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Useful but Not Interesting: Illuminating Student Task Values Surrounding Engineering Writing Classes

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Abstract: Students' learning motivation in their engineering writing classes is typically regarded as low—by researchers, educators, and students themselves. This low motivation is often attributed to students' lack of value for writing in general or engineering writing classes in particular. However, the claim that engineering students don't value writing has not been explored in great detail through research. In this paper, we report the results of mixed-methods research on student learning motivation. The results of this work suggest that, contrary to common perception of engineering students, these students in aggregate readily identified their writing courses as equally useful to their non-writing courses. However, these students were significantly less interested in their writing courses' content than that of other concurrent engineering classes. We conclude by providing actionable insights for educators that are suggested by our data.

> Q: Imagine that you are the instructor of an engineering writing class. What would you do to ensure that students stayed interested and motivated to learn?
>
> A: Ha! Good one. Honestly, I'm glad that's really not my problem, 'cause I have no clue. Best of luck with that, though. –Participant ID #13055947

Introduction

An engineer's professional duties typically demand a substantial amount of technical writing [1,2], and writing plays a role in hire, promotion, and long-term success [3–5]. In both industry and academia, writing provides an engineer access to his or her discourse community [6].
While employers, educators, and ABET agree that today's engineer needs to write well, often undergraduate students don't seem to be on the same page. Engineering students are reported to be resistant to writing and technical communication education, demotivated by writing assignments, and dubious of their writing instructors [7,8]. A common perception inside and outside of the engineering community is that our students are unmotivated in their writing classrooms and unmotivated to write in general.

Invariably, conversations around engineering student writing motivation turn to the topic of engineering student values: value for writing class content, value for writing as a skill, value for writing's role in their future careers. We intuitively understand that when a learner values content—that is, the student finds it useful, important, or interesting—the learner is motivated to succeed in learning tasks. Psychologists refer to this phenomenon as "task value motivation", and though it is but one of a constellation of learning motivation factors[9], research suggests that students with high task value use deeper cognitive strategies to succeed[10,11]. We tend to associate

our interests and values very strongly with our learning choices; so when we see students who are not motivated to learn, a reasonable first hypothesis is that their task value motivation is low.

This is a hypothesis shared by much of the engineering community. A very common presumption regarding students' low learning motivation is that they simply don't know that engineers have use for writing skills, that "real" engineers write; and if only they did, surely they would apply themselves in their writing classes. We can see some fleeting evidence of this kind of unmotivated student in qualitative data. For example, in case studies and interviews engineering students have reported that they don't see writing as important [1], or they view writing as incidental to the real work of engineering, reflecting cultural messages that they perceive in the behavior of industry professionals [2,12]. Beyond such glimpses, we have very little data about our engineering writing students' values that inform their learning motivations, positive or negative.

Given a better understanding of our students' learning motivation values surrounding writing, we might find new inspiration to seek effective strategies toward motivating our students to learn and succeed in their writing classes and their future lives as collaborative, communicative professionals. Toward this better foundational understanding, this work seeks to explore the following questions:

1. What are the task value-based learning motivations of students surrounding their engineering writing classes? Are they meaningfully different than student values concerning non-writing engineering classes?
2. Do our students share our belief that an engineering career requires writing skills? To what extent does this belief provide motivation?
3. With the understanding that classes are composed of many individuals with different values and interests, what are some promising avenues to increase students' value-related motivations?

About this work

The present work focuses exclusively on task value because of its high relevance to engineering writing educators who seek to motivate. Nearly all of the motivational strategies that stakeholders have proposed to the author in faculty development contexts have centered on attempts to raise students' task value for writing classes. These strategies can be strengthened considerably by better insights into the writing values students bring to engineering, and the often-surprising mosaic of values and motivations that may be present in a class that appears uniformly unmotivated. The exclusion of other worthy motivating considerations like student self-efficacy, engineering identity, beliefs about writing, and emotional response to writing tasks is not intended as a dismissal of their significance; they will be addressed in future work.

Task value

Task value describes a concept that is present in most cognitive theories of motivation: if a person believes that a task aligns with their values or will provide value to them, they will be more motivated to pursue and complete it. In education and learning motivation, the concept is most directly formalized in applications of the Value-Expectancy theory of motivation, which states that learning is a function of both the learner's value for the task and the learner's confident expectation that reasonable effort will yield success[13–15]. Values might include alignment with a learner's identity; belief that the learning will prove useful in the future; intrinsic interest in the subject; or even concern that the learning task will require a sacrifice of other values or valued resources[13].

The most common way to measure task value motivation in populations is through self-report questionnaires. Several validated self-report instruments have been developed to quantify task value in students[16–19]. Of these, the most common is the task value component of the Motivated Strategies for Learning Questionnaire (MSLQ). The MSLQ is an 81-item Likert instrument that is used to measure student learning motivation and cognitive study strategies in a given course[20]. The MSLQ encompasses questions relating to 15 motivational and strategic orientations, including task value. The MSLQ instrument was designed to be modular so that any one of these orientations (or any combination of them) may be isolated and surveyed independently of other orientations. Thus, the six task value items on the MSLQ comprise a validated instrument in their own right. A foundational assumption of the MSLQ is that students' learning motivation is situation-specific; each student has a particular profile of learning motivations tied to each class, and even these may change in time[21]. This makes the MSLQ an ideal instrument for uncovering students' motivational differences in two classes taken simultaneously, an approach that has some precedent in engineering scholarship of teaching[22].

Methods

Approach: In order to see a broad measure of students' task value for writing classes (and those classes' non-writing counterparts), we may use the MSLQ to collect quantitative data. Yet in consideration of the needs of practicing educators, a purely quantitative study would have a few shortcomings. The first, of course, is that our natural interpretation of quantized aggregate data tends to emphasize the results of the majority, which is not always a useful approach in educational contexts—particularly engineering education, which concerns itself with building a more welcoming culture for a breadth of students, including those who are presently underrepresented. The second shortcoming of qualitative measures is that while survey instruments can reveal broad trends in student attitudes, surveys have limited ability to explore the reasons and influences that underlie these trends, nor to enlist the collaboration of survey

participants in considering alternatives. A survey can describe student information, but can not capture nor react to student voice.

For these reasons, this study takes a pragmatic, mixed-methods approach, encompassing broad surveys and deep interviews. These sources are triangulated via a "holistic description" design, coded around themes that emerge in the survey analysis, in order to reveal contexts and background that contribute to trends in quantitative data[23]. By showcasing the stories beneath the survey, we provide images of possible student thoughts and reactions that may yield transferrable insights for educators. A schematic of the research is shown in Figure 1, and an explanation of each component follows.

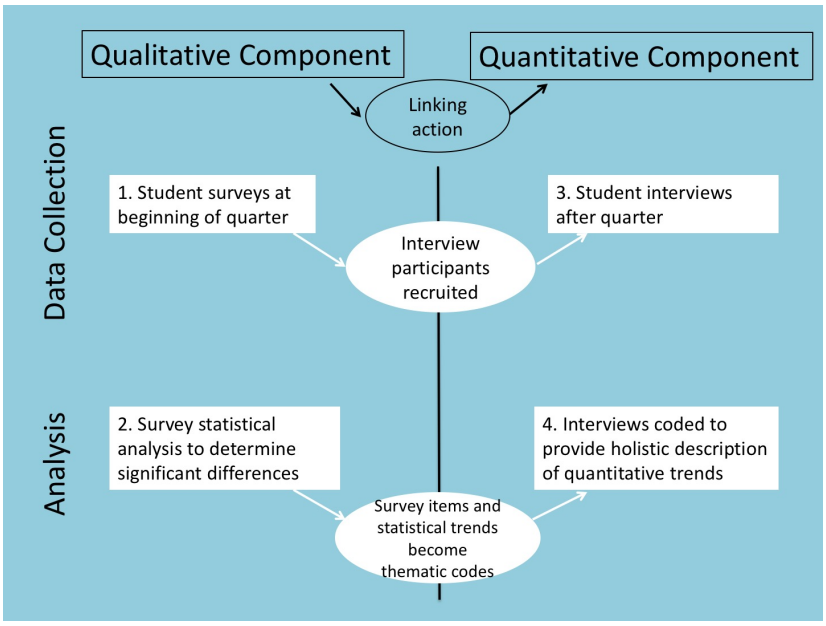

Figure 1: A schematic of the research design.

1. Student Surveys

The quantitative component of this research was collected via a survey administered to students online, through their participating engineering writing class, near the beginning of the quarter. This survey included motivational items from the MSLQ regarding their writing class, and parallel MSLQ items regarding a non-writing engineering class in which they were concurrently enrolled. The participants also completed two short-answer questions: 1) "How does it befit an engineer to write well?" 2) "Imagine that you are the instructor of an engineering writing class. What would you do to ensure that students stayed interested and motivated to learn?" Though the survey was intended primarily for research, in some cases it was used for a dual pedagogical role by allowing students an opportunity to reflect on their thoughts about engineering writing and see the aggregate motivations of their classmates. In accordance with this pedagogical context, short-answer question 1 is positively biased.

The survey was completed by 212 consenting students across 11 engineering disciplines, ranked freshman through super-senior, who were enrolled at a large public research university. These students were enrolled in one of nine sections of four engineering writing classes, offered by three disciplines, between Fall 2014 and Fall 2015. All students were required to take their respective engineering writing class as a condition for graduation.

2. Analysis: The quantitative data's statistical significance was calculated by assuming a linear numerical distribution of Likert terms (Not True = 1; True = 5). The student MSLQ responses regarding their writing class was paired with the corresponding set of responses regarding their non-writing class. A paired sample T-test (with a threshold of $p = 0.05$) was used to determine the significance of students' differences in response regarding their writing and non-writing class task value motivation.

3. Student interviews

From the pool of 212 survey participants, 15 volunteers were recruited for a follow-up interview. These interviews took place after the students' participating engineering writing class had concluded, in order to focus more generally on student attitudes and perceptions about writing and engineering rather than their reactions to classes in progress. These semi-structured interviews included questions about the students' background as writers, readers, and as engineering students; their concepts regarding engineering writing; and their ideas regarding writing education in engineering. The interviews also prompted the students to clarify, validate, or explain trends in their survey responses, and comment on the ideas they'd offered in the survey regarding the value of writing to an engineer and their imagined approach to ensuring student motivation in a similar class. The 15 participants were ranked sophomore through super-senior, and were enrolled in five engineering disciplines. Nine of the participating students were male and six were female.

4. Qualitative Analysis:

The quantitative MSLQ items, and interesting statistical data trends, became an initial set of codes around which to analyze qualitative results for related insights. For any given trend-code, special notation was given to interview participants whose survey answers reflected the trend.

Results and Discussion:

For educators who are concerned about students' task values, the big picture of this work's quantitative results should be heartening: for all task value items, across both writing and non-writing classes, *a majority of these students self-reported positive motivational task values* (Figure 2). This alone is an important insight for frustrated stakeholders. Given that these survey results were taken near the beginning of an engineering writing class, these results undermine a common conception that writing students arrive at our classrooms with no motivation. The mode

student in these writing classes valued engineering writing content in a way that is conducive to successful learning.

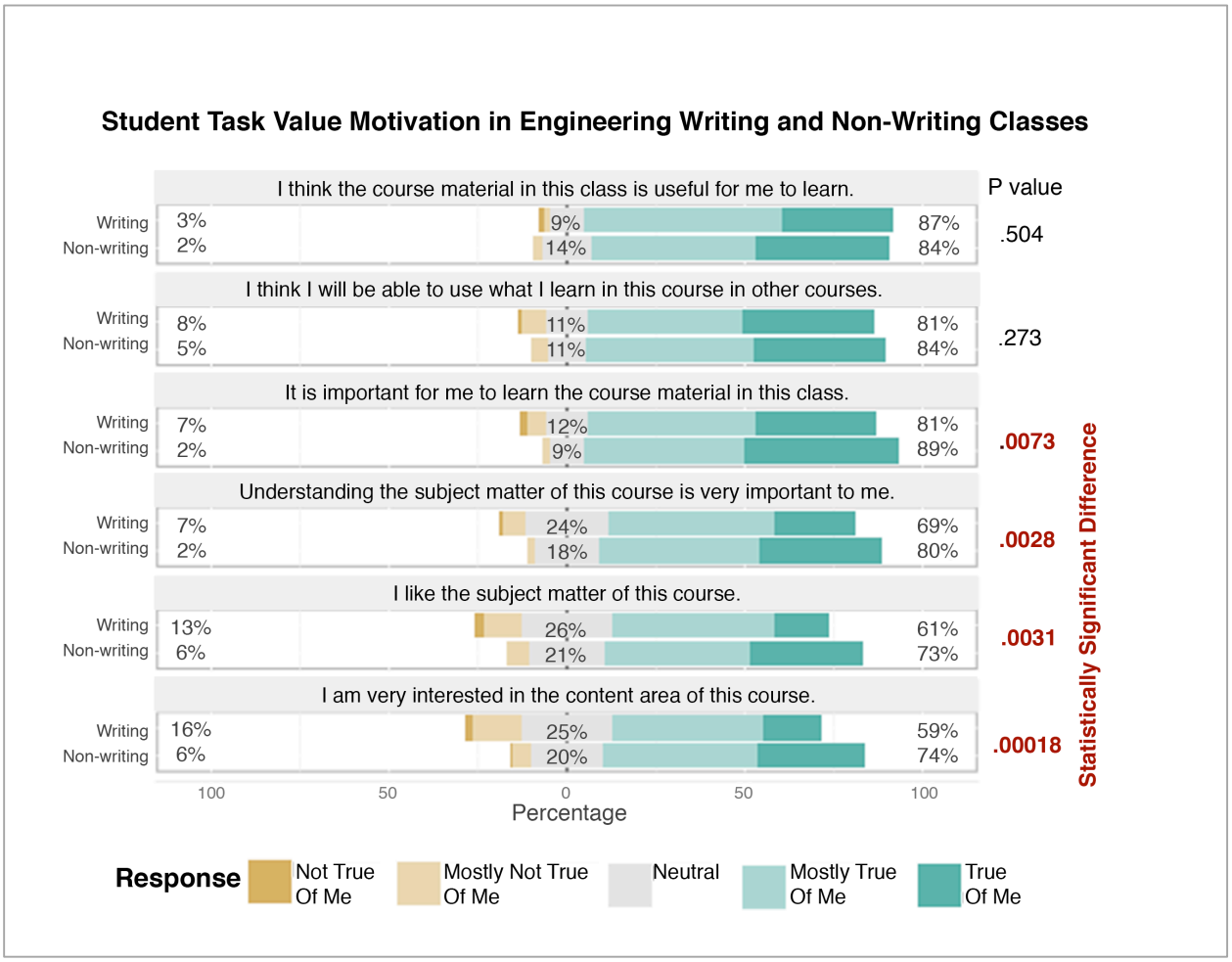

Figure 2: Student survey results for Task Value component of MSLQ. Students' motivational values concerning usefulness are equal (and very high) for both writing and non-writing classes. Student values concerning importance and interest are lower for their writing classes than their non-writing classes. The majority of students' task value associated with their writing classes *is positive*.

However, a subtle story takes shape when we look at the questions which evoked successively less positive responses from students. Students considered the content of their writing class to be as useful as their non-writing class (I think the course material in this class *is useful* for me to learn; I think I *will be able to use* what I learn in this course in other courses). Students' value for writing courses decreased, and also lagged behind their non-writing course motivations, around matters concerning the importance of the content (*it is important* for me to learn the course material in this class; Understanding the subject matter of this course is very *important* to me) and students' subjective enjoyment of the material (*I like* the subject matter of this course; *I am very interested* in the content area of this course). These depressed response trends support the

popular observation that students have less motivational task value for their writing classes than their technical engineering courses.

Students Know That Engineers Write

One of the most striking results of the student survey is that these students readily identified their writing classes as useful, which is contrary to the beliefs of many in the engineering community. It is very common for stakeholders to assume that students dismiss their writing classes because students simply aren't convinced that practicing engineers need to write; and convincing these students otherwise will require very strong messaging, preferably from a knowledgeable figure from outside of academia. In light of the survey and interview data, both of these assumptions should be reconsidered. Students who participated in this research do know that engineers write, and they accepted that message whether it came from inside or outside of their writing class.

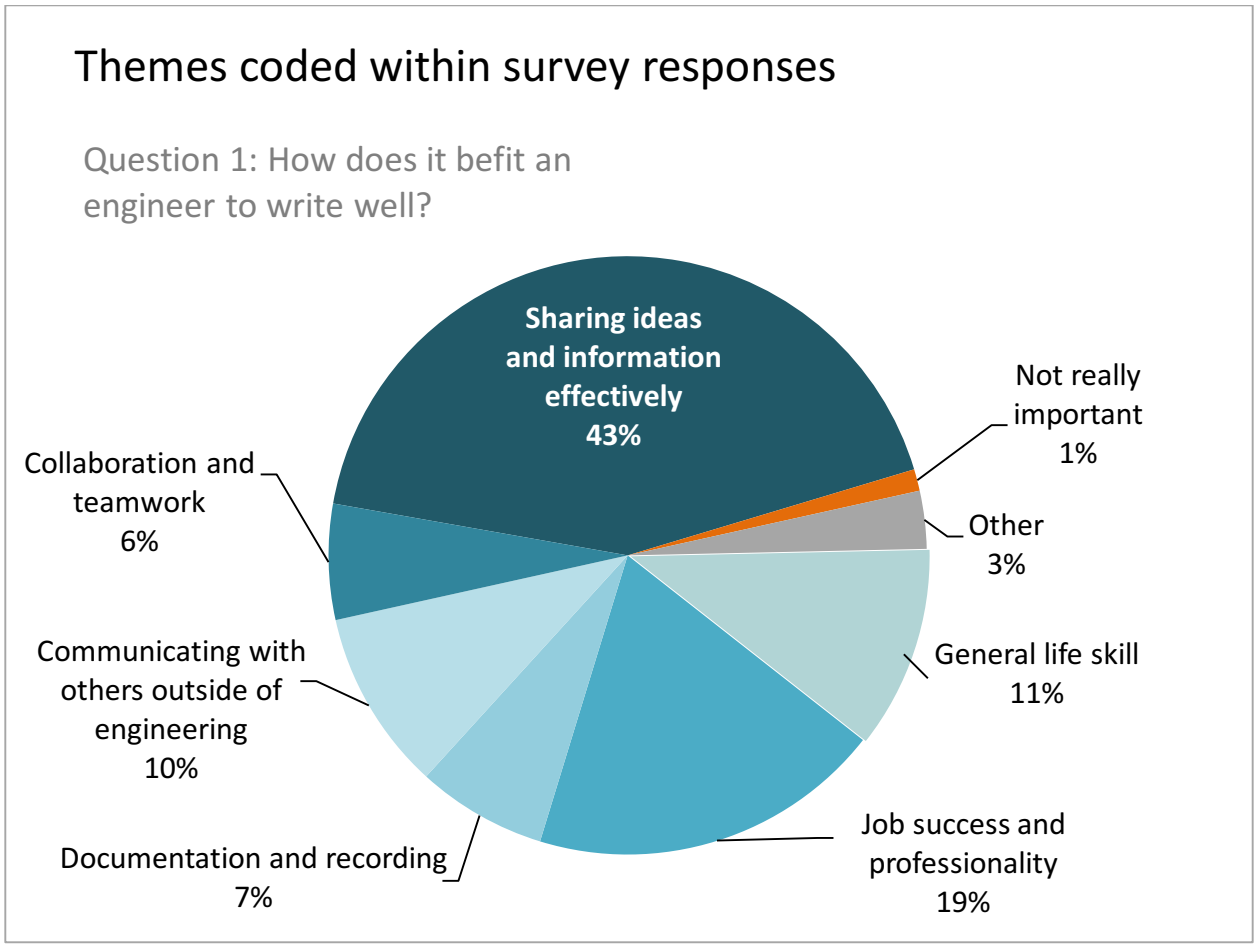

Figure 3: Themes that were coded within student responses to Open Ended Question 1: "How does it befit an engineer to write well?" Of 256 coded excerpts, only three expressed an opinion that writing was not important for engineers.

Of the students surveyed, a full 98% were able to conjure an affirmative answer to the first question, "How does it befit an engineer to write well?" (Figure 3). As noted in the Methods, this question's role in the survey was primarily pedagogical, and it prompts students to answer positively. Yet the answers are telling. Nearly all students could indeed articulate a positive way that writing helps an engineer. Of these answers, a large majority are specific to an engineer's career and professional role rather than simply general life skills. The message is clear—our students *do* know that it benefits engineers write, that "real" engineers write.

We are all aware of the strong stereotype of engineering as an overwhelmingly quantitative career, even among engineers themselves. It has often been suggested that students pursue engineering because they perceive it to be a career that requires little writing for success[24]. How is it that these students came to have such near-universal knowledge that engineers have professional needs and uses for writing? Our interviews shed a bit of light on the students' understanding of the role of writing in their future careers: thanks in part to their required writing courses, these students now receive sufficient messaging about the presence of writing in their career, and they retain that knowledge.

All of the students who participated in interviews had been told at least once that writing was important in an engineering career. Sometimes they'd received the message from an influential figure outside of academia—parents and relatives who are engineers, or successful industry and research role models. However, just as frequently the students' first source of the message had been their engineering writing instructor. In all but one of these cases, these students reported the instructor's influence as more than sufficient to convince them that a practicing engineer writes.

As a particular example, one student quoted her professor's colorful turn of phrase in a survey conducted on the first week of the quarter:

> As we … learned in [our engineering writing class], if you can't write well, then it is equal to the 'kiss of death'.

She referenced the same quote in an interview nearly nine months later, long after the class had concluded. In fact, all students' interviews indicated that their belief that a professional engineer writes hadn't changed much since the idea had first been suggested to them. This belief remained unchanged whether the initial suggestion had been made months or years, or in one case, decades ago. The interviewed students, even those with tepid average task value, tended to take for granted that their career would involve writing and technical communication.

If a student knows that engineers write, does this knowledge in itself increase the student's learning motivation in an engineering writing class? Among the students who were interviewed, it most generally did not. However, knowing that engineers write was sometimes a launching point for other more strongly motivating interactions. For example, the knowledge that engineers

write was a starting point for students who responded positively to authentic engineer-authored model texts (as discussed in a later section of this paper). But in most cases, these students reported that the knowledge that writing was a part of an engineering career, in itself, did not significantly increase their motivation toward their writing coursework.

This brings us to two important ideas suggested by the survey and interview data: First, getting students to *know* that engineers write does not seem to require a great deal of convincing or persuading; it simply requires an introduction from an educator or other role model. Second, for engineering students, simply *knowing* that engineers write is not necessarily sufficient to impart strong motivation for success in their writing classes. If the knowledge that engineers write is not translating to student learning motivation, we gain little by restating to exhaustion. We should seek other means to motivate.

Undermining the Value of Usefulness

The survey results suggest strongly that at the beginning of their engineering writing course, students believed the course to be generally useful, and in particular, useful toward future classes (Figure 2). When these ideas were revisited in interviews, the idea of usefulness in other classes had tarnished for many students. While one student felt that the values of her writing class were positively echoed in her discipline's collaborative coursework, others lamented the few explicit opportunities to formally practice technical communication as an engineering value outside of their writing classes. In effect, these students felt that any additional quality that a student's writing brought to a project or assignment outside of their writing class was not recognized in rubrics or grades. This lack of explicit curricular value for writing disappointed students who'd invested effort in their writing classes. Three students noted that they made a personal point of transferring the skills and standards of their writing class to other coursework, but they felt that they were doing it to satisfy their own intrinsic values. While they still believed that good writing was important to an engineering professional, the lack of continuity in the curriculum made writing seem far less important to an engineering student.

Compounding this devaluation, students often received negative social messages from other students and even faculty about the value of communication coursework. Some students had been told by peers to expect their writing class to be tedious, and mostly just a meaningless requirement. One student reported that in a subsequent class with a communication component, the instructor explicitly messaged that the students were there to get an easy grade on that component and pass through to more important work.

The picture that emerges when we consider students' perception of the usefulness of writing and their writing courses is complex. While individual educators and role models were often very successful in sharing the idea that an engineer writes, in many cases these figures served as

islands of positive influence within a broader educational paradigm that had little use or regard for writing. This underscores a point that is often made by engineering writing stakeholders: if we'd like students to adopt communication as an engineering value, we must show it as a *shared* value across our educational communities and curricula.

Interest-Related Student Task Value

Most students found their writing classes useful *and also* important and interesting. However, a significant faction of the students found their writing classes less interesting than useful, and also less interesting than other non-writing engineering courses they were taking at the same time (Figure 2). Asking students about what might keep them interested is a straightforward way to inform our understanding of task value data, as long as we consider student responses with the caveat that students often know a classroom only from the student's side. Understandably, they haven't had experience as engineers and educators and so they often have an incomplete knowledge of methods, constraints, and desired outcomes. (To wit, in education, the customer is not always right.) Student answers to "What would you do to ensure that students stayed interested and motivated to learn are shown in Figure 4.

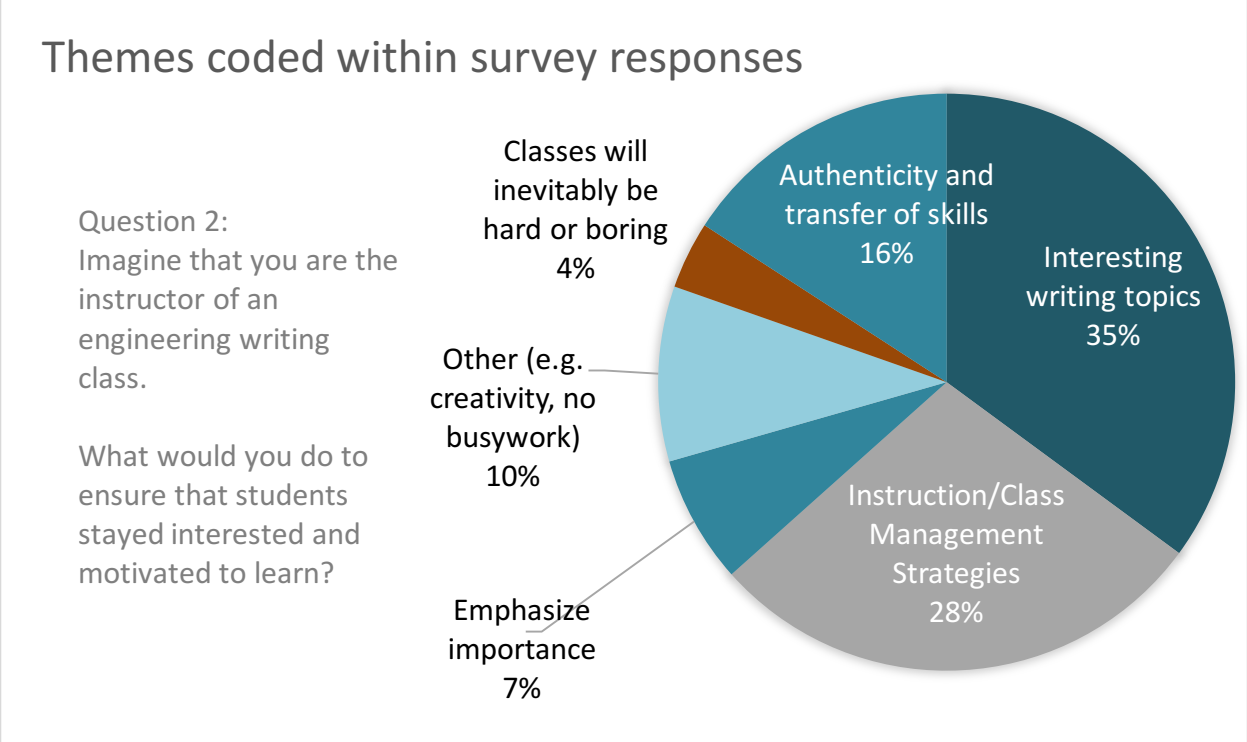

Figure 4: Themes that were coded within student responses to Open Ended Question 2: "Imagine that you are the instructor of an engineering writing class. What would you do to ensure that students stayed interested and motivated to learn?" Of the student responses, 65% of responses concerned task-value items; these are represented in blue. Of 265 total coded excerpts, ten suggested that engineering writing would inevitably be boring or difficult.

It is worth reinforcing the positive portrait of students in aggregate that emerges once again from this data. Out of 265 coded comments, only ten comments concerned a perceived inevitability of difficulty or tedium in writing classes. Most students provided an affirmative strategy. The lion's share of those strategies (65%) concerned task value.

The most common of these suggestions was that engineering writing courses should include interesting topics for students to write about. We might infer from this suggestion that these student advocates implicitly endorsed exploratory writing and writing-to-learn assignments as a motivating activity. Our interviews supported this notion. Many students spoke vividly about the value added to a writing assignment by having an interesting topic to pursue through writing.

Notably, there was a significant division within the students who called for interesting topics. Of the 93 students who mentioned interesting topics, 41% stated that students should be able to choose their own topics; 59% implied or said outright that the teacher should provide interesting topics on their behalf. One student, who proposed a hybrid solution, pointed neatly to the reasons underlying this rift:

> "For free style assignments where you get to choose a topic that fits under a general category, have two options for students. One is a more elaborately detailed topic suggestion and another is to have the option to choose whatever topic you want. *A significant portion of the dread from writing classes is from not knowing what to write about*." [Emphasis added.]

Indeed, within our interviews, the students who advocated most strongly for being allowed to choose topics were also students who voluntarily read a fair amount of literature outside of class that related to their field of study; in two cases, these students' choice of career path had been profoundly informed by books they'd read. It stands to reason that an open topic makes for a very compelling prompt to students who are already finding ways to engage with the narratives surrounding their fields. There may be more of these students within our classes than are immediately evident, and even more who would happily engage with similar literature if they understood that it was accessible to them.

Yet the background and eagerness of these students does not negate the difficulty of other students, faced with a blank page and no ideas for a suitable topic. Within our present engineering writing classes, we teach to some of the most extreme ranges in engineering—students vastly different in ability, linguistic background, technical/scientific background, and even class standing and experience. The different needs that are present even among students who want interesting writing topics underscores the balancing act that we must perform in order to design an engineering writing class that serves our many students.

Interest and Authenticity

A second theme that emerged between the survey results and the interviews was students' interest in authenticity and transferability—in other words, course content that spoke directly to real-world skills and tasks in the professional lives of engineers. Students' wish for authenticity is lightly at odds with students' wishes for interesting topics; students who proposed improved topics seemed to want opportunities to use writing as a vehicle to discuss, imagine, and critique new technologies, whereas students who proposed authenticity seemed more interested in learning form and formats that they could use as professionals.

In our interviews, authenticity provided a motivating or demotivating factor even when interest (or challenge) did not. Several interviewees, particularly those who had pursued their own out-of-class professional, outreach, or entrepreneurial experiences, expressed dissatisfaction with in-class assignments that had imaginary circumstances and impact. Yet two students spoke positively of the experience of seeing actual documents written by engineers. They recounted that seeing these documents somewhat mitigated the demotivation caused by their perception of the assignment's low stakes. Both students used these documents as standards against which to measure their own writing, and used the class as an opportunity to reach for a professional standard, regardless of their grade.

Useful But Not Interesting

The profile of student task values that emerged from the surveys might lead us to wonder what it looks like when a student finds course content useful, but not important and/or interesting. Four interview participants' survey responses fit this profile. Among them, a particular profile emerged: these students were competent writers with strong personal value for writing and belief that they would make use of those skills as engineers. However, even at the beginning of their engineering writing classes, they'd found the particular content to be "nagging", "tedious", "mostly common sense". As two of these students recounted in their interviews,

> "There was a lot of stuff that was redundant—'Yes, I know this already.' 'Yes, I know this already.'"

> "So there's those sort of brackets you have to fill in…'I Will Talk About This. This Is What's Going To Happen. I'm Going To Do This.' And it's *so* clunky. […] Technical writing doesn't require flair. I prefer to have the flair."

This cadre of students had often sought out more motivating writing experiences within and outside of engineering, such as major projects, contests and competitions, or satisfying

experiences writing for fun. They felt that these extracurricular pursuits had provided challenge, enjoyment, and more authentic stakes than their engineering writing classwork.

Knowing that many of our most competent students have diminished task values concerning interest and importance certainly complicates our image of the reluctant engineering writing student. When these students discussed what kinds of writing class would improve their interest, the results often concerned wanting more challenge, more freedom to devise satisfying projects, or simply wanting the bar to be raised.

Conclusions

The big picture of this work is a positive portrait of our students' task-value motivations in engineering. Student participants, on average, had constructive values surrounding their writing classes, and they believed their writing classes to be as useful as their non-writing engineering classes.

Yet within these broadly rosy results, we can also clearly see evidence that supports and clarify's educators' observations that students are less motivated in their writing classes. Significant portions of students reported less task-value motivation for their engineering writing classes than their non-writing engineering classes, particularly concerning their interest in the class and their belief in the content's important. Students further reported a decrease in task value related to their disappointment with curricular integration and reinforcement of writing skills. And themes of conflicting needs and interests within the student population underscore the difficulty of providing an educational experience that motivates a breadth of learners to improve and succeed.

There are a number of actionable takeaways from the student data:

1. It takes very little introduction to show students that professional engineers write. We gain little by repeatedly impressing this upon them. We might better focus our efforts to increase student task value motivation by finding ways to reinforce writing values, skills, and utility across our curricula and disciplinary culture, so that students would have more immediate reasons to value writing as an engineering skill.

2. Students are receptive to writing-to-learn assignments that allow them to explore engineering topics and ideas, and they respond motivationally to the topic that they write on. The topic can add quite a lot of interest to a writing assignment. However, students are divided on whether they'd prefer to choose a topic for themselves, or whether they wish a topic to be chosen for them. Finding a way to scaffold topic selection for students, or making topic selection more familiar by providing increased opportunities to engage with disciplinary literature, may help to ease the burden of decision for students with limited engineering or writing background.

3. The authenticity of writing assignments has great potential to enhance students' task value for the class. Even simple supporting actions, like providing current model texts written by professional engineers, can have a strong positive impact on student task value and self-motivation.

4. Our classes contain a significant population of students who are very different from the stereotype of the reluctant engineering writer. Many of our students would enjoy an opportunity to stretch their writing abilities, and would appreciate avenues to receive recognition for writing within engineering. We'd do well to recognize these students' presence in our classrooms, and consider their learning motivations as thoroughly as we consider the motivations of our students who are genuinely reluctant writers.

Future work

We as people—educators and students alike—have very strong associations between task value and motivation. Yet this isn't the only way to motivate students. In fact, the quantitative responses of this study suggest a very limited margin of improvement among the students surveyed. When we repeatedly and exclusively suggest task value-related strategies of improving student learning motivation, we are likely to ignore the wealth of less obvious but equally powerful motivational factors and strategies. For example, a majority of the student survey suggestions for motivation that fall under "Instruction/Class Management Strategies" might be mapped to expectancy-based motivation, or ways to help students perceive that their reasonable work leads to reasonable progress. We will consider student data in light of other promising motivational factors in future work.

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