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Self-reflection: Lessons learned from three years of teaching as an international Ph.D. student engineering instructor

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Abstract:

Graduate students, especially Ph.D. students, often work as teaching assistants (TAs) to support themselves financially. Recently, there has been a rise in the number of pre-doctoral or graduate student instructors, particularly in large public universities. These pre-doctoral instructors are Ph.D. students primarily focused on research but also take on independent teaching roles. However, instructors in STEM higher education, including faculty, do not often receive formal training on how to teach, posing a significant challenge for first-time graduate student instructors. Additionally, graduate student instructors do not often receive guidance, support, or mentoring for how to balance their independent teaching with dissertation research, classes, and personal life. Therefore, in this paper, I share my three-year experience as an international student and pre-doctoral instructor, including the lessons I learned and how my teaching philosophy has evolved to support future graduate student instructors.

Through self-assessment and reflexivity, I conducted a thorough self-reflection on my three-year experience as a graduate student instructor. My journey began when I was appointed as an individual instructor for the undergraduate thermodynamics class in the second quarter of my first year as a Ph.D. student. Over the following two years, I continued working as an instructor, teaching mechanical engineering core and elective classes, including thermodynamics, fluid mechanics, heat transfer, introduction of material mechanics, and cryo-bioengineering. To date, I have taught 10 courses to about 400 students across three different institutions. Throughout this journey, I maintained a self-reflection journal and collected teaching evaluations and student feedback. I have critically analyzed my self-reflections and evaluations to assess my personal and professional growth as an instructor over the last three years. In this paper, I present the results of my critical self-reflection through a set of lessons learned and how my teaching philosophy has evolved, including improvements in teaching skills, time management, career development, and Diversity, equity, and inclusion (DEI) in the classroom. Based on my personal experience, this paper aims to share a journal with peers who are interested in teaching while pursuing a Ph.D. degree and to bridge the teaching experience with career development.

Keywords: self-reflection, graduate student instructors, improvement of teaching skills

1. Introduction

Hiring PhD students for Teaching Assistant (TA) positions is a common method for universities to assist students with tuition and living expenses [1, 2]. Teaching assistant is majorly helping the instructor to build the class, conduct the exercise/lab section, and provide office hours. An increasing number of PhD students are also taking on roles as temporary instructors, particularly at research-oriented universities classified as R1 and R2 institutions [3, 4]. Typically, PhD students receive teaching opportunities during the summer semester or when faculty members are on leave, such as during illness or sabbaticals [5]. The titles for these teaching positions can vary and may include pre-doctoral instructor, graduate student instructor, part-time lecturer, or visiting lecturer. From now on, I will refer to all of these as Graduate Student Instructors (GSIs). While most GSIs have prior experience as TAs, they often lack formal training and guidance when they first take on the role of an independent instructor [6]. Furthermore, the primary responsibility of GSIs is their research, which directly contributes to their graduation [7]. As a result, GSIs must carefully balance their research tasks and teaching responsibilities, even while they are developing practical teaching skills. Therefore, it is crucial to provide GSIs with adequate support to foster their career growth and enhance their professional development.

The challenges for international GSIs are much more serious. These students have unique problems, like difficulties with language, cultural misunderstandings, and feeling alone because they are far away from family and their cultural identity [8, 9]. Despite the significance of these challenges, the academic literature addressing their struggles remains notably thin. This oversight underscores the need for comprehensive studies that explore the experiences of international GSIs, helping current and incoming international GSIs.

I am an international student who first came to the United States from a non-English country as a junior undergraduate majoring in STEM. After completing my master's degree, I began my Ph.D. at the same large public university in the northwest. My journey as a teaching assistant started with a thermodynamics course in the first quarter of my Ph.D. Then, I was recommended by the faculty instructor to become a GSI for the same course in the following quarter. Since then, I have taught more than ten courses (a total of 44 credits) to over 400 students across three different universities, with class sizes ranging from small to large. The courses included thermodynamics, heat transfer, fluid mechanics, material mechanics, and various elective courses in the biomedical area. In addition, I was selected as an outstanding teaching assistant in our department, the highest award for a GSI and TA.

With this diverse teaching experience, I aim to provide insights and lessons learned from my time as an international GSI by employing self-reflection in the form of reviewing the student's feedback. Thus, I conducted both qualitative and quantitative study to share reflections on my personal growth, teaching philosophy, and professional development, offering a unique perspective on the challenges and triumphs of navigating academia as an international scholar and GSI.

Research Questions

Through a self-reflection, I seek to answer the following questions: I. *How does an international graduate student navigate the challenges of teaching engineering courses without formal pedagogical training?* And II. *What lessons does an international graduate student learn through their journey from a novice to experienced instructor in engineering education*?

2. Methods

In this study, I applied a self-reflective approach exploring my GSI experiences, including developing a teaching philosophy, managing a teaching team, formal teaching evaluations, and incorporating informal feedback from students and personal experience [10]. Reflection is a fundamental skill that involves thoughtful introspection and a heightened awareness of one's actions and behaviors [11, 12]. Self-reflection is an effective self-evaluation tool that helps individuals analyze their work practices and learning techniques. The data was allocated from the course syllabus, course evaluation, and students' oral and email feedback.

My Teaching Experience

This study encompasses 14 quarters (140 weeks) of teaching experience and incorporates feedback from my personal journey as an international GSI. It covers courses taught at three different universities, with class sizes ranging from small to large, all located in the northwestern United States. Table 1 lists the courses that I taught as a GSA, and had responsibility for overseeing TAs, while Table 2 lists the courses for which I was a TA. Each class operates on a 10-week quarter schedule, with the number of 50-minute lectures per week determined by the course credits. For example, a four-credit course includes four lecture sessions each week. Additionally, all courses that were required courses in the mechanical engineering curriculum, except for the cryo-biomedical engineering course that I taught in Autumn 2022.

Table 1 List of taught courses as GSI

Time	Course	Enrollment	Credits	TA number
Winter 2022	Thermodynamics	71	5	2
Summer 2022	Heat Transfer	15	4	1
Autum 2022	Cryo-Biomedical Engineering	10	4	0
Winter 2023	Thermodynamics	76	5	2
Summer 2023	Heat Transfer	12	4	0
Autum 2023	Heat Transfer	52	4	1
Winter 2024	Material Mechanics	87	5	3
Summer 2024	Heat Transfer	14	4	0
Summer 2024	Fluid Mechanics	8	4	0
Winter 2025	Thermodynamics	119	5	3
Total	**10 Courses**	**464**	**44**	**12**

Table 2 List of taught courses as TA

Time	Course	Enrollment	Credits
Autum 2021	Thermodynamics		4
Spring 2022	Heat Transfer	112	4
Autum 2022	Thermodynamics	101	5
Spring 2023	Heat Transfer	100	4
Spring 2024	Kinematics and Dynamics	211	4
Autum 2024	Thermodynamics	120	4

Data Collection and Analysis

Course evaluation data was gathered from formal, anonymous online course evaluations. For each course, scores and feedback from both satisfactory and unsatisfactory aspects were collected. Syllabi were compiled and analyzed to observe changes over the quarters.

The course evaluation analysis was conducted both quantitatively and qualitatively. The quantitative analysis included examining overall scores and instructor-related scores. The qualitative analysis involved coding students' anonymous feedback. First, the feedback and changes in syllabi were coded inductively using descriptive coding .

The results of the descriptive coding were used to inform the self-reflection of my past experiences and growth, to evaluate my trajectory as a GSI, how I incorporated the feedback each year to improve my teaching, and the lessons that I learned. The self-reflection process occurred at the conclusion of each quarter through careful analysis of the student feedback. Insights gained from this reflection informed my teaching approach in subsequent quarters, creating a continuous improvement cycle. Having taught ten courses over the past three years, I have organized feedback chronologically by year. The descriptive coding and self-reflection ultimately resulted in a trajectory of strengths and areas of improvement in my teaching practice as well as a set of lessons learned as a GSI. My growth trajectory and lessons learned are detailed in the section below.

3. Results

The course evaluation scores, illustrated in Figure 1, reveal that while the scores are generally close to the school average, they tend to be lower in classes with more than 70 students. Conversely, the overall course score is higher in smaller classes, such as those offered in the summer of 2023 and 2024. Additionally, the score reflecting the instructor's contribution shows a positive trend with increasing teaching experience. Course evaluations have a maximum score of 5, and the university average is around 3.5.

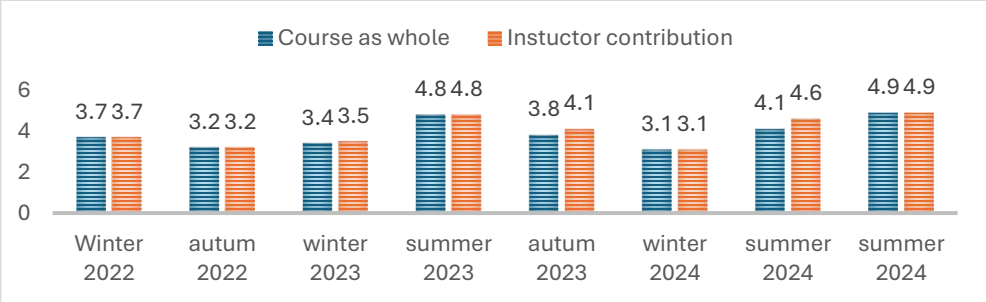

Figure 1 Course evaluation in overall and instructor contribution

Figure 2 displays the participation rates for the course evaluations, highlighting a significant increase starting from the fourth quarter of teaching, coinciding with a lower number of registered students. However, the participation rate remained high in subsequent quarters with higher enrollment, as instructors gained more experience in encouraging student participation.

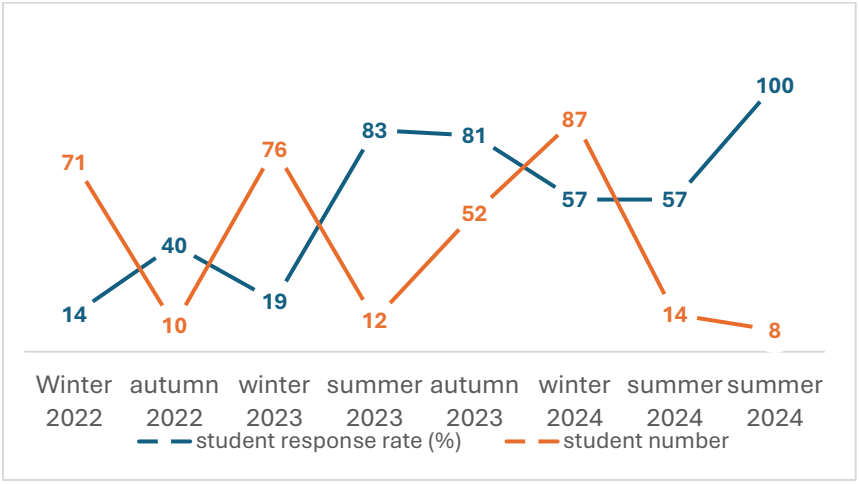

Figure 2 Student response rate and student enrollment numbers per quarter

Year 2022

In 2022, I independently taught three courses, marking the beginning of my teaching career. As a first-year Ph.D. student presented with an unexpected teaching opportunity, I was simultaneously preparing lectures and delivering them. Fortunately, I received valuable guidance from both my advisor and the previous course instructor, which contributed to numerous positive comments regarding course content. Nevertheless, areas such as organization and pacing require improvement. Table 3 presents selected coded feedback from multiple students from 2022.

Table 3 Descriptive codes from course evaluations in Year 2022

Year	Areas of Strength	Areas of Improvement
2022	1. stimulating experience 2. interesting lab design 3. helpful class discussion 4. final presentation and term paper is great format designed by instructor	1. lecture notes hard to follow, fast pace 2. content is not well prepared 3. LMS not organized 4. need more communication between instruction team and students in lab 5. professor accents 6. repeated information from old classes

Through analyzing this feedback, I gained appreciation for how pace management significantly impacts student learning experiences, prompting me to slow my lecture delivery in subsequent sessions deliberately, since it is one of the easiest changes I can make. Additionally, recognizing limitations in course organization, I sought informal student input during my second teaching quarter of 2022. Based on these conversations, I redesigned the LMS course page to prioritize simplicity and clarity for improved student navigation.

Year 2023

Building on lessons from 2022, I deliberately adjusted my lecture pace. To improve course organization, I streamlined content delivery by utilizing only the file module in LMS and introduced a LMS navigation demonstration at the beginning of each quarter. In addition, I have added flexibility into the course, for example, I guarantee two-time extensions on homework, which aims to help them build a time management ability as future engineers. Table 4 shows the descriptive codes from the comments I received in my course evaluations for 2023.

Table 4 Descriptive codes from course evaluations in Year 2023

Year	Areas of Strength	Areas of Improvement
2023	1. informative teaching content 2. extra topic about research from lecturer 3. useful tools from lecturer 4. helpful posted slides 5. helpful in class example 6. engaged instructor 7. organized class 8. well taught	1. need more time for example 2. lab material does not work 3. talk too quicky 4. more time in class example 5. more hints on example 6. hard in-class exercise 7. slow pace 8. too much wording in slides 9. rushed example

Student feedback confirmed continued appreciation for stimulating and comprehensive material, while new comments specifically praised the "organized class" structure, indicating successful improvement in this area. The slower teaching pace appeared to enhance the effectiveness of course examples, with numerous students highlighting these as particularly helpful. However, feedback regarding pacing became more polarized—some students found it too slow,

while others still considered it somewhat fast. This divergence helped me recognize the inherent challenge of balancing pacing preferences in large-enrollment courses, which are common at the large public university in the Northwest where I teach. This is what the analysis said I should improve on, understanding the overall class need about pacing is what I decided to focus on going forward. In response, I developed a strategy to incorporate regular classroom polls about pacing and modified my approach to examples by reducing calculations while asking students to outline their solution strategies and plan equations instead. In addition, this year, I was appointed to teach a new course 1 week prior to the school start, and I am actively seeking help from a senior lecturer, who has provided me with tremendous help in preparing the course material and getting familiar with the course content. I feel a great rule as an instructor is not being shy to ask for help.

Year 2024

Beginning in 2024, I intensified my focus on enhancing my student learning experience. My approach evolved to include overall reviews of prerequisite knowledge before introducing new concepts. Additionally, I developed more closely aligned homework assignments by designing the homework question to start with a conceptual question we discussed in class and then transition to numerical problems. Moreover, we expanded the availability of office hours for both the teaching assistants and me. Despite these improvements, student feedback suggests I may still progress too quickly through material, a challenge inherent to the substantial knowledge requirements of core Mechanical Engineering courses. Table 5 shows the descriptive codes from my 2024 course evaluations.

Table 5 Descriptive codes from course evaluations in Year 2024

Year	Areas of Strength	Areas of Improvement
2024	1. interesting and comprehensive 2. lots of new concepts in the course content 3. revisit old course stimulating 4. useful report and writing skill 5. helpful HW 6. helpful office hour 7. passionate instructor 8. always help 9. ample practice problems 10. great understanding from instructor explanation 11. inclusive class	1. fast paced slides 2. student skill vary greatly 3. picky lab grading 4. less labs 5. more office hour 6. too much content in slides 7. little fast 8. more attentive to email 9. more in-class practice and example 10. fast handwriting

Year 2025

To date in 2025, I taught a thermodynamics course to approximately 120 students. During this quarter, I further refined my teaching pace by implementing a hybrid instructional method that utilized slides for equations and conceptual definitions while providing handwritten step-by-step guidance for practice problems. I adapted by shifting from writing on an iPad to using slides that

included pre-built equations and solutions for examples. However, I noticed that students found it easier to follow when I wrote out solutions during demonstrations. This led me to adopt a hybrid format—using slides for presentations and final solutions but handwriting for demonstrations. The effectiveness of these pace adjustments was evident in the absence of pace-related concerns in course evaluations. Students also reported that the integration of real-life examples significantly enhanced their learning experience and conceptual understanding. In this quarter, the recitation adds a bonus quiz to encourage students' participation and strengthen the connection between students and our teaching team.

The greatest number of comments was about classroom location, although unfortunately, that is outside my control. The primary limitation noted in student feedback this quarter stemmed from the classroom location, which required more than a 10-minute walk during class transition periods—a challenge mentioned by numerous students. Table 6 shows the descriptive codes for the course evaluations I have received so far in 2025.

Table 6 Descriptive coded from course evaluations in Year 2025

Year	Areas of Strength	Areas of Improvement
2025	1. learned new concept 2. helpful recitation 3. very useful and well taught 4. helpful real-life examples 5. instructor availability and passion	1. long distance to walk 2. hard to find a seat 3. include some animation

Through annual self-reflection of student comments, clear improvements are evident in class organization, explanation quality, lecturer passion, and instructional pace. The highlights from student feedback reflect my development as an instructor over this period.

Lesson Learned about being a GSI

After learning about the mission of the ASEE, I was starting to organize my teaching experience and involve it in my teaching philosophy. Below are some lessons learning being a graduate student instructor. I am using the students' comments and my evaluation and reflection on the comments to synthesize my teaching experiences as a GSI into the lessons learned below.

Lesson 1: A thousand-mile trip begins with one step.

As an international graduate student, securing your first opportunity as a Graduate Student Instructor (GSI) can be the most challenging step. Based on my experience, being an effective TA and gaining recognition from a faculty member is crucial. To achieve this, graduate students should cultivate a deep understanding of and interest in the subject, often related to their research. I was lucky as I majored in thermal and power engineering as an undergraduate student at Asian. Additionally, as an international GSI, it's essential to refine your English-speaking skills, including presentation abilities and the capacity to answer spontaneous questions. Observing other faculty instructors can be an excellent method for learning these skills. First, I learned how to do time

management in the class and also learned how to raise questions effectively and motivate the students. Most importantly, it's critical to be proactive and seize any opportunities that arise. For example, after taking the initial step, GSIs may receive more attention and opportunities for exposure when a department or nearby school opens a part-time position. Personally, after accumulating some experience, I was hired for part-time instructor roles at other campuses and universities. This demonstrates how early experience as a GSI can lead to further opportunities in the academic field.

Many international GSIs often face challenges with networking due to being new to the environment. Once appointed as a GSI, there is typically only a 2-3 week window to prepare for the upcoming quarter. In one instance, I was appointed as a GSI less than a week before the start of the term, and this is a new course for me. Luckily, I was supported by the department and previous lecturers to get everything prepared before the quarter starts. Therefore, seeking assistance from the department or a previous faculty instructor doesn't indicate a lack of teaching ability. This support can include the assignment of experienced TAs, graders and access to lecture notes, homework, and other resources. Such help can significantly reduce the burden on a new GSI, allowing them to focus more on the content itself.

Lesson 2: It takes a village

As an engineering student, I was never systematically educated on how to teach, besides learning from personal experiences from familiar faculty members who might also not be an education major. Thus, the strategies they share can vary depending on class size, major, core or elective courses. After teaching core and elective mechanical engineering classes from small to large class sizes, there is a fact that GSI should know that you can not satisfy all students in the class. Students are also from different backgrounds and feel differently about pace, for example, difficulty and ability to absorb new knowledge. My suggestion for GSI is to change your mindset from student to instructor. For instance, as an international GSI, my lecture pace was a little fast sometimes, and a good way to check is to create an anonymous poll regularly to get feedback from students.

Lesson 3: Be organized and know your shortcomings

Tables 3-4 show that in my early career, I received comments about my unorganized approach and poor handwriting during classes. After receiving this feedback, I reviewed the Canvas page to understand the students' user experience better. Subsequently, I simplified the Canvas interface and introduced a guide on using Canvas effectively for my class, which proved extremely helpful. In later quarters, students noted that the classes were more organized. Additionally, as an international GSI, I recognized that handwriting in English was not my strong suit. This experience underscores the importance for GSI to recognize their weaknesses and address or circumvent them during lectures.

Lesson 4: Be passionate and be yourself

From above, I had a shift in teaching philosophy. When I first started as an instructor, I thought that because a teacher was only about teaching knowledge. However, I now believe that we are not only passing the knowledge but also instilling our energy and passion into students. Educators shape their students in a small manner. As shown in Tables 5-6, I am trying to be more passionate about the lecture and be more friendly to students, which helps me better interact with students. In addition, I learned the teaching philosophy from experienced faculty and started to grow my own understanding of undergraduate education, which was majorly expressed in the change of syllabus. To let students understand the real world, they need to pre-plan for multitasking and emergencies that always happen.

4. Discussion

Being a GSI poses challenges for graduate students, particularly when they lack formal training. Despite this, the number of GSIs teaching courses at large public institutions is increasing for various reasons, including the summer semester, faculty sabbatical leaves, and budget constraints. Based on my personal experience, my mentor and I evaluated teaching performance over the past three years and observed my significant improvements in classroom management, TA coordination, and time management. Furthermore, student satisfaction has also increased as skills and experience have been honed. From these lessons learned, we believe that encouraging GSIs to engage in engineering education can significantly enhance their teaching effectiveness and career development.

Teaching courses in a non-native language presents challenges for international students, from dealing with accents to navigating cultural differences. However, a well-prepared course consistently pleases students, who can recognize and appreciate the effort, as indicated in the course highlights. Enhancing presentation skills and incorporating new topics can improve the classroom environment. This approach not only enhances teaching effectiveness but also enables international GSIs to leverage their multicultural backgrounds, allowing them to distinguish themselves and bring unique perspectives to the classroom.

In addition to addressing the challenges faced by international Graduate Student Instructors (GSIs), our ongoing work also involves a comparative analysis between domestic and international GSIs. This analysis serves as an effective tool for determining whether domestic GSIs encounter similar challenges, particularly regarding the lack of formal training required to independently teach courses. Understanding these shared challenges will provide valuable insights into improving GSI training programs and enhancing overall teaching effectiveness within the curriculum.

5. Conclusion

The paper summarizes my self-reflection with descriptive coding method and quantitative study from course evaluation as an international GSI and the challenges I faced. Through course

evaluations, informal feedback, and personal experiences, lessons learned were distilled from both the perspective of the GSI position and that of a graduate student. Being an international GSI is an invaluable experience that requires time to improve both English and presentation skills. From the self-reflection, significant improvements were made, and a clearer teaching philosophy was developed. I hope this self-reflection can be a guide for future GSI in various directions.

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