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Integrating AI into Civil Engineering Classrooms: Implications for Teaching, Learning, and Professional Practice

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Abstract

Artificial Intelligence (AI) has emerged as a disruptive force in engineering education. It is reshaping how students ask questions, solve problems, and engage with data. As civil engineering educators, we strive not only to adapt to new technological advances, such as AI, but also to critically evaluate how they can enhance our teaching practices. This paper presents a cross-institutional collaboration between two civil engineering professors who have integrated generative AI tools and pedagogical strategies into their undergraduate and graduate courses. This paper targets engineering educators interested in active AI engagement and addressing AI in their current courses, but its scope may be considered foundational for educators who conduct classes specifically on artificial intelligence. The study illustrates three contexts for AI implementation: (a) live in-class use, (b) student out-of-class use, and (c) instructor out-of-class use. Live in-class use included instructor-led demonstrations, student concept brainstorming, and clarifying student questions. Permitted student out-of-class use included problem-based homework, course project idea generation, and AI reflection assignments. Instructor out-of-class use included generating syllabi content, developing icebreakers, refining assignment prompts, and generating grading rubrics. Through a combination of student surveys, classroom artifacts, and instructor reflections, the paper evaluates student and instructor engagement with AI for civil engineering coursework. The authors found that intentional integration of generative AI looked different from course to course and that both their own engagement with AI and their students' engagement with AI increased as they became more comfortable with tools and better at prompt engineering. Future work should focus on the impact of AI on engineering judgment, critical thinking, and creativity.

Introduction

Artificial Intelligence (AI) and Large Language Models (LLMs)

AI has been in the public domain since 1956, but it has become a disruptive force in society since its introduction to the general public in the 2020s, with the advent of large language models (LLMs) or generative AI [1]. LLMs use massive amounts of information (some have been trained on virtually the entire internet) to generate human-like language, reason across multiple domains, and interact in natural conversation [2]. As a result, LLMs now have simple chat interfaces rather than programming platforms as in years past. The most common LLMs available in the 2026 market are: ChatGPT (by OpenAI), Gemini (by Google), Claude (by Anthropic), Llama (by Meta), Mistral (by Mistral AI), Grok (by xAI), and Copilot (Microsoft built upon OpenAI's models) [3].

Since the introduction of generative AI, a public debate has emerged about the consequences of its widespread integration into everyday activities. Studies of generative AI in universities report that students and instructors are using generative AI to support idea generation, editing, and coding [4]. The general perception is that generative AI can improve efficiency and reduce workload, but there are also concerns about over-reliance and erosion of core skills [5]. Early

studies have shown that these tools can give a competitive advantage to their users, but also diminish their ability to perform without their help [6]. Some of the applications most prominently showcased in the media, like writing essays or creating custom images, do not translate directly to most civil engineering education and practice [7].

Generative AI in Education

The education field has historically been open to technological tools that can enhance learning. For example, pocket-sized calculators, popularized in the 1970s, are now widely used in engineering classrooms. Moreover, educational platforms have included interactive applications, training programs, customizable lessons, adaptive learning platforms, and analytical dashboards for years [8], [9]. Generative AI comes with a key difference to previous technologies: its breadth and accessibility. Students can use the same conversational interface to summarize readings, generate code, produce quiz questions, or role-play as a virtual coach. Academic research has identified potential benefits in personalization, formative feedback, and student engagement, alongside risks related to equity, transparency, and academic integrity [10].

Recent work on the use of generative AI in education has shown that LLMs have been supporting teaching and educational research. For educators, LLMs can help generate lecture materials, examples, and assessments; for researchers, they can help with idea generation or coding open-ended surveys; and for students, they can serve as a coach or peer reviewers [11]. Some surveys document students' early adoption of these tools by reporting the types of tasks for which they are used, such as studying, drafting emails, and learning unfamiliar concepts [12].

The widespread adoption of generative AI has come with nonuniform implementation in education. With inconsistent training, students have generally not developed generative AI literacy and thus often trust the technology's outputs, with limited verification of their accuracy [13]. For engineering programs, the stakes are high because graduates are expected to make decisions that affect public safety, infrastructure performance, and compliance with standards and specifications. As a result, there is a growing expectation that generative AI literacy be incorporated into engineering education, even as concerns persist about its appropriate and responsible implementation.

Generative AI Compliance with FERPA

To use generative AI in education, educators must understand relevant laws and regulations. In the United States, the Family Educational Rights and Privacy Act (FERPA) governs the access to, disclosure of, and protection of student educational records. FERPA requires institutions to maintain direct control over these educational records, obtain consent before sharing personally identifiable information with third parties, and provide mechanisms for students to inspect and challenge their records [14]. Data also may only be shared with other parties when there is a “legitimate educational interest” [15]. The arrival of cloud-based generative AI services adds complexity because default program settings will often transmit data to external providers for processing, logging, and model improvement. Transmitting identifiable student data for logging and model improvement is generally understood not to meet the legitimate educational interest threshold.

Recent guidance from the U.S. Department of Education and external privacy organizations emphasizes that AI tools that access or infer information from educational records must be evaluated like any vendor. The institutions must ensure appropriate contracts, limit data sharing, and clarify the role of AI systems with legitimate educational interests under FERPA [16]. These guidelines also note that interactions with generative AI tools may constitute educational records if maintained by the institution and directly related to the student. This definition raises questions about how chat histories, AI-generated feedback, and learning analytics are stored and accessed [17]. For many educators, this guidance is opaque and can lead to experimenting with generative AI while navigating regulations to find FERPA-compliant tools. Universities are increasingly purchasing generative AI licenses that do not upload your data into their training data, making these tools increasingly FERPA-compliant (e.g., ChatGPT Edu). Please consult with your university's specific guidance before uploading any FERPA data to generative AI sources. In the author's experience, if you are using a free version of any of these LLMs, the supplier may be logging into your chat, using it for model training, and it is not FERPA-compliant.

Even if you do not have access to a FERPA-compliant system, you can still use these LLMs to improve AI competency in your students and streamline your own workflow. Just remember that at no point should you upload students' work, grades, or other student records into non-compliant systems. Moreover, consider the ethics of uploading (or copying and pasting) any content from an external source to these services, as this information may now become part of the training data.

Advantages of Generative AI Integration

When implemented thoughtfully, generative AI can support several goals in engineering education. At the course level, generative AI can provide rapid, low-stakes feedback on student work, help students practice concepts, and support multiple iterations of brainstorming. Research surveys show that students perceive AI as helpful for brainstorming, receiving alternative explanations, and managing workload, particularly when instructors explicitly frame generative AI use as a supplement to human judgment [5].

In larger courses, generative AI can help provide students with on-demand feedback and examples tailored to their background and pace. Research reviews have found that generative AI can provide a review of foundational material, explore "what-if" scenarios, and develop metacognitive skills when students compare their reasoning with generative AI's reasoning [10]. For instructors, generative AI may reduce time spent on routine tasks such as drafting rubrics, generating practice problems, or preparing formative quiz questions [18].

Concerns and Limitations of AI Integration

Research on concerns and limitations of generative AI integration is limited, but some ideas are beginning to emerge. Research findings highlight concerns about academic integrity and the ethical use of generative AI, inequalities in use and implementation across a broad student demographic, and impact on students' core skills [19]. In addition, a central theme across the literature is that generative AI is prone to mistakes or hallucinations (confidently stating false or misleading information) [20]. These mistakes become even more critical in domains like

engineering, where explanations and calculations are crucial for making design decisions. Some researchers warn that heavy reliance on generative AI may create an "illusion of expertise," where users feel more competent because AI helps produce their work, even as their underlying skills are insufficient [21].

Concerns extend beyond individual learning. Reports shown risks related to research integrity, data security, and bias. Research has shown that AI-generated content can contaminate research records (e.g., introduce unverifiable or fabricated material into datasets), distort peer review (e.g., automated generation of reviews), and obscure the origin of data and analysis (unclear authorship or methodology) [22]. Finally, LLMs are trained on historical data that can reproduce and amplify biases, including those related to gender, race, and geography. This can have direct implications in civil engineering topics such as infrastructure, environment, and community engagement. When generative AI is integrated with its current limitations, the curricula should make visible these biases and address its limitations through AI literacy [20].

Successful AI Use in Civil Engineering Education

Despite the challenges, a growing body of research and teaching is incorporating generative AI into civil engineering. A case study reports that when instructors design tasks in which generative AI serves as a "second opinion, providing alternate explanations," students are more likely to engage critically with AI output rather than accept it uncritically [23]. In the same case study, students reported generally positive perceptions of the tool's usefulness for clarifying concepts and exploring design alternatives. Another study explored how generative AI can create realistic design scenarios, project briefs, and client profiles to enrich project-based learning [24]. Other work has explored the incorporation of generative AI to improve soft skills, including communication, teamwork, and ethical reasoning [25].

The following paper explores practical applications and implementation of generative AI for students and instructors in civil engineering. The student applications are presented for both in-class and out-of-class use, and the instructor presents out-of-class use. Following these use cases, the instructors reflect on the effectiveness of these approaches and on future use cases in their classrooms and beyond. See Figure 1 for a summary of the AI application areas discussed in this paper. This image was generated from the text of this paragraph using Napkin AI (https://www.napkin.ai/). I used the free version, it took less than five minutes, and all text, icons, colors, fonts, etc. can be changed inside the web-based software. A summary of the following discussion is included in Appendix A. This summary was generated using Gamma (https://gamma.app/) from the text of this paper and took approximately 15 minutes to complete.

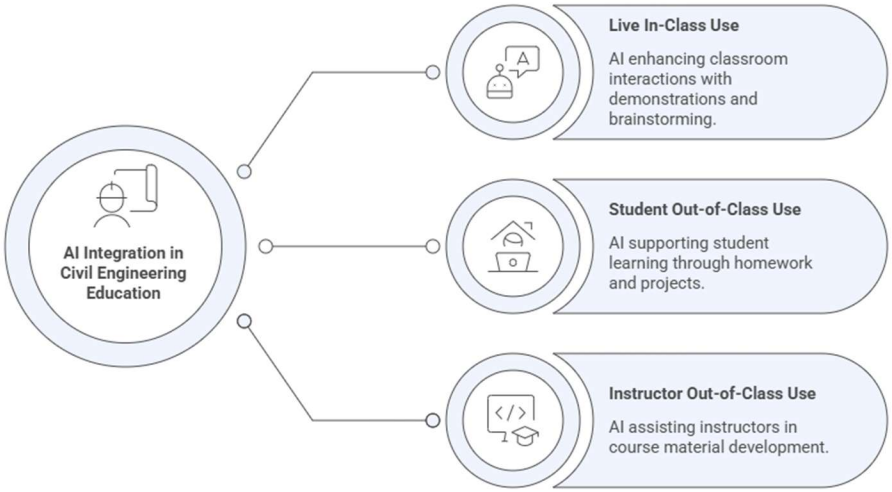

Figure 1. Recommended AI Integration for Civil Engineering Classrooms. Generated using Napkin AI (Free version), January 2025. Prompt: [Paragraph preceding the figure, lines 1-5]

Live In-Class Use

Live in-class use is important because it models how an engineer can interact with generative AI. As instructors, we are intentional about demonstrating generative AI with particular care to make our reasoning and prompt engineering visible, identifying misconceptions or AI hallucinations, and practicing critical evaluation of AI responses.

Instructor-led demonstrations

Instructor-led demonstrations are often my students' first structured exposure to generative AI in engineering. I typically design a short, focused prompt around a concept we are already working on, such as load paths in a frame or steel behavior, and show my interaction with generative AI on the projector screen in front of the classroom. I make my thinking explicit as I write the prompt on the screen, narrating why I choose certain words. I know that constraining a task or providing context to the prompt gives more tailored responses. Prompts 1 and 2 illustrate these applications.

> **Prompt 1**
> *What is the difference between a laminar and turbulent flow?*
>
> **Prompt 2**
> *Hi. You are an expert structural engineer. Can you tell me what is wrong with the calculations performed in this image?*

When the model responds, I ask students to help me evaluate its quality. Typical questions I ask are: "Does this make sense? Did we expect to get this? Where is it vague? Where is it overconfident? Do we have a way to verify the output?" This questioning turns the generative AI output into a product we can critique rather than the final definitive answer. When I first

introduced this approach, I would often test out prompts in the LLM environment before class, but as you become more familiar, it is easier to do on the fly as well.

Concept brainstorming

A second tool for live in-class use is concept brainstorming, where AI serves as a helper to generate ideas. Prompts 3 and 4 illustrate this approach.

> **Prompt 3**
> *List potential failure modes for a simply supported steel girder bridge under increasing live load.*
>
> **Prompt 4**
> *Act like a professional structural engineer. Provide 10 examples of temporary loads.*

The response is usually a mix of familiar ideas and a few that are slightly off or oversimplified. I review them with students, and we sort them together based on their level of usefulness. Questions are usually: “Which ideas align with the question? Which are missing key technical details? Which are interesting but unrealistic given constructability constraints?”

The brainstorming process helps students practice two important skills. First, they learn to treat AI-generated lists as starting points that require filtering. Second, they see how an engineer moves from an unstructured set of ideas. Concept brainstorming also gives quieter students low-risk participation ideas, since the generative AI provides starting points.

Clarifying student questions

The third way to use generative AI in class is to help clarify students' questions in real time. Students often ask for alternative explanations, analogies, or additional examples, especially when working with challenging topics. I show them in class how they can use generative AI to address these questions when studying on their own. In class, I answer the question and then propose, “Let’s see how an AI tool tries to explain this.” See Prompts 5 and 6 for examples of what these prompts have looked like in our classes.

> **Prompt 5**
> *What is an abutment on a bridge?*
>
> **Prompt 6**
> *How many times do we need to do an influence line analysis?*

When the response appears, we discuss: “Did the generative AI tool capture the key physical idea? Did it miss any assumptions? Was our question appropriate, or should we refine it?” I am explicit that students are not required to use a generative AI tool, but that it can be a great tool to consult, is available 24/7, and when used effectively, can be better than getting lost in internet searches.

In addition, generative AI can help explain complex concepts in simpler words or help identify elements in a figure. In these cases, the prompt can be customized to ask the LLM to explain an idea to a specific audience. My go-to audience is a "five-year-old," but other audiences are helpful as well: first-year undergraduate students, high school students, non-engineering majors, and many more. At the same time, new LLM models are now capable of providing a good guess on what an object is in a specific picture. You can give the figure in the LLM textbox and provide context for what you need the LLM to identify. Prompts 7 and 8 showcase this use.

Prompt 7
What is Bayesian probability? Explain it to me like I am five.

Prompt 8
Hi. What do engineers call the object in the picture? The one in grey color that seems to be overflowing with water. See image attached.

Student Out-Of-Class Use

Student out-of-class use varies widely based on students' prior experience with generative AI, class expectations, and instructor prompts. Recently, the authors have started explicitly encouraging students to use generative AI in particular assignments and providing clear guidance on acceptable use, suggested prompts, and proper citations.

Problem-based homework

One way students are encouraged to interact with generative AI is through problem-based homework assignments. I allow my students to use AI regularly in problem-based homework assignments, as long as they cite its use. Students are encouraged to use generative AI as a tutor when they are stuck on a problem or unsure what solution path to take. At first, students are often very hesitant or uninterested in engaging with generative AI, since it cannot provide a written solution to the problem-based homework assignment. Even if the generative AI is advanced enough to correctly solve the problem, students still need to write down the solutions. However, as they see generative AI in use in class, they generally become more comfortable engaging with it and better able to ask it good questions and critically evaluate its answers.

Course-project idea generation

Generative AI can also be an effective tool for idea generation. I have used it to help students brainstorm project ideas. For example, in a graduate class, I have students investigate a structural failure of their choosing in groups. I encourage them to solicit suggested project ideas and some initial sources to consult via generative AI. I also use this as an opportunity to demonstrate prompt engineering and generative AI hallucinations. I put the first step of the project prompt (Prompt 9) into the generative AI chat:

Prompt 9
Hi, can you create a ranked list of at least three steel-structure failures and consider steel failures in the U.S. and abroad?

This prompt (used in ChatGPT 4o) resulted in a list of 5 structural failures, including the 1991 collapse of the Ronald Reagan Federal Building and Courthouse. This structural failure is a hallucination of the LLM. A simple internet search indicates that this most likely refers to a building built in the 1960s, which did not become the Ronald Reagan Federal Building and Courthouse until it was renamed in the early 2000s, and was torn down in the mid-2020s. I could not find any record of a 1991 collapse. At this point, I suggest we ask the generative AI a better question to get a better answer. I asked Prompt 10 instead.

> **Prompt 10**
> *Hi, can you create a ranked list of at least three steel-structure failures and consider steel failures in the U.S. and abroad? Please cite at least three sources for each failure and double-check your work.*

This prompt yields four structural collapses, all of which I am familiar with. However, most of my students are new to studying structural collapse, and many of these failures are not known to them. I also suggest that, on their own time, students can personalize this approach to investigate projects they are more interested in. For example, they can look for projects in a specific location, structure type, or failure cause.

One note of caution on AI hallucinations: LLMs are updated frequently, sometimes without your knowledge, and they are providing a new response every time you enter a prompt. If I want to ensure I get a hallucination, I find it on my own time and then show the chat in class rather than interacting with the LLM live. This approach removes the chance from the equation.

Generative AI reflection assignments

LLMs continue to improve with each update, but some LLMs still provide incorrect information. When I encounter this for a particular example, I turn it into a short reflection question in one of my assignments. I ask my students to try to solve a specific part of an assignment using generative AI. They report the LLM answer and, in three sentences or fewer, answer the following: (a) Is the answer correct? (b) How did the LLM get the answer? (c) How do you know the answer is correct?

These short reflections help my students recognize the limitations of LLMs, practice engineering judgment, and actively evaluate information rather than passively accept its results. Prompt 11 illustrates this approach with a class concept. Notice how the prompt has been engineered to act like an expert (“You are an expert water resources engineer”), reduce hallucinations (“Take your time”), and constrain its scope (“Use the Rational Method”), but still provides different incorrect responses with ChatGPT 5.2 and Gemini 3. The Perplexity LLM advises you that it can proceed with the calculation, but the method requested has limitations. You may also have noticed that some of our prompts start by saying hi to the LLM. This is partly because the authors want to be respectful to the LLM (when newer version take over the world, we want them to know we were kind to their predecessor), and also because, in earlier models, the LLM was more likely to produce better outcomes when the prompt was respectful (e.g., “hi”, “thank you”, or “you did great”). That does not seem to matter with newer models.

Prompt 11
Hi. You are an expert water resources engineer. Use the Rational Method to estimate peak discharge for a 2,000-acre rural watershed. Take your time.

Non-permitted use

Students are never permitted to use generative AI without disclosing it. As with any other sources, students need to cite any use of generative AI. When we assign homework or other assignments that we believe would benefit from generative AI, we remind students of the policy. We are both familiar with our university's academic integrity policy regarding generative AI. Similarly, when we do not want students to use generative AI, we have those assignments in class. Anecdotally, students are less inclined to use non-permitted generative AI when assignments are low stakes (with little impact on the final grade or graded by completion). The instructor must think critically about how the course grade will be redistributed if this approach is used.

The authors believe it is too tempting to allow students to take out-of-class exams that they are not allowed to use generative AI on. If we do not want students to use AI on an assignment, it is an in-class, proctored assignment. In addition, assignments can be structured in ways that limit the benefits of using generative AI. These assignments are difficult to write, and the instructor must be familiar with the latest improvements in LLM technology to craft them effectively. Here are some examples:

- Develop a Mathcad or SMath Studio notebook with problem calculations (as long as the objective of the assignment is generating a working notebook itself and not the calculations)
- Produce CAD drawings
- Delineate a watershed by hand (if the student does not have access to the topography of the area)
- Reflect on a speaker's presentation (if the material is not available online).
- Reflect on class material and relate it to their own experience or personal anecdotes

Instructor Out-Of-Class Use

Generative AI can do a wide variety of class administration, preparation, and documentation tasks for instructors. Think to yourself: what daily class preparation effort do you spend on tasks that generative AI could do better or faster? We have found generative AI particularly useful for generating syllabi content, creating icebreaker activities, improving assignment prompts, generating assessment rubrics, digesting student feedback, and increasing the accessibility of course documents. In addition to these, generative AI can be beneficial for responding to student emails, especially those that are emotionally charged. Please be cognizant of FERPA compliance in email correspondence.

Syllabi content

Generative AI is very useful for originating, improving, or formatting syllabus content. At a minimum, I recommend using generative AI (and properly citing it) to write an AI policy for

your class. I used Prompt 12 as a starting point to develop classroom policies for typical undergraduate-level courses.

> **Prompt 12**
> *Hi, I want to write a policy for AI use for my college-level engineering class syllabus. I want to allow them to use AI like ChatGPT and others, but require them to cite that they are using it, be responsible for all outputs, use it for what it is best at, and acknowledge the bias and copyright issues associated with it. Could you help?*

ChatGPT 5 and I then went back and forth until we co-authored the following policy:

> **AI Policy 1**
> *Generative AI are tools that produce or generate a variety of content including text, images, videos, and music. Examples of this technology include ChatGPT, Bard, Copilot, Dall-E, and many others. These technologies are emerging and ever-changing. I would encourage you to learn more about these technologies and use them as appropriate. At no point is it appropriate to use these technologies to draft a paper or complete an exam problem but they can be useful for idea generation and brainstorming. Any content generated by artificial intelligence tools should be cited. Please refer to the examples/guidance provided by the University Library Research Guide on AI and Academic Integrity for more information.*
>
> *Keep in mind that generative AI systems are imperfect and that the ethics and biases of these systems are not fully understood. Please consult with me if you are unsure if a use case is appropriate before using generative AI or on any concerns you have about generative AI in the classroom. The use of content generated by artificial intelligence outside of the limits outlined in this policy will be considered academic dishonesty and reported to the Office of Academic Initiative and Integrity (OpenAI, 2025).*

I also like to use generative AI when I am teaching a course for the first time to get an idea of what the class schedule should look like. Prompt 13 shows an example of what I asked generative AI before teaching Mechanics of Materials for the first time:

> **Prompt 13**
> *Hi. You are an expert in organizing and preparing content for new classes. I am asking you to develop a list of topics we should cover for a university-level mechanics of materials class for undergraduate civil engineers. The course is 16 weeks and three credits. It meets twice a week for 75 minutes. Check your work before sending it to me. Take your time.*

Icebreakers

Generative AI is also helpful when creating icebreakers or other first-day-of-class activities. You can use it to generate ideas appropriate for different types of students, class sizes, or time constraints. In large classes, generative AI can create templates for students to fill out to get to know them better, such as their career aspirations, graduation date, and favorite class to date. In

smaller classes, generative AI has created bingo cards and word searches that students then work collaboratively to complete. From idea to posting or printing, these activities are ready to go in less than 15 minutes. I used Prompt 14 to create an icebreaker for a recent high school summer program.

> **Prompt 14**
> *Could you recommend ice breaker activities for 20 10th-12th graders who have never met before. I want it to take no more than 10 minutes and be used to form groups of 2-3 students.*

Assignment prompts

AI can also be useful as an assignment proofreader. It can refine assignment prompts, preempt student questions, and clarify instructor requirements. When creating a new assignment, I generally outline about 75% of it and then ask an LLM to proofread, polish, and clarify the assignment. I ask the LLM to do activities like Prompts 15, 16, and 17 below.

> **Prompt 15**
> *Please improve the clarity of this undergraduate steel design assignment. Do not increase the assignment length.*

> **Prompt 16**
> *You are a civil engineering sophomore in a mechanics of materials class. Is there anything about this assignment prompt that is confusing?*

> **Prompt 17**
> *Please format this assignment. Be careful to meet the requirements of WCAG 2.1 Level AA* [see following section on accessibility] *and clearly identify what students need to turn in, how they will turn it in, and where they will turn it in.*

Assignment questions

Generative AI can also create assignment questions. In our experience, it is particularly good at creating multiple-choice questions and/or answers. I start class with a warm-up question, and the LLM excels at generating them. I do not commonly use it for questions that require a figure, as the image-generation AI capabilities are still evolving, but I anticipate that this will improve in the future.

Not only can I, as the instructor, use this tool to generate questions, but I also encourage students to use it to generate possible questions, create an exam list, and turn them into questions they can assess if they know how to solve them. This can help them self-diagnose which areas they should spend more (or less) time reviewing.

Grading rubrics

Generative AI can quickly create rubrics based on assignments and grading criteria. I commonly use generative AI to generate a document with a grid rubric from a list of criteria, and then I can edit the rubric as I see appropriate. I have found this process more efficient than editing old rubrics or creating a new document from scratch. Generative AI can also quickly format it with colors, styles, and icons, as desired. In addition, if you are willing to share your old rubrics with the LLM, it can generate new ones matching your writing style. Prompt 18 illustrates this approach.

> **Prompt 18**
> *Hi. Can you create a grading rubric for the assignment attached? I am also attaching a previous rubric I made. Use the same writing tone and style to create the new rubric. Take your time.*

Student feedback

We solicit anonymous student feedback mid-semester and at the end of each term. This feedback, in turn, results in some changes to the course both this term and in the future. However, reading this feedback is time-consuming and can be unkind or unhelpful. I have used prompts like Prompt 19 to take this anonymous feedback and condense it down to main themes or actionable items. Since generative AI can recognize similar responses without requiring exact word matches, this approach has been much more efficient than prior approaches.

> **Prompt 19**
> *Can you identify some common themes from these responses? Identify no more than 5 themes and each identified theme must be in at least 3 of the responses. Check your work.*

In my senior capstone class, student teams periodically received feedback from the rest of the class. I then organize, de-identify, and provide summary feedback to each team. I use Prompt 20 to summarize the feedback and then provide the letter to project teams.

> **Prompt 20**
> *I am an engineering instructor who teaches a senior-level project engineering class where students work on teams for the semester. You are my assistant, who will help me provide formative feedback to my students. I collect peer comments periodically throughout the semester, and I would like you to summarize the comments into a performance feedback review in a way that is constructive and actionable. The output should be in the form of a letter, including strengths and areas for improvement with bulleted themes/headers with a closing statement at the end. Please avoid using the phrase 'soft skills'. Please also refer to projects as 'your project' or 'the project' rather than 'our project'. Please also exclude anything that is inappropriate for the workplace. Please avoid gender-specific pronouns.*

Accessibility

Generative AI can be particularly useful for improving the accessibility of course materials. This topic is especially important given the April 2026 deadline for large publicly funded entities (including many public universities) to be compliant with the updated ADA Title II up to Web Content Accessibility Guidelines (WCAG) 2.1 Level AA. Although access to education remains important to both professors and institutions, meeting this regulation requires faculty to change course websites and content posted to learning management systems (like Blackboard or Canvas), which requires a lot of repetitive, tedious work.

This type of work is where generative AI can be particularly helpful. Not only did I use generative AI to learn what WCAG 2.1 Level AA is, but it also pointed out common areas in your content that need to be edited to be compliant. Moreover, it can often handle repetitive, tedious tasks. For example, I recently used Copilot to make all Word documents that I upload for my Spring 2026 class compliant. The most common action Copilot took was to create content screen reader-friendly by autogenerating captions and changing text that appeared to be headings to the actual heading styles. Doing this myself would have taken a day of work, but generative AI completed it in about 30 minutes. Moreover, Copilot is better at spotting noncompliant items than I am. Microsoft products also include an "Accessibility Assistant" that can help you make assignments more accessible and compliant with the newly applied rules.

Analysis Of Generative AI Use

Reported use in weekly homework

A 16-student undergraduate civil engineering class (water resources engineering) was assigned weekly homework graded on completion, followed by a reflection assignment. The reflection assignment asks them to compare their homework to the instructor's solution, fix any errors, and reflect on their work with guiding questions. The homework included problems covering topics from the weekly class. Most assignments had 3 to 6 problems. At the end of each assignment, students were asked to complete an anonymous survey about the assignment's length, its effectiveness in helping them achieve the learning outcome, and the resources used to complete it. The last question included the following options: class material, class textbook, other textbook, internet resources, AI technology (ChatGPT, Copilot, etc.), office hours, classmate or study group, and other (specify).

98% of students reported using class materials to support their homework assignments, followed by internet resources (79%), the course textbook (74%), classmates/study groups (41%), and AI tools (35%). A typical response involved using 4 different resource types, with a mean of 3.76, a median of 4, and a range from 1 to 7. The three most common "bundle" uses were: (1) class materials + course textbook + internet, (2) class materials + course textbook + internet + office hours, (3) AI tools + class materials + internet.

The use of AI tools starts at 0% from the first homework and peaks at around 56% on homework 11. Internet resources are common throughout the semester (78%-100%), followed by study groups (60% for homework 5 and 7). The time spent on assignments ranges from 0.5 to 5 hours,

with a mean of 2.85 hours and a median of 3 hours. The number of resources used is associated with more time spent on the assignment, with an r of 0.63. AI tools alone were not a meaningful predictor of time spent, even when homework and other resources were accounted for in the same model. Finally, AI tools appear in a third of the homework, often alongside multiple other resources. AI users also used 4.85 resources on average compared to 3.18 for non-AI users.

The limitations of this analysis include the reliance on self-reported time spent, as students estimate hours differently. In addition, since the survey is anonymous, some homework groups have smaller samples than others. Finally, some homework can be considered more challenging than others, likely requiring more time and resources.

Reported use in final project

I allowed students to use generative AI for their final project in my undergraduate Structural Steel Design course, as long as they cited its use. Out of 29 teams, only 2 self-identified as using generative AI. Those who used generative AI said they used it to help them decide which design cases to consider.

Self-reflection by instructors

The instructors reflected on their own use and how it impacted their students' choices.

- AI as an "average" colleague: Talking to AI about my course can be like talking to dozens of colleagues and finding the average response. For example, when I talk to AI about a new course prep, it is like I am efficiently reviewing several other people's syllabi, and then writing a schedule that includes the most common elements from all of them. I am still responsible for the course content, but I am optimizing the process so I spend less time writing a topic list and more time preparing class activities.

- Common push backs: Some colleagues express concerns that using generative AI in my course will not allow students to learn because they are not "doing the problem themselves." Although we are also concerned about student learning in the age of generative AI, by the same logic, students do not learn anything when we solve problems in class. Students often learn to approach problems by looking at similar ones. Responsible generative AI can help by generating multiple new problems and providing scaffolding for homework questions when needed.

- Why are students not using it more often for the final project? I was very surprised that only a few students used generative AI on the semester project. Why would my students not use a resource they were allowed to use? I came to a couple of conclusions. First, I did not demonstrate how generative AI could be helpful. In this group of senior undergraduate students, I think many of them did not know how they could use generative AI to their advantage. Second, it was not possible to use AI to do the actual project work, which required a file type that generative AI cannot (currently) create. Because they could not turn in something generated by AI, they may have thought the help or time saved would be negligible. Finally, despite assurances that AI use would not

affect grades, some still viewed it as "cheating" and worried about possible consequences. Those who did use generative AI were generally teams with average course performance. I plan to address these next time around to help students use generative AI effectively.

Recommendations

Generative AI can be a practical and widely accessible tool that students and instructors are already using formally or informally in the classroom. In civil engineering, this reality has created an opportunity to improve student support, instructor efficiency, and a duty to teach AI literacy in a responsible manner.

Across the use cases discussed herein, generative AI has been a supplement to engineering judgment rather than a substitute. Live in-class demonstrations are an opportunity for the instructor to showcase the responsible use of generative AI, aid in concept brainstorming, and clarify student questions. Out-of-class use is helpful where there is a structure: prompts, reflection assignments, and paired with citation and accountability. Instructor out-of-class use aids in routine and repetitive tasks such as drafting text, refining assignment prompts, revising rubrics, and summarizing feedback.

Survey data suggest that generative AI tools are not replacing other resources. Instead, students appear to be using generative AI in addition to other resources as a broader study strategy rather than a replacement for effort. At the same time, the known generative AI limitations make it imperative to provide opportunities to practice and show ethics and responsibility in class.

Finally, compliance with University and federal policies (such as FERPA) requires instructors to treat generative AI like any other third-party vendor. Even when FERPA-compliant tools are available, students and faculty still need clear guidance on what data should never be shared, how chat histories are stored and used by the company, and how AI use should be documented and reported.

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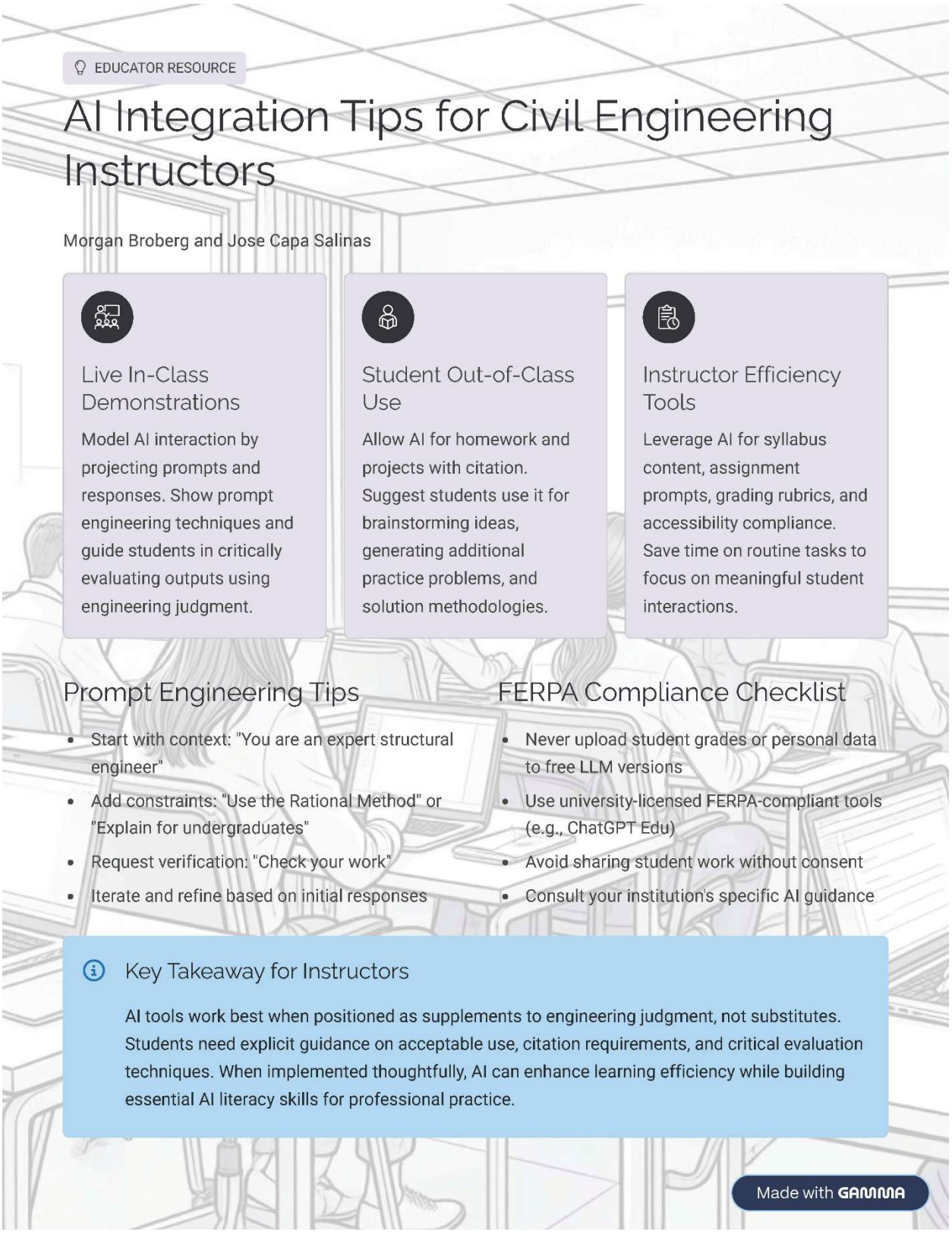
Appendix – Best Practices for Generative AI in the Classroom (generated using Gamma https://gamma.app/)



01

Establish Clear Policies

Create an AI policy for your syllabus acknowledging limitations, and defining acceptable use cases. Make expectations explicit from day one.

02

Demonstrate Critical Evaluation

Show students how to identify hallucinations, verify calculations, and question AI confidence. Ask: "Does this make sense? How do we verify this?"

03

Design AI-Resistant Assessments

Use in-class assessment for "no AI" assignments. Create assignments that AI cannot make like hand calculations or reflections on live presentations.

04

Build AI Literacy Gradually

Start with simple demonstrations, progress to guided practice, and eventually allow independent use with accountability measures.

Concept Clarification

Use Case: "What is an abutment on a bridge?" or "Explain Bayesian probability like I'm five."

Idea Generation

Use Case: "List potential failure modes for a steel girder bridge" or "Suggest structural failure case studies."

Assignment Development

Use Case: "Improve clarity of assignment" or "Create grading rubric matching my style."

Recognize Limitations

AI hallucinates, oversimplifies, and lacks engineering judgment. Teach students to verify all outputs.

Balance Innovation & Integrity

Allow AI use with clear boundaries. Require citations and maintain academic honesty standards.

Iterate and Improve

Your AI integration will evolve. Gather feedback, adjust policies, and share successes with colleagues.

Quick Reference: Sample Prompts by Use Case

Syllabus Development

"Develop a 16-week topic list for undergraduate Mechanics of Materials. Three credits, meets twice weekly for 75 minutes."

Icebreaker Activities

"Recommend icebreaker activities for 20 high school students, 10 minutes maximum, forming groups of 2-3."

Assignment Refinement

"Improve clarity of this assignment without increasing length. Format to meet WCAG 2.1 Level AA standards."

Feedback Synthesis

"Identify 5 common themes from student feedback. Each theme must appear in at least 3 responses."