

Assessing Inclusive Teaching Training of Graduate Student Instructors in Engineering

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Introduction

Graduate student instructors are essential to the teaching team at many research institutions. They often lead laboratories, discussion sessions, and/or hold office hours; and are the primary liaison between students and faculty. As such, they not only influence student learning, but they can also be agents of change and improve student retention [1]. Therefore, the training of student instructors is critical to enhancing the student experience as well as the classroom climate. Additionally, meaningful assessment of student instructor professional development is critical for ensuring quality of such training.

To support their key role in the teaching-learning environment, the College of Engineering (CoE) at the University of Michigan requires training of all first-time graduate student instructors. This training consists of two parts: a 7-hour orientation and an ongoing professional development during the term. The orientation begins with a session on inclusive teaching to align with the CoE strategic plan to improve diversity, equity, and inclusion (DEI). It also contains a variety of pedagogical workshops and an opportunity to practice delivering a lesson to a small group of their peers. The ongoing professional development allows students to choose from workshops, active-learning practice or a midterm student feedback consultation, along with reflective exercises. The structure of this training approach is in-between short programs (i.e., one-day events) and long programs (i.e., 20+ hours) carried out at other universities [e.g. 2, 3], and attempts to draw benefits from each while conforming to the time demands for engineering student instructors and institutional constraints.

In order to support the continuous improvement of the teaching professional development of this program, the center for teaching and learning (CTL) has devised an assessment plan to consider the impact of the training on inclusive teaching for the student instructors. This evidence-based practice paper describes a model for assessing and improving student instructor professional development in the College of Engineering at a large research university. Specifically, we asked the following research question:

- To what extent does the new instructor orientation prepare first-time engineering graduate student instructors (GSIs) to teach inclusively?

Improvements to the Orientation

Over the years, the teaching orientation has evolved to accommodate a growing population of graduate student instructors (e.g. 141 GSIs in 2011 to 179 in 2018), and the priorities of the College of Engineering. Most significantly, to support University and CoE diversity, equity and

inclusion strategic plans the orientation has been revamped to make inclusive teaching training more central. In the 2017-2018 academic year, we embarked on a pilot program to learn more about the experiences of GSIs, and to see if the orientation was meeting their needs, especially related to the inclusive teaching professional development. The results of this pilot helped direct our newest revision to the orientation [4]. The schedule for the Fall 2018 Engineering GSI Orientation is shown in table 1. The italicized print indicates new or updated sessions.

5 minutes	Welcome from the College of Engineering
15 minutes	Overview of the Program, Policies and Resources
25 minutes	<i>Introduction of the Science of Learning</i>
95 minutes	<i>Inclusive Teaching Theater Performance</i>
55 minutes	<i>Concurrent Workshops A</i> (One from: The Science of Learning, Leading Discussion Sections, Managing Lab Classes, or Handling Office Hours)
55 minutes	<i>Concurrent Workshops B</i> (One from: The Science of Learning, Teaching Problem Solving, Grading, or Handling Office Hours)
110 minutes	Practice Teaching

Table 1: Teaching Orientation Schedule for Graduate Student Instructors in the Fall of 2018 at a Large R1 Institution. The Introduction of the Science of Learning is new, the discussion around the theater performance was updated, and the concurrent sessions were revised to model backward design.

The first change to the orientation involved introducing the Science of Learning during the plenary. It focused on social constructivism [5] and we explained it as a framework for teaching: knowledge is constructed (not transmitted) by the learner in a social context. We also emphasized that we learn best when:

- We connect new knowledge to prior knowledge, the big picture, what’s important to the learning
- We engage in active learning
- We feel that we belong (in the classroom learning community and in our profession)

This last point helped us link the science of learning with inclusive teaching.

Modifications were also done to the inclusive teaching session. As in the past, the core of this session is a theater performance of short skits. The skits address student diversity, teaching persona, and microaggressions in a college setting. While the skits remained largely the same, the framing and discussions around the skits were modified to better accommodate the following goals:

- Increase participants’ capacity for teaching inclusively

- Identify behaviors that negatively affect classroom climate
- Identify practices that help cultivate an inclusive learning environment

A facilitator for the theater group began the session by defining inclusive teaching, discussing social identity and its relevance to teaching, and describing the continuum of classroom climate. The following definition for inclusive teaching was used and it is based on research and experience [4]:

"Inclusive teaching involves deliberately cultivating a learning environment where all students are treated equitably, have equal access to learning, and feel valued and supported in their learning. Such teaching attends to social identities and seeks to change the ways systemic inequities shape dynamics in teaching-learning spaces, affect individuals' experiences of those spaces, and influence course and curriculum design."

This definition emphasizes the deliberate role that instructors play, the importance of attending to student identities, and the fact that systemic inequities (e.g., sexism, racism, ableism, economic inequalities, etc.) still exist and create barriers to student learning.

Participants were grouped in tables of eight, and while watching the performance they were asked to take notes and reflect. The first several skits focused on student identity, and participants were asked to consider negative classroom experiences and how they might make choices to avoid them. After that part of the performance, GSIs participated in a structured discussion at their tables assisted by trained facilitators. This conversation teased out barriers to student learning, and helped GSIs identify strategies to promote an inclusive learning environment. The second series of skits focused on the instructor identity and experience. A second table discussion followed in which participants considered their teaching persona and its relationship to their identity. The inclusive teaching session ended with a skit that normalizes teaching challenges, and promotes the teaching center as a resource.

The topics of inclusive teaching and the science of learning were intentionally threaded throughout the concurrent sessions to reinforce their learning. All sessions used several active learning and inclusive teaching strategies. In addition, each concurrent was restructured to model backwards design and good lesson planning. Each session now has active and measurable learning objectives, as well as classroom assessments and learning activities aligned with such objectives. This change not only reflects best practices, but it was done in order to better align with our more rigorous assessment plan.

Assessment approach

Assessment of educational development programs have historically relied on data quantifying participation or self-reported data, such as satisfaction surveys. While this type of data can

provide valuable information for future logistical planning, it does not provide information regarding the effectiveness of programming. Recently, there have been numerous recommendations for outcomes-based assessment of educational development programs [7, 8, 9, 10]. Aligned with these recommendations, we employed a mixed-methods outcomes-based assessment approach (IRB exempted). Specifically, we used surveys and focus groups to assess graduate student instructors' awareness, confidence, and understanding of inclusive teaching practices.

A pilot study of this research was conducted using three online surveys implemented prior to orientation, one week after orientation, and at the end of the academic term. Additionally, focus groups were conducted. However, very little information was able to be inferred from the survey data due to very low response rates [4]. For this study, we reduced the number of surveys, and again conducted focus groups (as shown in Figure 1). The three surveys were replaced by implementing a single retrospective-pre survey [11, 12] on inclusive teaching practices immediately following the orientation. The number of questions on the survey was reduced after conducting an exploratory factor analysis, identifying potentially redundant questions. The inclusive teaching surveys were completed on paper and in-person at the end of the final session of the orientation. Additionally, while registering online to participate in the orientation, all registered participants were asked to define "Inclusive Teaching". All participants were again asked to define "Inclusive Teaching" as a part of the retrospective-pre survey. This reduced approach resulted in a 95% response rate.

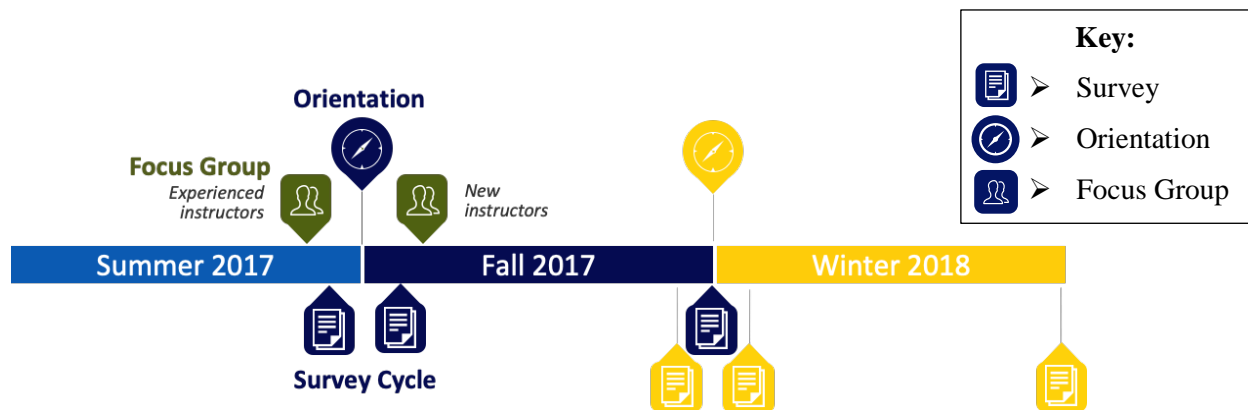


Figure 1a: Pilot Study Assessment Approach

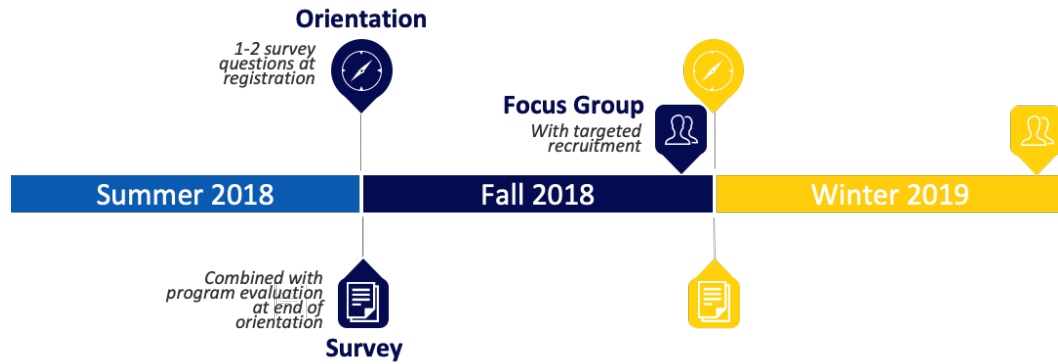


Figure 1b: Refined Assessment Approach

The survey questions (see Appendix A) were adapted from validated questions pertaining the instructors’ confidence in their ability to perform a variety of teaching practices related to inclusive teaching [13]. Instructors were also asked to define “Inclusive Teaching” in their own words, which was previously asked verbatim on the online registration form for orientation. Additionally, the survey asked questions regarding the expected teaching responsibilities and optional instructor demographics questions. The demographics of the survey participants are described in Table 2. Survey respondents represented every engineering department in the College of Engineering, the majority teaching in Mechanical (17%), Electrical & Computer (16%), and Computer Science (15%).

Table 2: Demographics of Survey Respondents - Assigned responsibilities, Gender, & Race

Responsibilities	#	Gender	#	Race	#
Grading	86	Male	97	Asian	68
Office Hours	81	Female	39	White	55
Teach a lab	52	Non-binary	1	Latinx/Hispanic	8
Teach a discussion	38	Prefer not to say	2	Black/African American	4
Give lectures	9			Prefer not to say	3
I do not know	9			American Indian/Alaska Native	0
				Native Hawaiian/Pacific Islander	0

Due to the nature of the survey questions, which could expose instructor vulnerabilities, we made the decision to keep survey responses anonymous. Since the survey used a retrospective-pre design, it was not necessary to track individual responses. However, the anonymity of the survey responses prevented us from being able to directly compare individual definitions of inclusive teaching. Instead, we compared the aggregated themes and sentiments that emerged from these

definitions prior to orientation and immediately following orientation. We believed this was a necessary and important trade-off for protecting the comfort of the student instructors, and to increase the chances for honest responses. Survey data was analyzed using descriptive statistics. Inclusive teaching definitions were scored on two categories: a nuance score and a role score, which will be described under the results section.

While this outcomes-based assessment better informs our research, it was still important to maintain the satisfaction-based evaluations to inform future logistical planning. We have recently shifted to including outcomes-based questions on this evaluation (see Appendix B), focusing on the key goals of the orientation. One of those key goals includes promoting equity and inclusion in the classroom. Therefore, in addition to the inclusive teaching survey previously described, we collected an additional set of data on how GSIs’ self-reported their perceived change in capacity to promote equity and inclusion in the classroom.

While the survey provided primarily quantitative data regarding instructors’ confidence in their ability to perform inclusive teaching practices, and the inclusive teaching definitions provided a small window into understanding how the instructors conceptualize inclusive teaching, we hoped to get a richer understanding of how these instructors describe their teaching experience, particularly with regard to inclusive teaching behaviors. We accomplished this by conducting three sets of focus groups (see Appendix C for protocol) and one interview with first-term engineering graduate student instructors. Focus groups were about 45 minutes long, and were conducted during the last 5 weeks of the academic term. The demographics of the focus group participants are described in Table 3. Audio recordings of the focus groups were transcribed, and the transcriptions were analyzed with *a priori* coding [14] based on the focus group questions as well as the findings from the pilot study [4], although additional codes were also allowed to emerge.

Table 3: Demographics of Focus Group Participants

Department	#	Gender	#
Mechanical	4	Female	2
Material	3	Male	8
Computer	2		
Electrical	1		

Results of the assessment

For this study we took a mixed methods three-phase approach. The first phase was to collect retrospective pre-survey responses immediately following the orientation. The second phase was to collect instructors’ definitions of “inclusive teaching” prior to orientation and immediately

following the orientation. The third phase was to conduct focus groups at the end of the academic term. The goal of the survey and the definitions was to measure the influence of orientation on new instructors' understanding and confidence toward inclusive teaching practices. The goal of the focus group was to more deeply understand how inclusive teaching attitudes, practices, or behaviors emerge after instructors have experienced a semester of teaching. The findings of each of these phases are discussed below.

Survey Findings

To inform future program planning, a standard satisfaction-based evaluation was conducted, as is normally done, as previously described. This evaluation asks new GSIs to rate their satisfaction for the different orientation sessions, but also asked outcomes-based questions on GSIs' perceived change in capacity on the items on a 4-point scale (1=decreased; 2=stayed the same; 3=improved slightly; 4=improved significantly) shown in Table 4. For the session on inclusive teaching, it was rated a 4.5 out of 5.0 on a Likert scale. Notably, the item referring to promoting equity and inclusion in my teaching practice was the item which GSIs rated the highest perceived change in capacity.

Table 4: Mean Ratings on Standard Orientation Evaluation. Of particular interest is the item on inclusive teaching (*italicized*).

Item	Mean Rating
Describe in general terms how people learn	3.12
Outline the roles and responsibilities of student instructors	3.25
Recognize elements of effective planning for lessons and/or office hours	3.29
Apply research-based instructional strategies in my teaching practice	3.03
<i>Promote equity and inclusion in my teaching practice</i>	<i>3.31</i>
Refer to useful resources and university policies relevant to my role as an GSI	3.25

This perception was also reflected in our outcomes-based assessment (see Appendix A). Generally, first-time engineering GSIs rated themselves as confident in their ability to perform inclusive teaching practices, as shown in table 5. Survey respondents could select a rating retrospectively reflecting on their changed confidence following orientation. They could choose a rating ranging from 1-5 for the items listed in Table 5, 1 indicating “much less confident” and 5 indicating “much more confident”. Respondents could also choose “Does not apply to my assigned role”, recognizing that some items might not be relevant for those who might only grade, for instance. The reported means below do not include those who selected this choice.

All items aggregated, the mean rating was 3.89, which would nearly equate to our indicated rating of “more confident”. The item with the lowest confidence rating was “Stay current in my knowledge of the subject I am teaching”, which had a mean rating of 3.66. “Appropriately grading my students’ exams/assignments” also had a relatively lower rating at 3.74. The three items with the highest ratings included “Create a positive climate for learning” (4.18), “Think of my students as active learners” (4.15), “Clearly identify the course objectives” (4.11).

The survey additionally asked three questions with regard to how often new instructors expected to employ specific inclusive teaching practices. Survey respondents could select a rating ranging from 1-5 for the items listed in Table 6, 1 indicating “Never” and 5 indicating “Always”. Again, respondents could choose “Does not apply to my assigned role”. The reported means below do not include those who selected this choice.

Table 5: Mean Ratings on Inclusive Teaching Survey.

Survey Items	Mean
Create a positive climate for learning	4.18
Think of my students as active learners	4.15
Clearly identify the course objectives	4.11
Encourage my students to ask questions in class	4.00
Promote a positive attitude toward learning in my students	3.93
Encourage the students to interact with each other	3.93
Actively engage my students in the learning activities that are included in the teaching plans/syllabus	3.90
Promote student participation in my class	3.89
Spend the time necessary to plan my classes	3.83
Appropriately grade my students’ exams/assignments	3.74
Stay current in my knowledge of the subject I am teaching	3.66
All Items Aggregated	3.89

Generally, most first-time GSIs expected to employ the three inclusive teaching practices somewhat regularly. When asked if the orientation experience influenced their responses to these items, 91% of respondents indicated that the orientation did influence their responses. The first statement, “Try to learn about student characteristics in order to improve class instruction”, had the lowest rating (3.38). Interestingly, the histogram for this item is bimodal, with the majority of responses landing either under “Sometimes” or “Most of the time”. Responses to the other two

items followed a skewed right bell curve, with most responses landing under “Most of the time” (Figure 2). The means for these items are reported in table 6. For the third item, “Vary teaching methods to encourage the active participants of all students”, had the most respondents (8%) indicating that this was not part of their assigned role.

Table 6: Mean ratings to the three items regarding inclusive teaching practices expectations.

Statement	Mean
Try to learn about student characteristics in order to improve class instruction	3.38
Evaluate student learning using multiple techniques	3.60
Vary teaching methods to encourage the active participation of all students	3.64

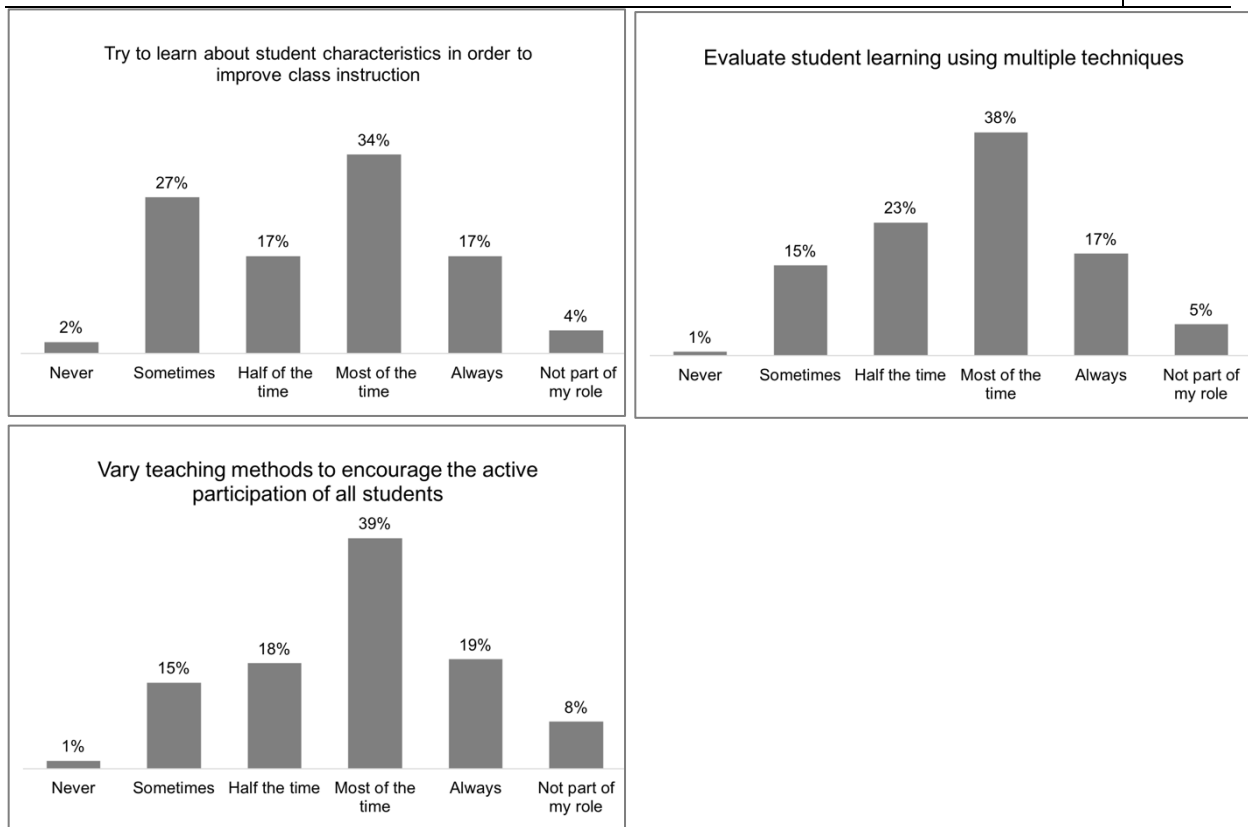


Figure 2: Histograms of the responses to the three items regarding inclusive teaching practices expectations.

Inclusive Teaching Definitions

As previously described, the inclusive teaching definitions were given two scores: a nuance score and a role score. The nuance score was a 3-point score of the level of nuance in the definition (3=nuanced; 2=some nuance; 1=little/no nuance). The role score was a 3-point score of the emphasis placed on the role student instructors have in creating inclusive classrooms (3=emphasized; 2=some emphasis; 1=little/no emphasis). Specifically, we were looking for the

same elements that are emphasized in our definition, shown above: emphasis on the deliberate role that instructors play, the importance of attending to student identities, and the fact that systemic inequities (e.g., sexism, racism, ableism) still exist and create barriers to student learning. (The latter two elements were lumped into the nuance score.) An example of a definition that scored high on both categories is:

Inclusive teaching involves creating a healthy learning environment in which each student is respected, engaged, heard and given a chance to contribute in spite of the cultural differences. Also it eliminates the stereotype threats, fosters a growth mindset, facilitate challenging conversations in the class and create assignments involving teamwork to ensure team building and leadership skills across a diverse group. An important aspect of inclusive teaching is the student feedback to assess 'inclusive teaching' to improve and ensure that the students and the instructors are on the same page.

This definition articulates the nuances pertaining to inclusive teaching, and addresses how an instructor plays a role in creating an inclusive classroom environment. An example of a definition that scored low on both categories is:

Inclusive teaching means teaching for all students, with different prior knowledge, background and different ideas etc.

This definition does not acknowledge any of the nuances of inclusive teaching, and does not address the role of the instructor in creating an inclusive classroom environment.

To be clear, these scores were used as a method to help organize and code a large collection of qualitative data. The scores were highly subjective, and the scoring system was not intended to serve as an assessment instrument to be validated. Rather, it was a useful exercise to help us understand and get a sense of the range of definitions provided by the new GSIs. Table 7 shows the mean scores for each category, prior to orientation (pre) and immediately following orientation (post). Generally, the scores were relatively low (means around 1.30), and the scores decreased slightly after the orientation, as shown in Figure 3 below. The majority of definitions (around 70%) scored low on both the nuance and role scores. The majority of definitions were similar to the low-score example above, simply defining inclusive teaching as teaching students with different “prior knowledge” or students with “different backgrounds”. Definitions tended to use passive language, not directly addressing the role instructors play in creating inclusive learning environments.

Table 7: Mean nuance and role scores, comparing inclusive teaching definitions before orientation and immediately following orientation.

	Nuance Score		Role Score	
	Pre	Post	Pre	Post
Mean	1.36	1.23	1.36	1.30

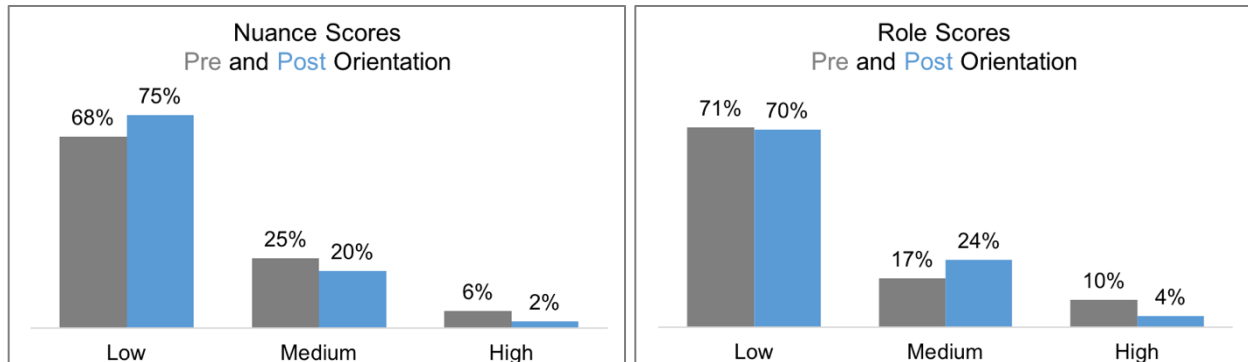


Figure 3: Comparison of nuance and role scores of inclusive teaching definitions before orientation and immediately following orientation.

Focus Group Findings

We also conducted focus groups with the goal of more deeply understanding how first-time engineering graduate student instructors experience, practice, and conceptualize inclusive teaching. Transcripts of the focus groups were *a priori* coded, using codes based on the questions asked and on findings from the pilot study [4]. As shown in Figure 4, the most common themes that emerged from the focus groups included “Inclusive teaching”, “Challenges”, “Resources”, “Orientation preparation”, and “Confidence”. This is likely because we directly asked questions regarding the instructors’ perceptions of inclusive teaching, challenges they had faced as an instructor, and the resources and preparation from orientation that they found to be helpful as new instructors. The focus group protocol is on Appendix C. While other codes not included in Figure 4 also emerged, we will limit our discussion to focus on these specific themes.

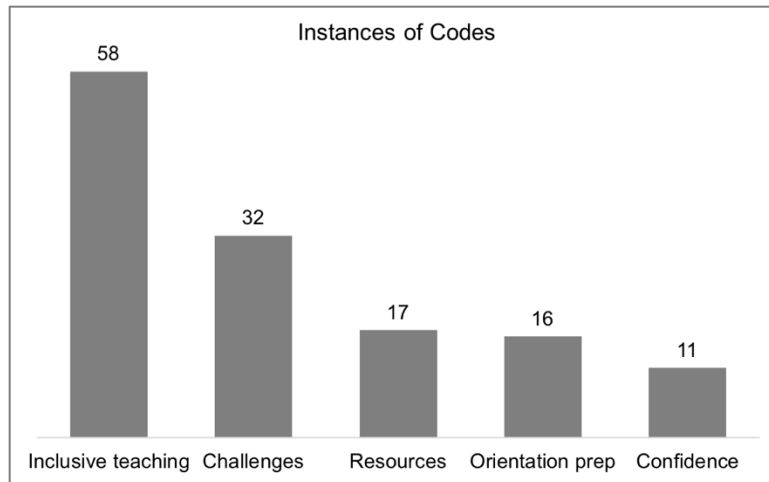


Figure 4: Number of instances that specific codes were identified in the focus group data.

Within the “Inclusive teaching” code were 8 subcodes that emerged from the data. The following Table 8 lists those 8 subcodes, what they indicate, and a sample quote from the focus group data. To provide some contextual background, all of the sample quotes come from GSI responses to questions directly asking about what inclusive teaching means, what roles GSIs play in creating inclusive learning environments, or what inclusive teaching practices strategies or challenges the GSIs experienced.

Looking at the other common themes from the focus groups, general challenges of a first-time GSI came up often. Many of the challenges that emerged are common teaching challenges, such as getting students to participate in class, dealing with teaching workloads, having students who are also friends or peers, and dealing with struggling students. These general challenges sometimes intersected with the theme of inclusive teaching. For example, the following quote was from a response to a question about general teaching challenges, before the question of inclusive teaching was brought up:

There’s been a student who was not feeling very confident in herself. She’s coming in a new country, new experience, pretty overwhelmed. At the end of each recitation section, she’ll come to me with a list of questions. It’ll take, usually, sometimes up to two hours. Recitation ends at 7:30 p.m. I’m pushing into 9:30, working with this one person. This is every week. I’m exhausted at the end of that. I can’t do my work at the end of that. At the same time, I want to make sure that she can succeed. Trying to strike that balance between my own well-being and making sure the students that come to me feel like they have the resources that they need.

Inquiring about resources, the most commonly referenced resource was peer instructors--as similar theme that emerged in our pilot study [4]. This theme intersected with our questions relating to how the orientation was helpful for preparing new instructors, for example:

...getting connected with other GSIs. I actually enjoyed the meal time where we got to talk to each other and you get to see all the other GSIs.

Supporting data from the satisfaction program evaluations described earlier, other memorable elements of the orientation brought up by the focus group participants included the session on how to grade, the inclusive teaching theater performance, and the Practice Teaching session.

Teaching on a board in front of students is different than just me at my desk writing down whatever on a piece of paper. That was an awesome resource, to be able to practice teaching in front of the other GSIs.

Table 8: Inclusive teaching sub-codes.

Subcode	Explanation	Sample quote
GSI role	The role graduate student instructors have in creating an inclusive learning environment	“I think it’s something that does really affect— especially with the class with undergrads in it. Professors can often have a lot of distance between the student experience and what they’re going about their lives doing. Being able to show students that you have a pulse on what’s going on with them is valuable.”
Engaging Students	A common conceptualization by student instructors of an inclusive teaching practice	“I tried to bring in more of an active learning component into it, more of a, “Here’s this problem. Why don’t you go take 5-10 minutes and try and solve this problem in small groups and come back to me?” That helped, actually. You could see the energy of the class dropping down on it and then perk back up after.”
Being accessible	A common conceptualization by student instructors of an inclusive teaching practice	“...when I catch myself stopping a certain behavior because I say to myself, “I need to be more inclusive.” It’s almost always because I want to give each of my students equal attention.”
Strategies	Strategies for teaching inclusively	“One thing that I thought was really helpful that I didn’t know about until the instructor for my course told me is that with [faculty/staff online portal], you can get photo rosters for your class, so by the end of week two, I had memorized all my students’ names, and that really helped me make an individual connection with them.”
Challenges	Challenges related to teaching inclusively	“Naturally, I think to myself, did I help to facilitate this kind of behavior. I don’t know, but it’s possible. It made me really think about how I treat the students. If I think something is a little bit funny, maybe they don’t see it that way, so I try to be more sensitive now.”
Relationships with students	The unexpected positive interactions and investments student instructors developed towards their students	“...they come to office hours with more than just class material questions. One student who’s a junior asked many more questions about career as an engineer than actual class material. I think she was looking for more

Subcode	Explanation	Sample quote
		than just—she was looking for a mentor as well—those unspoken needs that different people in different walks of life have different needs, and that’s something that I didn’t expect.”
Working with students	A common conceptualization by student instructors of an inclusive teaching practice	“whenever I am part of the classroom environment, it’s making it inclusive and encouraging students and working with students.”
Tangential	Responses to a question directly asking about inclusive teaching which were naive and tangential conceptualizations of inclusive teaching	“I was surprised by how different everyone’s learning style is, and how people care about classes differently.”

Another commonly referenced general resource was midterm feedback sessions, which is a service provided by graduate student staff at the CTL and is an option for ongoing professional development. For example, one of the focus group participants described their feedback session, and concluded the following:

Overall, I think that was really effective for me. We have still one more lab pending, so I’m looking forward to implementing those changes in the lab.

We also asked the focus group participants to reflect on our survey findings described earlier. All of the participants were not surprised that there was generally high confidence, and they all described feeling either similarly or even more confident now that they have had one semester’s worth of experience.

I feel much more confident now. That probably comes from experience. I had to go through the process of seeing that—when I gave a lecture, oh, this is the material I’m supposed to cover today, so I had to plan out how I’m going to cover that, so the next time I have to do that, I’ll be a little better.

Discussion of the assessment

As our program evaluation data indicated, our review of the first-time engineering GSIs’ satisfaction with the inclusive teaching session and their perceptions of their ability to promote equity and inclusion in their teaching practice after the orientation were quite favorable. Our survey responses agreed with this as well, in that the three items with the highest ratings included “Create a positive climate for learning” , “Think of my students as active learners”, and “Clearly identify the course objectives.” The first item offers a direct connection to inclusive teaching, while the second item is related to learner-centered instruction, which is an important principle within inclusive teaching. The item focusing on learning objectives in particular relates to the philosophy of transparent teaching, which is an inclusive teaching practice that has been shown to have notably positive effects on student learning [15, 16].

If we ended our assessment here, we might conclude that we might not need to do further refinements in our program or our assessment approach. However, upon analyzing the rest of the survey, definition, and focus group data, we notice some important items for consideration. For instance, one survey response associated with inclusive teaching, the ability to “Vary teaching methods to encourage the active participation of all students”, had the most “not part of my role” responses. The sentiment of lack of autonomy in course decisions was also mentioned during the focus groups. This reflects the limitation of the GSI role and may restrict what they can do to promote inclusion in their classes.

The analysis of the inclusive teaching definitions provided by GSIs demonstrated that many of the definitions did not have much nuance and the instructor role was not articulated. Further, the scores decreased slightly after the orientation. One possible reason for the decrease could be related to survey fatigue. The GSIs hand wrote their definitions of inclusive teaching after a long day at orientation and while also filling out the survey and orientation evaluations. Some GSI’s left this question blank (the response rate for this question was 85% versus a 95% overall response rate), while a few others wrote "We already answered this question." All of the responses were also much shorter (fewer sentences and words) than the responses on the pre-survey. This suggests that we might want to consider an alternative question at the end of the orientation or perhaps leverage the focus groups to ascertain whether the GSIs adopted this perspective upon gaining additional experience in the classroom. However, we cannot negate the possibility that a one-day exposure to these concepts, even though they were repeated throughout the day during concurrent sessions, might not have been enough to dispel less complex conceptions of inclusive teaching that the attendees may have brought with them to the orientation. This notion is supported in the educational development literature in that short workshops have a lesser impact on the instructor’s behavior change as compared to workshops that occur for a longer duration (or for multiple sessions) [17, 18].

Several of the focus group comments show that the first-time engineering GSIs have a greater awareness about inclusive teaching principles and the potential to reflect about their teaching choices. In addition, GSIs are using inclusive practices even though they are not calling it that. This may suggest that there is still a disconnect within the GSIs’ mental model of inclusive teaching practices. The GSIs maintain a superficial conceptualization of inclusive teaching (e.g., working with students, engaging with students), but do not articulate deeper understanding of the nuanced elements of inclusive teaching (i.e. attending to social identities and systemic inequities). Additionally, many GSIs maintain the notion of students having different “learning styles” as an element of inclusive teaching. Although this conceptualizing of inclusive teaching encourages new GSIs to mindfully plan their teaching, it is an inaccurate and unfounded concept [19].

As is often the case with qualitative data, one limitation of the focus group data is that it is only representative of the 10 GSIs who self-selected to be interviewed. However, paired with the more representative survey data, the focus group data provided a richer analysis of the GSI experience. Another limitation of the focus group data, is that we did not specifically ask them to define inclusive teaching, which is what we did during our pilot study [4]. Given the potential for survey fatigue, we may want to ask this question during the focus group or be more concrete regarding specific inclusive teaching behaviors we wanted the first-time instructors to reflect upon.

Conclusions and Future work

Our assessment approach helped us identify that GSIs generally feel confident in terms of their ability to teach inclusively after training. Additionally, we were able to get a sense of how GSIs conceptualize inclusive teaching at different stages of their first teaching experience (before orientation, after orientation, and at the end of the academic term). However, there appears to be a disconnect between GSIs relatively high confidence to teach inclusively and the ways GSIs articulate what inclusive teaching means to them. Questions remain on what specific challenges are GSIs confronted with related to inclusive teaching, and how GSIs approach specific inclusive teaching practices.

In light of these remaining questions, next steps for our assessment will be to focus away from definitions of inclusive teaching, to instead asking GSIs to name specific inclusive teaching behaviors. We plan to specifically ask about inclusive teaching strategies (e.g., “Have you used any of these strategies? Can you give an example?”). Additionally, we will address the issue of survey fatigue, in an effort to collect more meaningful data in a less intrusive manner. Given that our remaining questions are more specifically focused on practiced behaviors of GSIs, we will focus more intentionally on collecting data towards the last third of the academic term, after the GSIs have had some teaching experience.

Our results also suggest more improvements to our GSI training. We will continue integrating the principles of inclusive teaching and the science of learning throughout our orientation, and providing more specific examples to help student-instructors apply these ideas to their teaching practice. For example, participants will be asked explicitly to consider inclusion during practice teaching, both in the assignment and in the feedback forms. In our inclusive teaching session, we can be more intentional about confronting naive conceptions about inclusive teaching (e.g. that it is just about “learning styles”). However, a deeper learning of what it means to teach inclusively may require more time and deliberate practice. In this case, we need to examine our ongoing professional development and perhaps include more specific follow ups about inclusive teaching during the term. These may be in the form of short electronic messages, in the form of learning communities led by GSI teaching consultants, or both.

Some GSIs are already using inclusive teaching strategies without calling them that. While all good teaching should be inclusive, it is important to name inclusive strategies as such to make them salient. Our goal for instructors and future faculty is for them to be intentionally inclusive and reflective.

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Teaching Approach

The following questions are related to your teaching style and approach.

How often do you expect to do the following in your course section?

	Never	Sometimes	About half of the time	Most of the time	Always	Never, because of my assigned role
Try to learn about student characteristics in order to improve class instruction.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Evaluate student learning using multiple techniques.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vary your teaching methods to encourage the active participation of all students.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Did today's teaching orientation influence how you answered above statements?	Yes <input type="radio"/>	No <input type="radio"/>
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Please explain:

Inclusive Teaching

In your own words, how do you define 'inclusive teaching'?

Appendix B: Outcomes-Based Evaluation

For each item in the table, please check the box that corresponds to your answer to the following question.

As a result of the teaching orientation, how much did your capacity to do the following change?

(Check one response per row.)

	Decreased*	Stayed the same	Improved slightly	Improved significantly
Describe in general terms how people learn.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Outline the roles and responsibilities of student-instructors.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Recognize elements of effective planning for lessons and/or office hours.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Apply research-based instructional strategies in my teaching practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Promote equity and inclusion in my teaching practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Refer to useful resources and university policies relevant to my role as an IA/GSI.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Decreased means – “I am more confused about this topic now than before orientation”*

What aspects of this orientation did you find most useful?

Do you have any suggestions for how we could make this orientation more useful?

Additional comments and suggestions:

Appendix C: Focus Group Protocol

Introduction

Welcome and thank you for agreeing to participate. The purpose of this project is to gain a better understanding of the professional development needs of student instructors, especially as it relates to issues of diversity, equity, and inclusion (DEI) in the STEM context. Our intent is to improve our services to the GSI/IA population in the CoE.

[Pass out consent forms to be signed, and describe focus group process and terms of consent. Ask if anyone has any questions or concerns before getting started.]

Questions

1. Please describe your main responsibilities/roles as an instructor?
 - a. What have you learned, that you did not expect, about being a GSI/IA?

2. During orientation, you completed a survey that asked about your confidence in your ability to do certain teaching practice [refer to handout]. Generally, the majority of respondents said that they felt more confident following orientation. Has your confidence changed since orientation?
 - a. If so, how?
 - b. Can you describe the specific areas in which your confidence has changed?
 - i. Have copy of survey available as a reference to the questions asked.

3. Many of these items on the survey relate to best practices for inclusive teaching. How many of you remember hearing about the University's and College's support for diversity, equity, and inclusion during your GSI/IA orientation?
 - a. [Show of hands-*Be sure to state the total number of hands raised for the transcript*]
Note: Share the *values statement* with the participants.
 - b. Given this support of diversity, equity, and inclusion, we wanted to ask you some questions about how this translates or relates to your experiences as a GSI/IA.
 - i. What does teaching in a way that supports diversity, equity, and inclusion mean to you?
 - ii. What is the GSI/IA's role, if any, to help promote an inclusive learning environment (Which we define as: shape classroom dynamics, students experiences in classes, and influence discussion/lab section, course design and/or curriculum design)?
 - iii. Have you been able to use inclusive teaching strategies in your teaching? If so, how? (Did you learn that at orientation?)
 - iv. Are there any particular challenges around inclusive teaching that tripped you up - how did you respond?
 - v. How effectively did the teaching orientation prepare you for teaching inclusively? What else would have helped you?

4. Now we're going to shift gears a bit, to focus more specifically on what you might be learning through your role as a GSI/IA. A lot of teachers experience that they have a deeper understanding of a

topic after teaching it. Do you feel as though you better understand the content of your course, as a result of teaching it? Please elaborate.

- a. So, you can better understand certain topics you teach, and you can also develop other skills for professional success. Do you feel as though you have developed any of these skills through your GSI/IA experience? *[refer to handout]*
5. To finish up our discussion, we'd like to learn more about what has helped you in your role as a GSI/IA. What resources have you used, or do you wish were available, to support your role as GSI/IA? This can be specific to teaching inclusively, but can also be about supporting your role as GSI/IA more generally.
- a. (If they don't bring up orientation) I didn't hear anyone mention the orientation at the beginning of the semester. Did anyone find that particularly helpful, and if not, what might have helped it to be more helpful?
 - b. We are considering having pedagogical resources online, potentially shifting the focus of in-person orientation to be more practice or application-based. Do you think this would be a helpful approach?

[Thank participants for their time and willingness to share their perspectives.]