Teaching Philosophy Statement

How I Understand Learning

I believe that learning is an active process of constructing understanding rather than a passive process of receiving information. Students do not enter a classroom as blank slates, nor does hearing clear explanation guarantee that they have learned it. Instead, new knowledge is interpreted through what students already know, the experiences they have had, and the mental models they have developed. My role as an instructor is therefore not simply to communicate correct information, but to create an environment in which students can connect new ideas to prior knowledge, test their understanding, confront misconceptions, and progressively develop more sophisticated ways of thinking.

This view of learning is closely connected to how I think as a signal-processing researcher. Much of my research involves asking how meaningful structure can be extracted from complex measurements: which features are informative, how a representation changes what can be observed, and how multiple sources of information can be combined to develop a more complete understanding of a system. That perspective has made me especially interested in the process by which information becomes knowledge. Raw information alone is rarely sufficient. Meaning emerges through relationships, context, comparison, and interpretation.

For similar reasons, I am drawn to ideas such as those proposed by the Thousand Brains Project, in which intelligence is described as emerging from multiple learned reference frames or models that interact to form a more complete representation of the world. I find this idea useful as an analogy for learning. Students continually build new internal models and connect them to structures they already possess. A concept becomes more useful when it can be viewed from multiple perspectives and related to previous knowledge. Although artificial intelligence architecture is not itself a complete theory of classroom learning, the idea reinforces my belief that robust understanding develops through interconnected representations rather than through the memorization of isolated facts.

Cognitive theories of learning further shape this philosophy. Working memory is limited, prior knowledge affects what students notice and understand, and meaningful organization helps learners connect new information to longer-term knowledge structures. These principles are particularly important in engineering, where students are frequently asked to move among mathematical equations, graphical representations, physical systems, computational tools, and abstract concepts. A student may be able to complete an algebraic procedure without understanding what the procedure represents physically. Conversely, a student may possess useful intuition without yet having the mathematical language needed to express it. I therefore view learning as the gradual construction of connections among these different forms of representation.

Learning is also social. Explaining an idea, hearing another person’s reasoning, defending an assumption, or realizing that a peer has interpreted a problem differently can expose gaps that are difficult to recognize when working alone. For that reason, I value classrooms in which questions, incomplete reasoning, and mistakes can be treated as legitimate parts of learning. The clinical teaching frameworks I have studied similarly emphasize creating an environment where students feel safe being wrong, asking questions openly, receiving feedback, and sharing responsibility for learning.

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How My Beliefs Shape My Teaching

My experience leading discussion sections for Linear Systems has been especially influential in developing my teaching philosophy. I initially expected retrieval practice and problem solving to be the primary focus of my sessions because students had already encountered the material during lecture. I quickly learned, however, that prior exposure did not necessarily mean students had formed a usable prior understanding of the concepts. Before asking students to retrieve or apply knowledge, I often needed to reconstruct the conceptual foundation with them.

That experience changed how I think about active learning. Activity alone does not guarantee meaningful cognitive engagement. Students cannot productively retrieve knowledge that they did not meaningfully encode, and asking them to solve a problem before they possess the conceptual structure needed to interpret it may cause frustration rather than learning. Sometimes the appropriate instructional decision is to ask students to struggle productively; at other times, the appropriate decision is to stop and rebuild the foundation before moving forward.

I therefore began structing my Linear Systems sessions by first establishing the central idea, then modeling how it could be used, and finally asking students to apply it more independently. I spent substantial time developing foundational concepts early because later topics depended on them. This reflects many of the strategies emphasized in the clinical teaching materials I have studied: breaking complex material into manageable components, sequencing material from simpler to more complex, checking understanding before progressing, modeling effective learning strategies, and maintaining an appropriate level of challenge.

When introducing abstract concepts, I often begin with familiar experiences that provide students with a shared reference point. For example, the definition of a signal can initially feel arbitrary. In engineering, nearly anything that can be observed or measured can serve as a signal. I like to ground the idea by using body language as an example. We continuously interpret posture, attention, eye contact, facial expressions, and other observable cues when interacting with other people. We are, in a broad sense, constantly processing signals and adjusting our behavior according to the information we receive. I demonstrate someone that is disengaged with bad posture vs someone that is actively engaged with proper posture and ask the students to reflect on how they would approach me. By beginning with an experience that most students can recognize provides an intuitive model that can later be extended into mathematical definitions and formal system representations.

I deliberately prefer examples that are broadly accessibly because I want students to have a reasonable chance of entering the discussion from a shared starting point. Examples and analogies are not substitutes for disciplinary rigor; rather they provide structures onto which more abstract knowledge can be attached. The instructional framework used in my teaching coursework similarly emphasizes analogy, comparison with existing knowledge, questioning, explanation, and connecting new material to familiar situations for future applications.

My approach to mathematical instruction is also influenced by working-memory limitations. When solving problems, I prefer to develop equations and reasonings progressively on a board or a piece of paper rather than reveal an entire derivation at once. Writing at approximately the pace that students are processing allows them to see the sequence of decisions:

what information matters, why a particular expression is introduced, what changes from one line to the next, and how I decide whether an answer makes sense. In mathematically intensive courses, a student who misses one step may become disconnected from everything that follows. Pacing instruction alongside the reasoning process helps reduce the problem. When possible, I also provide completed materials afterwards so students have something to revisit independently.

Practice is then used to extend understanding rather than merely reproduce an example. In Linear Systems, I worked through problems that required approaches similar to students' homework while deliberately avoiding duplication. The purpose was to show why a mathematical tool was useful and how to recognize when it applied while preserving enough difference that students still had to make decisions for themselves. I reviewed commonly missed homework problems, but I tried to emphasize productive reasoning students should perform rather than simply presenting lists of errors to avoid. I want students to leave with questions they can ask themselves: What information matters here? What does this representation tell me? Which tool applies, and why?

I also explicitly taught students how to prepare for examinations. We worked through practice problems together, discussed how to approach unfamiliar questions before beginning calculations, and identified areas that required additional independent practice. I provided additional problems students could work through on their own. In this sense, I was teaching both course content and metacognition: how to identify what one understands, recognize what still needs work, select an appropriate learning strategy, and regulate one's studying. The cognitive-strategy framework used in my coursework similarly identifies self-testing, monitoring comprehension, reviewing unmastered material, and adapting study strategies as important components of learning.

My approach to discussion and questioning follows the same philosophy. Rather than asking only whether students know an answer, I want to know how they arrived at it. Questions that ask students to apply, analyze, justify assumptions, or identify relationships reveal much more about their developing mental models than recall alone. The classroom observation framework I have used emphasized higher-level questioning, allowing students time to think, probing for justification and assumptions, redirecting questions, and synthesizing contributions during discussion. These are practices I want to continue strengthening as I develop as an instructor.

Comments about AI Usage

The increasing availability of artificial intelligence (AI) adds another dimension to this philosophy. I do not view AI primarily as something that should either be prohibited or allowed to perform students' intellectual work for them. Its educational value depends on the cognitive activity surrounding its use. If a student simply accepts an AI-generated response, the tool may bypass exactly the processes through which meaningful learning occurs. Used differently, however, AI can encourage students to compare explanations, critique reasoning, identify assumptions or errors, generate alternate examples, and examine a concept from several representations.

In an AI-rich environment, disciplinary understanding becomes more important rather than less. Students need enough knowledge to determine whether an answer is reasonable,

recognize when a computational tool is being misapplied, question its assumptions, and explain why they trust a result. I therefore want AI to help students interrogate and refine their own models rather than replace them. The students must remain responsible for interpretation, judgment, and meaning-making.

How I Know Learning Is Occurring

I do not think the effectiveness of teaching can be measured only through final grades. Because I understand learning as a change in the way students organize and use knowledge, I look for evidence of that change throughout instruction.

Student questions, patterns in homework errors, explanations during discussion, and the decisions students make while working through unfamiliar problems all provide information about their understanding. These forms of formative assessment help me determine whether students are ready for greater independence or whether an idea needs to be revisited from another perspective. My own experience in Linear Systems is an example of this process: when I realized that students did not yet possess the conceptual framework necessary for the practice activities I had planned, I changed my instruction rather than continuing with a strategy that assumed understanding they did not have.

I am particularly interested in transfer. A student who can reproduce a worked example has demonstrated something different from a student who recognizes the same principle in a problem that looks unfamiliar. I thus consider it stronger evidence of learning when students can select an appropriate tool independently, explain why it applies, move among mathematical and graphical representations, identify flaws in their own reasoning, and adapt a previously learned idea to a new context.

For the same reason, I view increasing independence as an important measure of successful teaching. Scaffolding should not remain permanent. I want students to progress from following an example, to completing part of a solution, to explaining their reasoning, and ultimately to solving problems without needing me to specify every intermediate step. The goal is not simply for students to become better at completing my assignments, but for them to become better at directing their own learning.

I also evaluate my teaching through reflection and revision. Not every instructional strategy works as intended, and unsuccessful implementation can provide useful information. My experiences have taught me to pay attention to motivation, timing, cognitive load, the level of prior knowledge students actually possess, and whether an activity is meaningfully integrated into the course. The teaching frameworks I have studied also emphasized regularly checking understanding, obtaining feedback, and adjusting instruction rather than treating teaching as a fixed performance.

Ultimately, I want students to leave my classroom with more than the ability to reproduce procedures. I want them to develop connected mental models that allow them to reason about unfamiliar problems, evaluate information critically, explain how they reached a conclusion, and continue learning independently. Constructivism provides the foundation for this philosophy, cognitive theories help me understand the conditions that support learning, and instructional design helps me translate those principles into deliberate classroom choices. My background in signal processing further shapes how I see this process as information only becomes useful when

it can be represented, related, interpreted, and applied. My measure of successful teaching is therefore not how much information I present, but the extent to which students become increasingly capable of constructing, evaluating, and applying knowledge for themselves.