An Examination of Students' Perceptions of the Efficacy of Using Generative Artificial Intelligence in Structural Engineering Education

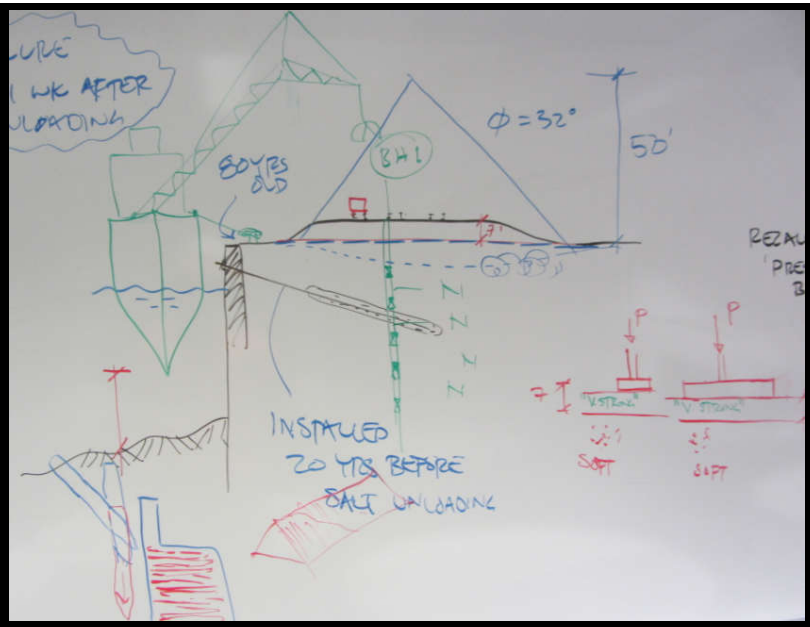
Ross Higgins, Michael Quilligan, Declan Phillips,
Terence Ryan, Michael Johnson and Thomas Cosgrove

Outline

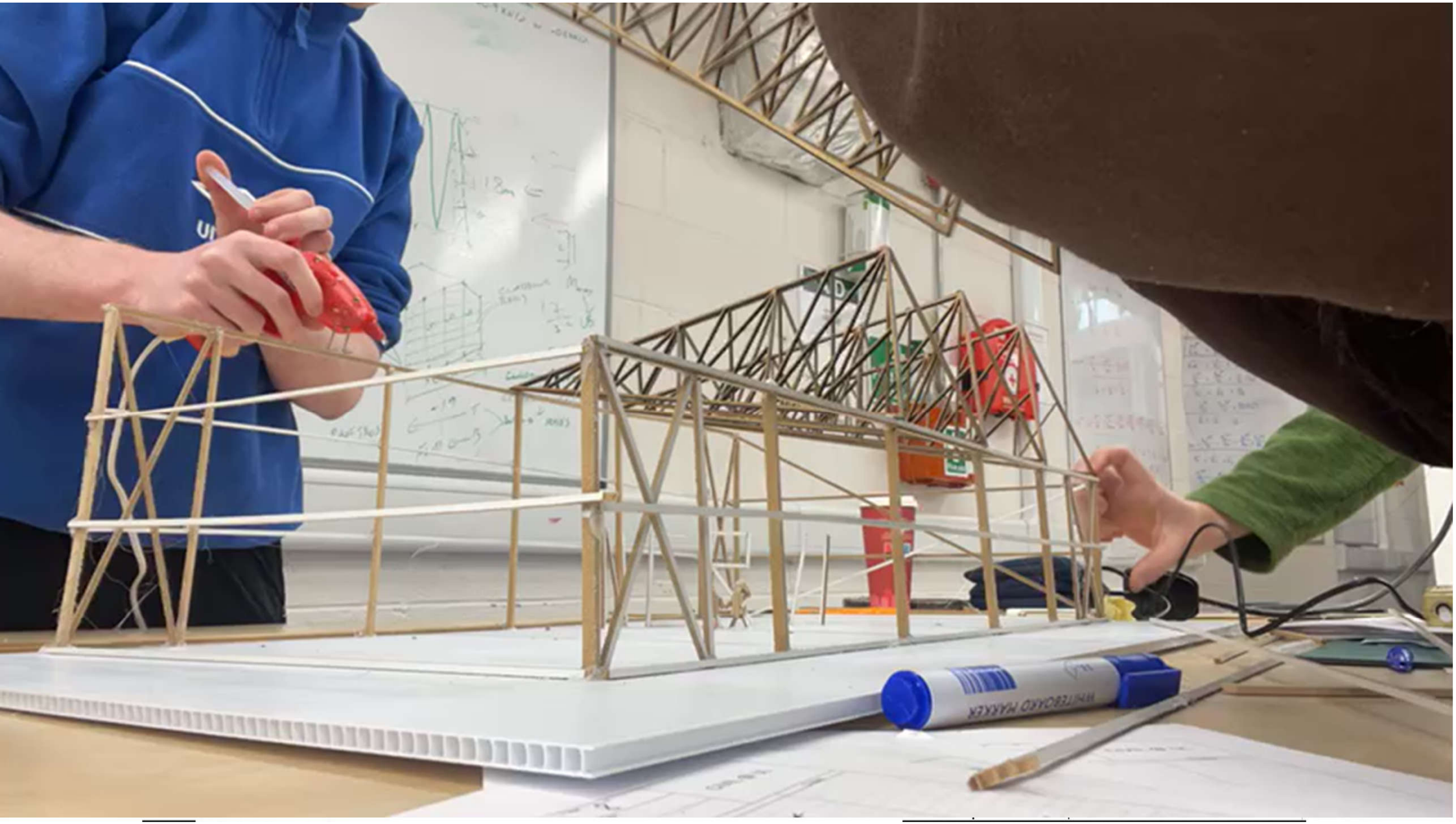
- Context
- Methodology
- Results & Discussion

Outline

- Context
- Methodology
- Results & Discussion



Year & Semester		Modules				
Year	*Semester*	*Module 1*	*Module 2*	*Module 3*	*Module 4*	*Module 5*
Year 1	Semester 1	PBL1				
	Semester 2	PBL 2				
Year 2	Semester 1	PBL 3	PBL4	PBL 5		
	Semester 2	PBL 6	PBL 7	PBL 8		
Year 3	Semester 1	PBL 9: IDP				
	Semester 2	8 Month Work Experience				
	Semester 3					
Year 4	Semester 1	PBL 10	PBL 11	FYP		
	Semester 2	PBL 12	PBL 13	FYP		


WHITEBOARD MARKER

CE4013 Structural Analysis
Problem Sheet

Civil Engineering

UNIVERSITY OF LIMERICK
OLLSCOIL LUIMNIGH

CE4013 **Structural Analysis**

Lecturer **Ross Higgins**

Problem Sheet

Instructions: Complete questions on CIVIL @ UL calculation paper. Refer to the final page for the variable dimensions. Ensure you write your name on Page 1 of the calculations. Scan the full set of calculations and upload to Brightspace by 11:00 Friday, Week 11 using the following filenaming system: CE4013_2023_Problem_Set_Surname_FirstInitial.pdf e.g. CE4013_2023_Problem_Set_Higgins_R.pdf.

0:00
14°C Mostly cloudy
Search
12:10 14/10/2025

Beam load analysis

chatgpt.com/c/68ee2fbb-629c-832d-a429-a63152de75df

ChatGPT 5 Instant

Share

New chat

Search chats

Library

Codex

GPTs

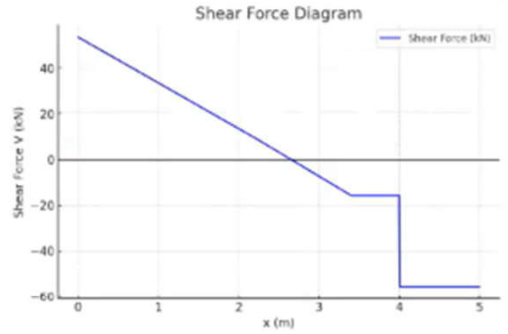
Projects

Chats

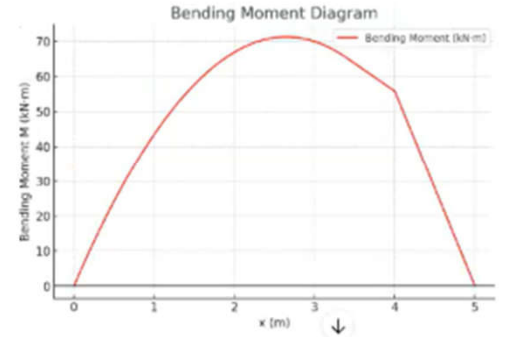
Beam load analysis

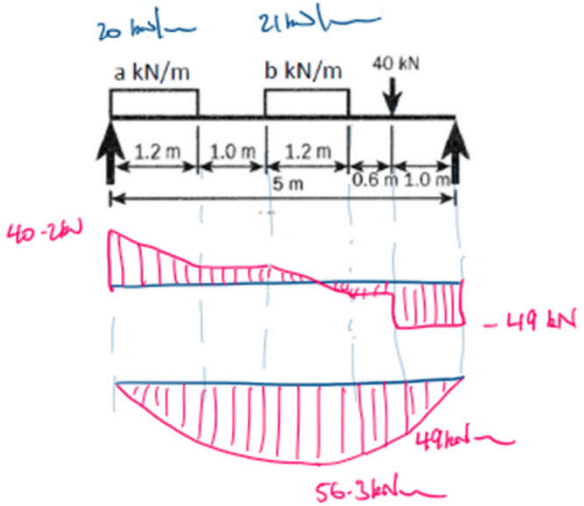
Yes

Shear Force Diagram



Bending Moment Diagram





Ask anything

Michael Quilligan
Plus

ChatGPT can make mistakes. Check important info. See Cookie Preferences

Outline

- Context
- Methodology
- Results & Discussion

Methodology

- Traditional Method Phase:

  Students solved structural analysis problems using hand calculation techniques.

- GenAI-Assisted Phase:

  Same problems were then approached using a GenAI tool;

  Students were tasked with comparing AI-generated solutions with their own.

- Three primary sources of data were collected:

  Pre-exercise survey (n = 41): Baseline attitudes, experience and proficiency with AI tools;

  Reflective survey (n = 33): Reflective commentary discussing the strengths, weaknesses, and implications of using GenAI in solving the problems;

  Post-exercise survey (n = 22): Assessed students' perceptions of GenAI's accuracy, efficiency, and educational value after completing both phases.

Outline

- Context
- Methodology
- Results & Discussion

Results and Discussion

- Pre-Exercise GenAI Use

  Vast majority had some experience

- ChatGPT

  Most widely used tool among sample (97%)

  Aligns with global patterns.

Response	No. Responses	%
I have never used it	1	2.4%
I have used it a few times but not for any coursework	10	24.4%
I have used it a few times including for some coursework	24	58.5%
I use it regularly including for coursework.	6	14.6%
Total	41	100.0%

Pre-exercise GenAI Experience

Insights: Not always accurate but…

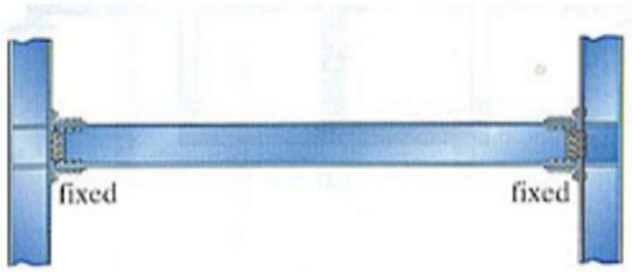
- Stability and Determinacy (accuracy: 68%)

  Step-by-step explanations
  "It broke down the structure…"

  Conceptual clarity and appropriate formulae
  "Explained why it was determinate",

  Most found it accurate and helpful

  Minority found it unhelpful
  "…keeps reading the picture incorrectly"



Classify each of the structures shown as statically determinate or indeterminate.

If indeterminate, specify the degree of indeterminacy.

Is each structure stable? Why?

Typical Question on stability / determinacy.

Insights: Not always accurate but…

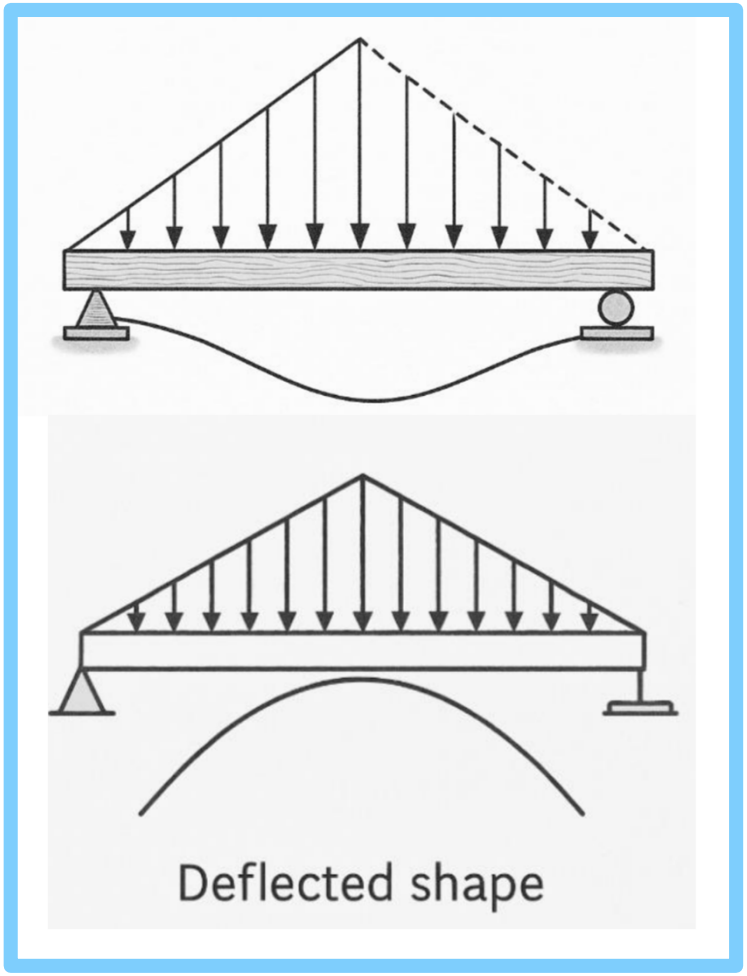
- Deflected Shapes (accuracy 28%)

  Written descriptions of shape
  "Written explanation of what the deflected shape would look like"
  "…described general deflected shape"

  Attempted sketch (accurate or not)

  Conceptual explanation
  "…where max deflection would occur"

  Incorrect or confusing output.



Typical GenAI deflected shape attempts

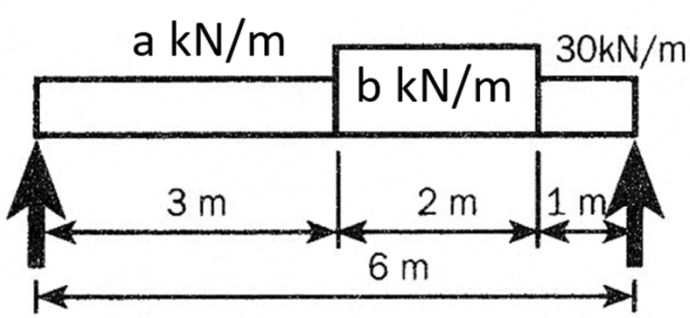
Insights: Not always accurate but…

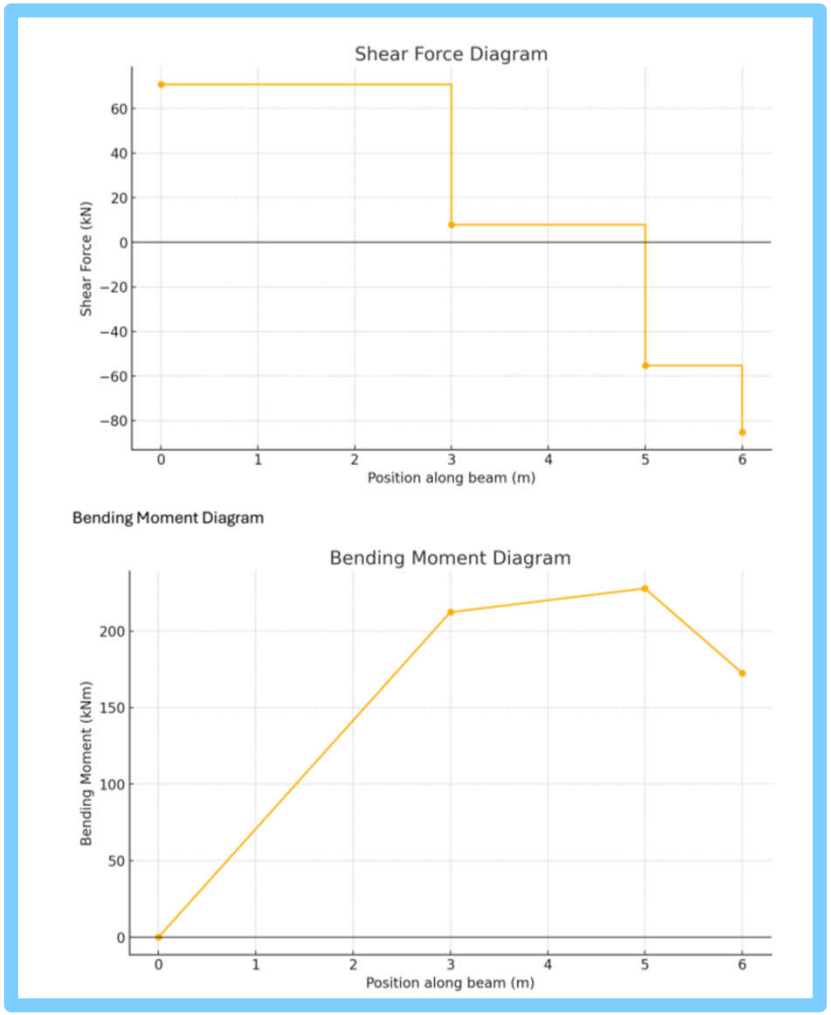
- Beam Analysis (accuracy 28%)

  Step-by-step guidance

  Correct method but incorrect math

  Partial accuracy
  "Correct reactions but incorrect diagrams"



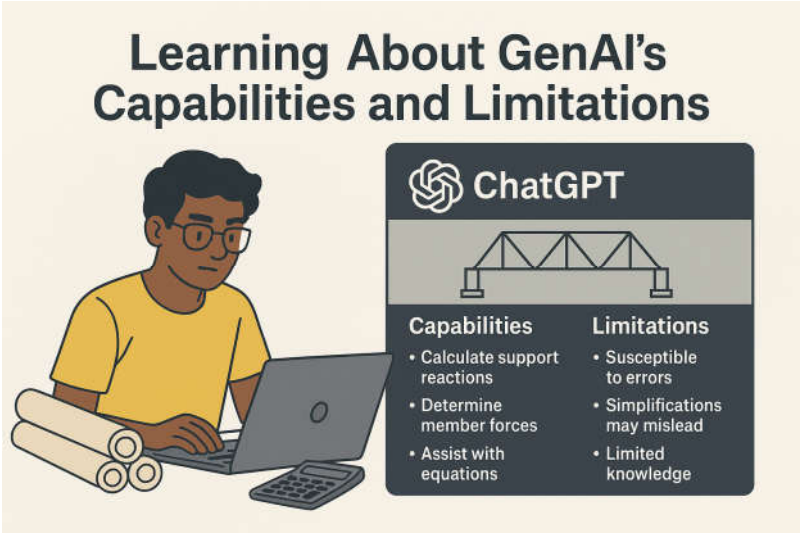


Inaccurate SF and BM Diagrams produced by GenAI tools (March 2025)

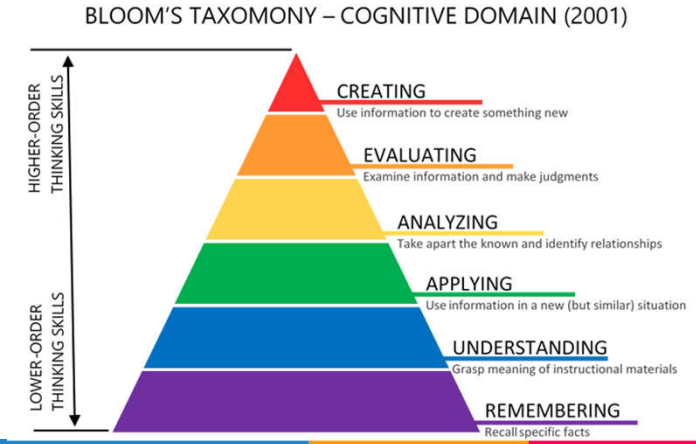
Value of Student Assignments using GenAI

Students learn:

- About GenAI's capabilities and limitations;



- To critically assess and verify outputs;
- Technical skills (formal use of GenAI, prompting, clarifying, etc);
- To judge GenAI tools responsibly.

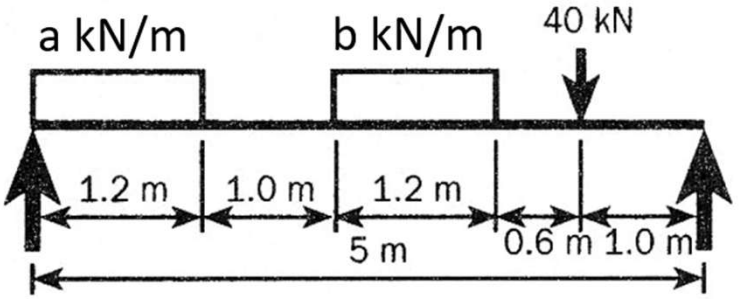


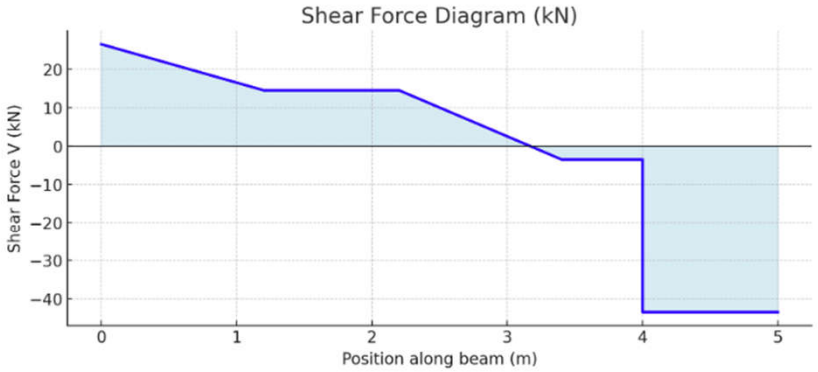
GenAI Improvement

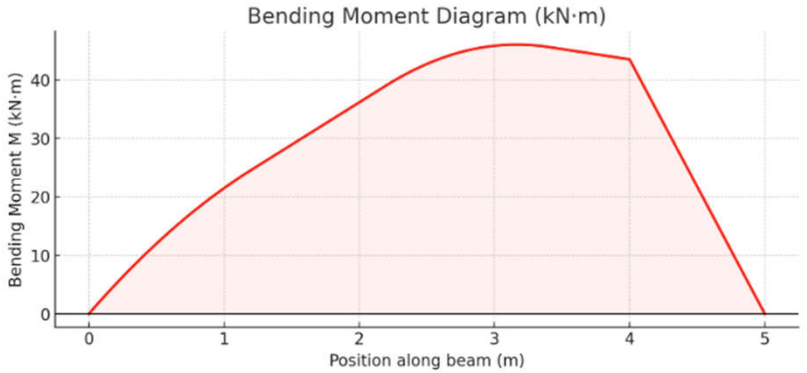
June 2024: Some GenAI tools unable to solve basic questions.

March 2025: Most GenAI tools unable to solve moderately complicated questions.

Oct 2025: Some GenAI tools able to accurately solve moderately complicated questions.







Here are the plotted diagrams for the given beam (a = 10 kN/m, b = 15 kN/m):

Thank you

Questions?