An Analysis of How Engineering Students' Epistemic Beliefs Interact with Course Design Choices

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I. Introduction

This empirical full paper examines the context and alignment of epistemic beliefs among engineering undergraduate students. Engineering practice requires navigating a multitude of ways of knowing from analytical, experimental evidence to design judgment, to social and contextual reasoning about users, teams, and constraints. For example, Figueiredo [1] describes engineering as drawing simultaneously on the epistemologies of basic science, design, and social dimensions of practice. Yet undergraduate courses often differ in the kinds of evidence and justification they reward, and these differences become especially salient in the middle years when students are often immersed in lecture- and lab-heavy coursework while often beginning internships or co-ops that expose them to real engineering decision-making. Because these expectations are rarely made explicit, students end up inferring what counts as legitimate knowledge and evidence in each setting. In other words, students must interpret what counts as knowledge and evidence as they move across lectures, labs, design experiences (where present), and the engineering workforce.

These interpretations are not trivial. Students' epistemic beliefs (i.e., their assumptions about what knowledge is, how it is justified, and what counts as credible evidence) shape how they approach problems, what they trust, and whether they experience engineering as a field where they can belong [2], [3]. A student who equates "facts" with memorized formulas may feel confident in a calculation-heavy lecture yet feel disoriented in a design course where modeling assumptions, stakeholder interviews, and prototype data are all legitimate forms of evidence. Because what counts as a "fact" is context-dependent in engineering, epistemic beliefs must be studied in the contexts where students actually learn and work, not only as decontextualized traits [3], [4].

At the same time, students do not infer epistemic expectations from course content alone, they infer them from pedagogical signals embedded in everyday course design. Assessment practices and instructional norms (e.g., what exams reward, whether an equation sheet is allowed, how instructors frame data and uncertainty, what kinds of justification are modeled in class) can implicitly communicate what the course values as knowledge. Importantly, our results suggest that epistemic misalignment does not necessarily reflect unsophisticated beliefs about engineering work. Many students articulated nuanced views of engineering practice yet experienced their lecture- and lab-based courses as signaling a narrower view of what counts as knowledge (e.g., memorization, procedural correctness, or test performance). In this way, misalignment is often experienced less as confusion and more as an authenticity gap: students may discount coursework as "not real engineering," or they may begin to question whether their understanding of engineering—and their fit within it—aligns with what engineers and instructors value.

Crucially, this gap has consequences beyond cognition. Person–environment fit perspectives emphasize that subjective misfit (i.e., when individuals perceive a mismatch between their values, goals, or ways of operating and the expectations of an environment) can elevate strain and reduce well-being [5]. In engineering education, a perceived disconnect between "how engineering works" (as students understand it) and "how engineering is rewarded" in their courses can therefore function as a form of experienced misfit, especially in programs where workload and culture are already linked to stress and well-being [6]. This mechanism also parallels and extends engineering identity research: students' perceptions of authenticity and instrumentality shape motivation, recognition, and persistence-relevant beliefs (e.g., identity-based motivation and connections between role identity, instrumentality, and future-time perspectives [7]). Because epistemic beliefs and identity are intertwined [8], epistemic signals that narrow what counts as knowledge can indirectly shape whether students feel recognized and aligned with the profession they are trying to join.

In this paper, we examine the variance of alignment in students' epistemic beliefs across course experiences, views of the engineering workforce, and pedagogical strategies. We use a factorial, within-person survey design in which students listed all current courses and responded to the same items for each course modality (e.g., lecture, lab, design, interactive), followed by parallel items for life and the engineering workforce. This paper focuses on qualitative analysis of students' open-ended explanations of their closed-ended ratings, using these explanations to surface how students interpret everyday pedagogical features, particularly assessment-related choices, as cues about what counts as knowledge. By linking students' explanations to concrete, modifiable course signals, this work provides actionable insight into how seemingly small pedagogical decisions can shape perceived alignment between engineering education and engineering work, with implications for motivation, identity, and well-being.

II. Background & Theoretical Framework

The background and theoretical framework for this project connects two areas of literature to theories of epistemic beliefs: (1) person-environment fit (P-E fit) and (2) engineering identity research. Through these connections, we address a gap by operationalizing the context-dependent nature of epistemic beliefs in a way that can inform pedagogical change. The language used to describe epistemic beliefs is vast and differs across scholars and disciplines; therefore, we offer a definition of key terms before expanding on the background and theoretical framework.

> **Epistemology** – The study of knowledge: what counts as knowledge, where knowledge comes from, and how knowledge claims are justified.
>
> **Epistemic Belief(s)** – An individual's constructed belief or set of beliefs about knowledge and knowing.

A. Motivating the study of context-dependent epistemic beliefs based on prior theories of P-E fit

We draw on person-environment (P-E) fit theory to interpret, and more precisely theorize, the tensions students describe between what it takes to succeed in their coursework and what they expect will be valued in future engineering work. P-E fit describes the degree to which an individual's attributes (e.g., skills, values, goals, and expectations) align with the demands, rewards, and normative practices of an environment (e.g., a role, organization, or team) [9], [10]. When alignment is strong, people are more likely to experience satisfaction, persistence, and effective performance; when it is weak, dissatisfaction, disengagement, and attrition increase [9], [10], [11], [12], [13]. Moreover, research on engineering stress culture shows that engineering students are at a greater risk for high stress and poor mental health [6]. Therefore, we position this work on the alignment of "fit" as a strong component of student well-being.

In organizational psychology, P-E fit is often operationalized as fit with jobs, organizations, or vocational contexts (e.g., person-job or person-organization fit) [9], [10]. Fit is also theorized as both subjective and objective: *subjective fit* refers to individuals' perceptions of their alignment and readiness for a role, whereas *objective fit* refers to how well their demonstrated abilities and behaviors match externally defined role requirements [9]. Importantly, subjective perceptions of fit can shape students' views of their future roles even when objective fit is uncertain or difficult to observe in the moment.

In this study, we extend P-E fit to focus specifically on epistemic fit: students' beliefs about what counts as legitimate knowledge and how knowledge is evaluated and rewarded in (1) their classrooms and (2) the engineering workforce, and the perceived alignment between those two environments. This extension of P-E fit to epistemic beliefs is novel; both theoretical foundations have been used extensively in engineering education research, but not in combination.

Epistemic beliefs are multifaceted and dynamic. They are known to vary not only across individuals but across contexts, such as different classes and modalities of courses [14]. In education research, epistemic beliefs are operationalized through four dimensions of students' beliefs:

(1) Certainty of knowledge (e.g., knowledge as absolute and objective versus tentative and shaped by interpretation),

(2) Simplicity/structure (e.g., knowledge as a set of isolated facts versus a complex, connected system),

(3) Source of knowledge (e.g., authority, textbooks, research, peers, or experience), and

(4) Justification of knowledge (e.g., what counts as a "good reason," such as data, logic, lived experience, or other forms of evidence) [15].

We use these dimensions to frame our thinking of how students situate their epistemic beliefs across different contexts and environments. Because engineering is a high-variance epistemic environment, students are in a constantly evaluating how the subjective beliefs about engineering and engineering knowledge that are communicated through their classes align with their personal goals in becoming an engineer [1].

Within this framing, misfit can arise through at least two related pathways:

1. Person-classroom epistemic fit: the alignment between a student's epistemic orientations (what they believe knowledge is and how it should be used) and the epistemic demands and rewards they perceive in a course.
2. Person-workforce epistemic fit (anticipated): the alignment between that same student's epistemic orientations and what they believe will be demanded and rewarded in professional engineering practice.

Crucially, students can also experience a third, cross-context tension: *classroom-workforce epistemic alignment* as they perceive it. Even if a student feels capable in a course, they may perceive that the course rewards ways of knowing that are misaligned with "real engineering," producing a sense that success in school is not evidence of readiness for work. Conversely, a course can be experienced as affirming when its epistemic norms resemble those students associate with professional practice, strengthening students' confidence that they are developing "the right kinds" of knowledge and judgment.

Guided by this extension, our analysis focuses on students' perceived epistemic fit: how they interpret and compare the knowledge values of their courses with those of the engineering workforce. Because these perceptions are themselves consequential for motivation, persistence, and professional identity formation, independent of whether external observers would judge the fit as objectively high or low [11], [12]. In our work, we therefore use P-E fit theory not only to describe "alignment with a course," but to theorize how students navigate (and sometimes contest) the epistemic continuity between schooling and the engineering workforce.

B. Parallels to and intersections between epistemic beliefs and engineering identity research

While PE fit addresses how students navigate a variety of environments, work in engineering identity research has examined how epistemic engineering norms and dominant ways of knowing impact students' identities as engineers. Epistemic beliefs are an essential component of both identity and how students situate themselves as knowers and learners such that students who exist on the boundaries of epistemic engineering norms must exercise different ways of framing their epistemic beliefs or they may consider leaving engineering [8]. While performance is a vital component of engineering identity, a student can perform well as in their classes and still feel isolated from epistemic engineering norms [8], [16]. This nuance implicates the role of epistemic beliefs in shaping how students understand who they are as engineers—and what kind of engineers they can become.

Prior work has shown how motivation in engineering connects not only engineering identity but also to students perceived instrumentality (how students view what they do in classes as useful for their future engineering self) and expectancy (a student's belief about how well they will do on a task) [7]. Each of these components impact student interest in engineering through their ability to see themselves as an engineer in the future [7]. Therefore, we motivate this work by examining potential misalignment between how students perceive instrumentality and how they understand engineering work. By extension, we argue that the implications of that (mis)alignment impact students' engineering identities and, in turn, their persistence in engineering. In utilizing factorial survey design to examine students' epistemic beliefs in a person-centric and context-specific manner, we emphasize the importance of findings that can aid instructors in improving teaching and benefit the development of their students in their understanding of engineering and their futures as engineers.

III. Methods

This paper is part of a larger project to develop and instrument a flexible measurement of students' epistemic beliefs as a situated professional skill in engineering coursework [3], [4]. Leveraging a factorial survey methodology, our approach asks students to respond to three questions (two closed-response, one open-response) on their beliefs about knowledge across multiple contexts (see Appendix A for a sample of the survey questions). The IRB-approved survey (IRB0148900) was distributed to undergraduate students enrolled in biomedical engineering (BME) degree programs at two large research-intensive universities in the United States.

At both universities, the respondents encompassed all four years of the undergraduate curriculum, with the largest representation being in the middle years. After cleaning, the data set contained responses from 331 students and 2,461 responses to the closed-response questions, representing 376 unique contexts. However, our data set contained only 2,103 responses, indicating missingness between the open- and closed-response questions. If students did not have a complete data set (i.e., were missing responses in engineering work or life), they were excluded from this analysis. For details on the survey development and implementation, see [4]. This paper will focus on the open-response responses to illuminate how student's justified and evaluated-their ratings on the closed-response items.

Students' open-ended explanations were coded emergently and inductively, with a focus on three features: course content (what is taught and the situated field of study), assessment practices (how students' knowledge is evaluated), and pedagogy (how the course is taught and by students). The first and second author coded a total of 1,233 responses. Through this emergent process, the coders independently coded for key phrases and underlying themes of each students' responses (e.g., "[Facts] ...are important but limited"). These codes were then clustered to develop broad explanatory categories differentiating thoughts on "Facts" and "Knowledge" as reflected in the codebook provided in Table 5 of Appendix B. Codes for two subsets of data were discussed between the author team until consensus was reached on the approach [17].

In this paper, we focus on assessment practices and how they interact with students' epistemic beliefs and their understanding of engineering work. We compare responses in two ways: (1) explanations from courses with assessment-related comments versus a design-oriented course, and (2) explanations that explicitly reference the use of a formula/cheat sheet during assessments.

The research team is comprised of graduate students, postdoctoral associates, and faculty who have backgrounds in biomedical, chemical, and interdisciplinary engineering.

The authors were involved in the conception of the project, data collection, and analysis at various points. AW and TF were involved in the conception of the survey and the collection of data, and all authors were involved in the data analysis process with KG and GG leading the analysis. Our diverse involvement with the project, interaction with the data, and backgrounds in research in teaching contributed to the development of the codebook and analysis process.

IV. Results & Discussion

Students' explanations reveal that assessment is not only a grading mechanism but also an indicator for what counts as knowledge in a course. Further, their statements reflect an evaluation of how said knowledge is (mis)aligned to their understanding of the engineering work force competencies. In our results and discussion, we first summarize how students commonly describe exams, homework, and lab reports as "right/wrong" or memorization driven. We then focus on a lecture-heavy course that generated many assessment-related comments, using a paired within-student course versus workforce responses to show two recurring comparison patterns (Table 1). Next, we provide a brief contrast from a design-oriented course to situate what "alignment language" looks like when students perceive coursework as more representative of engineering practice (Table 2). We close by examining a specific assessment feature from the same course, formula/equation sheets, to illustrate how a common tool can be interpreted in such divergent ways (Table 3). Exemplar responses were selected to aid the discussion of each issue.

A. Assessment as an epistemic indicator across courses

Students' epistemic beliefs were misaligned in their understanding of course assessment when comparing to their responses about engineering work. Commonly, if students mentioned the assessment process in their classes, they were noting a level of disagreement and discontent with the way they were being assessed. They saw exams as unfair or rooted entirely in memorization, homework assignments as being heavily rooted in fact, and answers across many assignment forms, including lab reports, having either a correct or incorrect answers. By rewarding certain types of reasoning and justification in assessment over others, students are at risk of both person-classroom epistemic misfit and person-workforce epistemic misfit, as seen in the examples below. We pose that these misfits have greater implications for students' engineering identity and consequential retention in engineering.

1. Conflicting understandings of engineering across the same lecture-heavy course

These patterns were especially visible in a course frequently referenced in assessment-related responses, which students described as memorization heavy and evaluated as "right or wrong. 13 of 39 students mentioned assessment, and the same number, but not inherently the same students, mentioned memorization in their responses. When comparing this course to their responses about engineering work, two patterns emerged: (1) some students framed engineering work as similarly "based on facts," while (2) others positioned engineering work as fundamentally different from how the course assessed and valued knowledge. To illustrate how assessment signals shape course–workforce comparisons within a single course context, we present three paired exemplars from this lecture-heavy course (Table 1).

Table 1. Paired within-student responses from the focal lecture-heavy course; students' descriptions of course assessment expectations alongside the same students' descriptions of engineering work

	Response for the Course	***Response for Engineering***
Student A	The prelim material is solely dependent on the lecture material. In addition, many of the questions come from niche lecture slides, for example, one of the fill-in-the-blank questions would ask a question on a topic that was only referenced once. It is a little frustrating, and it enables students to memorize every little detail that was covered in class.	Engineering is a field where you have to achieve a completely [sic] understanding of and have 100% confidence in yourself due to the fact that people's lives are at stake. It is crucial to be factual with our work and know a lot of specific information so that we can guarantee our work is safe and successful.
Student B	The answers are either right or wrong. Tends to be a lot of did you memorize the slides. It is important to have each bullet point on the slides memorized for the exam.	I also think in engineering that solutions are based on hypothesis which are proven through facts. I think that solutions can be changed over time depending on new technology and information so they are facts that can be challenged. I also think that engineering emphasized [sic] knowing how information is used and processes rather then [sic] memorizing the information itself. That is why in a lot of classes we are given reference sheets, since in industry and research we would have access to resources to guide or solution. We just have to know how to utilize these resources.

Student C	Exams and HW assignments test mundane, specific facts about processes. This devalues the learning process.	With AI and the internet making information more accessible than ever, engineers today are less about memorizing facts and more about knowing how to put that information to good use. Instead of relying on extensive knowledge, they're expected to solve problems by combining principles with digital tools that create solutions faster and more efficiently. This shift means engineers need strong critical thinking skills to make sense of complex data and understand the real-world impact of AI-driven solutions.

Student A: Engineering as factual certainty. As shown in Student A (Table 1), frustrations with niche, recall-based exam items co-occurred with a workforce view that equates engineering with factual certainty and exhaustive specific knowledge ("100% confidence… crucial to be factual").

Student B: Engineering as revisable, resource-supported reasoning. Student B illustrates a different stance: while describing the course as slide-memorization and "right or wrong," the same student characterizes engineering work as hypothesis-driven, revisable, and resource-supported. Thus, explicitly contrasting workplace reasoning with memorization and noting that reference materials are available in practice.

Student C: Engineering as problem solving with digital tools. Student C similarly describes assessments as "mundane, specific facts" that "devalue the learning process," while describing engineering as increasingly centered on using information strategically (including AI and internet resources) to solve problems and evaluate impact.

Together, these exemplars show that even within a single course context, students interpret assessment practices as powerful signals about what counts as knowledge. Notably, the mismatch is not always driven by an underdeveloped view of engineering work: some students express rich, expansive understandings of what engineering work entails and contrast lecture-based assessment norms with this more dynamic view of engineering broadly.

2. Contrasting language in a design-oriented course

For contrast, students in an upper-level design-based course more often described alignment between coursework and engineering work, discussing the use of knowledge to obtain solutions and the role of problem solving in engineering design. For example, **Student D** used the same language around creativity within science and engineering across their course (creativity-based class...supplement by engineering and scientific knowledge") and engineering work (Table 2).

Table 2. Paired within-student responses from the design-based course, illustrating alignment of language and engineering perspective in their responses.

	Response for the Course	***Response for Engineering***
Student D	This is more of a creativity-based class that is supplemented by engineering and scientific knowledge.	Engineering is the cross-section between creativity and science.
Student E	I think solutions in BME 4080 are more abstract because device ideas depends [sic] a lot on the potential users' preferences and needs. Sometimes the best solutions based on facts is not the best solutions for the customers.	Again, I think it is more important how you use the information because engineering is about solving problems.

Student F	This course exercises creativity and innovation, but I think the solutions are somewhat based on facts so I would have chosen a neither agree nor disagree option for that question	In engineering work I do think solutions are centered on facts, but I think elements like innovation and creativity, as well as the audience you are catering to are just as important

Students were likely to mention stakeholders and other more "human" aspects of design in their course and engineering descriptions than students who were not in a design-based course (5 of 51 compared to 0 of 39). **Student E** discussed the role of stakeholders and patience in device design, claiming that "the best solutions based on facts is not the best solutions for the customers." This perspective aligns with their response for engineering as they discuss engineering as a matter of problem solving, indicating a strong sense of epistemic fit between their understanding of the experiences they have in this design class compared to their understanding of engineering work.

Finally, even when students claim the importance of facts within the class and engineering, they contextualize the role of facts and other important factors to engineering. **Student F,** for example, discusses that "solutions are somewhat based on facts" in their course. Similarly, they describe solutions in engineering work as being "centered on facts" while also highlighting the role of innovation, creativity, and audience. In this paper, we treat these design-course responses as a contrast case (not a second focal analysis) to illustrate what course–workforce alignment language looks like when students experience assessment and pedagogy as more representative of engineering practice.

3. Impact of formula sheets lecture-heavy courses

Students' references to formula/equation sheets further illustrate how a specific assessment feature can shape students' interpretations of what counts as knowledge in a course. However, interestingly, even when students described the same tool, their interpretations differed: some framed formula sheets as compatible with reasoning, while others treated them as shaping (or reflecting) what the course valued: memorization, versus conceptual understanding. Table 3 presents two paired exemplars from the same focal course in which students explicitly referenced formula/equation sheets.

Table 3. Paired within-student responses that reference formula/equation sheets in course assessments and the same students' descriptions of engineering work, illustrating divergent interpretations of a common assessment tool.

	Response for the Course	***Response for Engineering***
Student G	We have [a] formula sheet and a lot of things can be reasoned through on the test which is great just people tend to focus on the formula sheet and so it's hard to reason through because they [don't] try to conceptually understand it	…only worked in research professionally and the data is the most important thing there, you also need knowledge of how to interpret the data
Student H	[This course] allows me to apply mathematical and physical properties of fluids to biological fluids. It is based on mathematical relationships but also relevant examples and applications. The course emphasizes conceptual understanding over memorization. We are allowed equation sheets on the exam and [the professor] prioritizes everyone learning over simply giving grades. We will have extended conversations as a class to ensure everyone's questions are answered	Solutions in engineering work are based on real world problems. [These] problems, especially in the context of BME, are oftentimes complex and multifactorial. Usually it is less important to know lots of specific information and more important to know how to use resources, problem solve, and work with others.

	which eliminates any judgement for not knowing specific information.

As shown with **Student G**, the student noted that "a lot of things can be reasoned through on the test," but described peer reliance on the sheet as interfering with conceptual understanding ("they don't try to conceptually understand it"). In the corresponding workforce response, the student emphasized data and interpretation as central to professional work. **Student H** interpreted equation sheets as one element of a broader instructional stance, one prioritizing learning over grades, reducing judgment for not knowing specific information, and creating space for extended sensemaking. In the paired workforce response, the student described engineering work as complex and multifactorial, emphasizing resource use, problem solving, and collaboration over memorizing specific information (Table 3).

These exemplars suggest that formula sheets do not carry a single meaning. Instead, students interpret them through the surrounding assessment culture and instructional framing, which can either reinforce a narrow "memorize to perform" message or support a "reason with resources" message that students more readily connect to professional engineering practice. These findings suggest that recommendations for certain pedagogical or assessment strategies may not prevent misalignment between students' epistemic beliefs and what they experience in the classroom; rather, conversation with students and intention around selected strategies are essential to students' development.

B. Interpreting misalignment as an authenticity gap

Across these results, perceived misalignment is often experienced less as confusion and more as an authenticity gap: students may view course assessment expectations as disconnected from the kinds of reasoning they associate with engineering work, or they may question whether their understanding of engineering aligns with what instructors and institutions value. Because these interpretations are shaped by modifiable course features (e.g., how assessments reward reasoning, how equation sheets are framed, how uncertainty and justification are modeled), the results point to a practical lever for instruction: making epistemic expectations explicit and aligning assessment practices with stated learning objectives in ways that help students see how course work connects to engineering practice.

V. Conclusion

With these results, we are not arguing that courses should not be teaching engineering students facts or use formula sheets. Students being able to understand and utilize facts is necessary for them to develop expert-like engineering epistemic beliefs. However, pedagogical decisions matter in developing students' epistemic beliefs, especially when they create a misalignment between students' experiences in their courses and their understanding of the engineering workforce. With the middle years of undergraduate engineering education being so conceptual and rooted in fact, our awareness and intention in framing pedagogical decisions matters to the development of students as more expert-like and epistemically flexible engineers.

We also offer practical applications for instructors to implement in their courses to aid in the alignment of their course work and the engineering work students imagine themselves doing by utilizing backward design principles, utilizing project-based curriculum and active learning initiatives, and having conversations with students about how this class can help them develop as engineers. By making even small, intentional pedagogical changes within our classrooms, we can help students persist in engineering by allowing them to envision a future as an engineer.

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Appendix A. Survey Questions

Table 4. Example of survey given to students

Section	Code Type	Question
In Course 1,	Likert Scale (1-Strongly Disagree, 2-Disagree, 3-Agree, 4-Strongly Agree)	Solutions are based on **facts.**
	Likert Scale (1-Strongly Disagree, 2-Disagree, 3-Agree, 4-Strongly Agree)	It's important that I know a lot of **specific information**.
	Open Response	Please briefly explain your responses to help us understand them.
In Course 2,	Likert Scale (1-Strongly Disagree, 2-Disagree, 3-Agree, 4-Strongly Agree)	Solutions are based on **facts.**
	Likert Scale (1-Strongly Disagree, 2-Disagree, 3-Agree, 4-Strongly Agree)	It's important that I know a lot of **specific information**.
	Open Response	Please briefly explain your responses to help us understand them.
...	...	...
In Engineering Work,	Likert Scale (1-Strongly Disagree, 2-Disagree, 3-Agree, 4-Strongly Agree)	Solutions are based on **facts.**
	Likert Scale (1-Strongly Disagree, 2-Disagree, 3-Agree, 4-Strongly Agree)	It's important that I know a lot of **specific information**.
	Open Response	Please briefly explain your responses to help us understand them.
In Life,	Likert Scale (1-Strongly Disagree, 2-Disagree, 3-Agree, 4-Strongly Agree)	Solutions are based on **facts.**
	Likert Scale (1-Strongly Disagree, 2-Disagree, 3-Agree, 4-Strongly Agree)	It's important that I know a lot of **specific information**.
	Open Response	Please briefly explain your responses to help us understand them.

Appendix B. Codebook

Table 5. Emergent codebook created from the first round of qualitative coding. Codes and sub-codes were clustered to elucidate themes

Section	Code	Sub Codes
What is important to know / I know from...	Facts	...are important but limited (Contextual); ...are unchangeable (Positivism); ...inform process; ...are not solutions; ...can test understanding; principles and theories are not...; Problem solving and critical thinking are meaningless without...
	Knowledge	...is important but limited (Contextual); … required for experiments; ...on subjects outside of school is important; ...and skills create reality; ...of methods and implementation are specific information; … is necessary to help; ...can have an amount; ...of the self; Extent of...; "Good" ...

	Specific Information	...is important but limited (Contextual); …is not needed; stories are not...; ...is un-friendly; ...is needed for variability; failure without...; interpretation and curiosity vs ...
	Understanding	Depth of...; depth of ... is vital; ...to be successful; Breadth vs Depth; exactness of...
	Previous Solutions	
	Experience	
	Analysis	
	Application	...is more important than amount; Many ways to get to a solution; apply knowledge...
Thoughts on Truth	Positivism	
	Post Positivism	Contextual; Pragmatism; Co-construction
	Subjective	
Systems / Design /Epistemic Thinking	Interdisciplinary / Cross disciplinary Thinking	
	Systems Thinking	Systems of Thought; facts vs system of knowledge & facts
	Design Thinking	Constraints / Problem Scoping; Real World Implications
	Epistemic Thinking	
	Epistemic Flexibility	systems of knowledge and information
I know I'm an engineer because I can/ have...	Create Successfully	
	Critical Thinking	...informed by facts
	Problem Solving	...informed by facts
How do engineers make decisions?	Judgement	
	Evidence-Based	
	Common sense	
	Intuition	
	Scientific Rigor	
Engineering creates...	Solutions	...are not based in facts (Post-Positivism); ...are based on facts; ...are based on application; ...come from fundamentals; ...are based on informed speculation; ...are based on feelings; ...are based on prior literature; ...are based on data
	Ideas	
	Environments / Systems	
Class / Discipline / Context	Science	Literature, Math, Music, Sociology / Psychology; Cell Biology; Physics; Anthropology; Circuits and Systems; Chemistry; Biomechanics; Computer Organization and Programming; MSE; Student Success; Microeconomics
	AS class for AFROTC	
	Research	
	Engineering	...is using math and science
	Life	
	Class Type / Characteristics	Seminar; Lab; Student Friendly; Knowledge Dense
Content of the class	Science	Physics; Math; Circuits; Medicine; Imaging
	Mathematics	Formulas; Calculations; Problems; Techniques
	Research	
	Literature	Stories; Books; Papers; Reading Comprehension
	Communication	Presentations; Writing
	Social	Culture; Society

	Assessments	Tests / Exams
	Experiment	
	System	...are based on facts
	People	... are hard
	Real World	Finance; Voting; Current Events; Relationships; Hobbies
Positionality	Role	TA
Teaching Theory	Pedagogy	
	Case Study	
	Knowledge Organization	
Student Feelings / Perceptions	Frustration	
	You do not get help	
	"Should be"	
	Expectations	
	Agency	teaching yourself information; Self-improvement; improvement though self-knowledge
Beliefs on Wellness / Support	Service	knowledge can help; helping students
	prioritize happiness and well-being	
	Humanity	...in finding solutions
Characteristics	Fundamental	
	Theoretical	
	Conceptual	
	Terminology	
Action Taken	Memorization	
	Brainstorming	
	Interpretation	
	Practice	
	Thinking	
	Modeling	
Other	lol	
	unclear	
	contradictory language	
	courses not workforce	
	assignments are based on prior literature	