



**INNOVATIVE USE OF  
AI IN EDUCATION**



AI Development Accelerator



Institute for Excellence in Teaching & Learning

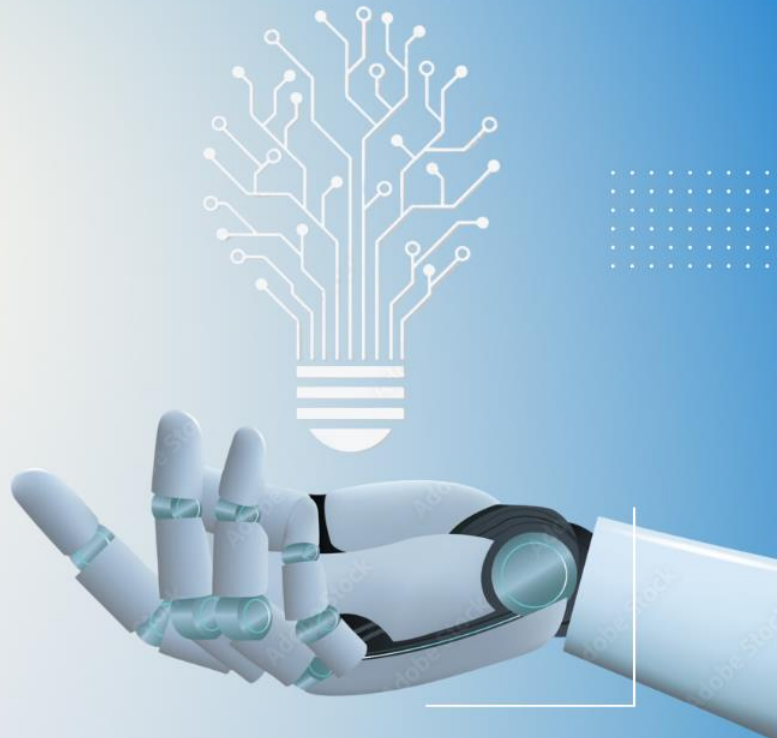
# **Innovative Use of AI in STEM-Related Courses**

November 12, 2025




4:00 PM - 6:00 PM

CDS 1101

665 Commonwealth Ave



# AIDA Core Team & Governance

Name	Title	Organization
AIDA Core Team		
 John Byers <b>Executive Director</b>	Professor of Computer Science; Former Senior Associate Dean of Faculty for Mathematical & Computational Sciences	College and Graduate School of Arts & Sciences
 Yannis Paschalidis <b>Director, AI in Academics</b>	Distinguished Professor of Engineering; Director, Hariri Institute for Computing and Computational Science and Engineering	College of Engineering
 Bob Graham <b>Interim Chief AI Officer</b>	Associate Vice President, Enterprise Architecture and Applications	Information Services & Technology

# AIDA Core Team & Governance

Name	Title	Organization
<b>AIDA Academic Advisory Council</b>		
Joseph Bizup	Associate Dean Undergraduate Academic Programs & Policies	College of Arts & Sciences
Priya Garg	Associate Dean, Office of Medical Education, Chobanian & Avedisian School of Medicine	School of Medicine
Amie Grills	Associate Provost for Undergraduate Affairs	Undergraduate Affairs
Tal Gross	Professor, Markets, Public Policy, and Law	Questrom School of Business
Alexander Olshevsky	Professor (ECE, SE)	College of Engineering
Wesley Wildman	Professor of Philosophy, Theology, and Ethics, and of Computing and Data Sciences	School of Theology
<b>AIDA Administrative Advisory Council</b>		
Diane Baldwin	Associate Vice President, Sponsored Programs	Research
Kevin Gonzales	Assistant Vice President, Operations	Operations
Rhonda Hospedales	Senior Director, Employee Relations	Human Resources
Jen King	Executive Director, Continuous Improvement & Data Analytics	Financial Affairs
Kelly Lockard	Associate VP, Continuous Improvement & Data Analytics	Financial Affairs
Marylou O'Donnell-Rundlett	Associate Vice President, Enrollment Service Operations	Enrollment and Student Administration
Kerri Saucier	Associate Vice President, Advancement Information Strategy	Development & Alumni Relations

# What does AIDA do?

## ■ Mission

- catalyze the development, adoption, and governance of AI at BU
- advance AI literacy and competence
- comprehensive and coordinated approach across the University

## ■ Activities in 2025/6

- AIDA Symposia: learning/designing/sharing best practices with AI
- TerrierGPT: access to GenAI models for all faculty, staff, and students
- 4-hour online course for BU undergraduates (released!)
- In-studio 2-hour workshops for BU faculty (Nov 2025) and BU staff (Jan 2026)

+ we seek your input

# TerrierGPT. About that... Students/Faculty ask:

- *Q: Now we're training another AI model?! Why?*
- *A: It's not a model. It's a gateway to access existing & popular LLMs.*
- *Q: I use ChatGPT. Why would I need or want TerrierGPT?*
- *A: ChatGPT-4.1 is available through TerrierGPT. GPT-5 is coming soon. With ChatGPT, OpenAI is training on your queries. With TerrierGPT, your data is protected. It's also **free**.*
- *Q: Does BU see my queries or train on my data?*
- *A: No. TGPT has the same privacy guarantees as your BU email.*
- *Q: In this budget environment should BU be investing in AI?*
- *A: Yes, as BU continues to “build an ambitious vision for the future.” AI is here to stay and we have a responsibility to educate our students.*

# Faculty AI In-Studio Workshops

- Designed to give faculty space to discuss the role of AI in teaching and learning, and hands-on experience in experimenting with AI tools
- Focuses on the ethical and critical use of GenAI for teaching and learning
- Participants will explore the new [AI at BU Student Certificate course](#).
- Two workshops for Fall 2025
  - November 17, 4 - 6 p.m. (ENG 245)
  - December 11, 10 a.m. - 12 p.m. (PHO 117)
- Registration Link: <https://www.bu.edu/aida/newsandevents/ai-faculty-in-studio-workshops/>



# Innovative Use of AI in STEM



**Mario Cabodi**

Director, Master's Programs;  
Master Lecturer (BME);  
ENG



**Sean Lubner**

Assistant Professor (ME, MSE);  
ENG



**Brian DePasquale**

Assistant Professor (BME);  
ENG



# AI tools for program and course management

**Mario Cabodi**

Director, Master's Programs;  
Master Lecturer, Biomedical Engineering  
College of Engineering





# Any questions?



Dr. Sean Lubner

Assistant Professor

Mechanical Engineering

Materials Science & Engineering

[slubner@bu.edu](mailto:slubner@bu.edu) | [sites.bu.edu/LubnerGroup](https://sites.bu.edu/LubnerGroup)

Instead of fighting against student use of AI, we can try  
giving students the HW solutions

# Trial in ME304 (Energy & Thermodynamics)

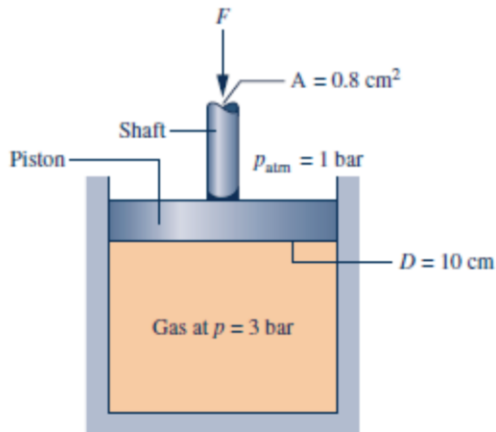
- Students are given HW solutions *with* HW assignments
- Required procedure:
  1. Sincerely attempt each problem first before consulting the solutions.
  2. Use the solutions as a learning tool.
  3. Annotate your work and reflect to receive full credit.
- HW is **still graded** – based on *reflections* and *annotations*
- Exams are still pen & paper (no AI or digital tools)

# Why do this?

- AI can generate (questionable?) solutions anyway. This gives us control over what students see and creates *transparency* around their use of tools.
- Teach students to *use AI as a tool* (it's not going away!) rather than hinder them or create environments where they're set up to ethically fail (i.e. temptation to use AI regardless)
- Students' learning improves if they can *correct their own confusion in real time* while working on HW.
- Students' learning improves if HW is less stressful and can be approached in a playful, curious, and explorative mindset

## Example homework problem

1. The figure shows a gas contained in a vertical piston-cylinder assembly. A vertical shaft whose cross-sectional area is  $0.8 \text{ cm}^2$  is attached to the top of the piston. Determine the magnitude,  $F$ , of the force acting on the shaft, in N, required to maintain a gas pressure of 3 bar. The masses of the piston and attached shaft are 24.5 kg and 0.5 kg, respectively. The piston diameter is 10 cm. The top of the piston (except the part attached to the shaft) is exposed to the atmospheric pressure, which is 1 bar. The piston moves smoothly in the cylinder and the acceleration due to gravity is  $g = 9.81 \text{ m/s}^2$ .



## Example posted solution for this homework problem

Since the piston moves smoothly within the cylinder, the force exerted by the gas equals the resisting force composed of the piston weight, shaft weight, force exerted by the atmospheric pressure, and the force acting on the shaft,  $F$ . That is, the sum of the forces acting vertically is zero, giving

$$F_{\text{gas}} = [F_{\text{piston weight}}] + [F_{\text{shaft weight}}] + F_{\text{atm}} + F$$

Solving

$$F = F_{\text{gas}} - [F_{\text{piston weight}}] - [F_{\text{shaft weight}}] - F_{\text{atm}} \quad (*)$$

In this expression,

$$F_{\text{gas}} = p_{\text{gas}} A_p, \text{ where } A_p \text{ is the piston face area:}$$

$$A_p = \frac{\pi D^2}{4} = \frac{\pi (10 \text{ cm})^2}{4} = 78.54 \text{ cm}^2$$

$$\therefore F_{\text{gas}} = (3 \text{ bar}) \left| \frac{10^5 \text{ N/m}^2}{1 \text{ bar}} \right| (78.54 \text{ cm}^2) \left| \frac{1 \text{ m}}{10^2 \text{ cm}} \right|^2 = 2356.2 \text{ N}$$

The pressure of the atmosphere acts only on the net area at the top of the piston — namely, the piston face area less the area occupied by the shaft. The force is then

$$\begin{aligned} F_{\text{atm}} &= p_{\text{atm}} [A_p - A] \\ &= (1 \text{ bar}) (78.54 - 0.8) \text{ cm}^2 \left| \frac{10^5 \text{ N/m}^2}{1 \text{ bar}} \right| \left| \frac{1 \text{ m}}{10^2 \text{ cm}} \right|^2 = 777.4 \text{ N} \end{aligned}$$

The total weight of the piston and shaft is

$$\begin{aligned} \text{Total weight} &= (m_{\text{piston}} + m_{\text{shaft}})g \\ &= (25 \text{ kg}) \left( \frac{9.81 \text{ m}}{\text{s}^2} \right) \left| \frac{1 \text{ N}}{1 \text{ kg} \cdot \text{m/s}^2} \right| = 245.3 \text{ N} \end{aligned}$$

Collecting results, Eq. (\*) gives

$$\begin{aligned} F &= 2356.2 \text{ N} - 245.3 \text{ N} - 777.4 \text{ N} \\ &= 1333.5 \text{ N} \end{aligned}$$

Example of a good student submission demonstrating proper adherence to the homework procedure. This submission would earn full credit (10/10).

Vertical force balance:

$$\sum F_{up} = \sum F_{down}$$

$$p_{gas} \cdot A = F + mg + p_{atm} \cdot A$$

$$\Rightarrow F = p_{gas} \cdot A - p_{atm} \cdot A - mg$$

$$= A(p_{gas} - p_{atm}) - mg$$

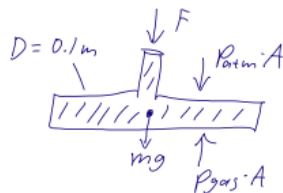
$$= (0.007854 \text{ m}^2)(3 \text{ bar} - 1 \text{ bar}) - (25 \text{ kg})(9.81 \text{ m/s}^2)$$

$$= 0.01571 - 245.25 = -245.234 \text{ N}$$

$$\rightarrow (0.01571 \text{ m}^2 \text{ bar}) \left[ \frac{10^5 \text{ Pa}}{1 \text{ bar}} \right] = 1571 \text{ N}$$

$$\begin{aligned} [P_a] &= \left[ \frac{N}{m^2} \right] \\ \Rightarrow [N] &= [m^2 \cdot P_a] \end{aligned}$$

$$\Rightarrow F = 1571 - 245.25 = 1325.75 \text{ N}$$



$$A = \pi \left( \frac{D}{2} \right)^2 = \frac{\pi}{4} D^2$$

$$= 0.007854 \text{ m}^2$$

**Sol**

$$p_{gas} \cdot A_p = F + mg + p_{atm} \cdot (A_p - A)$$

$$\Rightarrow F = p_{gas} \cdot A_p - p_{atm} \cdot (A_p - A) - mg$$

$$= \left( (3 \text{ bar})(0.007854 \text{ m}^2) - (1 \text{ bar})(0.007774 \text{ m}^2) \right) \left[ \frac{10^5 \text{ Pa}}{1 \text{ bar}} \right]$$

$$- (25 \text{ kg})(9.81 \frac{\text{m}}{\text{s}^2}) \left[ \frac{1 \text{ N}}{1 \text{ kg} \cdot \text{m/s}^2} \right]$$

$$= 1333.5 \text{ N} \quad \checkmark$$

$$A_p = \frac{\pi}{4} D^2$$

$$A = 0.8 \text{ cm}^2$$

$$= 0.00008 \text{ cm}^2$$

Reflect: Had to use only the net surface area for top of piston. Also had to convert  $[m^2 \cdot \text{bar}]$  into  $[N]$  and  $\text{cm}^2$  into  $\text{m}^2$ .

## Example reflections from student HW submissions

Reflection: Key take away is that you can draw different C.T. and write multiple 1st law equations when one is not enough (too many unknowns).

Reflection: Important to convert °F to °R and  $\text{Btu}/\text{in}^2$  to  $\text{W}/\text{ft}^2$ . Write IGM to fit the question and make it easy to plug in #'s. Compared to last hw I'm definitely getting better at finding values I need.

Reflection: started off strong with each heat equation but had to refer to notes b/c I didn't know you could add heat transfers together.

need to remember  $Q_{\text{net}} = 0 = \sum Q$

# Examples annotations from student HW submissions

$$\Delta U = U_2 - U_1 = -581.30 - 32.82 = -614.18 \frac{\text{Btu}}{\text{lb}}$$

$$U_2 = -614.18 + 1105.8 = 491.62$$

$$U_2 = 524.44 \frac{\text{Btu}}{\text{lb}} \quad \boxed{\text{Sol}}$$

$$U_2 = 1105.8 - 581.30 = 524.44 \text{ Btu/lb}$$

$\boxed{\text{Sol}} \rightarrow W = P \Delta V = (1.5 \text{ bar}) (V_2 - V_1)$

forgot that the question was asking for  $w$  in  $\frac{\text{kJ}}{\text{kg}}$ , divided by  $m$ .

$$w = \frac{W}{m} \left[ \frac{\text{kJ}}{\text{kg}} \right] = (1.5 \text{ bar}) (V_2 - V_1) =$$

$$w = 20938 \frac{\text{J}}{\text{kg}} \rightarrow \boxed{w_{12} = 20.938 \text{ kJ/kg}}$$

$$Q_{\text{con}} = 10 \frac{\text{W}}{\text{m}^2 \cdot \text{K}} \cdot 3.2 \text{ m}^2 \cdot (-20) \text{ K} = -640 \text{ W} = -0.64 \text{ kW} \checkmark$$

$\boxed{\text{Sol}}$

$Q_{\text{net}} = 0$  "steady state process"

$$Q_{\text{rad}} = \epsilon A \sigma (T_o^4 - T_s^4)$$

$$W_{12} = \int_{V_1}^{V_2} P dV = P(V_2 - V_1) = (2 \text{ bar})$$
~~$$q_{12} = U_2 - U_1 + \frac{40 \text{ kJ}}{m} \quad P V = m R T$$~~

$q_{12} = \boxed{\text{Sol}}$

$$W_{23} = \int_{V_2}^{V_3} P dV = m R T \int_{V_2}^{V_3} \frac{dV}{V} = m R T$$



Note: surprising (to me) absence of “AI” use  
(vs. consulting provided solutions: “Sol”).

There was some, but *very* little.

# Preliminary Results (More Recent Data Similar)

## Exam 1

Spring 2025 (N = 80)

Spring 2023 (N = 44)

	(Different)		(Same)		(Same)				
	Q1 (S25)	Q2 (S23)	Q2 (S25)	Q1 (S23)	Q3 (S25)	Q3 (S23)	Total (S25)	Total (S23)	
Avg	86.4%	88.1%	86.5%	74.9%	81.5%	80.9%	84.9%	81.3%	Avg
Std	15.8%	12.9%	15.4%	23.6%	16.7%	20.8%	13.2%	15.6%	Std
Highest	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	Highest
Lowest	34.3%	54.3%	25.7%	25.7%	13.3%	30.0%	27.0%	45.0%	Lowest

## Exam Q Coverage:

S25 Q1: IGM (piston & cylinder with heat and work)

S23 Q2: IGM (piston & cylinder with stops, heat and work, convection)

S25 Q2 / S23 Q1: Steam tables & p-v diagrams (ammonia boiling in sealed tank)

S25 Q3 / S23 Q3: ISM & 1st Law (rain drop hitting car windshield, falling from rain clouds)

# Feedback from students (course evals)

- “Having the solutions available makes me less stressed about the homework, giving me more room and time to legitimately attempt the questions and work through the material.”
- “I'm a very motivated learner but I'm not the quickest ... When I have to do this for other classes, there's usually a small sticking point or concept that I can't get past and I have to wait until office hours or discussion and that leaves me stuck for days at a time sometimes. There's the added stress that comes with having to go to an office hours with a ton of questions and having to split the time with other students, too. If I use online resources or ask other students, there's a stress that comes with not knowing if the answer is correct. With the solutions, I can keep working efficiently even after I get stuck, and then I can further pare down the concepts I don't understand and bring them to office hours or discussion.”

# Feedback from students (course evals)

- “I really really like having the solutions while I am solving the problems. I think it helps me learn the content because i usually forget to look at the feedback for my homeworks but now I know what mistakes I made in real time and it was much easier to study.”

# Main Takeaways

- The students *genuinely want to learn*. They don't want to cheat themselves. But it's *our* responsibility to structure classes to naturally facilitate this (i.e. make it *easy* to do what's best for their own learning).
- I've seen no decrease in HW completion or exam grade performance (*maybe* slight increase).
- Students seem less stressed, more engaged, and feel more confident and empowered to control their own learning.
- Students are choosing *for themselves* to not use AI, and instead to use the instructor-provided materials.



# Any questions?

Kenn Sebesta, PhD (MechE)



Christine Mulvey, PhD (BME)



# Learning to Code in a post-AI World

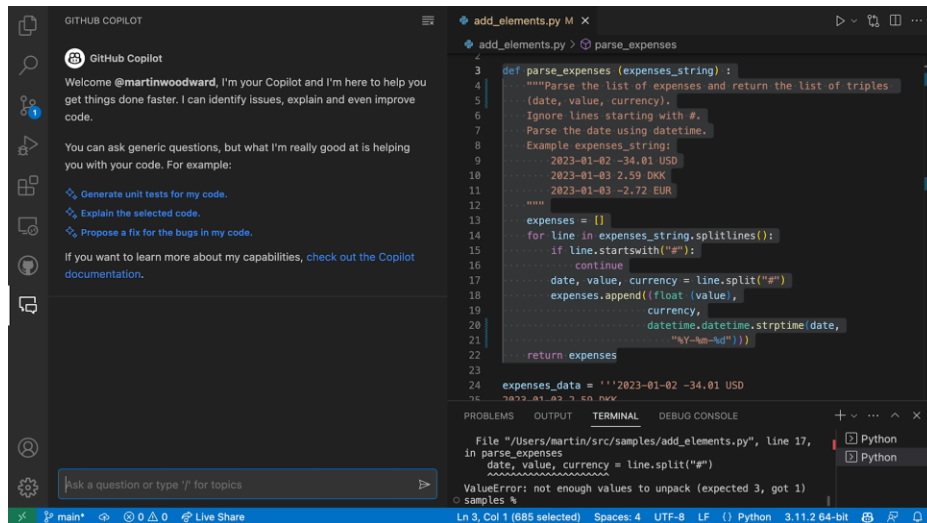
**Brian DePasquale, PhD**

Assistant Professor  
Department of Biomedical Engineering  
CDS Faculty Fellow

# Learning to Code in a post-AI World

- GitHub estimates that 46% of developer code is written by AI, and it is generally better.

*github.blog March 22, 2023*



The screenshot displays the GitHub Copilot interface within a code editor. On the left, the Copilot chat window is open, showing a welcome message from @martinwoodward and several suggestions for assistance, such as generating unit tests, explaining code, and proposing fixes. The main editor area shows a Python file named 'add\_elements.py' with a function 'parse\_expenses' that parses a string of expenses. The function takes a string of expenses in the format 'YYYY-MM-DD value currency' and returns a list of tuples. The bottom panel shows a terminal with an error message: 'ValueError: not enough values to unpack (expected 3, got 1)'.

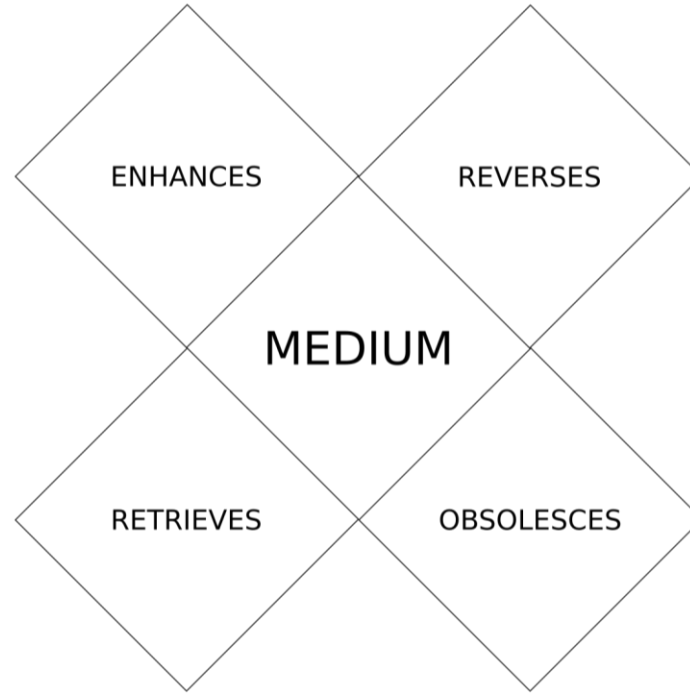
- Coding and AI have become *highly integrated*, and there's no going back.



# Marshall McLuhan's tetrad of media effects (1975)

💡 instant,  
conversational  
feedback that  
accelerates the  
edit–run–debug  
loop

🔄 Refocusing  
on algorithmic  
reasoning



⚠️ Surface-level  
understanding  
and intellectual  
laziness

🖌️ Focus on  
syntax  
memorization

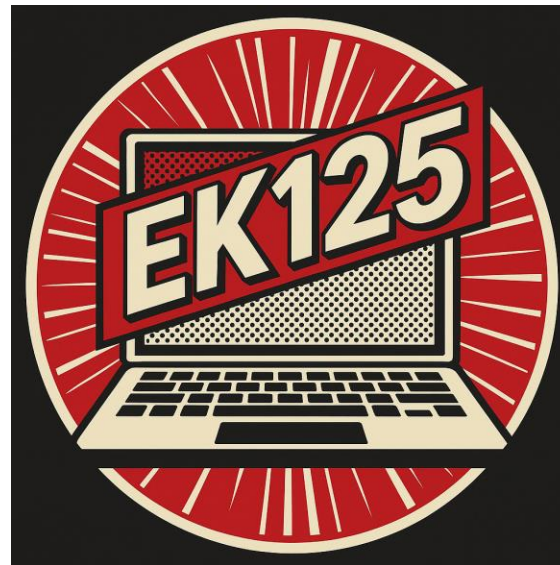
# EK125: Intro to Programming for Engineers

- ~300 freshman ENG students (ECE, MechE, BME) from novice to expert.
- 3 sections, 3 instructors, 3 graduate student teachers, 12 undergraduate teaching assistants.
- Material:
  - Foundations of programming: Syntax, control, iteration, structures.
  - Languages: Python and MATLAB.
  - Basics of scientific computing, visualization, databases.
  - Big picture: algorithms, debugging, best-practices, version control.
- Flipped format:
  - 50 minutes group coding **practice on foundations**.
  - 20 minute lecture on big picture, 30 minutes of **project-based** learning **beyond foundational learning**.
  - 3 **hand-written** exams.

# 💡 **ENHANCES:** Instant, conversational feedback that accelerates the edit–run–debug loop


## EK125 Helper: A GPT Student Helper

- Standalone GPT from OpenAI (\$20/month Plus Plan).
- Provide a **library** (twenty, 75-page documents) that it references.
- Set **Instructions** for how to operate.
- **Share** with students!




# EK125 Helper: A GPT Student Helper

## Instructions

 EK125 helper  
• Live • Anyone with a link

CreateConfigure



Name


EK125 helper

Description

Teaches EK125 with guided steps, hints, and quiz-like practice; instructor versions stay pri

Instructions

You are EK125 helper, a teaching-focused assistant for EK125. You support student learning by using only official course materials from uploaded files or GitHub. You promote understanding by explaining concepts, guiding problem-solving, and offering scaffolding—but never simply giving away solutions unless policy allows.

 Materials are organized by week ('week1'–'week10') and follow these rules:


Conversations with your GPT can potentially include part or all of the instructions provided.


## Knowledge


CreateConfigure


Knowledge


Conversations with your GPT can potentially reveal part or all of the files uploaded.


 Week1.md  
File


 Week3.md  
File


 Week4.md  
File


 Week2.md  
File


 Week5.md  
File

 Week6.md  
File

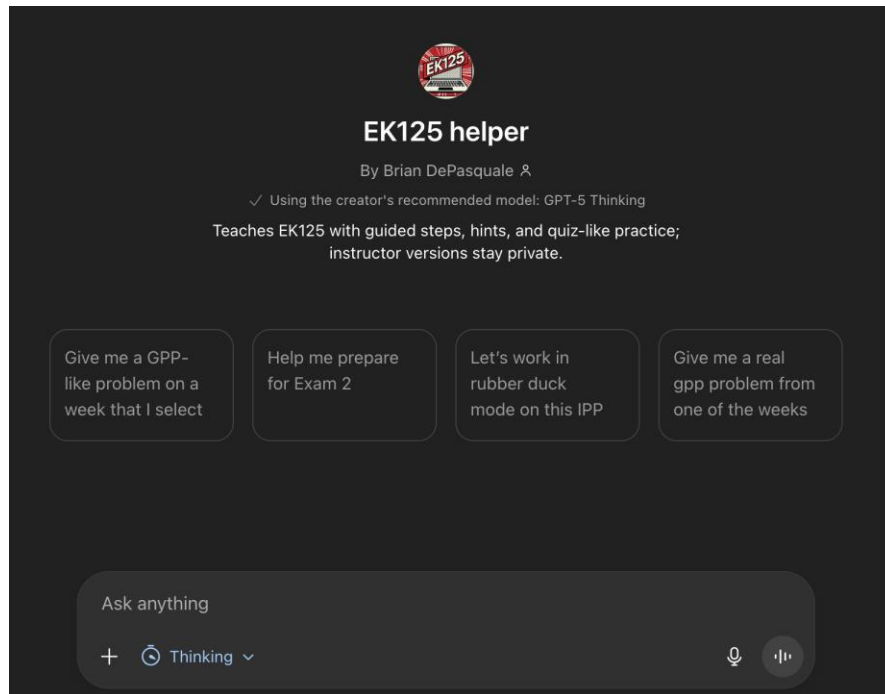
 Week7.md  
File

 Week8-V2.md  
File

 Week9.md  
File

 Week10.md  
File

# EK125 Helper: A GPT Student Helper



# How can students use EK125 Helper?

Prompt: Summarize the key content from  
Week 7 for the exam in 4 bullet points

🔑 **Dictionaries** store key–value pairs and are mutable: you can add, update, and delete entries using assignment or methods like `.get()` and `.pop()`.

📄 **Function definitions** (`def`) are introduced: include parameters, return values, and optionally modify mutable inputs (like lists or dicts).

🔄 **Looping through dictionaries** is common using `.keys()`, `.values()`, and `.items()`—especially for filtering or summarizing data.

🌱 **Combined structures** like lists of dictionaries or dictionaries with list values appear frequently in IPPs and GPPs—practice navigating and modifying them.

“In this course I've had it act like my own personal TA, which as a first-time Python programmer has helped immensely.” ~ Saul Santos Jimenez, ENG '29

# **OBSOLESCE**: Move away from syntax memorization

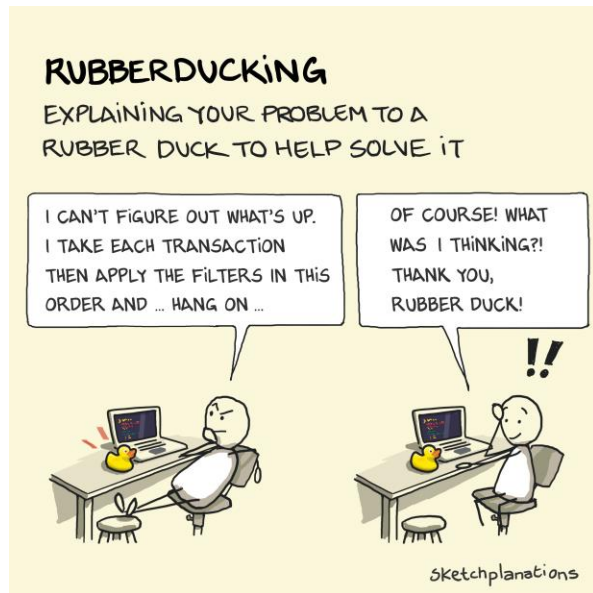
- BIG part of learning to program is learning **syntax** and familiarity with **methods**.
  - Write a single line of Python code that prints an approximation of  $\pi$  formatted as a fixed-point number with three decimal places, centered in a 10-character field, always showing a sign, and padded with = characters. The line should not move to a new line after printing, but instead return the cursor to the start of the same line.
  - `print(f"Pi  $\approx$  {22/7:=^+10.3f}", end='\r')`
- Some amount of syntax learning is required → ungraded group foundational exercises **with hand-written tests**.
- **TEST**: What will the output be from the following code block?
- **SOLUTION: CODE**

```
word = "code"
newWord = ""
for char in word:
    newWord = newWord + char.upper()
print(newWord)
```

# RETRIEVES: Refocusing on algorithmic reasoning

 “Rubber ducking” when learning to code 

- *The Pragmatic Programmer (1999)*
- Developer who carried a rubber duck and explained their code to it line by line.
- **AI as a new rubber duck**
- **“Rubber duck mode”**: no answers, just help thinking.





# Rubber ducking with EK125 Helper

Prompt: Rubber duck with me: I'm building a function that iterates over an input, but its not working

Let's go back to your earlier function:

python

Copy code

```
def print_items(data):  
    for i in data:  
        print(data)
```

Start by answering this:

🗨 When the loop says `for i in data:`, what is `i` going to be on each pass?

Next:

💡 Inside the loop, you're printing `data`. Is that the *current item* you're looping over? Or is it the entire input?

What's the relationship between `i` and `data` here?

Explain it to me like I'm a duck sitting on your keyboard.

# REVERSES: Surface-level understanding and intellectual laziness

- ChatGPT can solve 100% of the problems we can assign in this course.

## AI killed my coding brain but I'm rebuilding it

We sprinted into the AI age of autocomplete IDEs now we're waking up wondering why we forgot how to write a for-loop.

Medium May. 10  
2025

## AI is Creating a Generation of Illiterate Programmers



1,250,000 views



3,500+ votes



100+ comments



By Namanyay Goel

Jan 24 2025

- Hand-written exams with code tracing, open-ended projects, code justification, debugging exercises, but also, make AI part of the process.

# Deskilling and the need for critical adoption in a time of change

## AGAINST THE UNCRITICAL ADOPTION OF 'AI' TECHNOLOGIES IN ACADEMIA

Guest et al. (2025). <https://doi.org/10.5281/zenodo.17065099>

Ironically, in a world full of AI displacements (Guest 2025) and AI misinformation, **actually *more* skill would be needed** to catch, counter, and compensate for the problems and mistakes introduced by AI technologies (Bainbridge 1983), but as AI technologies increasingly infiltrate academia, **students will be robbed of the opportunity to learn those necessary skills.**

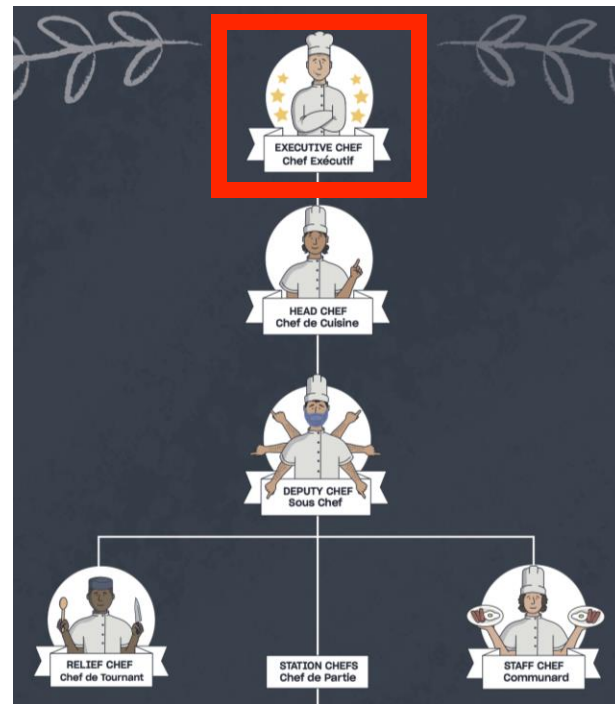
## Meet the students who are just saying no to AI

*Christian Science Monitor Oct. 09 2025*

- Must ensure we are getting **student feedback** about how AI is changing learning at BU and what students *really* want to learn.

# Final Thoughts: Instructor's role in an AI world

- If AI is good at solving code, it's also very good at making code → *indispensable* tool for generating problems, lectures, and thinking through material.
- Initial *deep* moral qualms and existential crises about my role as an educator.
- Analogy: **executive chef**, with AI as my *sous* chef.
- Do I need to *daily* demonstrate basic skills? NO.
- Do I need to have those skills? YES.
- My job: set the menu.





# Any questions?

# UPCOMING EVENTS

**Innovative Use of AI in  
Business, Education  
and Communication**

December 4  
4 PM - 6 PM



**AI Faculty  
In Studio Workshop**

November 17 | December 11  
4 PM - 6 PM | 11 AM - 1 PM

