From Textbook to Reality: AI-Crafted Homework Narratives and Student Perceptions of Real-World Relevance

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Abstract

This evidence-based Work in Progress (WIP) paper explores the incorporation of Artificial Intelligence (AI)-generated narratives in homework assignments in undergraduate-level thermodynamics course and shares initial findings regarding students' perspectives on the real-world relevance of the homework questions.

Homework is a cornerstone of education, providing opportunities for practice and deeper understanding of concepts. Traditionally, homework assignments are criticized for lacking relevance to real-world experiences, which can limit motivation and the perceived value of academic work, especially in courses without laboratory activities. Recent innovations in educational practices emphasize narrative-rich, contextually meaningful assignments that bridge classroom learning with real-life applications, triggering both emotional and cognitive engagement.

In this study, narrative homework problems were initially drafted with the assistance of generative AI tools, which were prompted with textbook problem statements and then human-curated for factual genuineness and clarity. The advent of such AI support offers a new way to generate diverse, realistic, and personalized experiences, both for teachers and students. By surveying students, this study aims to understand how the integration of AI-generated narratives in homework assignments of a theoretical course improves students' perceived relevance, engagement, and understanding of academic content.

Our preliminary results point to a trade-off: while narrative framing can improve understanding and perceived real-world relevance of the homework questions, the additional contextual detail may also introduce extraneous cognitive load. Future iterations of the narratives will therefore adjust the amount and placement of contextual information to better balance this engagement-load trade-off. The future work will identify effective strategies and key challenges for integrating AI into engineering education in this context.

The authors intend to present a postcard to share the preliminary findings from this WIP study.

Introduction

In engineering disciplines, homework assignments are a foundational educational tool designed to promote skill mastery, knowledge retention, and the ability to apply theory to practical situations [1]. Traditional engineering homework problems often focus on abstract, quantitative exercises that can seem disconnected from engineering's applied nature and societal relevance. This disconnection may limit both student motivation and their perception of the relevance of academic learning to real-world [2], [3].

Narrative pedagogies serve as a powerful approach to link abstract concepts with real-world experiences and help students connect with course materials on a deeper level by introducing relatable scenarios, stories, role-play and authentic situations into technical problems [1], [4], [5]. For instance, Sloboda [1] found that when identical homework assignments were presented both with and without contextual narratives, students with real-world context rated the assignments as

more realistic, relevant, and interesting. Freitas [4] shared that narrative-based pedagogy engaged students and supported their understanding of technical concepts in a more accessible way. Although recent research continues to explore the possibilities of narrative and storytelling in education [1], [4], [6], [7], [8], limited evidence exists regarding how embedding this approach into assignments within engineering coursework can benefit engineering students.

Across undergraduate engineering programs, AI is increasingly used both as an instructional tool and as a focus of curricular innovation, supporting personalized learning, automated feedback, and data-driven teaching [9], [10], [11]. The emergence of generative AI tools, especially large language models (LLMs), holds promise for making narrative homework even more personalized and engaging [4]. AI-driven platforms can automatically generate scenario-rich problems tailored to diverse interests and backgrounds, offer interactive feedback, and help students explore the creative possibilities of storytelling in STEM contexts [12].

The central thesis of this WIP is: "How does integrating AI-assisted narratives into engineering homework assignments, compared to traditional methods, enhance student learning and students' perceived connection between coursework and real-world engineering practices?" In this preliminary study, AI-generated narratives were incorporated into selective homework assignments in undergraduate-level thermodynamics course with 32 students. We wrote prompts in paid versions of Perplexity and ChatGPT, both are generative AI-powered tools that use large language models to interpret queries and generate narrative texts. To examine the impact, an anonymous survey was conducted with thirty students that included Likert-scale questions and open-ended questions.

Method

There was a total of five homework assignments in this course (chapter 3, 4, 5, 7 and 9), each containing an average of two to three questions. Three questions across three homework assignments were narrative-based (chapter 3, 4 and 7). These questions were based on phase identification, the first law for closed system and entropy. Students completed these three narrative-based questions as part of their regular homework assignments given in the first, second, and third months of the semester, respectively. Two of the three narrative-based questions also included a relevant AI-generated image to help students visualize the scenario

In this WIP study, we used LLMs to support the generation of homework-related narrative problems. The AI tool was not used to replace instructor judgment, but rather to rapidly prototype context-rich scenarios that could be iteratively refined. The role of AI in this process was twofold: idea generation (producing varied narrative frames around a core concept), and surface-level revision (improving clarity and flow). Importantly, all final narratives were human-curated. Specifically, the instructor provided the AI system with problem statements and then prompted it to generate real-world narratives that could plausibly and genuinely occur in practice. The resulting narratives were subsequently reviewed and edited by the authors for conceptual accuracy and appropriateness of context.

In addition to using the AI model for initial narrative drafting, the authors systematically examined whether the real-world contexts proposed by the model were genuine and appropriate. The authors

cross-checked key contextual details (e.g., scenarios) against other online and disciplinary resources to identify incorrect assumptions or fabricated elements. When the AI produced misleading or factually inaccurate content, the authors documented these instances and revised the narratives by using authoritative sources and re-prompting the model with more specific constraints to better match authentic practices and settings. A more detailed comparison between the AI model's inaccurate responses, the verification process used by the authors, and the evolution of the prompting strategies to improve contextual genuineness is planned for future work.

Example of Narrative-based Assignment Question

Figure 1 presents the AI-generated image provided to students with the narrative-based question (A) from chapter 4. Selective words were bolded in the narrative-based question to help students easily locate the given properties. We later realized that we did not bold the values given in the other two narrative-based questions. The word counts of the three narrated questions were 3.71 to 5.74 times higher than those of their original versions, which helps explain why most students viewed the narration length as the main barrier in the modified homework assignments. The corresponding textbook problem is not reproduced here because permission to reprint the original item was not granted by the publisher.

Narrative-based Question (A): "Imagine you work at a large industrial laundry facility that uses steam to power a press for ironing clothes. The steam is generated in a boiler and then sent to a piston-cylinder device that acts as the press. Initially, the cylinder contains [state data from the textbook problem]. To operate the press, more energy is needed, so the steam is heated. The heating process occurs at [state data from the textbook problem]. This heating causes the steam to expand, pushing the piston up and lifting the press plate. The work done by steam is the energy transferred to the piston, which in turn does the work of pressing the clothes. Calculate the work done by the steam during this process."

Figure 1: Image created by a generative AI model for question (A)

Student Feedback

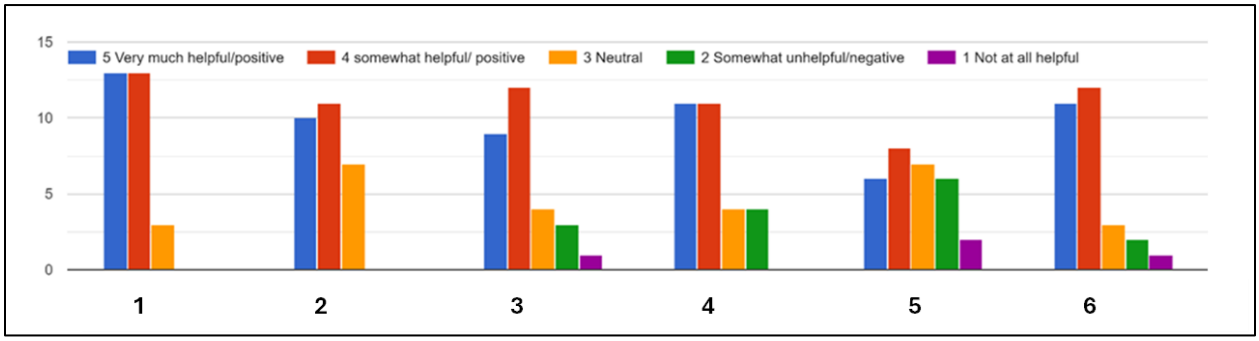

Figure 2: Bar chart of student responses to the six Likert-scale questions reported in Table 1, with response categories coded from 5 (very positive) to 1 (not at all positive

Table 1: Quantitative analysis of student responses to six Likert-scale questions. The column bordered in red represents the % of student number in favor (5: Very much helpful/positive + 4: Somewhat helpful/positive)

	Survey Question	**% of student number in favor**
1	How relevant did you find the storytelling narratives and the added figures to real-world engineering applications compared to the textbook problem?	89.66%
2	How well did the storytelling narrative and added figures help you understand the engineering concepts compared to the textbook problem?	75%
3	How engaging did you find the storytelling narrative compared to the traditional textbook problem?	72.41%
4	How likely are you to remember the engineering concepts presented through the storytelling narrative compared to those from the textbook problem?	73.33%
5	How motivated would you feel to solve problems with the storytelling narrative compared to traditional textbook problems?	48.28%
6	How helpful did you find the added figures in the narrative questions in understanding/making connection to the engineering applications?	79.31%

The quantitative results of the Likert-scale survey are summarized in **Table 1**. Before administering the survey, we provided students with both the textbook problems and their narrated versions to allow for direct comparison.

A large majority of students reported that the storytelling narratives and added figures increased the perceived relevance of the problems to real-world engineering applications, enhanced their understanding of the engineering concepts, and made the tasks more engaging compared to traditional textbook problems. Students also indicated that the narrative format modestly improved their anticipated retention of concepts and that the added figures were particularly helpful for making connections to engineering applications. In contrast, fewer than half of the students

reported feeling more motivated to solve the narrative-based problems than traditional textbook problems, and a substantial number of students selected a neutral position on this item (7 out of 29), suggesting a notable misalignment between perceived learning benefits and motivational impact.

To better understand this pattern, a deeper exploration through the following open-ended survey questions (Q1-Q6) was undertaken to identify obstacles that may hinder enthusiasm, as well as aspects of the storytelling approach that effectively support learning. Student responses to Q1-Q5 reflected similar themes and tones. A thematic analysis, summarized in **Table 2** with representative student quotes revealed four major themes across student responses- "Real-World Connection", "Visualization & Conceptual Clarity", "Engagement & Motivation", "Cognitive Load/Length Concerns". Preliminary coding assistance was provided by an AI-based tool, with all themes and categorizations verified and refined by the authors.

Q1. **Real-world relevance:** "How relevant did you find the converted assignment question with storytelling narrative to real-world engineering applications compared to the textbook question? Do you think that incorporating these narratives and added figures improved the real-world relevance?"

- Mostly positive about increased real-world relevance and engagement, with recurring concerns about length and cognitive load.

Q2. **Conceptual understanding:** "How did the converted assignment question with storytelling narrative help you understand the engineering concepts compared to the textbook question and how did it influence your perception of that particular engineering topic?"

- Generally positive for helping connect concepts to real systems and making ideas more intuitive; mixed on whether it improves procedural understanding.

Q3. **Engagement:** "How engaging did you find the storytelling narrative used in the converted assignment question compared to the traditional book question and what aspects of the converted assignment question did you find the most engaging?"

- Largely positive; many find narratives and images more engaging and "real," but a subset find extra reading disengaging or tiring.

Q4. **Learning enhancement:** "How do you think the converted assignment question with storytelling narrative can enhance learning?"

- Mostly positive; narratives are seen as enhancing learning by linking theory to real systems though benefits depend on learning preference.

Q5. **Motivation:** "How may the use of storytelling narratives affect your motivation to learn and solve engineering problems compared to traditional methods? Why?"

- Mixed; many say narratives increase motivation by making problems meaningful and authentic, while others' motivation is unchanged or slightly reduced due to length.

Table 2: Representative student quotes for major themes

Major theme	Short example quotes (with question number)
Real world connection	- "The story driven narrative attaches an abstract system to a real-world scenario." (Q1) - "I found the converted assignment questions to be much more engaging…….Unlike the textbook where it just feels like numbers" (Q1) - "I found it very relevant as these are problems… faced by many engineers daily." (Q1) - "The narrative version was helping me understand… because it showed me how to use it in real situations." (Q2)
Visualization and conceptual clarity	- "Featuring a real system and pictures of said system bring to question to life and make it meaningful rather than simply computing numbers." (Q1) - "… the added story and figures made the concepts feel more practical than the normal textbook version." (Q1) -"… connecting constant-pressure heating to a steam-powered press or relating cooling in a rigid tank to sterilization at a dairy plant, made the abstract ideas of work, phase change, and entropy feel more intuitive." (Q2) - "It makes you picture the problem in your head and makes it easier to understand." (Q4)
Engagement and motivation	-"I found it much more fun, because I care a lot more about the information when I get to learn how it is used, and how it's applied." (Q2) -"..gives us more of an incentive to learn the topics and not just memorize how to complete the problems." (Q4) -"It's more fun than simply plugging numbers into equations." (Q4) - "When a problem is framed within a real-world scenario, it feels more purposeful." (Q5)
Cognitive load / length concerns	- "My eyes skip down to the second paragraph to scan for the numbers." (Q1) - "I am more confused with more words to look at." (Q1) - "It may affect motivation because it makes it longer and more process than the textbook method." (Q5) - "I see the wall of text and feel tired." (Q5). -" I can see how narratives can be useful during lectures; however, in homework, I'll always tend to just scan for the information needed." (Q5) - "I think it would negatively affect my motivation. I might learn more from the longer problems, but the shorter ones are simpler and easier to take in."

In response to Q6, **"**Do you think storytelling narratives (the narratives can be shorter) should be used more frequently in engineering education? Why or why not?**"**, most students (20 out of 27 responses) strongly supported using storytelling narratives more frequently in engineering education, explaining that narratives help connect equations to authentic engineering situations and make assignments feel more meaningful.

One said- “I think they should be used more often. The application of some real-world tangibility to the problems increases my chances of retaining and possibly using the same techniques in my own engineering projects.”

Another said- “They should be used more frequently. Most engineering students do not get a chance to relate their learning to the real world until they are very late into their degree and beginning capstone.”

A smaller subset (3 out of 27 responses) strongly opposed broader use because of added reading time and cognitive load.

One said- “No I don't think they should be used more frequently because it adds more information which may be necessary for understanding how something works but not so necessary for solving the problems.”

While another small subset (4 out of 27 responses) took a middle position, valuing narratives when they are shorter, clearly structured with givens, and used mainly in homework rather than timed tests.

One said-“I think the storytelling should be used more frequently to set up relevant context for better understanding of things learned in class. There is something to say about being concise and not adding too much information which may get confusing as you try to sort through values you actually need. Shortening these narrative problems would really help that.”

Conclusion and Future Work

Our preliminary findings suggest a trade-off in the use of AI-generated narrative problems. On one hand, narrative framing appears to increase students’ perceived real-world relevance of the questions, which can support engagement and meaningful learning. On the other hand, the added contextual detail may introduce additional extraneous cognitive load. In this WIP study, we interpret our results as evidence that narrative contexts need to be carefully calibrated, rich enough to foster engagement and relevance, but sufficiently focused to avoid overwhelming students with unnecessary details. Future iterations of the narratives will therefore adjust the amount and placement of contextual information to better balance this engagement-load trade-off.

Building on these initial findings, future work can extend this study in the following targeted directions:

- Systematically varying length and technical depth of narratives to compare student perceptions and sharing instructor’s reflections on how to design effective AI-generated narratives for engineering courses using different AI models or AI–powered search engines.
- Including additional cohorts and courses to see whether attitudes toward storytelling narratives and AI-generated materials generalize beyond one class and setting.
- Combining qualitative comments with more systematic quantitative measures (e.g., concept tests) to test whether perceived benefits translate into measurable learning gains.

- Exploring workflows where students co-create or edit AI-generated narratives as part of learning, and study how this affects conceptual understanding and attitudes toward AI in engineering education.

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