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# Bringing Supervisor-Subordinate Interaction Skills into the Classroom: A Missing Piece in Transitioning Students from Academia to the Workplace

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## Introduction

Current approaches to engineering education incorporate learning experiences to develop the problem-solving, critical thinking, and interpersonal skills needed in the modern workplace. These skills are cultivated through increased exposure to real-world scenarios and challenges, and practiced during group projects, internships, and capstone experiences. While significant attention has been devoted to bridging the gaps between engineering theory and practice, classroom learning and workplace realities, and individual vs. teamwork, one crucial area that remains under-recognized is the development of effective supervisor-subordinate skills.

The traditional dynamic present in the professor-student relationship differs markedly from analogous workplace relationships. Years of training in navigating academic power structures often fail to prepare students for effective interaction with their future supervisors in professional settings. Consequently, students may need to unlearn certain classroom habits and acquire new skills to thrive in the workplace hierarchy.

This paper investigates strategies to modify the professor-student relationship within the classroom environment to foster stronger supervisor-subordinate interaction skills. By reimagining this fundamental academic relationship, engineering students can be better equipped with the interpersonal competencies essential for success in their future careers. This research explores innovative pedagogical approaches that simulate workplace dynamics, enabling students to develop the adaptability and communication skills necessary for productive relationships with supervisors in professional settings.

The paper is organized to first provide an overview of key differences between academic and work environments and common deficiencies displayed by early career engineers in the workplace. It then analyzes these deficiencies and differences to identify three general areas of importance and suggests multiple strategies for leveraging classroom activities to develop the desired skills. Finally, it offers two examples of classroom activities using those strategies to modify the professor-student relationship in the classroom to one more analogous to supervisor-subordinate. The recommendations do not require rethinking curricula, but instead focus on practical, easy-to-implement changes in the professor-student dynamic.

## Key Differences and Deficiencies

Both sides of the academic-industry divide have responded to concerns that undergraduate engineering programs are not sufficiently preparing students for the work world. Early concerns addressed the difference between theory and practice by incorporating more laboratory work and practicums. The focus then shifted to the types of problems that students were exposed to. Significant attention was given to incorporate real-world problems into the classroom to provide students with the experience of working on complex, messy problems. Project-based learning brought project management classes into the curriculum to develop the skills necessary for small scale project/task management while working in student teams. One and two semester capstone courses, particularly those focused on industry problems, required students to integrate their technical and project management skills to produce meaningful products and exercise their teamwork skills. In addition, industry internships and Co-Op programs moved students out of the campus bubble and into the workplace, at least temporarily.

The steps in this evolution are credited with improving early career transition outcomes. However, industry continues to employ students who display issues categorized by Murray [1] in areas such as:

- Adaptation: adjustment to the organizational culture
- Collaboration: effective partnership with others
- Communication: clear expression of ideas, thoughts, and solutions
- Technical competence: knowledge about the technical domain
- Context: knowledge about the organization
- Maturation: general professional capabilities and
- Socialization: connection with others for a purpose

More recently, Baukal, Stokeld and Thurman [2] highlighted the need for improved skills in interviewing, project management, critical thinking, teamwork, communication, and lifelong learning. While curricula have been evolving to close the professional skills gap for engineering graduates [3], there is still work to be done. Advances can be hampered by value conflicts between education and workplace [4] due to "valuing of technical over social, marginalizing the influence of finance, prioritizing individual performance over socialization and collaboration, prioritizing written communication and hiding social and emotional influences." Further, old associations of collaboration with cheating make it difficult to address curriculum gaps [4].

Differences between academia and the workplace contribute to the challenges inherent in closing the gap on workplace readiness. Pan, Strobel & Cordella [5] provide a detailed comparison of the differences in problem solving, which includes:

- Well vs. ill-defined, or "wicked" [6] problem definitions
- Approaches to solving problems: compartmentalized vs. open ended; given vs. may need to be invented
- Right solutions vs. open to interpretation

- Problems scoped to fit within the class vs. dynamic real-world problems
- Individual work with implied competition between students vs. collaboration
- Availability and credibility of information
- Fixed, short-term team membership vs. dynamic, long-term evolving membership
- Fixed problem statement vs. evolving understanding of the problem

The differences can be generalized to those that are related to time; availability and type of feedback; the nature of the problems being solved or products being designed; the nature of the work environment; and attitudes and behaviors related to such areas as participation, conflict, engagement, uncertainty, and visibility. Given the wide array of differences between academia and the workplace, it is not surprising that gaps exist – and that it is challenging to address them.

**Analysis**

From this discussion of skills deficiencies and differences between academic and work environments, this work focuses on three general areas of importance: leader-member exchange quality and the inherent power differentials, the need to "unlearn" old patterns of interaction, and the level of "realness" embedded in learning opportunities.

1. Leader-Member Exchange Quality

The professor-student relationship can be viewed from the perspective of leader-member exchange (LMX), with the professor as leader and the student as member. Defined from a work-world perspective, the relationship is two-way and aimed primarily at attaining mutual goals [7]. The quality of the relationship that develops between a leader and a follower influences performance [8]. Low LMX quality exchanges are primarily task-oriented and relate to the employment contract, while high LMX quality relationships are characterized by "high trust, interaction, support, and rewards, resulting in employees and supervisors being loyal to one another and sharing mutual feelings of liking and respect." [9].

While an imperfect analogy, as viewed from an LMX perspective, the Professor-Student relationship is one that would be characterized as having low LMX quality. Rather than being two-way and focused on mutual goals, professors control what happens in the classroom and what materials are covered; they devise tests and assignments, set the schedule, organize student teams, and are the sole arbiters of performance. The relationship generally is governed by the "contract" of the syllabus, which states the policies, content, and schedule of the course. The student typically has very little ability to influence anything related to a course. The mutual goal of "learning" is not necessarily tightly coupled to mutual outcomes. At the end of the class, the professor moves on to the next semester regardless of whether any individual student has learned the material. The student, however, bears any negative consequences of a bad grade.

Conversely, in a Supervisor-Subordinate relationship, the supervisor does have a vested interest in the subordinate succeeding. The negative outcomes if the subordinate fails can impact the supervisor through poor performance of their unit, project failure, substandard products, increased demands on their time to train or manage the employee, or, in the worst case, having to fire and replace the employee. Therefore, both the supervisor and the subordinate are impacted by the consequences of poor performance. As a result, the relationship can be much more collaborative than that of the professor-student.

One approach to improving student workplace transitions is therefore to increase the quality of LMX in the professor-student relationship. This could include providing more opportunities for student input into the class contract, consciously working to build student trust, and providing more interpersonal support. The biggest benefit, however, could be to create situations where professors and students have tangible mutual goals.

2. Unlearning

Over the course of their education, students have been habituated to perceive the dynamic between themselves and their instructors as nearly authoritarian in nature. The teacher mandates and judges, the student performs and follows instructions. By the time students reach college, these patterns of interaction have been ingrained in both the students' and professors' behavior in the classroom. Moving to a different paradigm, where students and professors have a more collaborative relationship therefore requires unlearning old behaviors while learning new ones.

While empirical evidence related to unlearning is less prevalent [10] [11], there is an abundance of theoretical and conceptual work potentially relevant to "unlearning" in the context of professor-student relationships. Rushmer & Davies [12] (as highlighted in [10]) propose three separate and distinctive types of individual unlearning: fading, wiping, and deep unlearning. Fading occurs gradually due to lack of use; wiping results from a deliberate process of change that has been externally imposed; and deep unlearning is a radical form that occurs rapidly due to unexpected outcomes or experiences that cause someone to question basic assumptions.

Some school-workplace transition issues may be caused by a mismatch between academic habits and the new realities of the work environment. When what worked in the past no longer does, students may be confused and lack the perspective to make sense of why and how things are different. Wiping, which is the process of unlearning old ways and developing new competencies, requires students to recognize that old ways of interacting with authority figures no longer work and they need to develop new approaches. Therefore, the impetus for change is the need to fit into their new organizational environment. Similarly, deep unlearning may be needed.

Students may experience pressure towards a combination of wiping and deep unlearning as they adapt to a new environment. Wiping is closely related to change at the organizational level [10] but can also be viewed as the individual changing based on the requirements of their new organizational setting. Deep unlearning causes people to question their assumptions, often based on unusual experiences, defined by Garud et al. [13] as "situations that bear little or no resemblance to the types of experiences that have occurred in the past" [p. 587]. Receiving negative feedback for behaviors that previously received, for example, good grades, could be an example of one such unusual experience.

Quick changes may be required in the work environment to adapt to new situations. While students who have mastered performance under a professor-student dynamic may need to adjust their behavior, the nature of the change may not be to eliminate knowledge of how to behave in that environment. Rather, it is to avoid defaulting to unproductive behaviors, although these behaviors may still be relevant in other circumstances. Unlearning, therefore, does not mean forgetting. Instead, a shift causes a new way to become dominant. Our brains don't remove existing neural connections but "does something called 'inhibitory learning' where the brain 'depotenciates' the old neural pattern and prioritizes access to the new one" [14]. Unlearning can therefore be defined as "reducing the influence of old knowledge on our cognitive capacity" [15].

Learning to be successful in the workplace therefore depends on three things: (1) recognizing that a behavior is counterproductive, (2) identifying any behaviorally ingrained actions that lead to that behavior, and (3) consciously switching to a new, more effective behavior. Practice with new behaviors in the classroom, along with conscious reflection, can prepare students to more readily adapt to the workplace environment.

## 3. Realness

As discussed above, differences in the school and workplace environments present challenges for students making the transition from one to the other. Relevant differences exist, for example in the nature of problems addressed [9] and the socio-technical performances required [4]. These, and other differences, contribute to the issue of "realness" in the educational experiences.

Realness is defined here as *the degree to which assigned work has a direct and personal impact on the student*. This is distinct from the degree to which a project or problem definition uses information from the "real world" to add richness and context to an otherwise artificially constructed assignment. While students often benefit from details that provide motivation for learning a particular technique or approach, the underlying structure is a scaffold on which a

predefined set of skills are being developed. The outcome of the activity is a grade, and the consequence is some degree of learning.

Alternatively, extra and co-curricular activities, Co-Ops, and internships often provide experiences that have direct, tangible results that affect the student's life. For example:

- A student robotics team may succeed or fail at a competition based on the performance of their design.
- The performance at recruitment for a club or fraternity can determine the financial viability of the organization
- How well they perform their work during an internship or Co-Op today impacts the customers of that work and determines what new opportunities they'll be offered.

Other than through grades and the long-term goal of learning, engineering class assignments do not routinely provide the level of realness needed to make the same type of direct, immediate impact. Nor can that be reasonably expected relative to the technical skills being developed. It is possible, however, to incorporate activities with a high degree of realness when it comes to promoting the *soft skills* that are highly sought after in industry.

Soft skills are transferable; they are not dependent on the technical context of projects or assignments. The skills needed to work effectively on an engineering team are largely the same as for any other team. They can be learned, experimented with, and practiced across a broad spectrum of domains [16]. The application therefore does not need to be "engineering" to be real although they can be in the context of an engineering project. Professors can give students practice with soft skills by designing teamwork-related "realness" into their activities.

**Strategies**

This section contains strategies that instructors can use to incorporate supervisor-subordinate interaction into their engineering courses. These strategies incorporate elements of high quality LMX, unlearning, and realness.

1. Reframing assignments as delegation of tasks

A powerful way to emulate the supervisor-subordinate relationship is to frame assignments as delegation. When students are entrusted with, for example, the teaching of important material to their peers, they enter into a partnership with the professor. Because the instructor remains responsible for the material being taught, both the students and the professor have a vested interest in the success of the students.

Engineering assignments can become more meaningful when framed as delegation. By reframing assignments this way, instructors engage with the team throughout, providing guidance, support, critique, ideas, and sometimes even helping with the work. The professor uses these interactions to monitor the project and make adjustments as needed to keep it on track. This contrasts with a typical college approach where the professor is hands-off after the assignment is made, and the team succeeds or fails based solely on their efforts. One application of this strategy is presented in the Examples section of this paper.

2. Promoting Conversation as part of Oral Communication

Employers and instructors both place significant emphasis on developing strong oral communication skills. In the classroom, these efforts concentrate on presentation skills, often as the culmination of a group project. Students present the end-point of their design or analysis, usually accompanied by Powerpoint or other graphical aid. While being able to effectively present the end results of a work effort to an audience is a critical professional skill, it is only part of oral communication.

All work, including engineering, takes place within the social fabric of the organization [17], therefore teaching engineers should include skills to help them learn the social mores associated with practicing their profession. Trevelyn [4] reports in work environments “face-to-face, oral communication is essential for accessing critical distributed technical expertise.” Much of the hard work, particularly on complex projects, is done through discussion.

Conversation skills are needed to build rapport with team members, to question assumptions, to propose ideas in their ill-formed state, to refine those ideas, to brainstorm, to negotiate, and all the other actions that enable the team to work through the hundreds of decisions that go into a project. “Talking it through” is one way that teams develop insights about the problem and identify interactions, which aids in developing an intuitive understanding of, for example, risk [18].

Many workplace conversations are informal, often aided by rough sketches and conceptual drawings. Whether on a whiteboard in a conference room or on the back of a napkin in the cafeteria, visually and verbally presenting the seeds of ideas provides a focal point for exploration and refinement. These conversations do not consist of smooth, polished statements presented in a convincing narrative. They are messy, iterative, and full of false starts and stops. They can often lead to conflict. And they rarely occur within the confines of the classroom.

In the workplace, supervisors often lead discussions and facilitate exploration while also managing conflict. In the classroom, instructors can provide a similar service by creating opportunities for students to interact in ways that would be natural in the workplace. For

example, an instructor can have small groups gather around the whiteboard to work through a problem, brainstorm, or draw a map, diagram, or flow chart. This is not the same as calling a student to the front of the class to publicly work through a problem. Instead, it is small groups informally working their way through an exercise using the whiteboard as a tool to facilitate their discussion.

Other collaborative activities can include taking quizzes as a group, decision-making/role-playing exercises, or scenario analyses. Meaningful discussion can arise from exercises where students need to, for example, interpret events from multiple perspectives, integrate disparate knowledge sets, choose between different solution approaches, or make decisions when there is no obvious right answer.

Instructors can model good conversational etiquette and practice by having conversations with their students. These can occur at the students' instigation during office hours or advising appointments, which provide opportunities for one-on-one interaction. Instructors can also require conversations with teams by requiring small group meetings in support of, for example, group projects. The goal is to give the students practice with informal oral communication.

One simple way that a professor can facilitate conversation in the classroom is to use ice-breaker exercises to get students accustomed to talking to each other. As the name implies, these exercises provide an opportunity to interact with classmates in a low-stress, non-judgmental way, which can make higher-stakes, topic-specific discussions easier in the future.

Name tents are another way of facilitating interaction by removing the social concern of not knowing how to address a student. The use of a person's name is perceived as a sign of respect, helps develop trust, and indicates caring [19]. Often used to help professors learn students' names, a side effect is that it helps students learn each other's names which promotes interaction among them [19].

3. Asking Questions

Asking questions is an important tool in the workplace. According to Brooks & John [20] asking questions unlocks value in organizations: it "spurs learning and exchange of information, fuels innovation and performance improvement, … builds rapport and trust among team members …[and] can mitigate business risk by uncovering unforeseen pitfalls and hazards." They suggest that the "first step in becoming a better questioner is simply to ask more questions" [20]. Asking better questions leads to making better decisions [21] and to the sharing and application of expertise [22].

Employees learn what types of questions are appropriate, who to ask, and when by being immersed in the environment. Part of acculturation is learning the norms governing interaction among different hierarchical levels in the company and how to ask questions that are appropriate for the time and circumstances. For students transitioning into the workplace, this process may be more intimidating because a lack of practice in effective questioning inhibits formulating questions, and a fear of negative reactions prevents speaking up [23].

Significant research has gone in to identifying ways to improve engagement such as flipping the classroom, group problem-solving, or culturally responsive teaching [24]. However, students often feel inhibited because they are afraid of looking "stupid." Developing question-asking skills therefore requires establishing a psychologically safe zone [25] that supports experimenting and is based on mutual trust among the teacher and students.

In conventional wisdom, there are no "stupid" questions. There are, however, lazy, ill-timed, poorly formulated, or otherwise unproductive questions. "Lazy" questions, for example, are those where the question could easily be answered by consulting available references (e.g., the internet). As explained by a chief engineer at a national laboratory, lazy questions devalue his time. But if, after doing their homework, someone still needed help, he was happy to provide it. The chief engineer was an outstanding mentor to multiple generations of engineers in part because he was a master at asking questions that led people to discover answers, but also because he trained people to formulate better questions.

Professors set the tone for student questioning in the classroom and via the way they construct their assignments. One easy way to model good questions is to simply tell students what questions they should be asking. Another way is to brainstorm questions that the students want or need answered to complete an assignment. Brainstorming questions can also be used to prepare for classroom visitors. By generating large volumes of questions, students can compare to identify which are the most potentially impactful.

In the workplace, people learn by being immersed in the environment. They hear the questions their colleagues ask, note the ones that are effective, and store them for future reuse. Through these observations they learn the culturally appropriate times and topics and people to query. In an engineering setting, technical questions are generally addressed to people who have the necessary expertise or experience. While one can ask one's supervisor technical questions, there are other topics that they are uniquely qualified to answer, for example, questions related to:

- interpreting or making sense of events
- understanding how the subordinate's work fits into the bigger picture
- identifying who has the desired experience, knowledge or skills
- identifying who to go to for help
- prioritizing work

- resolving uncertainty or ambiguity around instructions or requirements
- resolving resource contention issues
- playing devil's advocate
- obtaining career advice
- getting feedback

Each of these areas has an analog in the academic environment. By explicitly encouraging students to raise these types of questions, professors enable them to practice the types of interactions useful in the supervisor-subordinate relationship.

4. Self-Advocacy

One of the biggest differences between the classroom and workplace is the nature of feedback. Feedback in the classroom occurs regularly throughout the semester, is tied to specific assignments, is timely, is evaluated against clear standards, and there is a sole arbiter (the professor) simultaneously evaluating everyone's work. Workplace feedback is none of these things. Feedback may come from the supervisor, co-workers, customers or others affected by the work. There are no set standards other than the evaluation of acceptability by those impacted by the work. Feedback may be separated in time from the work. Often the only regular feedback is through Annual Performance Reviews, which also fulfills other organizational purposes.

While good management practice includes providing regular feedback to employees, the realities of the workplace are often different. Therefore, it is incumbent upon the new employee to advocate for themselves, which includes seeking feedback, communicating their work and accomplishments, and representing their interests in a professional manner.

Providing students opportunities for self-advocacy in the classroom can be challenging. In the academic setting, seeking feedback sometimes devolves into the student arguing over point deductions on an assignment. The use of detailed rubrics, especially for subjectively graded assignments can prevent grade haggling – and they also provide a valuable lesson in the importance of understanding expectations. Professors can mimic supervisors by requiring students to interact to clarify expectations and by setting up peer review situations to provide experience in both getting and receiving feedback. They can also establish professional standards of behavior such as students providing advance notice of absences, including relevant information in the subject lines of emails, and attempting to resolve conflicts directly rather than escalating them up in the organization prematurely.

Summary

There are multiple ways for Professors to simulate supervisor-subordinate interactions in the classroom and better prepare students for succeeding in the workplace. None of these strategies require major changes to existing curricula or pedagogy. Instead, small adjustments and reframing of assignments can provide valuable practice of workplace skills in the relatively safe and supportive environment of the classroom. The next section presents two examples of how these strategies were implemented in undergraduate engineering classes.

**Examples**

The following are two examples of classroom activities that incorporate many of the strategies discussed above. The first is a semester-long group project conducted in an engineering management class that teaches "soft skills." The second is an example of a class exercise in collaborative design.

1. Peer Teaching Example: The Workshop Project

One example of applying the delegation mindset is a peer-teaching assignment that's been conducted multiple times in an upper-level engineering management class. Student teams are *delegated responsibility* for teaching a key concept to their fellow students using a workshop format. The workshops consist of a teaching component, class activity, and quiz based on a relevant popular book related to the class. The assignment spans most of the semester, with student teams progressing through three check-ins with the professor before execution of their workshop.

The first check-in occurs after teams have had an opportunity to meet and coordinate their schedules and preferences. During this brief meeting, the team advocates for their choice of topic, their preferred presentation date, and why they would be the best group to address the subject. In return, the professor provides insight into the challenges associated with the given material and any special expectations for the team. The meeting also provides an opportunity to assess early team dynamics and coordination. At the end of the meeting, the students are assigned their topic/book and presentation date.

The second check-in occurs at roughly the half-way point in the project, taking advantage of the natural midpoint transition [26] to best leverage feedback. By this time, the team is expected to have analyzed their material, pared it down to five key take-aways and associated quiz questions, created a rough time map for execution of their workshop, and have ideas for their interactive component. The session provides an opportunity to sanity check the team's understanding of the material and ability to teach it to the class. It's also an opportunity for creative collaboration to define the interactive component and make any needed adjustments. These sessions have included activities such as highly dynamic brainstorming, prototyping the activity, and

conducting a premortem [27]. They tend to be high energy, and students quickly lose their inhibitions and begin treating the professor as a member of the team.

The final check-in consists of a walk-through of the team's materials for quality control and to address any questions the students have. The teams are not limited to only these check-ins. They are also encouraged to use email or office visits to ask questions, get input, or request feedback.

The structure of this project is analogous to how an involved supervisor would interact with their team in five key ways. First, the professor is fully invested in their success. Teams are given clear feedback on where they would "lose points" based on the current state – but also how this would affect the audience for their workshop. They can try what-if scenarios for how to improve. If an area is deficient, they work together to come up with ways to improve it. Second, the focus is on meeting quality standards, being creative, and providing the greatest possible value to their fellow students. The students have a clear customer, one that they understand well. The professor works to keep the focus on the customer, as would be done in the work environment. Third, the students get to experience the give and take common in exploratory design discussions. They aren't going to an authority figure to get the answer – they are instead engaging with an older, more experienced colleague to jointly discover an answer they can use. Fourth, the students learn the material more in depth because they need to teach it. It's on-the-job training with the boss in the role of mentor. Finally, they experience the types of actions a supervisor may take to adjust the trajectory of a team relative to both task and teamwork.

The structure of the assignment requires collaboration rather than just coordination. By limiting the students to only 5 key lessons, they need to work together to determine which five are most valuable and, in the process, eliminate multiple other possibilities. The students advocate for themselves with their preferences of subject matter (they can choose from a list of over 20 potential books – or propose their own). They also advocate for themselves by stating their date preference – which enables them to better balance their workloads from other classes. Students are limited to 30-35 minutes, which at first seems like a lot to them, until they try to fit in everything. Again, they need to collaborate to integrate material, design the overall flow of the workshop, and assign presentation and time management duties.

The goal of the workshop is to teach their fellow students; therefore, part of the workshop is a quiz to test comprehension. Students need to formulate questions to test whether their audience understood the concepts they were teaching. The team is graded on the quality of the questions and their ability to use the questions to reinforce learning. Finally, the team is also encouraged to develop a set of questions they would like to be asked. These questions can, for example, relate to extra material they didn't have time to cover, or to areas where there is more depth to explore. They are encouraged to use these questions to either ask themselves during their Q&A period, or to prime the audience to get the Q&A rolling.

2. Student Input Example: Class Contribution Extra Credit Assignment Design

Students rarely get to provide input on class structure or the content of individual modules. Often the class syllabus has often been carefully crafted to balance learning goals, workloads (for teachers, graders, and students), and overall flow. While not set in stone, changing one element of the syllabus can have cascading effects for the rest.

In the work world, however, there is more flexibility with respect to the detailed specification and timing of individual tasks. Autonomy is associated with higher job satisfaction [28], and workers value their ability to control, or at least influence, the structure and content of their work. This ability to push back on management decisions and adjust, for example, due dates or project scope, are important for workers.

Within the context of a syllabus there are several ways that students can interact with professors to provide a modicum of autonomy. The first is to negotiate when assignments are due. There may be no practical difference between an assignment being submitted at midnight vs. 8:00 am relative to grading. Scheduling weekly assignments for Monday rather than Sunday could help offset hard deadlines in other classes. Similarly, avoiding having major assignments due around major events such as Parent's Weekend can increase the attention students give to those assignments and result in better quality.

Because students are balancing the workloads from multiple classes – and report that "each professor thinks their work is the most important" – giving students options for delivery of major assignments could also be valuable. For example, if student presentations are going to be spread across multiple class periods, one could select teams by having students indicate their date preferences. This way they can better balance their workload and avoid stacking multiple large assignments into the same day or week, as was done in the previously discussed Workshop Project. In the workplace, if a person is working more than one project, they may need to modulate their workload on one project to compensate for intense periods on another. Rarely will one worker, especially a new-hire, be expected to balance 4 or 5 projects, yet we require our students to do this.

On a large scale, the professor and class could develop an assignment collaboratively. The professor can set the context and constraints and give students the flexibility to explore options within the allowable space. This approach was used to design an extra credit assignment in response to research that found that students entering the workforce lacked experience *articulating their accomplishments* [1].

The Class Contribution Extra Credit Assignment provides students with an opportunity to record instances when they made a substantive contribution to class. At the end of the semester, based on the quantity and quality of contributions, they could earn extra credit. Rather than simply announce this new opportunity, the class was asked to confirm they would find it valuable, and then to help design it.

Via class discussion, students identified multiple approaches to capturing their contributions in a Class Contribution Log using different features of the learning management system. They debated what constituted a "contribution." They evaluated the work involved and proposed a reasonable point value for the assignment. Finally, they identified ways students could abuse the system and proposed safeguards to prevent it. They also developed guidelines for how to evaluate entries and award points.

At the end of the 15–20-minute discussion, the students designed a reasonable, valuable extra credit assignment that they were fully invested in. They gained valuable experience in multiple areas:

- working collaboratively as a class under the guidance of their supervisor
- expanding their perspective-taking abilities [29] to include the supervisor's point of view.
- articulating what constitutes a valuable contribution in class, in a way that's analogous to the type of contributions one would make in a work-world design discussion
- establishing standards of performance for a task.

As a side benefit, in the next class after the design session, student participation increased significantly and was higher quality.

**Conclusion**

By the time they graduate from college, most students have spent 16 or more years operating in a classroom environment. They have become habituated to the ways in which a classroom operates and are experts at understanding the student-teacher dynamic. We then turn these students loose in the workplace and expect them to learn a whole new set of power dynamics and strategies to be successful. Over the years industry and academia have developed new approaches and programs to improve the readiness of engineering students, but industry still reports problems. While it is likely impossible to completely prepare students for their next environment while simultaneously meeting the needs of the academic environment, relatively small changes have the potential to provide a positive impact.

This paper proposed strategies to modify the professor-student relationship to incorporate elements of the supervisor-subordinate relationship. In doing so, it is suggested that these strategies can target specific issues raised by industry. Two examples were presented to

demonstrate approaches taken and deployed successfully in the classroom that incorporate these strategies. While the evidence is anecdotal at this point, it is grounded in research from fields such as education, psychology, management, and organizational behavior. Future research could empirically explore the effectiveness of these approaches relative to workplace outcomes. It could also investigate the challenges of implementing them in different types of engineering classes.

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