SAFEGUARDING HUMAN CREATIVITY: USING GEN AI TO PROTECT AGAINST GEN AI

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ABSTRACT

This paper puts forward an argument that while exploring and pushing the boundaries of what generative artificial intelligence (GenAI) can achieve, we should not lose sight of its erosion on core human capacities. This paper provides explanations from a cognitive perspective, how human creativity is at risk of being compromised by GenAI, as we continue to outsource such cognitive tasks to GenAI. The use of GenAI is disruptive because it does not lend itself easily to scrutiny, and much of its decision-making is a black box and as such is in constant need for human oversight. The paper suggests that we can leverage on GenAI's strengths to address its potential harm and illustrate this using creativity as the discussion point. The choice of creativity is rather straightforward: it was not long ago hailed as something that is uniquely human, but recent advances in GenAI technologies had threatened this claim. For example, artefacts produced by GenAI in the creative industries are now indistinguishable from those of human creation. This paper focuses on GenAI use in promoting creativity engineering education, an area where past attempts were not met with much success. In addition, impact of GenAI on creativity is already extensively studied in non-engineering disciplines where we have much to learn from. One important aspect is the greater emphasis on importance of creation process in addition to creative product. The approach made use of a mental model developed by the author that showed how use of GenAI can be scrutinized at several levels to ensure that it can be responsibly used in teaching and learning. A key feature of the model is the use of CDIO Core Standards to provide human-in-the-loop oversight on GenAI responses. This has the dual benefits of ensuring that the processes enhance core human capacity while the engineering products demonstrate strict adherence to professional standards in meeting ethical and safety obligations. The paper shares an idea of moving forward to use the approach outlined in this paper to enhance faculty contribution to innovative teaching and learning by addressing challenges that are "unknown unknowns" via working collaboratively with GenAI.

KEYWORDS

Generative Artificial Intelligence, Human Intelligence, Creativity, Unknown Unknowns, CDIO Standards 3, 5, 7, 12

INTRODUCTION

The importance of creativity in engineering education had long been recognized, yet progress to-date had not been satisfactory (Corrêa & Mourão, 2025; Egan *et al*, 2017). This paper posits that integrating creativity can be facilitated by the use of generative artificial intelligence (GenAI). This paper argues that now it is more imperative than ever to address this challenge, because creativity, being an important human capacity, needs to be protected against over-reliance on GenAI use. Creativity was once hailed as one of the several human traits that is difficult to duplicate in machines. However, in today's fast-changing world, GenAI-based creativity has surpassed human creativity, where artefacts produced by GenAI (arts, music, poetry, etc) are virtually indistinguishable from that produced by humans.

This paper suggests that through the use of a mental model developed by the author, the judicious use of GenAI can help not only to counter the potential negative effects but can potentially lead to innovative teaching and learning practices. The model shown in Figure 1 (Cheah, 2026a) provides guidance on how faculty can be cognizant of potential pitfalls when using GenAI in curriculum redesign where CDIO Core Standards are among other approaches forming multiple layers of protection and serving as guardrails (Cheah, 2026b) to check against GenAI outputs. Collectively these various layers of protection will a robust safeguard against an event termed Swiss Cheese Phenomenon, where a hazard (in this case, wrong GenAI output) managed to slip through due to failure of all layers of protection.

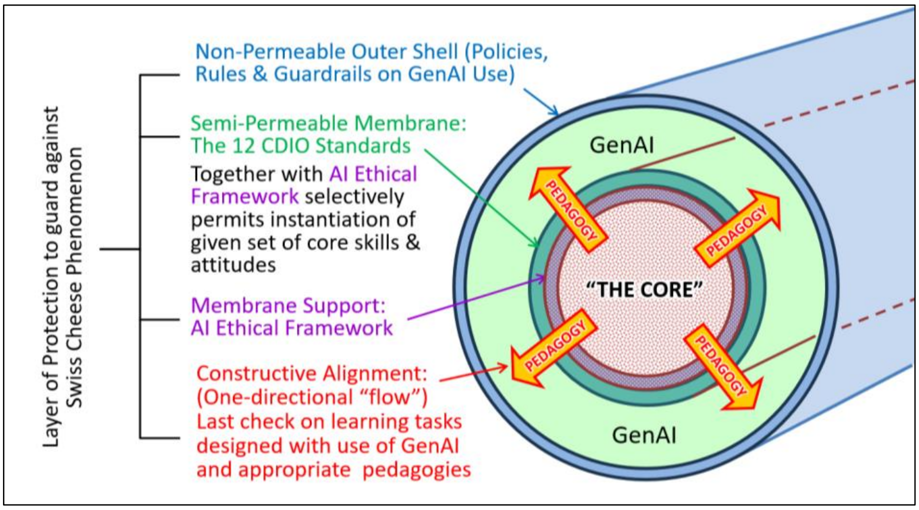

Figure 1. Model of GenAI use in T&L Guided by CDIO and AI Ethical Frameworks

While there is no single, universally agreed-upon formal definition of the human cognitive and affective aspects to be protected from GenAI, a consensus is emerging in research and commentary around several key capabilities that are considered fundamental and most susceptible to erosion from overuse or over-reliance on AI. For his work, Cheah (2026a) considers creativity, along with critical thinking, emotional regulation, metacognition and resilience, etc as the important human capacities, labelled as "The Core" in Figure 1.

Scope of This Paper

Whereas CDIO Standards and AI Ethical Framework provide the outer protection against GenAI misuse, this paper focuses on strengthening "The Core" itself, notably by enhancing human creativity and creative thinking. It firstly informs of the cognitive basis of creativity and hence argued that creative thinking can be trained. Not discounting the positive contributions of GenAI to teaching and learning, this paper focuses more on the negative impacts of GenAI overuse and over-reliance to illuminate GenAI's impact on creativity with particular emphasis on engineering education. The paper moves on to discuss and unpack the underlying mechanisms of how GenAI works and the way it handles various aspects related to creativity, such as intuition and serendipity; and argues that the best safeguards against the erosion of the traits by GenAI is the use of GenAI itself.

The suggestion is based on the premise that in engineering education, the process of engineering design is more important than the product of engineering design, and this had remained the case even with the use of GenAI. Lastly this paper concludes with a call for the revamp of engineering education that leverages on GenAI to address the "Unknown Unknowns" domain of knowledge, arguing that with assistance of GenAI, faculty can more effectively innovate teaching and learning.

LITERATURE REVIEW

The Neurocognitive Basis of Creativity

Creativity is a multifaceted human ability that depends heavily on the confluence of personal attributes and environmental conditions (Weir, 2024). Various studies have confirmed the neurological basis of creativity (Chan *et al*, 2025; Kutsche *et al*, 2025; Malach, 2024; Beaty *et al*, 2019). Dietrich (2024) showed from studies in neuroscience that creativity does not exist as its own specialized entity in the brain. It is "everywhere" in that its neurocognitive mechanisms are distributed, embedded, and varied. Fundamentally, it requires dispositions such as curiosity (which drives the exploration of new ideas and the questioning of established norms) and open-mindedness (which allows one to suspend judgment, consider unconventional perspectives and integrate disparate concepts). Intuition – a neurological process (Volz & von Cramon, 2006) is another human trait that is linked to creativity (Styhre & Sundgren, 2005). Intuition can be described from a psychological perspective as anticipatory ability to understand or know something without knowing how you know or understand (Hardman, 2021). Another crucial factor is intrinsic motivation, for which research has shown connections to creativity (Cromwell *et al* 2023; de Jesus *et al*, 2013).

Creativity in Engineering Education: Opportunities & Challenges

Creative thinking in engineering education is essential for preparing students to develop novel and effective technological solutions to complex, evolving problems. It moves the focus beyond routine problem-solving, which relies on known procedures, toward innovation in design by encouraging students to challenge assumptions, generate diverse ideas, and synthesize disparate concepts. This ability is crucial for driving global economic competitiveness, meeting societal challenges (e.g. climate change, infrastructure), and transforming new ideas into tangible, useful products and systems.

Studies from neuroscience show that creativity can be learned through divergent training (Sun *et al*, 2016). A recent study Sio & Lortie-Forgues (2024) showed a meta-analysis of 169 creativity training studies across five decades and found a positive effect size of creativity training. Peng *et al* (2025) suggest that integrating neuroscience principles into educational practice appears to foster creativity. However, the integration of creativity and critical thinking in engineering programs remains poor (Sola *et al*, 2017). A more recent study by Beaulieu (2022) showed that engineering students do appreciate the importance of creativity but more needs to be done to integrate it into engineering education. A key challenge in embedding creativity is the traditional heavy emphasis on narrow, deep technical specifications and rigorous, structured scientific paradigms in engineering curricula, leaving little room for flexible, ambiguous, or open-ended creative exploration.

Creativity and GenAI in Engineering Education Context: Benefits and Pitfalls

The use of GenAI is a rapidly evolving area that can significantly enhance creativity education by fundamentally altering the ideation, prototyping, and feedback stages of the creative process. Instead of acting as a replacement, GenAI functions as a cognitive co-pilot that expands human capabilities, especially in overcoming initial barriers to creation – the so-called "blank page syndrome", a modern spin on the common experience of 'writer's block,' coined by Austrian psychiatrist Edmund Bergler in 1947.

The "dual-edge sword" nature of GenAI use in education is often described as the "cognitive paradox of AI" (Jose *et al*, 2025). From a cognitive science perspective, GenAI raises significant concerns about "cognitive offloading", a term introduced by Risko & Gilbert (2016) to mean "the use of physical action to alter the information processing requirements of a task so as to reduce cognitive demand". In the context of today's advances in AI, it refers to the reliance on AI tools to perform mental tasks like information retrieval, data analysis, and problem-solving to reduce the mental effort required of humans. While this can increase efficiency by freeing up cognitive resources, it also raises concerns about potentially eroding critical thinking and deeper understanding by bypassing active, independent thought (Gerlich, 2025). One such risk is "cognitive atrophy", the term borrowed directly from the medical concept of "atrophy" which means the wasting away of a body part due to underuse, e.g. muscle atrophy. It is the "use it or lose it" principle applied to the mind. "Cognitive atrophy" therefore, describes the hypothesized degradation of cognitive skills (e.g. critical thinking, creativity) because they are no longer being exercised, having been "offloaded" with technology. Examples on impact of GenAI on creativity include the reduction of originality and divergent thinking for heavy GenAI (Moongela *et al*, 2024) and stifled creativity when defaulting to AI-generated ideas (Gonsalves, 2024), just to name a few.

Some findings from the impact of GenAI on creativity from non-engineering studies can be generalized to engineering, as both fields involve creative processes, problem-solving, and innovation. Here are the key transferable insights from Heigl (2025):

1. <u>GenAI Literacy</u>: Developing technical skills and understanding the limitations of GenAI is crucial. Engineers need to learn prompt engineering and understand the trade-offs of using GenAI compared to traditional methods.
2. <u>Human-AI Collaboration</u>: The importance of human agency in guiding GenAI creativity is important in engineering design. Engineers, like artists, act as curators and supervisors of AI-generated solutions and steer GenAI systems to ensure outputs align with technical requirements and creative vision.
3. <u>Redefining Workflows</u>: Design workflow can be improved by using GenAI as a companion. A cited example is the "triple-loop approach" of Seidel *et al* (2019) where engineers can use GenAI to generate design alternatives and refine inputs based on feedback. It is an active, iterative process of mutual learning with GenAI that influence the design process (i.e. reshaping the workflow) to attain the design goal.
4. <u>Bias and Ethical Considerations</u>: In engineering, similar concerns about inclusivity, fairness, transparency and ethical implications of AI-generated designs exist and should be addressed, especially in fields like product design and architecture.
5. <u>Human Perception and Acceptance</u>: Skepticism toward GenAI-generated content can arise during the conceiving state and distrusts during the designing stage. Moreover,

cultural background, expertise, and individual differences in evaluating GenAI outputs are also factors to consider. Understanding how these factors influence the adoption and perception of GenAI tools are important. Strategies are required to emphasize human oversight and promote collaboration to help improve integration of GenAI tools into engineering practices and drive acceptance of GenAI-generated solutions.

6. <u>Evaluation Metrics</u>: The use of subjective and objective measures to evaluate GenAI-generated content in creative contexts can be adapted to engineering. Metrics such as novelty, quality, and functionality can be used to assess the impact of GenAI on engineering designs.

DISCUSSIONS

Despite fundamental differences in human intelligence and GenAI, and more specifically in human creativity compared to artificial creativity (Runco, 2023) the rapid advances in technology in general and changes in GenAI capabilities in particular are cause for concern. This is because unlike other technologies before this, AI is fundamentally different in its relationship with humans. In the past, human creations have amplified our capabilities while remaining fundamentally under control. Today's AI systems are agents, not tools – they are capable of learning from data and possess a form of autonomy that no previous technology has exhibited before. Unlike previous technologies that process information using prescribed rules, an AI system is capable of developing its own rules from patterns it extracted from the information. We are faced with decisions from AI-based algorithms that affect our lives that are opaque to us (Whitaker, 2025).

The pace of change today offers little time for gradual societal adaptation (Whitaker, 2025). GenAI is fast catching up in replicating traits that once considered uniquely human. As mentioned in the scope of this paper, GenAI has already mimicked and exceeded humans in producing creative artefacts. Next, we briefly looked into how GenAI tackle the 2 aspects closely related to creativity namely serendipity and intuition:

- Serendipity arises from curiosity, intuition, and noticing something unexpected – a happy accident of finding something valuable or delightful when you are not looking for it, and is deeply tied to context, values and lived experience. GenAI on the other hand, uses its technology to facilitate unexpected discoveries and connections that surfaces surprising but relevant patterns. It is *engineered serendipity* relying on probabilistic exploration, randomness, or cross-domain data recombination.
- Human intuition is a fast, unconscious process derived from a lifetime of diverse learning and experiences. It often acts as a "gut feeling" that produce sudden insights and connections that helps the creative process by generating ideas and evaluating them. GenAI does not possess human-like intuition as it lacks consciousness, emotions, and lived experience. But its ability to identify complex statistical patterns and correlations in its training data that would be imperceptible to humans enables it to provide quick, seemingly insightful answers that mimic intuitive-like responses.

Here we see a common pattern that leads to GenAI's perceived superiority: it is the GenAI's foundation models that can process massive amounts of data to understand context, generate novel content, and solve complex problems across diverse domains with human-like proficiency. From a creativity perspective, this also means that GenAI is prone to the challenge of fixation bias as humans. A study by Desdevises (2025) showed that GenAI exhibited a comparable fixation bias, even as it demonstrated impressive fluency by producing a large number of creative ideas; most fall within conventional categories. The inability of GenAI to overcome the fixation bias highlights the necessity of human involvement, particularly for properly evaluating and filtering the ideas generated. The fundamental differences between human creativity and machine creativity can be succinctly summarized in Table 1.

Table 1. Fundamental differences between human creativity and machine creativity

Human Creativity	Machine Creativity
Type: Generative, conceptual – can invent truly novel concepts or artefacts based on subjective insights, metaphor and intuition	Type: Combinatorial, pattern-based – generates output by remixing and statistically combining elements from its training data
Learning mechanism: Experience-based, can learn from sparse data; learn through direct sensory, social and emotional experiences often requiring only a few examples	Learning mechanism: Data-driven, feeds on bog data and learn through statistical correlation and pattern recognition across massive, pre-existing data sets

AI's ability to make consequential decisions without deep understanding we would expect from human decision makers is causing a fair bit of anxiety. Dennett (2018) had warned against the human tendency to attribute an excessive or inappropriate number of human characteristics, emotions, or intentions to such non-human entities. Despite this, advances in AI systems continue to demonstrate remarkable competence across domains without the comprehension we associate with human expertise: "competence without comprehension" (Dennett, 2018). While work had been on-going to make GenAI more transparent for example in "Explainable AI" (Ali *et al*, 2023) we need more immediate measures to help us address this challenge. Since we cannot look inside the black box, the next best thing is to scrutinize the outputs and identify needed improvements to be fed back as inputs to the models.

SAFEGUARDING HUMAN CREATIVITY: USE GEN AI TO PROTECT FROM GEN AI

We can now look into how the mental model introduced in Figure 1 can be used to protect core human capacities from being compromised by overuse of GenAI. Recall that one of the guardrails ("layers of protection") is the semi-permeable membrane, which permits movement of materials in one direction only. Using this analogy, elements of creativity such as intuition, open-mindedness are "retained" inside the inner tube. This means that one is required to use the innate human capacity, to benefit from serendipity and intuition; and not relying on GenAI use. In the mental model, this is referred to as "instantiations" of the human capacities permitting their use (Cheah, 2026a). Pedagogically (the arrows in Figure 1), faculty can design learning tasks (CDIO integrated learning experiences, design-implement experiences) supported by GenAI use; that facilitate the use of the "instantiations" of these human capacities to build up students creativity, guided by the CDIO Core Standards providing human oversight: human-in-the-loop (Cheah, 2026b) to evaluate appropriateness of GenAI outputs.

From these descriptions, one can see that Figure 1 emphasizes using the learning process to strengthen the core human creativity. There have been many debates, especially in the creative industries, on the importance of the process of creation if the products are virtually indistinguishable whether they were produced resulting from human intelligence or GenAI – the Process vs Product debate. Having said that, it has also been shown that GenAI exhibited a comparable fixation bias, with most ideas falling within conventional categories. Hence it can be argued that focusing on processes is important to protect the core human creativity.

The author argued that in engineering education, the engineering design process is even more important than the designed product. Engineering is a professional discipline where a heavy emphasis is placed on macro ethics which directs the engineer's ethical and professional duty in doing what is needed for the long-term improvement of society (Vallero, 2008). An engineer is to hold paramount the safety, health, and welfare of the public. This duty of care is primarily discharged through the rigor and ethical standards applied *during* the design process, not merely judged by the final outcome. This applies to today's AI world as well, where engineers must balance the potential benefits to society of advances in AI technologies, while also avoiding their negative societal consequences. There is also a good alignment with the CDIO Core Standards, with their process-driven nature towards curriculum revamp and redesign; where human-in-the-loop oversight can be implemented (Cheah, 2026b). Collectively this can enhance the accountability needed in design decisions and demonstrate duty of care, therefore fostering greater trust in the use of GenAI in engineering design.

GenAI can be used to strengthen human creativity by tapping into its advantage to generate many ideas quickly, albeit the challenge of "fixation bias". An example of this can be illustrated using by aligning GenAI use with the *triple-loop approach* by Seidel et al. (2019) where autonomous tools and humans iteratively reshape tasks, processes, and even design logic through mutual learning. Building on this, the present paper situates GenAI within the CDIO Standards and ethical guardrails, not as a replacement for human ingenuity but as a structured mechanism for iterative co-creation. In this framing, GenAI's outputs are continuously scrutinized and refined through human oversight, ensuring that the process strengthens core capacities such as creativity and intuition. This conceptual alignment provides the foundation for moving from theoretical models to pedagogical practice, where faculty can design learning activities that cultivate reflective engagement, critical thinking, and creative confidence in students.

From the teaching perspective, faculty can harness the benefits of GenAI to cultivate critical and creative thinking, ethical awareness, and problem-solving skills in students. Stranges & MacNutt (2025) suggests that skilful use of reflective writing encourage students to engage deeply with course content and with their experiences, thoughts, and emotions to gain insights, make meaning, and develop as learner in the age of GenAI. Through timely feedback on the reflections, faculty can further strengthen the core human capacities by facilitating students in consolidating the learning outcomes.

With reference to Figure 1 although not explicitly shown, this is akin to the reverse osmosis process used in seawater desalination; where water under applied pressure, is pushed through a membrane to travel from the seawater side (with high salt content) to the purified water side (with lower salt content). In a pedagogical sense, this is analogous to the learnings gained outside the membrane is being "pushed back" into the inner tube containing the core human capacities. Students can now assimilate these learnings into their prior knowledge, forming new knowledge, hence enhancing the core capacities.

MOVING AHEAD: REVAMP OF ENGINEERING EDUCATION IN THE AGE OF AI

We propose that the opportunity is ripe to simultaneously achieve multiple objectives for the benefits of both students and faculty: rekindle the redesign effort to integrate creativity in engineering curriculum, imparting AI literacy to students, and building faculty resilience to GenAI by strengthening their creative capacity which is one of key elements of the human core. Doing so will enable faculty to better prepare in tackling the challenges in today's world, using GenAI as partners to address "wicked problems" typical of sustainable development issues, and in doing so, also help students reinforce their own creative capacity.

This paper proposes that the revamp of undergraduate engineering curriculum should be carried out using the CDIO approach in 2-part manner beyond what is covered in an introductory AI Literacy course which typically include the following areas as shown in Table 2. Details of the work done is covered separately by Cheah (2026d).

Table 2. Typical contents in an introductory AI Literacy course

Content Area	Key Topics
Fundamentals of AI	Key concepts like Machine Learning, Generative AI (e.g. Large Language Models), and the AI Lifecycle. Understanding the difference between AI, algorithms, and data.
Practical Application	Best Practices for Prompting/Interacting with AI tools (e.g. structuring prompts for clarity and precision). Identifying common AI tools and how they enhance learning and professional tasks.
Critical Evaluation	Learning to Evaluate AI Output for accuracy, bias, and credibility. Fact-checking and validating AI-generated content.
Ethics and Integrity	Responsible AI use, understanding algorithmic bias, data privacy, and security. Establishing best practices for academic integrity and avoiding over-reliance on AI.
Societal Impact	Reflecting on how AI is shaping the future of the workforce and its broader role in society, including issues of inclusion and equity.

- Part 1 is to equip students with knowledge beyond those covered in Table 2; to include elements of cognitive science on how the brain works, creativity and the supporting elements of curiosity, intuition, serendipity, etc; and how humans can work collaboratively with AI-powered machines. This should start with Standard 4 Introduction to Engineering where use of AI can be added to the coverage of roles and responsibilities of engineers. The coverage can be progressively enhanced as part of Standard 3 Integrated Curriculum over the early semesters on a program and include learning tasks designed with suitable pedagogies that carefully integrate AI resources with traditional teaching methodologies to foster creative confidence, divergent, and convergent thinking skills in students (Habib *et al*, 2023).
- Part 2 is to review and update the existing CDIO Syllabus (version 3.0) to include competencies needed to work collaboratively with AI-powered machines, thus reflecting the new reality of today's work environment. Cheah (2026d) had proposed changes to version 3 of the CDIO Syllabus to include the human-AI hybrid competencies. Part 1 of the syllabus, which is a placeholder for disciplinary fundamentals may need to make explicit importance of understanding cognitive science as well. There is also a need to review if existing skills and/or attitudes need to be strengthened, for example those related to intuition, serendipity, resilience, etc.

The revamp should be supported by faculty professional development programs to prepare them for the new challenge ahead: develop in students the required competency to work collaboratively with machines while understanding the benefits and pitfalls of GenAI. Cheah (2026c) presented a framework shown in Figure 2 on how different strategies can be used for faculty professional development using GenAI in innovating teaching and learning practices, depending on the relative distribution of knowledge between human intelligence and AI.

The framework can be used to guide the integration of creativity and creative thinking in engineering education to build faculty confidence in teaching this subject and in designing learning touchpoints for students via CDIO Standard 5 Design-Implement Experiences and Standard 7 Integrated Learning Experiences that requires human-AI collaboration.

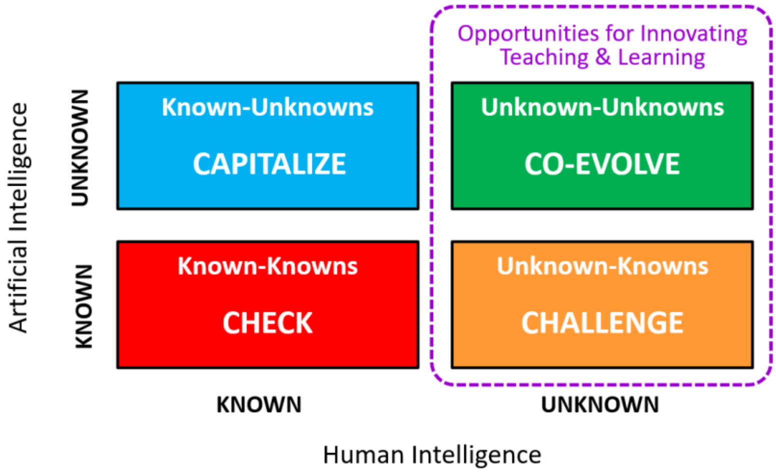

Figure 2. Engaging with GenAI under different scenarios and opportunity for innovation

The 4 strategies (CHECK, CAPITALIZE, CHALLENGE and CO-EVOLVE executed through Standards 5 and 7 provide a structured pathway for faculty and students to engage with GenAI while strengthening core human capacities. These are briefly explained below:

CHECK: Building Creative Confidence through Known Knowns

The CHECK strategy sets students off in comfortable footing. GenAI can be used to support ideation within familiar boundaries to build human confidence. For example, students can employ GenAI alongside established creativity tools such as SCAMPER or Six Thinking Hats to generate diverse design alternatives. A good application will be to address sustainability issues. Faculty can then prompt students to act as "Devil's Advocates," interrogating GenAI's suggestions, identifying assumptions, and refining ideas. In can also be GenAI that plays the role of "Devil's Advocate", helping students to uncover blind spots or identify confirmation bas. This process not only enhances creative and critical thinking but also reinforces the *process over product* ethos, ensuring that creativity is exercised rather than offloaded.

CAPITALIZE: Leveraging GenAI's Fluency to Expand Divergent Thinking

The CAPITALIZE strategy emphasizes harnessing GenAI's ability to rapidly produce multiple ideas. In practice, students might use GenAI to brainstorm dozens of potential solutions to a complex engineering challenge, such as low-cost renewable energy systems. Faculty guide students to sift through these outputs, identify unconventional possibilities, and recombine them with human intuition and contextual knowledge. By capitalizing on GenAI's fluency while retaining human judgment, students strengthen their capacity for divergent thinking and originality. Challenging GenAI in empathy, inequality and ethical nuances will further enhance students capacity to tackle wicked sustainability issues.

CHALLENGE: Strengthening Human Oversight and Ethical Awareness

The CHALLENGE strategy positions GenAI as a sparring partner. GenAI can inform faculty what it "knows" that faculty are not aware of yet. GenAI can easily process large amount of data and identify patterns, and faculty (or students) will study for plausible causations among key variables. Faculty can design tasks where students deliberately push GenAI to defend its outputs — for instance, asking the system to justify design trade-offs in terms of safety, sustainability, or inclusivity. Students then critique these responses, uncover biases, and propose counter-arguments. On the other hand, GenAI can be tasked to challenge students with constraints on proposed solutions, requiring them to be creative in proposing alternatives. This iterative exchange sharpens metacognition, ethical reasoning, and resilience, ensuring that human creativity remains central in decision-making processes.

CO-EVOLVE: Advancing Human-AI Mutual Learning for Wicked Problems

The CO-EVOLVE strategy, as the most advanced form of human-AI collaboration, moves beyond oversight into genuine co-creation. It is most likely used for advanced-level design-implement experiences in the form of final-year capstone projects. This stage presupposes competence and experience with three earlier strategies of CHECK, CAPITALIZE and CHALLENGE. At this stage, students and faculty can iteratively co-create with GenAI, for example, using Seidel's "triple-loop approach" (Seidel *et al*, 2019) in tackling "wicked" sustainability problems where solutions are complex, uncertain, and constantly shifting due to changes in social, environmental, and economic contexts. GenAI contributes fluency and rapid prototyping, but human creativity, e.g. intuition, serendipity, and ethical judgment ensures that suggested solutions remain adaptive and inclusive. Wicked problems demand resilience and the ability to navigate uncertainty, capacities strengthened through earlier strategies: CHECK builds confidence in critical engagement, CAPITALIZE expands divergent thinking, and CHALLENGE reinforces ethical oversight. With these foundations, CO-EVOLVE amplifies human creativity, fostering responsible innovation for sustainability's "unknown unknowns."

CONCLUSION

If we continue to defer human judgements in favor of AI's recommendations, the asymmetrical relationship between human intelligence and AI will just widen, much to our detriment. There will be a profound shift in authority from human judgment with its capacity for empathy and contextual understanding and ethical reasoning, to algorithmic processes optimized for pattern recognition and statistical prediction (Whitaker, 2025).

This paper shares an approach to take advantage of GenAI's strengths and outlined strategies to develop and strengthen human creativity – a core capacity at risk of being eroded by overuse of GenAI, whose capabilities are increasing with every iteration of technological advancement. We suggest an approach using a mental model coupled with CDIO Standards to guide GenAI usage in teaching and learning. GenAI is like a coin with both a positive and a negative side. Using GenAI is like spinning the coin, but we want to "rig it so that it always lands with the positive side facing up".

Summing up, we note that John Culkin's reflection on Marshall McLuhan's insights "We shape our tools and thereafter they shape us" (Culkin, 1967), remains instructive for the adoption of GenAI in education. *"*We shape our tools*"* when educators and institutions determine whether AI is employed to enhance teaching and support student learning, or to automate instructional processes. Yet, *"*thereafter they shape us": If GenAI is used without regard to its limitations, the very meaning of learning risks being reduced to the replication of machine outputs rather than the cultivation of human judgment and understanding. The challenge, therefore, lies not simply in adopting GenAI, but in doing so with deliberate intention, ensuring that its integration sustains rather than undermines the human dimensions of education.

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