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Encouraging Students into the Driver's Seat: Communicating Regarding Learning Responsibility

Dr. Adrienne Minerick, Michigan Technological University

Adrienne R. Minerick is a Distinguished Professor of Chemical Engineering. After serving in administration, she has returned to research and the classroom to teach graduate chemical engineering courses.

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Abstract

Student narratives about a course include what they tell themselves and what they tell their peers, friends, and family. These student narratives can either evolve to reinforce attitudes beneficial to student learning or degrade into reasoning that hinders student learning. One common narrative that is detrimental to student learning is one that blames the teacher or transfers the responsibility for learning onto the teacher, often in the form, “I could learn the material if the teacher just worked more examples.” Additionally, the easy access to AI provides easy access to answers that may circumvent problem-solving and practice. This paper is a great-ideas-for-teaching/perspective article that purports that beneficial student attitudes can be cultivated with growth mindset-inspired conversations, and deliberate messaging can counter narratives that transfer blame, which aligns more with fixed mindset thinking.

Faculty have far more influence over these narratives than many realize. As a course is designed, organized, arranged in the learning management system, and deployed, these factors can influence how students perceive the subject, their ability to master challenging material, and their own role in learning in the age of AI. Regular faculty communication with students that incorporates growth mindset concepts alongside beneficial AI use can influence students' narratives. However, faculty often need to independently explore how to present and motivate students’ attitudes to encourage them to proactively take responsibility for their own learning.

This article compiles a review of resources to aid faculty in this challenging endeavor, with a clear focus on regularly emphasizing student growth to rise to the challenge. Accessible, practical strategies are intertwined in the narrative for faculty to implement at any stage of their careers. These include narratives that repeatedly nudge and, progressively, shift students' attitudes toward a growth mindset, simultaneously leveraging the strengths of AI resources and building their confidence. The overarching goal is to equip students with the creativity and resilience to thrive in engineering practice, which will increasingly be integrated with AI assistants.

Introduction

<u>First challenge: the blame game</u>

Student narratives about a course include what they tell themselves and what they tell others when talking about the course. A fraction of the time, this includes a narrative of the form, “I’m struggling to learn because the teacher does {fill in the blank}.” or “The teacher expects us to know {fill in content from prerequisite courses}, which isn’t realistic.” These student narratives can either evolve to reinforce attitudes beneficial to student learning or degrade into reasoning that hinders student learning. Unfortunately, one common narrative that is detrimental to student learning is one that blames the teacher or transfers the responsibility for learning onto the teacher. Examples of this attitude include, “I could learn the material if the teacher just worked more examples.” “If the teacher demonstrated more {fill in the blank}, then I would’ve known how to do the problem on the exam.” These are examples of students deflecting the responsibility for the work associated with learning onto the instructor.

Second challenge: expectations of frictionless

Student expectations may not always be grounded in reality and may even be influenced by media portrayals of learning as rapid, frictionless, and easy. One example of this is in The Matrix, where Neo (Keanu Reeves) has a new program loaded and, in 15 seconds, says, “I know kung fu.” Scholars' messaging in academia doesn’t help. How often are complex topics described as elementary or simple? The moment a text is titled, “Tensor Calculus Made Simple” or “Elementary Differential Equations and Boundary Value Problems,” it sends a message that learning complex concepts should be frictionless, like reading an engaging novel, or simply prompting AI to do it for them. These are examples of messaging, internalized by students, that set unrealistic expectations.

One example that has resonated well in my graduate classes is an analogy of working engineering problems with learning to drive a car. If the student remains a passenger, always watching the driver, they can trick themselves into thinking that they know how to drive. However, few of us would trust such a “driver”. Thus, working engineering problems requires the student to transition from watching example problems to doing the problems themselves, eventually reaching a point where they are practicing without constantly consulting a pre-worked solution.

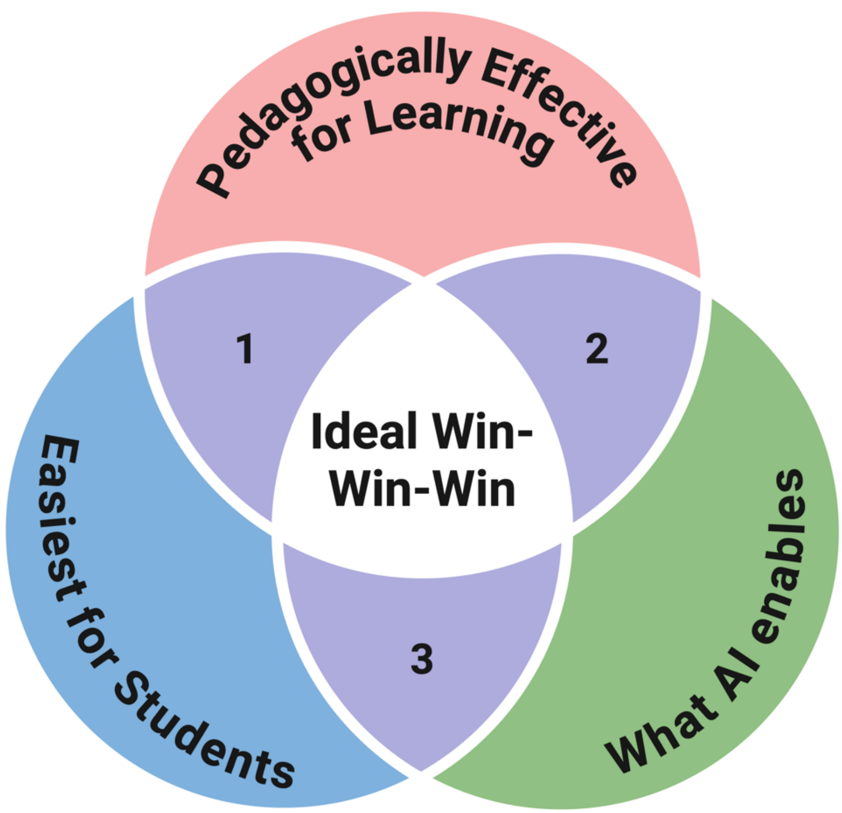

Figure 1: *Venn diagram illustrating that the plethora of strategies that are pedagogically effective for learning do not perfectly overlap with what is easiest or frictionless for students. Teaching evaluations correlate with how frictionless the content is for students, but not effective student learning. AI tools can increase ease for students and, if used properly, can be effective for learning challenging processes and engineering concepts.*

Literature Review:
There is a plethora of literature on growth and fixed mindsets, but less on ownership of learning, especially in engineering. Further, while the AI literature is rapidly expanding, how students leverage this in engineering classes is at its infancy and rapidly evolving. When students are fixed in their attitudes toward intelligence and ability in a course, their inner voice sends messages that they can't do it, resulting in lower motivation and an unwillingness to try new study strategies; this is termed a fixed mindset. When students dynamically shift their study strategies and adapt to new challenges, their engagement and motivation increase, along with their performance. Their inner voice echoes messages that they can do it, embracing a growth mindset [1]. The most comprehensive curation of interventions to foster a growth mindset in engineering students was by Campbell et al.[2]. They state, "the dominant intervention, seen in ten of the studies, was sharing mindset ideas with students through readings, videos, lectures, or online tutorials, followed by discussion or reflective writing, including students writing advice for other students." The use of open-ended projects to encourage growth mindset thinking by incentivizing alternative strategies rather than a single solution was found to be inconclusive in efficacy [3]. The comprehensive review concluded that "growth mindsets can be developed in engineering students and that some types of interventions are more effective than others." The analysis further suggested that for interventions to be effective, repeated interactions with the concept were needed [2]. This work in progress embraces growth mindset messaging intertwined with encouragement on how to practice and master challenging course materials. This work further discusses the challenge of assessing student learning, progress, and proficiency through grades.

Grade negotiations have been classified by Allen into four categories: grade neutral, grade enquiry, grade challenge, and grade-grubbing [4]. From an engineering instructor's perspective, grades are a means to incentivize behaviors and activities for content mastery and to assess the proficiency reached in solving problems. However, Horne et al. notes that grade challenging and grade grubbing can have detrimental effects [5]. Their qualitative findings were that students "are extrinsically driven by career goals and view their grades as a way to competitively distinguish themselves." Discussions are increasingly examining whether students' pursuit of grades is replacing learning [6]. Horne et. al continues to study potential interventions to deter these detrimental behaviors [5].

Further, grade-challenge and grade-grubbing interactions can carry over into student attitudes in the classroom and learning environments. When an instructor repeatedly encounters adversarial behaviors from students, whether from a grade-motivated mindset or other, it impacts the character and quality of instructor/student interactions.

The root way of thinking that performance is valued was originally studied by Elliot and Dweck [7]. Unintended consequences are that the students harbor an inner belief that their ability is low, so they choose the lowest-stakes task possible and avoid taking risks. Further, when grades are computed on a curve, earning high scores becomes competitive, so students gravitate away from working together and learning toward grade grubbing [8]. Thus, strategies to increase internal motivation and learning for the sake of learning are a means to counter this.

Excellent books on this topic include *Ungrading: Why Rating Students Undermines Learning (and What to Do Instead)* edited by Susan D. Bloom [9] and *Specifications Grading: Restoring Rigor, Motivating Students, and Saving Faculty Time* by Linda B. Nilson (2014) [10] and a new edition *Specifications Grading 2.0: Restoring Rigor, Motivating Students, Saving Faculty Time, and Developing Career Competencies* (2025)[11]. Both provide a valuable framework but overstate what can be achieved and under-deliver on implementation, primarily because the vast majority of the courses discussed and positioned as exemplars are not STEM or engineering. Engineering has the added challenge of technical competency and proficiency that, in roles directly tied to structures, equipment, and processes, endanger lives and the environment.

Thus, engineering lies at a unique intersection where technical proficiency and creative problem-solving must be assessed while remaining sensitive to the social dynamics that unfold under the rigidity of our current grading system. Thus, this paper focuses on compiling initial resources on course structure and messaging to reduce (but not eliminate) adversarial student-teacher interactions and to enable pathways that guide students to use AI in a manner that maximizes their learning and proficiency in problem solving with the rapidly evolving tools available to them.

This article is organized into four sections, each intertwined with experiential perspectives, as a starting point for faculty to proactively communicate with students. Within each section, practical strategies are shared that can be implemented by faculty at any stage of their career to repeatedly nudge and hopefully shift student narratives toward a growth mindset.

1. Organizational frameworks for course structure that empower students.
2. Outlines of weekly messaging alongside content that reinforce beneficial learning attitudes; a strategy to build trust in intention.
3. Conversations that frame learning responsibility in the age of AI.
4. Additional miscellaneous strategies to guide students to seek to understand concepts instead of searching for the shortest pathway to the correct answer (or points for a grade).

This article will draw parallels between existing resources, compile options for grading strategies, and aid in communicating growth mindset attitudes after students receive feedback. These and other supporting tools can help instructors counter the growing narrative that the teacher is to blame for student learning or that learning is frictionless. The goal is to seed conversations that transform narratives into student-empowered messaging that encourages them to take responsibility for their learning while utilizing AI in ways that maximize understanding.

Strategies

1. <u>A necessary foundation: Organization and Course Structure that Empowers Students</u>

During the introductory class and in the online learning management (LM) resources, students are less adversarial when they can easily understand expectations. The tools available to faculty to achieve this are to present expectations in a well-organized manner. Setting tone and expectations are most crucial to communicate at the start of the class. On day 1, if students exit the class with the impression that the instructor will do whatever it takes to help them learn, this is typically viewed as a good thing. However, students can internalize unrealistic expectations, such as the belief that learning is solely (or primarily) a function of how well the instructor presents the material. This then places the responsibility on the instructor to be entertaining and to explain things in a manner that allows all students to passively and frictionlessly absorb the information by simply paying attention (an unrealistic expectation). If the course's learning process is intentionally framed out in the syllabus and the LMS, fewer adversarial interactions arise throughout the semester. Examples of inadvertent messaging can be students interpreting that reading the book and/or supporting materials is optional, and/or that homework can only be attempted once the professor has worked examples that are nearly identical to the homework, or that the instructor will not move forward to the next topic until 100% of the students "get it".

In the language of math, if L_s is student learning, I_p is information presented, and the f(-) notation is meant to indicate "function of", then students' view of learning in a course can be limited to:

$$L_s = f(I_p)$$

However, learning, especially complex engineering concepts, is much more involved. It also includes focused effort, E, prior knowledge, K_p, practice, P, reading, R_d, and reflection, R_x. Faculty view of learning in a course:

$$L_f = f(E, K_p, I_p, P, R_d, R_x)$$

Each of these behaviors is not necessarily equally weighted, and depending on the engineering topic, the weight distributions may vary widely. Consistent with the growth mindset, larger weighting parameters should likely be included before E and P. Including these two equations in the syllabus is a mathematical way to convey expectations.

The course structure is largely conveyed with the syllabus and within that, the grading system. Aligning points/credit to beneficial studying/learning behaviors. A course's point system directly guides how students spend their time, which in turn influences the strategies they use to learn the material. Closely coupled with this is timely feedback to students that rewards demonstrating understanding and making connections across multiple concepts.

Students are well-practiced at allocating effort with point distributions. When homework is graded on correctness, students will use any means necessary to simply get the correct answer, shifting the goal away from learning and practicing the material. The rise in Chegg [12] and other online solutions repositories demonstrates this. I've shifted to grading on a rubric that rewards demonstrating and communicating problem-solving strategies. I also added in peer-review of homework with a transparently communicated rubric, encouraging constructive feedback on approaches. I've also provided a worked solution and asked students to record themselves explaining it step by step. With a graduate class in engineering, there are insufficient enrollments to conduct a rigorous, well-controlled study, but student feedback has noted, "I found the peer-review process to be interesting and helpful. For example, in Homework 2, where we had to record a video, there were some parts that I did not fully understand at first. However, after watching one of my peers' videos, where the problem was approached and explained from a different perspective, those parts became much clearer to me."

2. <u>Outlines of weekly messaging alongside content that reinforce beneficial learning attitudes; a strategy to build trust in intention</u>

Our educational systems have become increasingly dogmatic about rewarding trivia-like knowledge. This is likely because it is far easier to grade right/wrong and to simply add the totals to return as an indicator of learning. In engineering, providing "plug and chug" problems is also low-level problem-solving, but these problems do not teach creativity or problem-solving approaches to multi-disciplinary problems. They do not represent the types of problems students will encounter on the job because AI assistants are increasingly able to solve these types of problems faster with greater accuracy and considering multiple parameter variations. Students are concerned about how AI could replace the entry-level positions and if job opportunities will be limited by the time they graduate [13, 14].

It is against this backdrop that the instructor can motivate the importance of learning the foundational concepts, applying them in different scenarios, developing the experiential intuition, and practicing to become a versatile problem solver. Practicing engineers will likely increasingly use AI agents or co-pilots to perform job functions. Thus, their entry-level position may be more about strategy than "crunching numbers." Explaining this to students motivates them to focus on concepts and relational associations instead of searching for the relevant equation, identifying the parameters from the problem statement, and chugging through the calculation. I've found that bringing up the driving analogy can be beneficial because how a driver synthesizes information and responds to less typical situations is key to avoiding an accident or adapting to treacherous road conditions. The most successful responses to unexpected road conditions stem from a deeper understanding of the physics of how a car behaves. In short, black box operation works some of the time, but not all the time, which isn't good enough in engineering.

By directly addressing these background concerns, how the students intersect with the course material, and framing them as growth opportunities (e.g., the growth mindset), this can become a key component in building trust with students. Through these short side conversations, students perceive the instructor's good intentions toward their education and subsequently adapt attitudes and narratives that empower their learning and resilience. Often, directly conveying the learning goals behind an assignment approach [15] helps students understand the educational value of the activities and practice assigned to them.

Another reason for ongoing, regular communication about the importance of students maintaining responsibility for their learning (e.g., staying in the driver's seat) is that this runs counter to blame narratives and the frictionless expectations the students have developed throughout their education. In addition, the courses that they take concurrently can also influence attitudes and narratives. Thus, while it is valuable to set expectations at the beginning and to communicate these unfamiliar standards and structures, it is necessary to continue to acknowledge that the material is challenging and to convey belief in the student's ability to rise to the challenges in front of them and to focus on learning the concepts, making connections, and practicing applying those in new situations.

3. Conversations that Frame Learning Responsibility

Teachers have become attuned to seeking student feedback. In one extreme, this can lead a teacher to feel a constant need to read body language and to adjust/respond to any signs of discomfort. At the other extreme is the individual who has decided they will broadcast the information and leave students to fend for themselves: those who sink, sink; those who swim, good for them. Individuals dedicated to reading this paper likely fall closer to the needy side of the spectrum.

These same feedback-seeking individuals are thus susceptible to accepting the blame in the blame game. These instructors are in a constant cycle of trying to do more to accommodate student learning (e.g. make it frictionless). Unfortunately, in this cycle, it isn't usually the instructors who need to work harder; it is the students. The cycle is reinforced by tenure, promotion, and reappointment-driven evaluation systems because there are punitive repercussions for faculty who do not earn high teaching evaluations.

In my experience, a good strategy for this rock-and-hard-place situation is to periodically seek feedback, synthesize it, and share it with students, thereby acknowledging their perspectives. This is best followed by a discussion of the perspectives, adding any necessary narratives to nudge fixed-mindset ideas toward the broader learning goals (growth mindset). Without periodically seeking feedback and addressing student thinking, there is a higher probability that student narratives will devolve and hinder learning. In addition, this approach enables an instructor to directly ask and address questions about how to use AI to maximize understanding and learning.

One example of feedback I received from students was complaints about how much work the homework was, and how they still needed time to study for the exam. This opened the opportunity to discuss that working homework problems was the most valuable and important way to study for the exam because the exam consisted of problems testing the same concepts. It enabled open discussion about how students approach homework, such as trying the problem without consulting aids/books/ others first, outlining the main steps from the starting information to the desired goal, and then practicing the intermediate steps. This became a valuable opportunity to emphasize that the exams do not test whether a student can follow or mimic an existing problem; the exams instead test whether the student can independently apply concepts by starting, navigating through, and completing a problem.

In my experience, each week or two, a trust-building gesture is needed, and every second or third week, a reminder on growth mindset is needed. Guiding students to engage AI by asking it to explain or to employ the Socratic method (Gemini enables this mode) is a weekly message. Conversations leading up to exams and after exams tend to have the greatest effect on student motivation.

4. <u>Additional miscellaneous strategies to guide students to seek to understand concepts instead of searching for the shortest pathway to the correct answer (or points).</u>

Homework provides lower stakes (provided the points are allocated for low stakes) opportunities to practice, while exams and quizzes are a means for students to demonstrate and show off their own independent understanding and skills in solving problems. However, these two mechanisms alone do not address how to apply the concepts to complex, wicked problems. Thus, opportunities for students to team together to apply concepts and problem-solve through projects help develop their skill sets. I've found that using MythBusters episodes is an excellent way to situate projects. The students can watch the episode, draw diagrams, debate governing assumptions, and then set up/solve the pertinent equations. Presenting this to others in the class provides an extra motivation to narrate assumptions and explain how the governing equations can capture the physical behavior. Of course, for accuracy, I have the students do a practice run-through before presenting to the class [16].

Faculty are the Stewards of Engineering Culture

Another perspective in this instructor/student dynamic is that students who get in the habit of blaming others for their learning don't make great practicing engineers. It becomes a habit to expect that all information is carefully curated for them, and they do not gain the practice necessary to become self-sufficient, resourceful problem solvers. By deliberately crafting a narrative that promotes empowerment, deeper understanding, connection of concepts, and resiliency, faculty demonstrate in direct and indirect ways what qualities, habits, and practices are desired and valued in engineering practice. Thus, it is our responsibility to position our students for success in this rapidly changing world.

Conclusions

This great-ideas-for-teaching/perspective article argues that students' narratives about a course strongly influence how they approach learning the material, how proficient they become with the course concepts, and how they connect to other concepts in the field. Narratives that blame the teacher or transfer the responsibility for learning onto the teacher are related to fixed mindset thinking. Narratives that empower the student to meaningfully practice sample problems to build confidence in their abilities and then move into practicing connecting concepts with other courses in the curriculum, job experiences, research, etc., are related to growth mindset thinking. Faculty have significant influence over these narratives; strategies are outlined that enable instructor to regularly engage in these conversations. As a course is designed, organized, arranged in the learning management system, and deployed, these factors can all influence how students perceive the subject and their own role in learning.

Using the analogy of learning to drive a car, four broad categories of strategies are outlined: organizational frameworks for course structure that empower students, weekly messaging to build trust, ongoing conversations that frame learning responsibilities, and faculty stewardship of engineering culture. Experiences are shared so other educators can expand upon these, especially in the rapidly changing landscape of AI utilization.

The goal is that the reflections contained herein will assist and empower other faculty to break free of the cycle of placing blame/responsibility for learning predominantly on the faculty and help the faculty empower and shift students to gain deeper understandings of engineering approaches so they can problem-solve and direct AI assistants to conduct the "plug and chug" analysis while our talented human engineers focus on the creative design tasks to address global grand challenges.

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