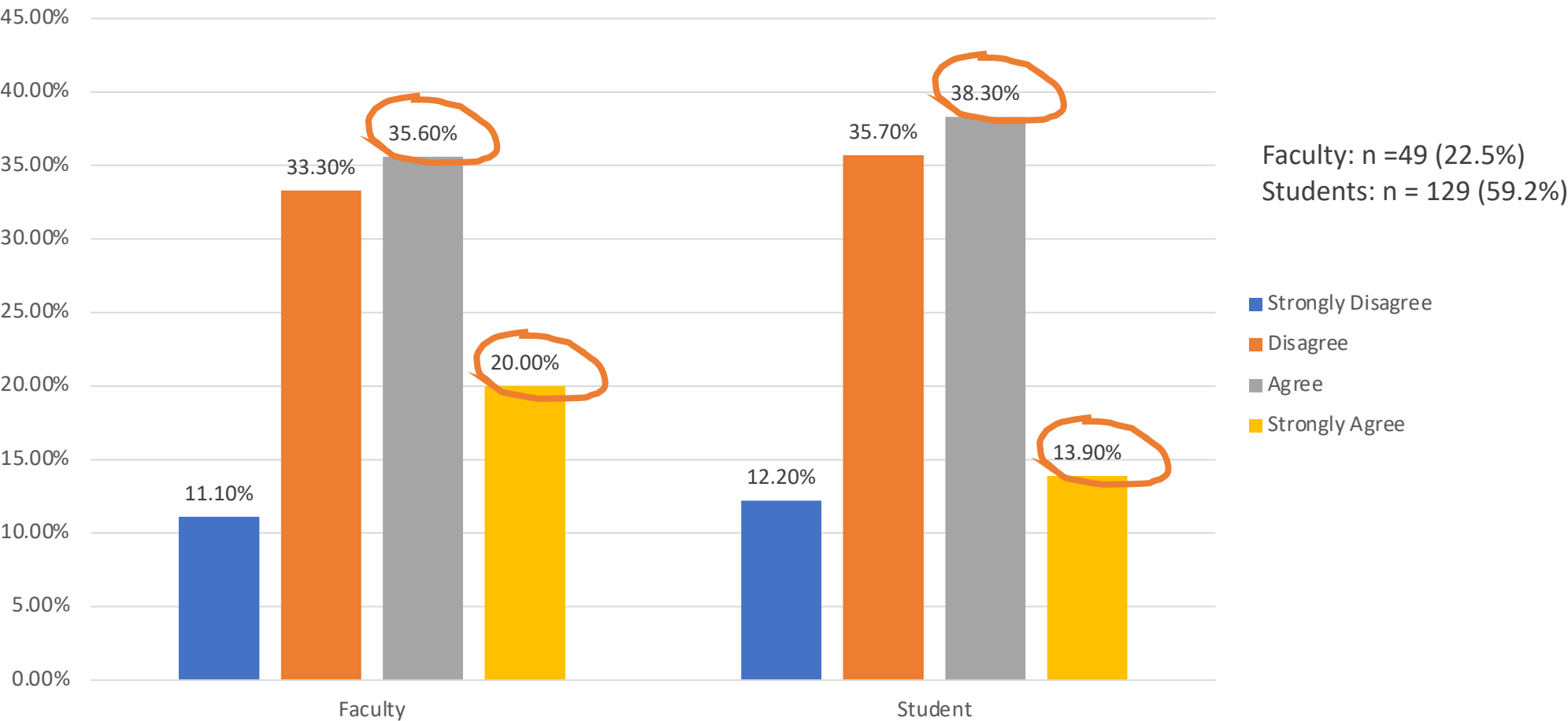


In 2 or 3 words, what do you think are the main **drawbacks and concerns** of using generative AI such as ChatGPT in dental education?

Type in the chat area.



# Pacific survey: The use of generative AI in dental education **makes me nervous.**



# Pacific survey: Concerns

## Faculty

- *“ChatGPT is neither predictable as a source **nor reliable** as an outcome. Students can pay for an essay to be written for them or homework to be done for them; this is the free version of the same.”*
- *“I am concerned that...we risk losing - or never getting - the chance to develop our **critical thinking**, reasoning, and executive-level cognitive function.”*

## Student

- *“Challenges is that we don’t know if information we’re using is **credible** or non **plagiarized**.”*
- *“The calculator replaced most of my mental math that I've learned from school, so similarly will AI **replace my writing skills**?”*

# Limitations and risks

Hallucination

Bias and  
stereotypes

Intellectual  
property and  
copyright

Privacy and  
confidentiality

Cyber fraud

Academic  
integrity

# Inaccurate response



Does Arthur A. Dugoni School of Dentistry University of the Pacific has a residency program in pediatric dentistry?



As of my knowledge cutoff in September 2021, the Arthur A. Dugoni School of Dentistry at the University of the Pacific does offer a residency program in Pediatric Dentistry. This program typically leads to a certificate in Pediatric Dentistry and a Master of Science in Dentistry (MSD) degree. However, programs and offerings can change over time, so it is best to consult the school's website or contact the admissions office for the most up-to-date information on their pediatric dentistry residency program.

No, we don't...😊

# Fake references

**Prompt:** Provide 3 references on online learning in dental education published in PubMed. Provide the full reference in APA format. Include the link to the paper.

## ChatGPT response

1. Alqahtani ND, Al-Jewair TS. Distance education in dental hygiene: A review of the literature. J Dent Educ. 2010 Aug;74(8):859-68. PMID: 20679400.

<https://www.ncbi.nlm.nih.gov/pubmed/20679400>

2. Glogauer M, Tennant M, McCracken M. A critical evaluation of online learning in dental education. J Dent Educ. 2012 Dec;76

<https://www.ncbi.nlm.nih.gov/pubmed/22711111>

3. Stone JR, Born D, Barker MK, editors. Distance education in dental education. J Dent Educ. 2010 Aug;74(8):859-68.

<https://www.ncbi.nlm.nih.gov/pubmed/20679400>

> J Exp Med. 2010 Aug 30;207(9):1871-8. doi: 10.1084/jem.20100209. Epub 2010 Aug 2.

## IL-2 reverses established type 1 diabetes in NOD mice by a local effect on pancreatic regulatory T cells

Yenkel Grinberg-Bleyer<sup>1</sup>, Audrey Baeyens, Sylvaine You, Rima Elhage, Gwladys Fourcade, Sylvie Gregoire, Nicolas Cagnard, Wassila Carpentier, Qizhi Tang, Jeffrey Bluestone,

None of these references exist. 😞

# Considerations



AI is incredibly smart and shockingly stupid (TED)

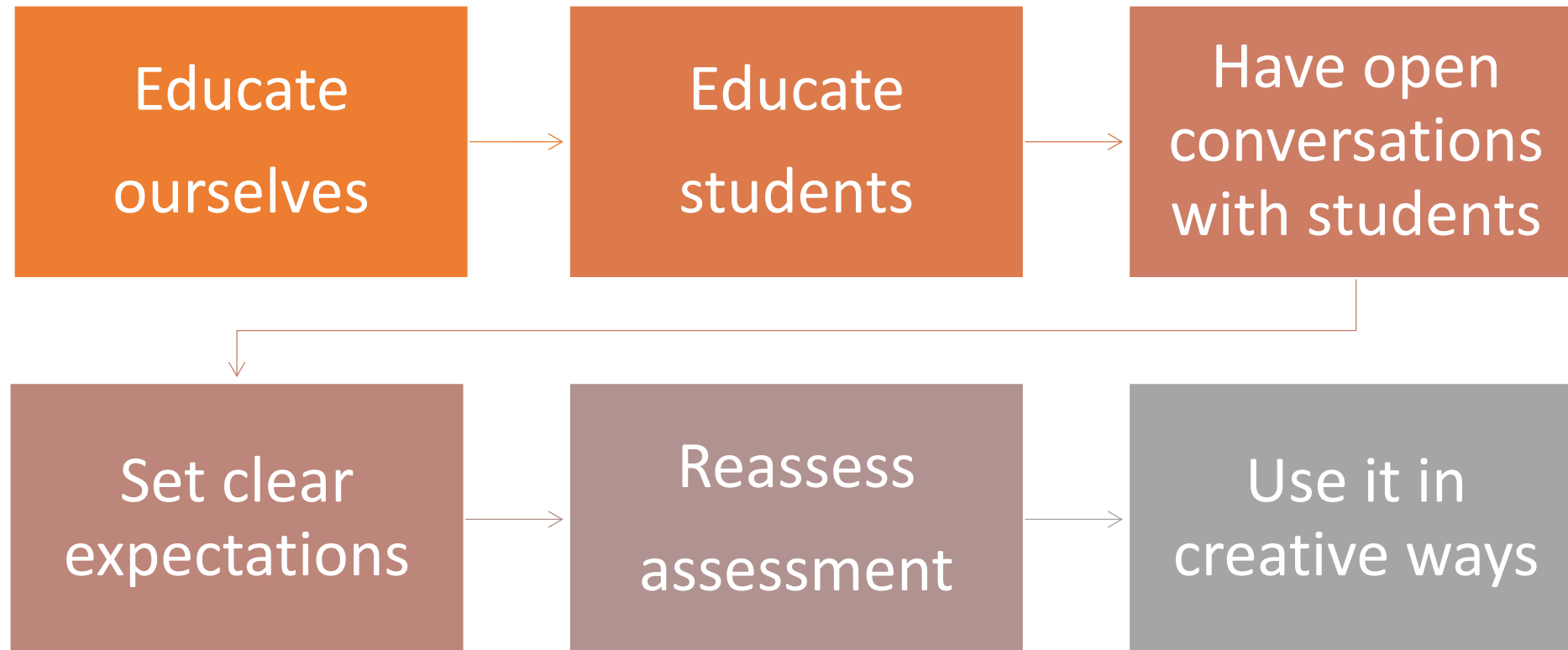


**Augmented** Intelligence (American Medical Association)



Use of generative AI does NOT have to be "all or nothing".

# Recommendations for educators



# Writing effective prompts (GIGO)

Ask ChatGPT to...

- Write for a particular **audience**
  - *Explain [concept] to me like I am a 5<sup>th</sup> grader.*
- Write in a particular **style**
  - Academic, casual, blogging
- Write in a particular **format**
  - *Explain a dental implant procedure to a patient.  
Present each step as a bullet point.*

Assign ChatGPT a role

Prompt: I would like you to act as a biomedical science faculty at a dental school. Please write 5 multiple choice questions that will test **first year** dental students' knowledge about the **physiology of diabetes.**

Original prompt:

I want to lose weight. What should I do?

1. **Set Realistic Goals:** Be realistic about the weight you want to lose and the timeframe. A goal of losing 1-2 pounds per week is often considered reasonable.
2. **Eat a Balanced Diet:** Focus on consuming a variety of foods including fruits, vegetables, lean proteins, whole grains, and healthy fats. Consider reducing your intake of processed foods, sugary drinks, and high-calorie snacks.
3. **Control Portion Sizes:** Sometimes it's not what you eat, but how much. Be mindful of portion sizes and try not to eat until you're overly full.
4. **Stay Hydrated:** Drink water throughout the day. Sometimes thirst is confused with hunger.
5. **Regular Physical Activity:** Include both aerobic (e.g. running, swimming) and strength training exercises in your routine. Aim for at least 150 minutes of moderate aerobic activity or 75 minutes of vigorous aerobic activity a week, plus strength training activities on 2 or more days a week.
6. **Sleep Well:** Poor sleep can affect your metabolism and hunger hormones, so aim for 7-9 hours of quality sleep each night.
7. **Manage Stress:** High stress levels can lead to emotional eating. Find healthy ways to manage stress like exercise, talking to a friend, or engaging in a hobby.
8. **Keep Track:** Monitor your food intake, physical activity, and weight. This can help you become more aware of your habits and motivate you to stay on track.
9. **Seek Support:** Share your goals with friends or family, or consider joining a support group. Having others to share the journey with can be motivating.
10. **Be Patient and Persistent:** Weight loss can be a slow process and may have plateaus.

Revised prompt:

I want to lose 5lbs in a month. Could you please suggest a weekly plan for me?

### Week 1:

- **Diet:**

- Breakfast: Oatmeal with a handful of berries and almonds.
- Lunch: Grilled chicken salad with mixed vegetables.
- Dinner: Baked fish with a side of steamed broccoli and quinoa.
- Snacks: Apple slices with almond butter, a handful of mixed nuts.

- **Exercise:**

- Monday: 30 minutes of moderate cardio (e.g. brisk walking).
- Tuesday: Strength training focusing on legs and core.
- Wednesday: Rest or light activity like stretching.
- Thursday: 30 minutes of moderate cardio.
- Friday: Strength training focusing on upper body.
- Weekend: Active rest, like a walk in the park.

### Week 2:

- **Diet:**

- Breakfast: Whole grain toast with avocado and a boiled egg.
- Lunch: Turkey and vegetable stir-fry.
- Dinner: Baked sweet potato with a side of grilled vegetables.
- Snacks: Greek yogurt with honey and walnuts, carrot sticks.

# Course guidelines (UPenn - Business)

I expect you to use AI in this class. In fact, some assignments will **require it**. Learning to use AI is an emerging skill, and I provide tutorials in Canvas about how to use them. I am happy to meet and help with these tools during office hours or after class. Be aware of the **limits** of ChatGPT:

- If you provide minimum effort prompts, you will get low-quality results. You will need to refine your prompts to get good outcomes.
- Don't trust anything it says. If it gives you a number or fact, assume it is wrong unless you either know the answer or can check in with another source. You will be responsible for any errors or omissions provided by the tool. It works best for topics you understand.

AI is a tool, but one that you need to acknowledge using. Please include a paragraph at the end of any assignment that uses AI **explaining** what you used the AI for and what prompts you used to get the results. Failure to do so is in violation of the academic honesty policies.

# Course guidelines (Sinky at UoP - Program Evaluation)

You are welcome to use generative AI models such as ChatGPT in this course. Learning to use AI is an emerging skill, and I will discuss **how to use them** responsibly and effectively during our first class.

The use of AI tools must be done in accordance with the following:

- AI-generated responses may be inaccurate or biased. Don't trust anything it says. Always **check its accuracy**. You are responsible for inaccurate or unethical content you submit.
- **Quote and cite** AI-generated text - like any other reference material. Copying AI-generated text verbatim is plagiarism. Even if you have paraphrased it without citation, it is also a violation of academic integrity.
- **Highlight** the AI-generated text.

# Citing generative AI

## In-text

According to ChatGPT, although the two brain hemispheres are somewhat specialized, *it is a myth to characterize people as left-brained or right-brained* (ChatGPT, 2023; see **Appendix A** for the full chat transcript).

## References

- Tool name. (Date). “*Your text of query.*” Company that developed the tool. Link to the tool. **Brief description of how you used it.**
- ChatGPT. (2023). “*Your text of query.*” OpenAI. <https://chat.openai.com/>. Requested on initial draft of the Introduction section of the essay, which I then edited and expanded.

# Some ways to harness generative AI

## Faculty

- Write/improve emails
- Draft letters of support
- Help with course planning
- Refine learning objectives
- Create presentations/outlines
- Write clinical cases
- Create test items
- Ask students to critique/improve an AI-generated response → critical thinking
- Analyze data

## Students

- Use it as a personalized tutor
- Clarify concepts
- Summarize/paraphrase text
- Correct grammatical errors/tone in writing
- Generate practice questions
- Assist with clinical training
  - Explain procedures to patients
  - Practice with AI-simulated patients

## Ask students to critique an AI-generated treatment plan



Based on the diagnosis of irreversible pulpitis of tooth 37, the recommended treatment plan for this patient would be:

1. Root canal therapy for tooth 37: As the tooth is non-vital and there is evidence of pulpitis, root canal therapy is necessary to remove the inflamed pulp and save the tooth.
2. Antibiotics: To control the infection and reduce the swelling, a course of antibiotics should be prescribed. Amoxicillin 500mg three times a day for seven days is recommended.
3. Pain management: To manage the severe pain, a combination of acetaminophen and ibuprofen is recommended. The patient can take 1000mg of acetaminophen and 600mg of ibuprofen together every 6 hours as needed for pain.
4. Follow-up appointment: A follow-up appointment should be scheduled to monitor the healing of the tooth and ensure that the infection has been completely eliminated.

# Course planning



To create a schedule for a 15-week course with 6 groups of 3 students each, where each group member takes turns being a patient, an observer, and a clinician, and ensuring that a clinician does not work with the same patient twice, while shuffling the names in each grouping, here's a schedule using the provided names:

## Week 1:

Group 1: (Solyna - Patient), (Jenny - Observer), (Becky - Clinician)

Group 2: (Lena - Patient), (Brooklyn - Observer), (Jeison - Clinician)

Group 3: (Alyssa - Patient), (Julie - Observer), (Danish - Clinician)

Group 4: (Erik - Patient), (Khadija - Observer), (Kiana - Clinician)

Group 5: (Ky - Patient), (Lucienne - Observer), (Hagar - Clinician)

Group 6: (Rim - Patient), (Paola - Observer), (Jeanette - Clinician)

## Week 2:

Group 1: (Lena - Patient), (Danish - Observer), (Jeanette - Clinician)

Group 2: (Alyssa - Patient), (Becky - Observer), (Hagar - Clinician)

Group 3: (Erik - Patient), (Jenny - Observer), (Solyna - Clinician)

Group 4: (Ky - Patient), (Khadija - Observer), (Jeison - Clinician)

Group 5: (Rim - Patient), (Lucienne - Observer), (Julie - Clinician)

Group 6: (Paola - Patient), (Brooklyn - Observer), (Kiana - Clinician)

## Qualitative analysis:

Merge all reflections  
into top 5-6 themes.



Certainly, let's merge all reflections into top 5-6 main outcomes:

1. **Self-Reflection and Growth:** One of the most significant outcomes was the opportunity to self-reflect, which led to a realization of personal and professional growth. By compiling the e-portfolio, students found a sense of accomplishment, pride, and surprise at how much they had achieved during their program.
2. **Visual Presentation and Organization:** Many of you acknowledged the impact of a well-organized and aesthetically pleasing e-portfolio. Key aspects included a clean layout, the effective use of images, especially black and white ones for a professional touch, and a consistent overall theme.
3. **Personalization and Context:** Adding personal touches and context to your work stood out as an important outcome. This involved detailed descriptions of assignments, personal statements, goals, and about me sections. Including such personal elements made your e-portfolio unique and gave viewers a more in-depth understanding of your personality and professional aspirations.
4. **Peer Learning and Inspiration:** Observing your classmates' e-portfolios emerged as a significant learning experience. Not only did it give you a chance to understand your peers better, but it also offered new perspectives and ideas to improve your own portfolios.
5. **Career-Oriented Content:** Many of you highlighted the importance of including content that demonstrates your career ambitions and dedication to the field of dental hygiene. The inclusion of future goals, updated CVs, and professional accomplishments was seen as a way to make your e-portfolio more compelling to potential employers.
6. **Sense of Resilience and Shared Achievement:** Creating the e-portfolio encapsulated the hard work and commitment put into the program. It stood as a testament to your

# Quantitative analysis

S

Please calculate descriptive data for the data in this file. Present the mean, standard deviation, and sample size in a table format.



Remote learning course grade.xlsx



Class of 2019 (in-person) vs. class of 2020 (remote)?



Finished working

Show work ▼

Here are the descriptive statistics for the two classes in your dataset:

	Mean	Standard Deviation	Sample Size
Class of 2019	83.38	10.36	29
Class of 2020	80.17	8.47	29

S

Please create a subplot for each class and overlay a normal distribution line on top of it.

S

But where is the normal distribution line?



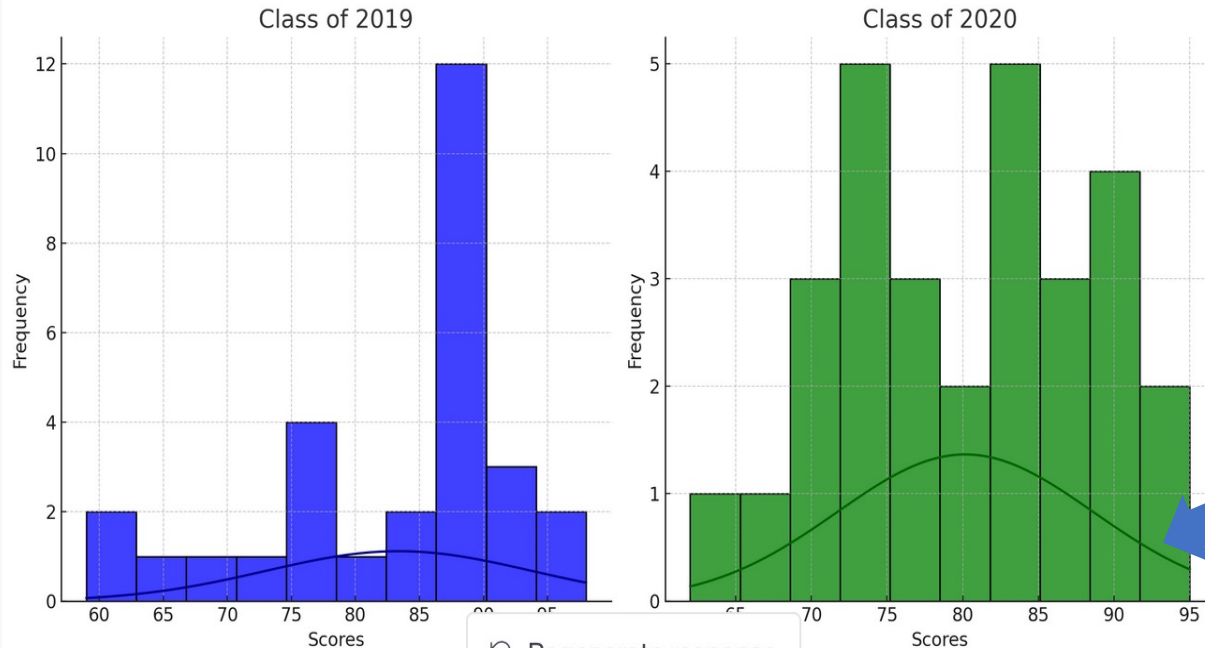
Finished working

Show work ▼

I apologize for the oversight. It appears there was an error because I forgot to import the numpy library, which is necessary to generate the range of values for the x-axis. Let me correct that and regenerate the graphs.

Finished working

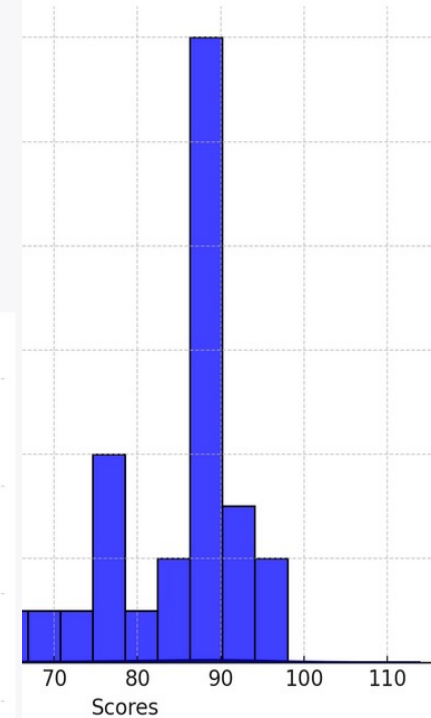
Show work ▼



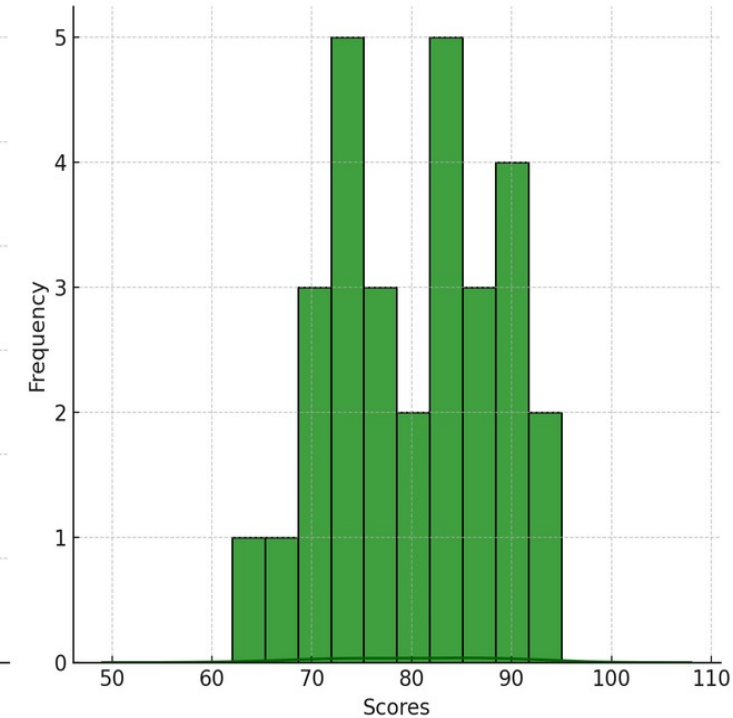
Regenerate response

Show work ▼

Class of 2019



Class of 2020



# Data visualization

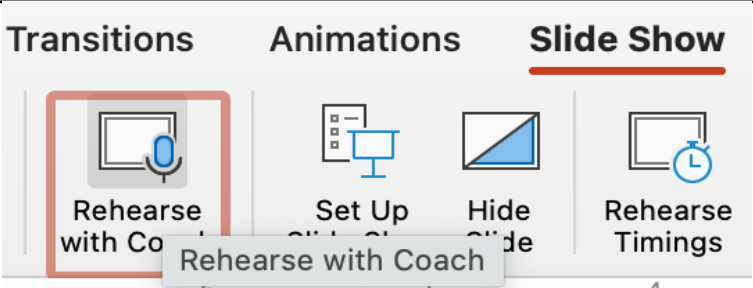
# Recap: A few key points



- Understand its capabilities and limitations – **try it if you haven't.**
- Teach students about effective and responsible use.
- Set clear course policies
- Rethink assessment
- Use it in creative ways
- Use it as a **jumping-off** point – rather than as the final authority!

Have a “learning” mindset!

# Resources: AI-powered educational tools

PowerPoint: Rehearse Coach	Feedback on speed, tone, filler words, etc.	
Yoodi	Feedback on speed, tone, filler words, etc. <a href="https://app.yoodli.ai/">https://app.yoodli.ai/</a>	
Canva: Magic Design	Presentations, 360* images, flyers, newsletters, etc. <a href="https://www.canva.com/magic-design/">https://www.canva.com/magic-design/</a>	
Beautiful AI	Presentations <a href="https://www.beautiful.ai/">https://www.beautiful.ai/</a>	
Slides AI	Presentations <a href="https://www.slidesai.io/">https://www.slidesai.io/</a>	
ElevenLabs	Text to speech <a href="https://beta.elevenlabs.io/">https://beta.elevenlabs.io/</a>	

## Your Rehearsal Report (Preview)

Rehearse Again

### Summary

Good job rehearsing! Keep up the hard work.

**30:18**

total time spent

**62**

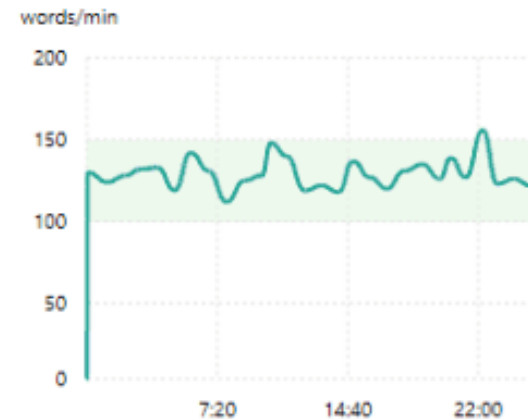
slides rehearsed

### Pace



Your pace is just right! Keep it up!

### Your average pace over time



[Learn More](#)

### Fillers

To sound more polished and confident, try to avoid using filler words. Pause or take a breath to relax. Some filler words to avoid are:

umm

You know

actually

[Learn More](#)

### Repetitive Language

NEW

Try using synonyms to avoid repetition. Below are the repeated words from your rehearsal.

very

maybe

ok

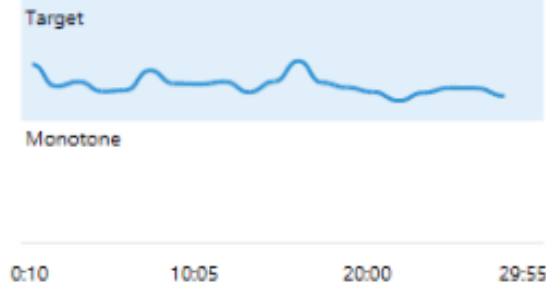
### Speech Refinements

Consider rephrasing these sentences to better communicate with your audience.

How was your experience? ☆☆☆☆☆

### Pitch

Low pitch variation will make your audience lose interest. Try increasing the tone for your key points.



[Learn More](#)

### Originality

✓ You avoided reading slide text aloud. That's good for keeping the audience engaged with your message.

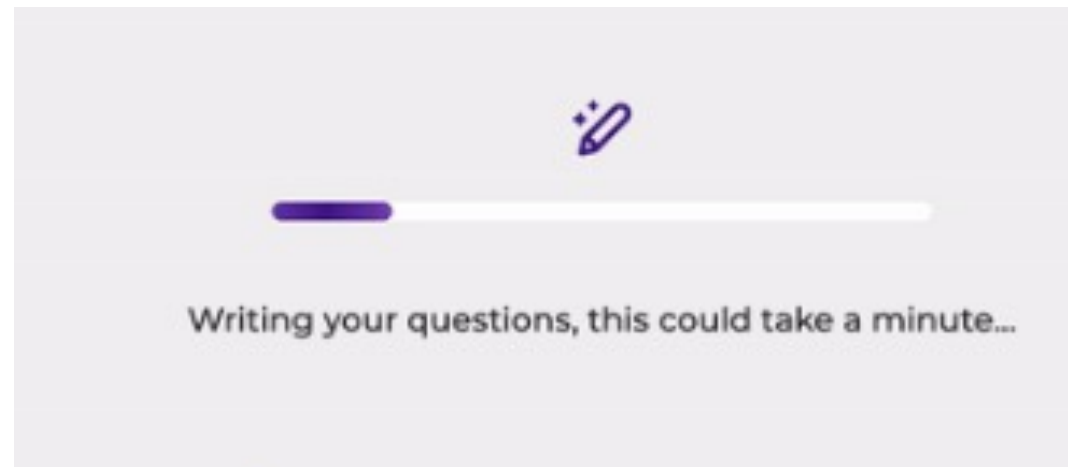
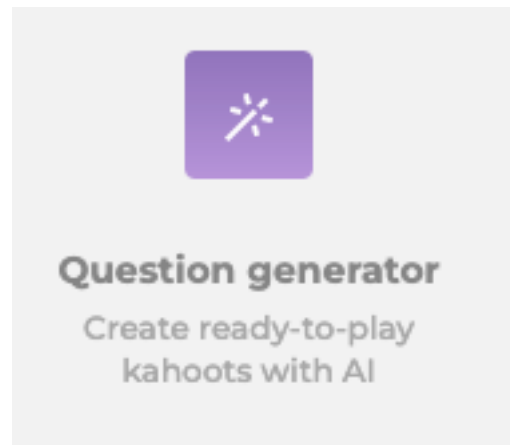
[Learn More](#)

PowerPoint:  
Rehearsal  
feedback

# Resources: AI-powered educational tools

## Kahoot!

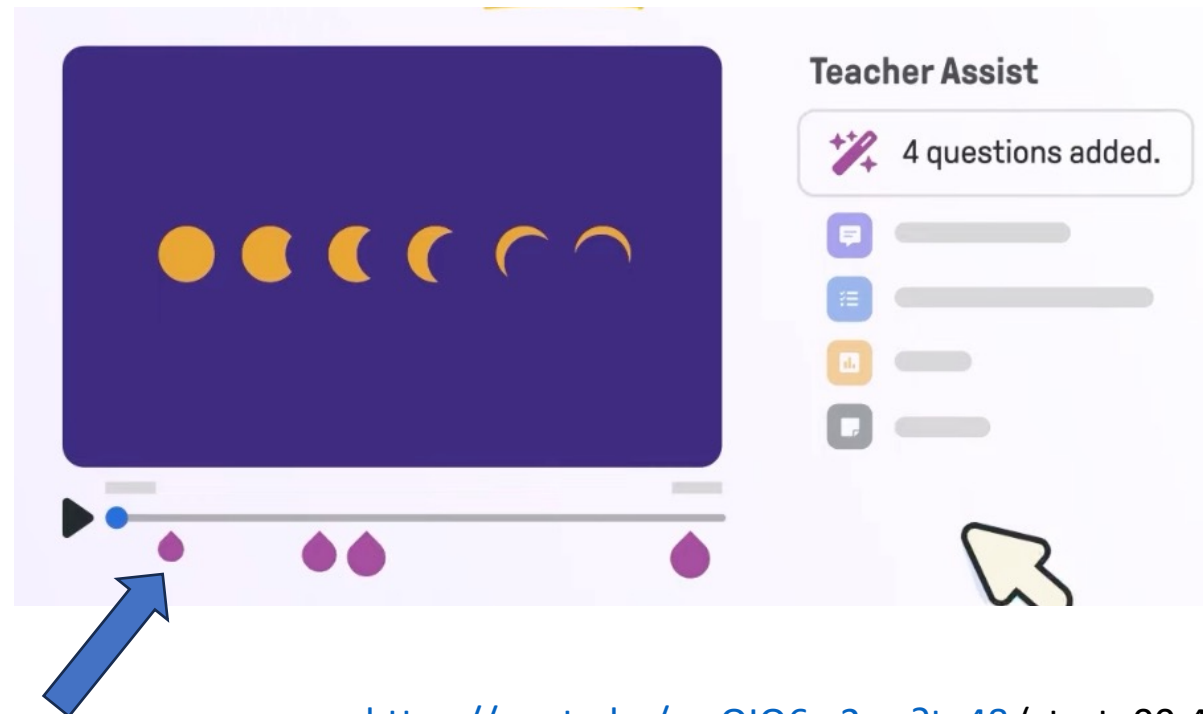
- Polling questions; games
- AI-powered “Question generator”: automatically generate polling questions.



# Resources: AI-powered educational tools

## Edpuzzle

- Insert time-stamped questions into the video.
- AI-powered “Teacher Assist”: automatically generates time-stamped questions.



<https://youtu.be/-cgOIQ6w2cw?t=48> (start: 00:47)

# Resources: AI-powered educational tools

## Quizlet

- Flashcards, games, competition
- Adaptive AI tutor “Q-Chat”: self-testing in a conversational style.



Great! Let's start with an easy one. What is the smallest unit of life?



Correct! What is the function of the mitochondria within a cell?



The mitochondria are responsible for producing energy in the form of ATP through cellular respiration.

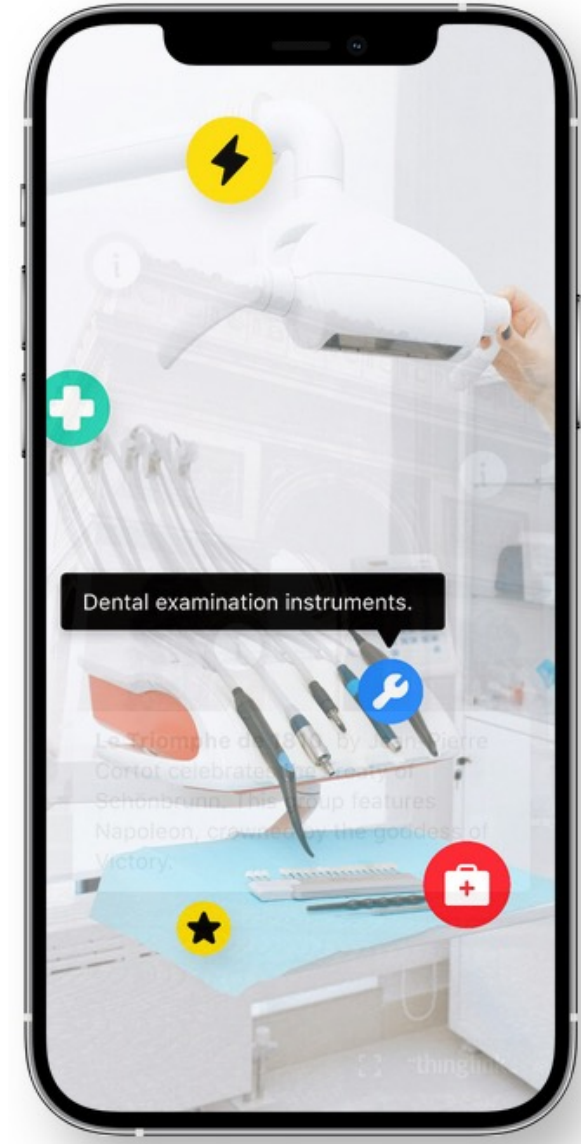
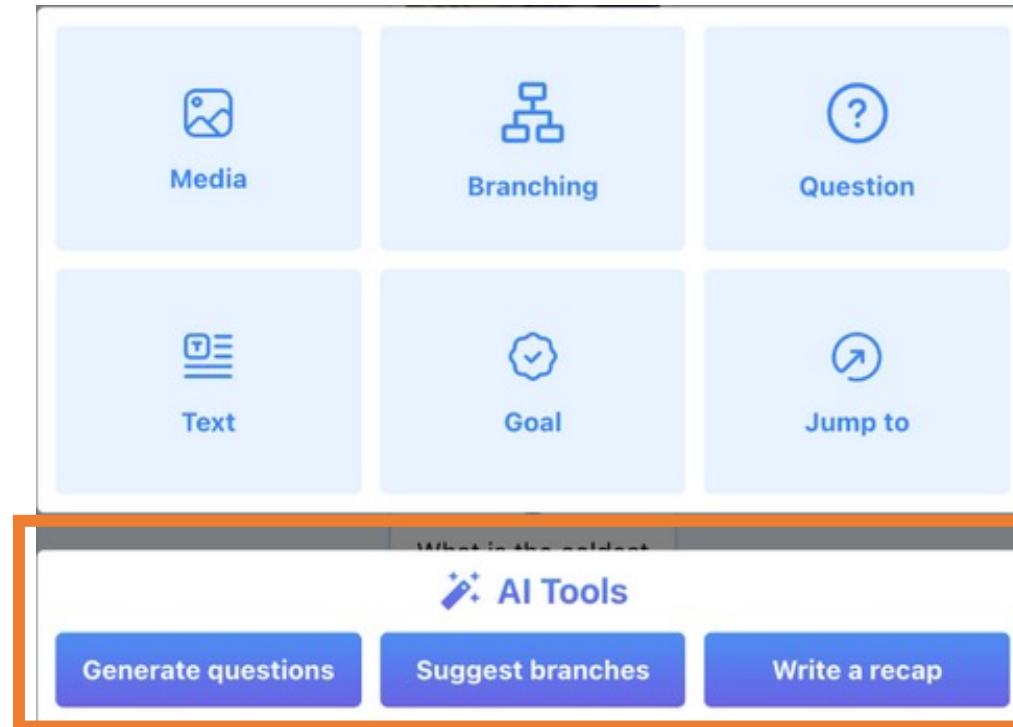
cell S

no idea S

# Resources: AI-powered educational tools

## ThingLink

- Tagging multimedia (images, 360 degree images, videos, 3D)
- Embedded questions
- Branching scenarios
- Escape rooms



# Resources: AI-powered educational tools



## Unlock your potential with a smart AI assistant

Zoom's AI companion helps draft emails and chat messages, summarize meetings and chat threads, and make brainstorming sessions more fun and productive – so you can focus on what matters and collaborate better.

Try some of these features in Zoom Meetings, Team Chat and IQ for Sales as part of selected paid plans\*

<https://explore.zoom.us/en/ai-assistant/#:~:text=Zoom's AI companion helps draft,what matters and collaborate better>

Thank you!