



## **Work in Progress: Increasing communication avenues between Mechanical Engineering doctoral students, faculty and administration**

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Adrienne Scott is currently a graduate student at the University of Colorado Boulder working towards her PhD in Mechanical Engineering. Her research currently focuses on cellular biomechanics and mechanobiology. She recently received her masters from the University of Colorado Boulder in Mechanical Engineering. She also holds a Bachelor of Science degree in Chemical Engineering from Cornell University. In addition to her research in the field of mechanobiology, she is also interested in research in engineering education. Specifically, she explores increasing graduate student retention rates, mentoring graduate students and supporting underrepresented populations in STEM.

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Dr. Madalyn D. Kern received her B.S., M.S. and Ph.D. in Mechanical Engineering through the University of Colorado at Boulder. Her doctoral thesis focused on characterizing adhesion between a micro-patterned surface and a soft substrate for the application of optimizing the mobility of a surgical robot capable of navigating portions of the gastrointestinal tract. She is a recipient of a NSF Graduate Research Fellowship and served as the Lead TA for the Department of Mechanical Engineering for one year. Dr. Kern also received a grant through the NSF's GROW program allowing her to travel to South Africa to work on designing a more accessible prosthetic socket for lower limb amputees. Her work in South Africa led to her founding a company, ReForm, Inc., to further pursue this work. Currently, Dr. Kern is a design engineer for Stryker Corporation and works on product design and development of neurovascular devices.

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Julie Steinbrenner earned her PhD in Mechanical Engineering at Stanford University in 2011. She is currently a Senior Instructor in the Department of Mechanical Engineering at University of Colorado Boulder, where she teaches Senior Design, Mechanical Engineering as a Profession, and thermo-fluids courses. She has also developed new curriculum and programming for student professional development and career exploration which have strengthened connections between students, alumni and industry partners. She serves as chair of External Relations for the Department of Mechanical Engineering at CU Boulder. She has been the Wolenski/Roller Faculty Fellow since 2017.

# **Work in Progress: Increasing communication avenues between Mechanical Engineering doctoral students, faculty and administration**

## **Abstract**

The attrition rate of doctoral students is approximately 50% and many doctoral students leave during the first year of their program. The Paul M. Rady Mechanical Engineering Department at the University of Colorado Boulder (CU Boulder) has supported numerous initiatives to increase communication avenues between first-year doctoral students and department faculty and staff so that our students do not follow this statistic. Overall, the goal is to aid students' transitions to graduate school by providing a more supportive environment with clear expectations and improved communication avenues. Many of the initiatives have been outcomes of our department's Lead Teaching Assistant (Lead TA) role. Our department partners with our University's Center for Teaching and Learning to elect a more senior graduate student within our department as the Lead TA. In addition to supporting the first-year students (both first-year TAs and first-year students that are not TAs) in their development of teaching and professional skills, our Lead TAs take the time to listen to and address feedback from the first-year students to support their strong initial trajectory into their doctoral study.

Common issues that arise during graduate school include, advisor-advisee disagreements, time management of research and teaching, social isolation, and academic challenges. Several Lead TAs noticed that students did not seek help immediately when these issues developed leading to frustration or increased stress. In response, the Lead TAs organized mandatory 20-minute meetings between each first-year student, the Lead TA, and the graduate advisor. These conversations allowed the team to identify areas where support or intervention was needed. Many first-year students have shared their appreciation for these check-in meetings and have remarked on the department's commitment to help each student succeed.

Additionally, other methods for increasing communication were identified. For example, several students found that there was a lack of conversation establishing clear expectations with their PhD advisor. In fact, a study of the graduate school revealed that 26% of mechanical engineering PhD students were dissatisfied with the clarity of expectations about academic requirements and expected progress. To address this problem, the Lead TA created a one-page document that listed suggested topics (e.g. vacation time, research hours, academic progress) for students to discuss with their research advisors. Teaching assistants (TAs) also found the expectations of their TA positions were unclear and varied greatly depending on the class. Similarly, a one-page expectations document was developed for TAs to review with the professor or instructor responsible for the class to help establish the scope of their responsibilities. Finally, the Lead TA distributed surveys to collect data on how TAs allocate their time for different teaching related activities (e.g. grading, office hours) so that the expectations and variations for each class can be shared with incoming TAs.

This paper explores the impact of these different initiatives to increase communication between first-year doctorate students, faculty and the department administration in the Paul M. Rady

Mechanical Engineering Department at CU Boulder. We are using surveys to evaluate the effect of these changes on student satisfaction levels. We also are gathering feedback from professors about the implementation of these tools. The changes described and analyzed in this paper have been made organically; initiatives have been developed and implemented over time as different needs and potential solutions have been identified. This approach increases the complexity of analysis, so we have presented the data that has been collected to date, but also recognize there are many contributing variables. We will continue to collect and analyze data to assess the impact of the various initiatives of the Lead TA more concretely.

## **Introduction**

The attrition rate of doctoral students is approximately 50% [1], [2]. Although retention of undergraduate students has been well studied, the recruitment and retention of graduate students, specifically doctoral students, is less understood [3]. Research suggests that contributing factors to high attrition for doctoral students include: unclear expectations, conflicting requirements, lack of consistent supervision, conflicts with an advisor, coursework and inadequate funding [4], [5]. Overall, numerous problems can arise throughout graduate school that lead to extremely stressful situations for students and sometimes cause them to leave their respective programs [6].

Evidence suggests that nearly one third of all doctoral student attrition occurs during the first year of graduate school [7]. The Paul M. Rady Mechanical Engineering Department at CU Boulder has supported numerous initiatives to ensure that the doctorate students in our department do not follow this statistic. Our department is attempting to curtail many of the common problems that first-year doctorate students face by increasing communication between these students and their mentors in the program. By increasing communication avenues with available mentors, we hope that the doctoral students can express their concerns before the issues escalate, thus avoiding problems which cause high levels of stress and negative emotions.

One example of a mentor role that our department supports is the Lead Teaching Assistant, or Lead TA. The Lead TA is a senior graduate student in the department who is elected to assist with professional development and training for teaching. The Lead TA is also responsible for aiding the first-year doctoral students' transition to graduate school. As a result, numerous initiatives centered around increasing communication have been developed by the Lead TAs in the department to avoid common graduate student pitfalls. For example, the Lead TAs, in conjunction with the department administration, have planned orientations, started periodic "check-in" meetings with the first-year students, created expectation documents for first-year students to review with their advisors, and organized peer-mentor programs.

The objective of this paper is to explore the impact of various initiatives developed by the Lead TA and the Paul M. Rady Department of Mechanical Engineering at CU Boulder. Our primary research question is: "Do approaches to increasing communication avenues between first-year doctorate students, faculty and department administration positively impact the first-year experience at our university?" Overall, our goal is to foster a supportive environment and provide the tools first-year doctorate students need to succeed throughout their doctoral study.

## **Background**

***Organization and Training of the Lead TA position:*** The Center for Teaching and Learning (CTL) is an organization on CU Boulder's campus that promotes teaching and learning best practices for faculty, instructors and graduate students. The CTL organizes a specific division, formerly known as the Graduate Teaching Program, that focuses on providing opportunities for professional development for graduate students on campus. Specifically, the CTL emphasizes the development of skills involved in teaching, research, and service. Overall, the vision of the CTL division is to serve as an exceptional graduate student and postdoctoral scholar development program. To accomplish this, the CTL encourages each department in the university to choose a student representative to act as the Lead TA for the department. The group of Lead TAs on campus are called the Lead Network. In each department, the main job of the Lead TA is to serve as a liaison between the CTL and the department as well as to assist with professional development and instructor training. Lead TAs are required to have some teaching experience in their own department (e.g. TA for a class, Graduate Student Instructor). All Lead TAs are required to attend a three-day training, which includes training on various pedagogical topics such as the Universal Classroom, using dialogues in the classroom, formative assessments, microteaching and more. Although all Lead TAs go through the same training, the work of the Lead TA can look very different in each department. Lead TAs have the freedom to develop their own projects to improve specific aspects of teacher training and professional development within their own department. In the Paul M. Rady Mechanical Engineering Department, the Lead TA primarily focuses on training and supporting all first-year doctoral students (both first-year TAs and first-year students that are not TAs). The initiatives carried out by the Lead TA and the Paul M. Rady Mechanical Engineering Department for the first-year doctoral students will be the main focus on this paper.

To become the Lead TA in our department, a student applies for the position and is accepted one year before they intend to serve as the Lead TA. The year before their term starts, the student shadows the Lead TA and is referred to as the Lead TA Elect. This allows students to gradually transition into the Lead TA role and helps the department provide more consistent support to the students. The following year, the Lead TA Elect transitions to the role of Lead TA and, as such, attends the formal Lead TA training offered by the CTL. Financial support for the Lead TA is funded by both the CTL and the Paul M. Rady Mechanical Engineering Department. Because of the amount of time the Lead TA dedicates to helping our department, the Lead TA is supported with a 50% appointment (average of 20 work hours/week), similar to the other TAs in the department.

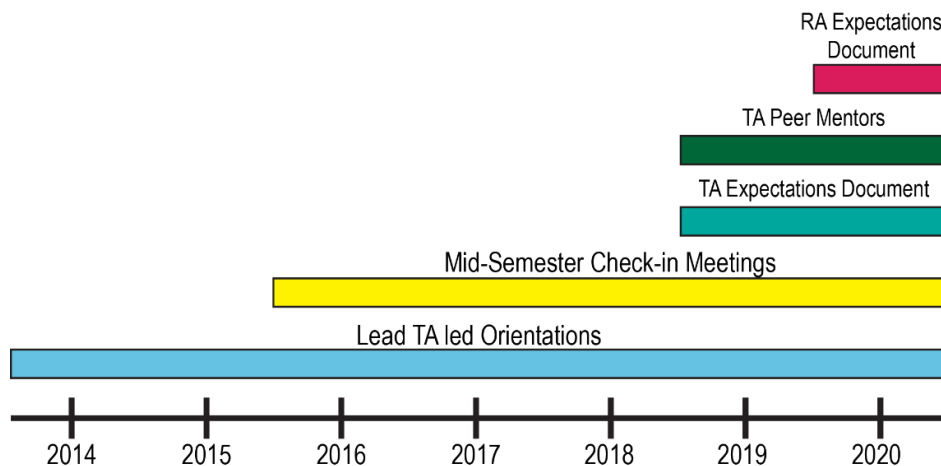
***Mechanical Engineering first-year class:*** In order to understand how the initiatives of the Lead TA and the Paul M. Rady Mechanical Engineering Department influence first-year student satisfaction, it is important to understand the structural make up of our first-year class. Usually, the first-year class is around 20-30 students. All first-year PhD students are either funded by a Teaching Assistant position (TA) or a Research Assistant (RA) position. Historically, almost all first-year PhD students were funded by TA positions (around 75% from 2016-2018). However, over time, more first-year students are funded through a RA position (around 50% in 2019). All

first-year students work with a single research advisor, unless they switch research groups to find a better fit for their own interests. Because of the different funding pathways, there are different first-year expectations for each student. The students who are required to TA are also expected to start in a research lab and begin their research projects. The RA students are not required to TA, but, in general, are expected to accomplish more research during their first year when compared to their peers who are TAs. Both groups, TAs and RAs, also usually take three classes per semester during the first year. Therefore, the experience of the first-year PhD student is demanding; students are balancing research responsibilities, their classwork and, if required, teaching responsibilities.

**Methods**

**Overall Procedure:** Over the course of five years from 2014-2019 (Figure 1), many changes have been implemented in our department to support the first-year doctorate students. Surveys were sent out to review how these changes affected the PhD student experience. Because the changes described in this paper have been developed and implemented over time as different needs and potential solutions have been identified, it is a complicated data set to interpret. Given this complexity, we presented the data collected so far and appropriately described contributing variables. We will continue to collect and analyze data to assess the impact more concretely. The following sections detail the changes implemented by the Lead TAs.

**Responsibilities and New Initiatives to Increase Communication:** The freedom of responsibilities of the Lead TA in our department has led to many new initiatives. The following sections include the initiatives designed to support the academic and social experience of the first-year doctorate students. Figure 1 shows a timeline of which interventions were employed in each year, beginning in 2014. The initiatives were developed by the Lead TA in conjunction with Mechanical Engineering faculty and the graduate advisors for the department.



**Figure 1:** Different initiatives were started and continued by Lead TAs over time. The implementation of the RA Expectation document started this academic year (2019-2020). The TA peer mentor and TA Expectations document were implemented during the 2018-2019 academic year. Mid-semester Check-in meetings started during the 2015-2016 academic year. Finally, the Lead TA led Orientations started before 2014.

*Orientation:* The Lead TA is responsible for organizing and leading the orientation for the incoming doctoral students in conjunction with the graduate advisor in the Paul M. Rady Mechanical Engineering Department. The orientation takes place the week before classes start and lasts one day. During the event, the graduate advisor provides an overview of all the requirements and a typical timeline of the doctorate program. The Lead TA then reviews information such as resources available, both on campus and within the department, RA and TA responsibilities, methods for helping students in distress, and compensation logistics. Additionally, the Lead TA organizes and presents a microteaching workshop designed to prepare students for their roles as a TA, which include teaching and presenting technical information. A grading workshop is conducted to inform students of different ways to grade homework, exams and other assessments. Finally, separate panels are organized. A student panel of current doctorate students and a faculty panel allow the new doctorate class to ask questions about the graduate student experience and receive answers from both the student and faculty perspective.

*Mentoring Program:* The department mentorship program which began in the Fall of 2018, matches current TAs with senior doctorate students who have previously worked as a TA in the same class. During the first-year orientation, each new student TA is paired with a TA mentor. Orientation time is allocated for each TA mentor to meet with the mentee. During that meeting, the senior TA gives advice related to the TA process of the specific course and answers any questions that arise. This mentorship program was implemented so that each TA has an opportunity to learn from the mistakes and ultimately, promote successes of the previous TAs.

*Check-in meetings:* Check-in meetings are mandatory individual 20-30 minute meetings that the Lead TA and the graduate advisor have with each first-year doctoral student during the first and second semester of the first academic year. The meetings typically occur during the middle of each semester (first semester meetings occur in October, second semester meetings occur in March). The Department Chair and the Lead TA started these meetings during the 2015-2016 academic year, to improve communication between the group of first-year students and the department administration. This way, if any problems arise (e.g. conflicts with an advisor, academic challenges, time management), students have the opportunity to express their concerns before the problem(s) escalate.

*Electronic Surveys:* One of the recent initiatives which began in the 2019-2020 academic year involves a survey to be completed by the current TAs. At the end of each course, the Lead TA distributes surveys designed to collect data regarding allocation of TA time for different teaching related activities, such as grading and office hours. Because this survey is new and the sample size is low, the data have not been shared yet with the incoming TA students. However, the goal is that this information will allow incoming TAs to understand the expectations and variations of each class before the student begins the TA process. Ultimately, this will give each TA a starting framework that they can then expand upon.

*Expectations Documents:* With the Graduate Program Chair of the department, the Lead TA developed a one-page expectations document for TAs to review with the professor or instructor responsible for each class. The expectations documents were first distributed to the incoming doctorate students who held TA appointments in 2018 and are designed to help establish the

scope of their specific course TA responsibilities (Figure 2). Students are highly encouraged, but not required, to use this document as a tool for establishing their TA expectations. Similarly, the Lead TA and the Graduate Program Chair developed a one-page expectation document for first-year students working with an advisor and conducting research (Figure 3). Because all first-year doctorate students are involved in research, this group encompasses the whole first-year class. This document was first distributed at the beginning of the 2019-2020 school year. Since then, the department requires all first-year students to sign and review the expectations document with their advisor. Having students initiate the conversation of expectations may seem contradictory to the normal model in which the supervisor would initiate this conversation. This process was implemented because the Lead TA typically has a greater influence when recommending actions for students over recommending actions for faculty.

**Participants:** We began this project by assessing doctorate students who started the PhD program from the years 2014-2019 in the Mechanical Engineering department of a public university. Future work will assess both doctorate students and faculty. Table 1 details the number of doctorate students who completed the survey distributed. The year that each graduate student started the program was recorded in order to ascertain if a particular student actually experienced the initiatives studied.

Year of entry into the PhD program	Number of Students Responses	Response Rate to the Survey	Research Expectations document	TA Peer Mentors & TA Expectations document	Mid Semester Check-ins
2019	21	55.3 % (21/38)	X	X	X
2018	16	66.7 % (16/24)		X	X
2017	19	95.0 % (19/20)			X
2016	12	57.1% (12/21)			X
2015	9	50.0 % (9/18)			X
2014	3	100.0 % (3/3)			
2013	1	100.0 % (1/1)			

**Table 1:** Doctorate students who started the Mechanical Engineering doctoral program from 2013 through 2019 were surveyed. The number of responses from each cohort is listed. The year in which the Lead TA initiatives were started is indicated with an “X”. A total of 81 students responded to the survey.

**Data Collection:** Electronic surveys are the main tool used in this study to assess the impact of the changes listed in the methods section. Ideally, to understand how the communication initiatives impact the doctoral student experience, we would have distributed surveys to the doctoral students at specific milestones during their graduate process (after their first year, after TAing their first class, after passing research prelims, etc). However, we did not anticipate the changes in communication initiatives, and therefore do not have historic data specific to these initiatives. Instead, we distributed one survey to all the doctoral students at the same time. By knowing which year each student started the doctorate program, we then sorted the students into groups that had or had not experienced a specific initiative. For example, Table 1 shows that we

had a sample size of 21 students who had access to the research expectations document, while we have a sample size of 60 students who did not. It is important to note that, the surveys were not distributed to all the students at the same stage in their program. Therefore, the years of experience that the students have in the program is a confounding factor when comparing the impact of specific initiatives on the doctoral student experience. For this reason, we grouped the results to the survey not only by whether a student experienced a specific initiative, but also by year of entry (Figures 4 and 5)

Moving forward, we will continue to send the same survey annually to all the doctoral students, so that we will eventually be able to collect survey data from students that have and have not experienced specific initiatives. Furthermore, this will enable us to compare data from different cohorts of doctoral students that took the survey with the same amount of time elapsed since entering the program. Additionally, we plan to send surveys to students in another department who have not experienced the initiatives. Although this would not be a perfect comparison to assess the impact of our initiatives, the results may provide some insight into how the experience of the doctoral students in our department differs from other departments at our same university.

The survey questions are focused on understanding the graduate student experience, concentrating on conducting research and working as a TA. There are a total of 15 questions. Seven questions focus on the awareness of resources in the department, two questions focus on the research experience and four questions focus on the experience of being a TA. After responding to the questions focused on the TA experience and research, students are then asked to rate their level of satisfaction level for each year in graduate school. The survey includes a logical framework, so that if the questions do not apply to a particular student, they do not appear. For example, if a student selected that they did not TA, other questions relating to being a TA do not appear. A variety of different types of questions are used, such as multiple choice, open responses, and matrix questions, when students are asked to rate how satisfied they felt with a particular experience. All rating scales have five increments (e.g. Extremely Satisfied, Somewhat Satisfied, Neither Satisfied or Dissatisfied, Somewhat Dissatisfied, Extremely Dissatisfied).

Retention data of the doctorate program in Mechanical Engineering were also analyzed. The college of engineering provided a roster of deidentified students who entered the Mechanical Engineering program each year from 2015 to 2018 and indicated if that student remained in the program or discontinued the program. Therefore, we analyzed the retention of 87 students in the doctorate program over the course of three years. All students who entered the program as a PhD student and then left after completing the Master's Program were marked as students who discontinued. Additionally, students who graduated with their PhD successfully during this time were not counted as students who discontinued the program. To calculate the retention of each class to date, the number of students currently enrolled in the PhD program was divided by the total number of students who started the program for that year. As this project continues, we will continue to collect retention data each year.



## Graduate Teaching Assistant Expectations

Rev. 8/07/2019

### OBJECTIVE

The objective of this document is to outline guidelines and topics of discussion to establish clear expectations for the role of the graduate teaching assistant (TA) and the Instructor.

### WORKING HOURS

According to the graduate school TA appointment manual, "The percentage of appointment must be equated to the number of hours the graduate student is expected to work. For example, a student who is appointed for 50% can be expected to work no more than 20 hours per week. These 20 hours must include all duties necessary for the completion of the student's teaching assignment, i.e., office hours, in-class time, grading, and preparation time." Although the appointment specifies a maximum number of hours, there will be weeks in which TAs will work less than 20 hours and weeks that the work exceeds 20 hours. However, if the number of hours worked consistently reaches or exceeds 20 hours, the TA should speak to their Lead TA, Graduate Advisor, or Graduate Chair immediately to see how the workload can be redistributed.

### PROFESSIONAL CONDUCT

Professional and respectful behavior is expected at all times, including email and verbal communication between the TA and the course instructor and students. Take care to be sensitive to each individual student concerns. Punctuality for meetings and classes is also expected. Grading should be consistent across all assignments and exams. Teamwork and coordination between the course instructor and TAs is required. TAs on a 50% appointment are expected to place priority on their TA duties, and TAs with lower appointments are expected to balance TA duties with other professional (e.g., research) activities.

### REQUIREMENTS

To maintain the TA appointment graduate students must achieve and maintain a minimum GPA of 3.25. Evaluations of TAs will also be solicited from instructors at the end of the semester, and strongly negative reviews may impact future TA assignments.

### DISCUSSION POINTS

To establish more specific expectations for each TA appointment, please discuss the following information and questions with the instructor during, or before, the first week of classes. *If expectations change throughout the semester, please update this document accordingly.*

#### Communication

- Best way to communicate with the instructor is through (phone, email, etc) \_\_\_\_\_.
- Can the TA send emails to the class directly?
- Brief check-in meetings will occur every \_\_\_\_\_. Meetings will take about \_\_\_\_ minutes.

#### Assignments and Grading

- Assignments should be graded within \_\_\_\_\_ days of being handed in by the students.
- There will be \_\_\_\_\_ number of assignments to grade each week that should take approximately \_\_\_\_\_ hours.
- Will the TA be expected to construct homework problems or other assignments?
- How should the assignments be graded (e.g., check+/check/check-)?
- Will solutions to the homework be provided by the course instructor?
- Will the TA be expected to upload assignments, homework solutions, forums etc. to Canvas/D2L?
- Grades should be updated on D2L/Canvas every \_\_\_\_\_. Additionally, a copy of the grade book should be saved \_\_\_\_\_.

#### Exams and Grading

- Exam grading should be completed in \_\_\_\_\_ days.
- Will the TA be expected to develop a grading rubric for the exams?
- Will the TA be expected to proctor exams?
- Will the TA be expected to proof-read or take the exam before administering the exam to the class?
- Please note, TAs are *not* expected to construct the exam problems.

#### Additional Responsibilities

- The TA will hold office hours and/or lab sections \_\_\_\_\_ times a week, on \_\_\_\_\_ day at \_\_\_\_\_ time.
- Will the TA be expected to attend classes?
- Will the TA be expected to present a lecture at any point in the semester? If so, the TA will present \_\_\_\_\_ times and always will be given 2 weeks notice before teaching a class.
- Will the TA be expected to conduct review sessions before exams?
- Please review the syllabus for the course to establish additional responsibilities.

#### Conflict

- How should the TA handle argumentative or disruptive students?
- How should the TA handle suspected or clear-cut cases of cheating on exams or assignments?

Please sign below to acknowledge that the above information and questions have been discussed. Please note a copy of this completed document should be kept by both the student and Instructor to refer to throughout the semester.

\_\_\_\_\_  
Course Instructor

\_\_\_\_\_  
Date

\_\_\_\_\_  
Teaching Assistant

\_\_\_\_\_  
Date

**Figure 2:** The Teaching Assistant Expectations document is distributed in August to all first-year doctoral students who will have TA responsibilities. This is completed while each TA meets with the faculty member with whom they will be working with during the semester. Although we highly encourage everyone to use this document, we do not require all TAs to review the document with their individual faculty member. The intent of this document is to clearly define the role of the TA appointment for each doctoral student. It was first implemented in the Fall of 2018.

## Research Assistant Expectations

Rev 8/7/2019

### OBJECTIVE

The objective of this document is to outline guidelines and topics of discussion to establish clear expectations for the role of the graduate research assistant and the advisor. For more details see *The Graduate School's Advising Agreement Guidelines*.

### PROFESSIONAL CONDUCT

Professional and respectful behavior is expected at all times, including in email and verbal communication with the instructor and students. Punctuality for meetings and deadlines is also expected. Teamwork and coordination with the professor and other lab members is required.

### EXPECTATIONS

To establish more specific expectations for each research assistant appointment, please discuss the following information and questions. If expectations change, please update this document accordingly.

#### Communication

- Best way to communicate with you is through \_\_\_\_\_.
- Responses to emails are expected to be within \_\_\_\_\_ hours.
- Check-in meetings will occur every \_\_\_\_\_.
- If not in person, what is the best way to keep you updated on my research progress?
- Group lab meetings will occur every \_\_\_\_\_.
- What is the format for group meetings? If students present, how formal is the presentation?

#### Laboratory Standards and Culture

- How should I store my data? Is there a preferred back up method?
- How should I approve large and small purchases with you?
- In general, what are the hours that I am expected to be present in lab?
- Can I work from other locations (e.g. library, home, coffee shop) if I am being productive in this location?
- What should I do if I make a mistake (e.g. incorrect experimental design, damaged equipment)?
- How should I manage other priorities (e.g. classes, TAing)?
- Should I consult you before joining student groups (e.g. GEARRS)?
- How would you describe the lab culture?

#### Publications and Conferences

- How often do you expect me to publish my work?
- Is there a preferred system for citing papers (e.g. Mendeley, Zotero)?
- How often do students in this lab typically attend conferences?
- What conferences do students in this lab usually attend?
- Is there funding for traveling to conferences?

#### Logistics

- How should I ask for time off for vacation?
- What should I do when I am sick?
- What should I do if I have an emergency that needs my attention outside of work?

#### Funding

- Is there funding for my current project?
- Am I expected to apply for external funding?
- What fellowships are available for students in this field of study?

#### Conflict

- How do students handle conflict with another student in this lab?
- How do students in this lab handle conflict with you if an issue arises?

### ME PHD REQUIREMENTS & EXPECTED TIMELINE

Milestone	Expected Year of Completion
<i>Preliminary Topic Exams: Please list topic exams below (1) _____, (2) _____</i>	
<i>Preliminary Research Exams</i>	
<i>Comprehensive Exam</i>	
<i>Defense</i>	

Please sign below to acknowledge that the above information and questions have been discussed.

\_\_\_\_\_ PI                                  \_\_\_\_\_ Date                                  \_\_\_\_\_ Research Assistant                                  \_\_\_\_\_ Date

**Figure 3:** The Research Assistant (RA) Expectations document is required to be reviewed and signed by all incoming doctoral students and their advisor. The document was first implemented in the Fall of 2019. The intent of the document is to encourage all students to establish expectations with their advisors for the first year and for years to come, in an attempt to limit misunderstandings and open the door for future conversations.

## **Initial Findings & Discussion**

For our initial studies, we are analyzing the results of one survey sent to all current doctoral students. From this survey, we are comparing the changes in responses to the survey questions of students that entered the program at different times. By knowing the time of entry into the program, we indicated if these students entered the program before (pre-) or after (post-) implementation of a specific initiative (Figure 4 and 5). Although, this comparison does not account for the fact that students' opinions will change over the course of time in the program, this represents the currently available data. Additionally, we would like to note that our department is constantly changing. Each year we hire new faculty, so each new class will have a different set of mentors. The Graduate Program Chair and the graduate advisor have also changed during the past two years. Therefore, these initiatives listed in the methods are not the only major changes in our department which could influence the experience of the doctorate students.

*Research and TA Experiences:* Our initial findings suggest that the satisfaction of a few research experiences improved for students who communicated with their advisor to fill out the Research Assistant Expectations document. Students who responded to the survey were grouped by the year of entry into the program and also divided into two groups, pre- and post-implementation of the RA Expectation document. Overall, two-thirds of the post-implementation of the RA Expectations document group felt extremely or somewhat satisfied with the RA Expectations document, while the rest of the post-implementation group felt neither dissatisfied or satisfied. Each group also rated their satisfaction with various research experiences (Figure 4). Our results indicate that more students were extremely or somewhat satisfied with receiving a written set of expectations and feeling expectations were reasonable in the post-implementation group, compared with pre-implementation. However, the sample sizes of students from each year are still relatively low, suggesting that the results could change if more students were surveyed. Additionally, because all students from each year were surveyed at the same time, the results could be influenced by the timing of receiving the survey during their program experience. We will need to continue to distribute the surveys to students who have used the Research Expectations document to see if these trends hold over time.

TA related initiatives, the TA Expectations document and the TA peer mentors, were implemented in the 2018-2019 academic year. In the previous year, many students struggled because they did not understand their TA expectations and some TA responsibilities took much longer than anticipated. Therefore, we implemented the TA Expectations document and paired each TA with a more senior student who had been a TA for the same course in the past. Our goal was to inform students what to expect out of this position by both speaking to faculty and students. We grouped the students again by the year of entry into the program and also by if they experienced each of the TA related initiatives (post-implementation) or did not experience the TA related initiatives (pre-implementation). 75% of the post-implementation group felt extremely or somewhat satisfied with the TA Expectations document. Additionally, 70% of these students felt extremely or somewhat satisfied with meeting with the TA mentor. By comparing the satisfaction levels of TA experiences of the pre-implementation group and the post-

implementation group, we found that there seemed to be very little change or improvement between the students in the pre-implementation and the post-implementation group (Figure 5). Overall, students in the post-implementation group seemed to be more satisfied with how quickly problems were solved and with the helpfulness of the mid-semester check-in meetings. However, students tended to be less satisfied with knowing the expectations of TAing in the post-implementation group. We are not sure if the initiatives implemented negatively impacted understanding expectations or if the survey timing may have impacted these results, as all students in the post-implementation group are early in their doctoral program. We will survey the same students later to see if their results change as they are in a later stage in the program. However, setting up communication lines early by talking about expectations may result in additional benefits, such as increased communication (students were more likely to be extremely satisfied with communication with their instructor). Overall, a larger sample size of people who have and have not experienced the initiatives related to providing communication avenues for TAs would help to identify if the changes positively influenced the TAs.

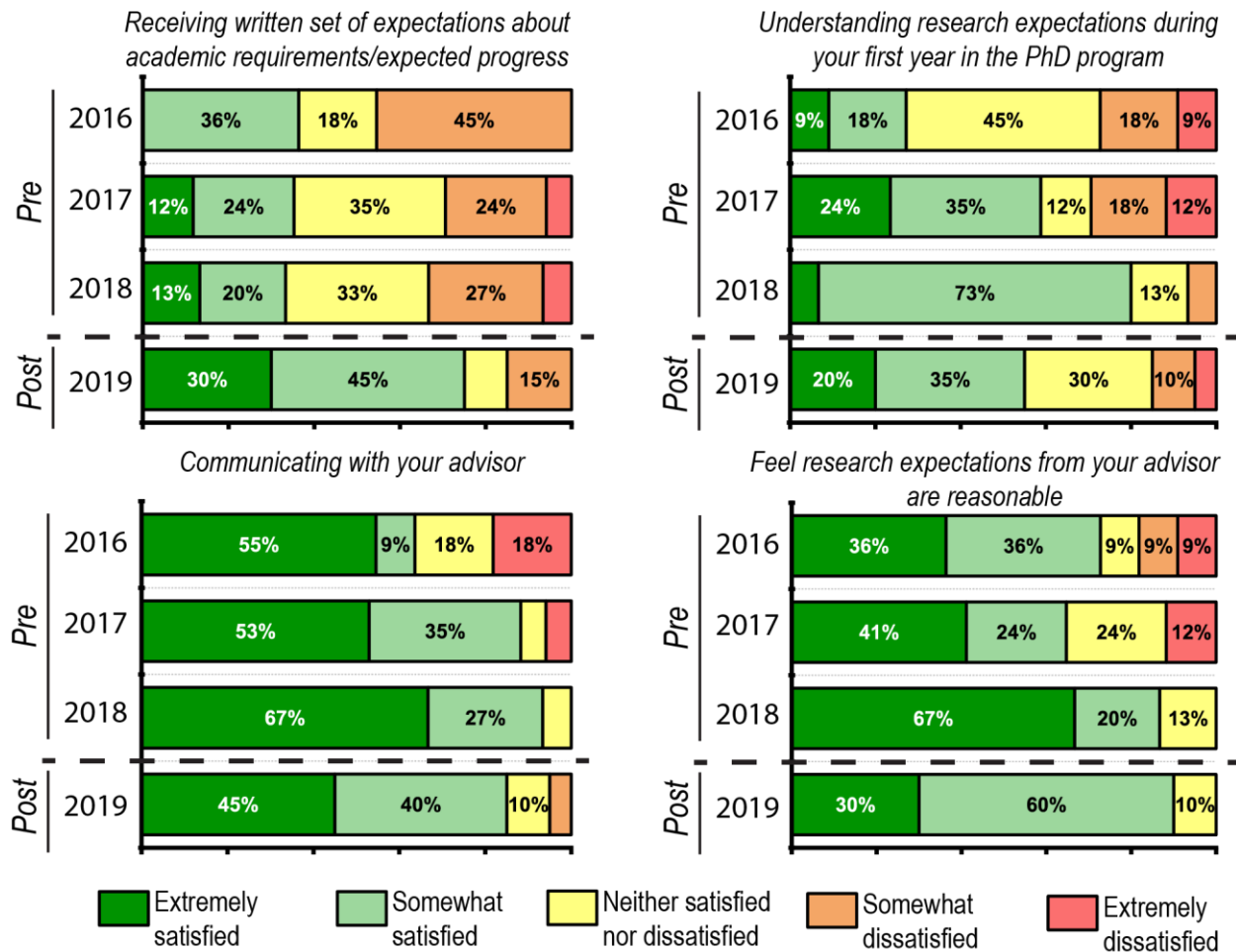
When using both the TA and RA expectations document, the role of the supervisor and supervisee is reversed when compared to common practices. Usually, the supervisor initiates the conversation to establish their own expectations. We have not investigated if this role-reversal helps to improve communication. We speculate that when the student initiates the conversation, the student can think about additional questions before hand, which may improve the quality of communication. Thinking about the TA or RA role as more of an employment position may also engender a greater sense of responsibility. Additionally, the expectations documents may include information that the supervisor did not think to talk about, which may extend the conversation. Finally, some supervisors may not plan to have this conversation at all and in this case, the document would be helpful for students because they may gain information that they would not have otherwise received.

*Overall Satisfaction during the first year of the doctorate program:* Our initial survey results suggest that satisfaction with the first year of the doctorate program increased in the 2018 academic year (Figure 6). As shown by Figure 1, many of the initiatives started began in 2018 and thus could contribute to the increased levels of satisfaction. When sorting the data by people who felt extremely satisfied with the first year of graduate school, we found that 91% felt extremely satisfied with knowing the best way to contact their advisor, 82% felt extremely satisfied with communicating with their advisor, 68% felt extremely satisfied with feeling their expectations were reasonable, and 73% felt extremely satisfied with guidance from their advisor. In contrast, when sorting the data by people who felt dissatisfied (extremely or somewhat dissatisfied), only 58% felt extremely satisfied with knowing the best way to contact their advisor, 33% felt extremely satisfied with communicating with their advisor, 33% felt extremely satisfied with feeling their expectations were reasonable and 8% felt extremely satisfied with guidance from their advisor. These data suggest that knowing expectations and having clear communication between a student and the advisor could impact overall satisfaction levels with academic programs.

In addition, the guidance from an advisor seems to impact the overall experience. Satisfaction of knowing TA expectations was similar for people who felt satisfied or dissatisfied by their first-year experience, however, the percentage of people who knew who to contact when a problem arose was different. Of the students who were satisfied with their first-year experience, 69% were extremely satisfied with knowing who to contact if they had a problem. Of the students who felt dissatisfied with their first-year experience, only 43% of people knew who to contact when they encountered a problem. Overall, this suggests that having available options for communication increases overall satisfaction. Again, a larger data set would help to better understand the impact of these initiatives.

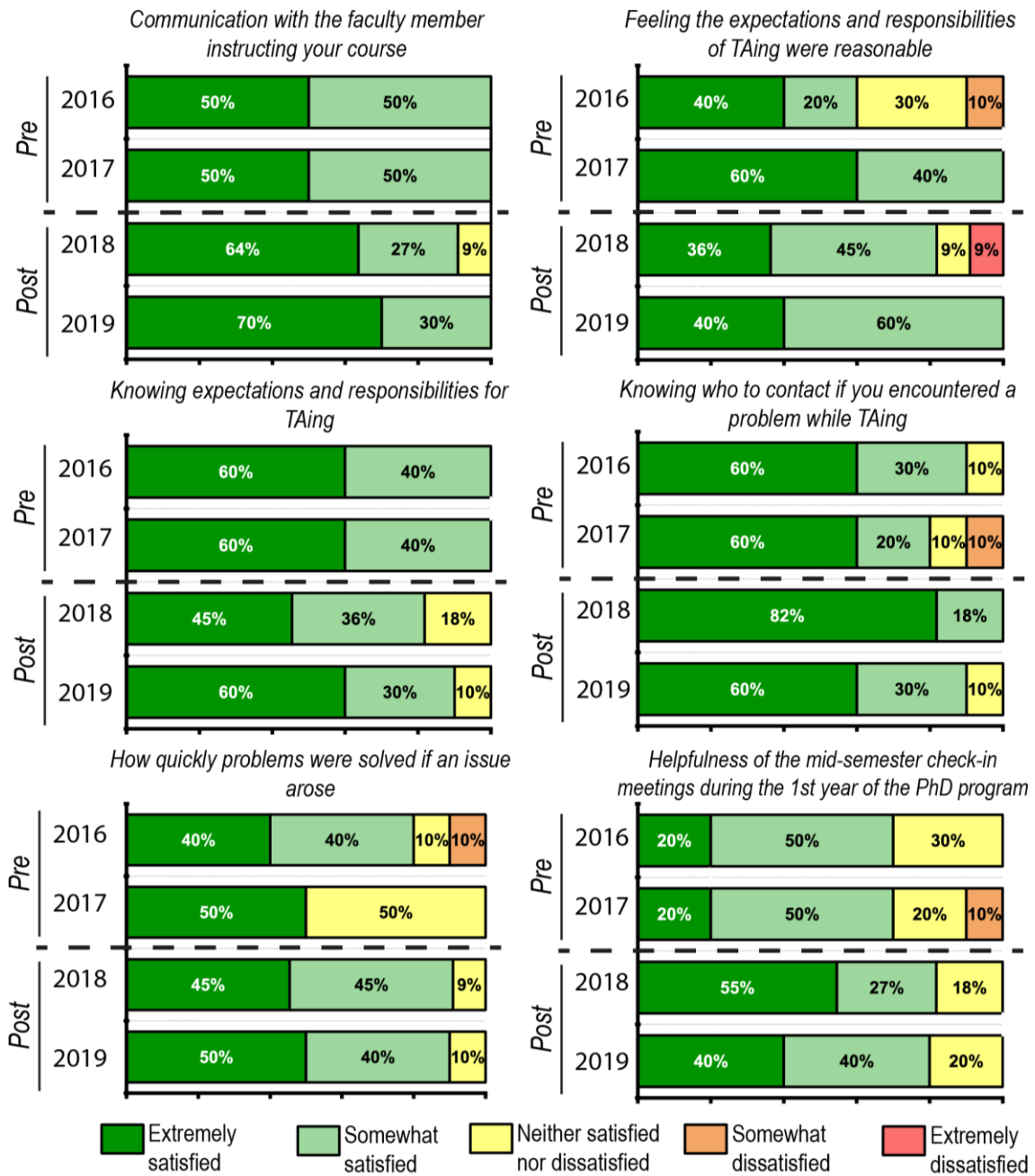
*Retention Data:* We compiled retention data of doctorate Mechanical Engineering students provided from the graduate school from 2015 through 2018 (Figure 7). We found that the percent of students retained is relatively high compared to previous numbers reported [2]. The overall percent of retained students who entered the PhD program from 2015-2018 is 88% with a standard deviation of 7%. There is a small decrease in retention of the class that began in 2017, however, the cause of this decrease is unknown. The number of students entering the program also remains relatively constant from 2015-2018 (average of 22 students and a standard deviation of 1.9). We cannot relate the retention data to specific initiatives started by the Lead TA and the department because the sample size of students is too low. We will continue to track how retention of each incoming doctorate class changes over time.

**Question Posed-** Please rate your satisfaction with the following research experiences:



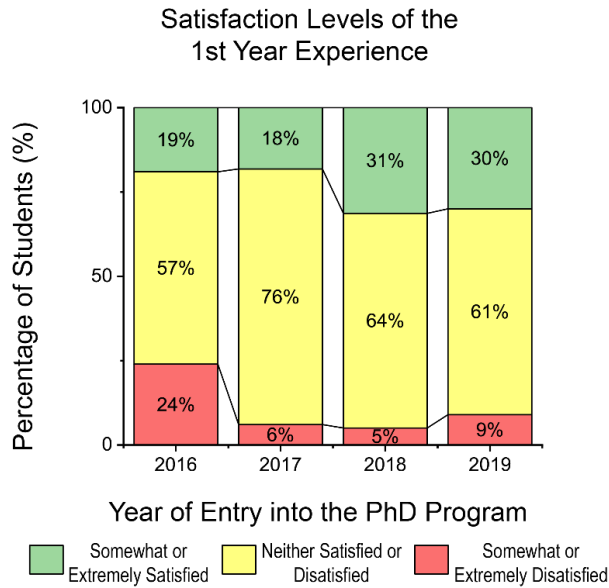
**Figure 4:** Students who were required to use the Research Expectations document (Post-implementation: 2019 n=21) and students who were not given the Research Expectations document (Pre-implementation: 2018 n=16, 2017 n=19, 2016 n=12) were asked to rate their satisfaction level with listed research experiences. Select research experiences were chosen for the figure because of relevance to the overall research question. The current results suggest that the group who did use the Research Expectations document (Post) are more likely to report being extremely or somewhat satisfied with feeling their research expectations are reasonable and receiving a set of written expectations.

**Question Posed-** Please rate your satisfaction with the following TAing experiences:

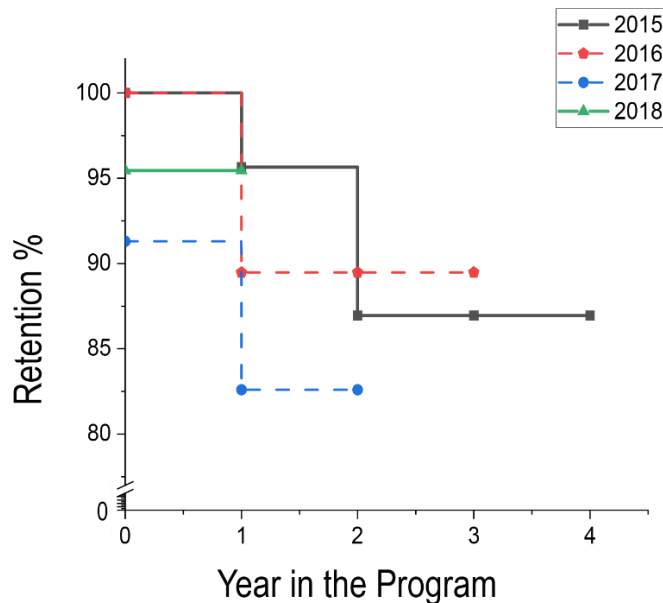


**Figure 5:** Students who were required to use the TA Expectations document and who were paired with a TA mentor (Post-implementation: 2018 n=16, 2019 n=21) and students who did not have these resources (Pre-implementation: 2017 n=19, 2016 n=12, ) were asked to rate their satisfaction level with listed TA experiences. Select TA experiences were chosen for the figure because of relevance to the overall research question. The current results suggest that the group who did use the TA expectations document and had TA mentors (Post) are more likely to report being extremely or somewhat satisfied with how quickly problems were solved and helpfulness of the mid-semester check-in meetings.





**Figure 6:** The percent of students satisfied (somewhat or extremely satisfied), dissatisfied (somewhat or extremely dissatisfied) and neither satisfied or dissatisfied with their first-year experience was calculated for each class that entered the from 2016 to 2019. The number of students surveyed in each class varies (2016 n=12, 2017 n=19, 2018 n=16, 2019 n=21). We did not show the percentages for other classes because the sample size was lower (7 people or lower). Overall, the number of students who were satisfied (somewhat or extremely) with their first-year experience increased after 2017.



**Figure 7:** Retention data were collected and tracked over time for doctorate students who entered the program in 2015, 2016, 2017 and 2018. The percent of students retained each year is displayed on the y-axis. Overall, the average retention rate overtime is 88% (standard deviation 7%). The total number of students who entered the program from 2015 to 2018 is 87. As additional retention data is collected, we will be able to compare trends.



## **Conclusion & Future Work**

Our initial findings suggest that providing tools to set expectations and increase communication could positively impact certain aspects of the TA and research experience for doctoral students in our department. Overall, our initial results indicate that satisfaction levels of the first-year experience increased after 2018, which is when many of the initiatives described in our methods were implemented. In fact, our students who felt more satisfied with their first-year experience, often felt guidance from their advisor, knew how to communicate with their advisor, felt their research expectations were reasonable and knew who to contact if they encountered a problem with TA responsibilities. These results suggest that having available communication avenues is an important component to increasing student satisfaction in our department. From our data, we cannot determine which initiative was most effective to increase overall satisfaction because the initiatives were not introduced separately on different groups of students (see Table 1).

However, it is important to note that this work is in progress. We will continue to survey all doctoral students at the same time of the academic year as well as survey other graduate students in other departments. By surveying more doctorate students along with faculty, we will be better positioned to understand how these different initiatives to increase communication impact the first-year experience from both a student and a faculty perspective.

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