

Theatre in Engineering Classes: An Interdisciplinary Approach to Address Bias in Student Engineering Teams

Paul Kritschgau
Morgantown, WV, USA
paul.kritschgau@gmail.com

Irene Alby
School of Theatre and Dance
West Virginia University
Morgantown, WV, USA
irene.alby@mail.wvu.edu

Rebecca Brown Adelman
Affinity Arts Consulting
Colorado/New York, USA
rebecca@affinityartsconsulting.com

Robin Hensel
Statler College of Engineering
and Mineral Resources
West Virginia University
Morgantown, WV, USA
robin.hensel@mail.wvu.edu
<https://orcid.org/0000-0003-1858-645>

Kristin Brewster
Statler College of Engineering
and Mineral Resources
West Virginia University
Morgantown, WV, USA
kristin.brewster@mail.wvu.edu

Susie A. Huggins
Statler College Fundamentals
of Engineering
West Virginia University
Morgantown, WV, USA
susie.huggins@mail.wvu.edu

Karen Rambo-Hernandez*
Teaching Learning and Culture &
Educational Psychology
Texas A&M University
College Stations, TX, USA
rambohernandez@tamu.edu
<https://orcid.org/0000-0001-8107-2898>

Abstract— This full paper describes an innovative approach to teaching professional skills in engineering classrooms using the medium of theatre. Professional skills are not frequently or explicitly taught in engineering classrooms, especially those that are addressing issues of bias or discrimination. We provide two examples of how our interdisciplinary team implemented in-person theatre scenes and virtual interactive theatre scenes to directly address gender discrimination and bias in engineering teams. In both settings, engineering students first watched student actors perform a scene of a highly dysfunctional team. Two trained facilitators then helped the student audience identify and address the dysfunction. In the in-person scenes, engineering students were invited to join the scene as an additional team member to try to redirect or to directly address the conflict as the actors replayed the scene. After the scene, the facilitators asked the rest of the students to identify what they liked about the approach. In the virtual performances (enacted due to COVID interruptions), the engineering students asked questions of the actors to understand and resolve the underlying issues. In both settings, the facilitators end by debriefing the activity with the engineering students. To adapt to the virtual setting, we modified the script so that the students were working as a team in a virtual setting (e.g., a zoom meeting) and added an additional facilitator role to manage the online platform. In both formats, the students attended, observed, participated, and brainstormed effective ways of collaborating and communicating with their peers. The online version has been easier to implement and is able to host more students. Thus, we have continued to use this format even though classes are now fully in-person. In this paper, we walk through the roles of each of our interdisciplinary team leads, the nature of the facilitator training, and the details of implementing this training. Further, we describe the evolution from conception to institutionalization of these efforts into the first-year engineering experience. Finally, the interdisciplinary team from the participating universities share

lessons learned and practical tips on how to initiate similar efforts at other universities.

Keywords—Active Learning, virtual teamwork, engineering, bias, gender discrimination, professional skills, theater, theatre

I. INTRODUCTION

Despite earning more than half of the total bachelor degrees awarded [1], those who identify as women are underrepresented in undergraduate engineering majors and in the engineering workforce [2]. Those who identify as women make up about 20% of the undergraduate engineering majors [3] and only 16% of the engineering workforce [4]. Perhaps even more problematic, those who identify as women consistently drop out of the engineering workforce at higher rates than those who identify as men [5]. Some have attributed the lack of representation and persistence by women to problems with discrimination or sexual harassment [6] as well as a lack of organization support [7]. Further, engineering programs are built around teaching technical skills and often fail to deliberately incorporate the professional skills, such as teamwork, into the curriculum [8]. To this end, we applied for and were funded by NSF to address this (and other) issues in engineering classrooms, which were further extended to computer science classrooms, by integrating course-based activities at four institutions.

In this paper, we describe one of the interdisciplinary activities with two types of implementation — a teaching innovation that directly addresses the engineering culture and helps promote engineering students' ability to address problematic behavior in engineering teams, particularly as they

are related to women. We intentionally elected to work with first-year students. Most engineering programs include capstone courses during the student's senior year. In these courses, teamwork is explicitly addressed. We argue this is much too late to explicitly address effect behavior in teams.

II. ENGINEERING SCENE

A. Introduction to the Technique

Professional skills such as collaboration and working together are essential components to being on a team. However, such skills are not frequently or explicitly taught in engineering classrooms, especially those that are addressing issues of bias or discrimination. Through consultation with Affinity Arts Consulting, we created a live intervention using an interactive theatre scene which was adapted from Augusto Boal's "Forum Theatre" [10] approach. This approach provides an opportunity for engineering teams to experience real world situations in a highly facilitated environment in order to explore opportunities to learn and build skills.

In this method, a staged scene is presented which poses an issue or problem that is not resolved. The audience watches the situation unfold and then brainstorms solutions. Then, an audience member is invited onstage by a facilitator to practice a skill and works to change the outcome of one of the challenging moments in the scene. The rest of the audience witnesses the event unfold spontaneously, having the opportunity to analyze, elaborate, and potentially explore another skill as well.

The theatre scene itself is approximately 10 minutes in length with gender, group dynamics, and leadership at play within it. The theatre scene involves three characters and an empty chair. The "empty chair" is the fourth participant in the study group and participants are told to imagine they are sitting in the empty chair as they watch the short performance. The concept of the "empty chair" is not new (it stems originally from Gestalt Therapy and is also used in Psychodrama), however, the integration into the interactive theatre scene was an innovation created by [redacted for blind review]. Based on Augusto Boal's Forum Theatre technique [11], the Empty Chair enables participants to join a scene as themselves, with their own personal identities influenced by Boal's Forum Theatre approach.

Our prior work [9,10] has demonstrated that the technique helps student recognize their own biases and generate ways to work more effectively in teams. However, with the onset of COVID-19 we had to pivot from in-person sketches to virtual sketches and discussions. In this paper, we describe the two formats and adjustments we made to conduct the sketches virtually. Because we have previously illustrated the benefits of this technique [9,10], we focus this paper on the feasibility of moving to a virtual format.

B. Description of In-person Scene

Each session follows a similar trajectory: a group warm-up, the performance by three actors, an interactive "problem-

solving" component with actors and audiences, a moment where the characters are taken out of role, and a discussion and conclusion. All components are led by the facilitators.

Expectations are also set. Given that this is a highly interactive experience and sometimes with large groups, it is important that facilitators set some group guidelines. A helpful and empowering approach is to let participants know that they already have the ability and skills to create effective and inclusive teams. Participants are then asked to show their best selves in this process so that the learning can happen within the community.

The audience warm-up involves undertaking a physical task, led by the facilitators, that engages all participants in an activity that is tricky and challenging to accomplish. Some examples include: "XO" [11] and "The Thumb Grab" [12]. Both are simple activities that begin with resistance from the group and end with laughter. Facilitators encourage participants to move from thinking intellectually, to being more connected to their bodies. Facilitators also enforce the notion that "our task ahead will not be an easy fix, but that we are all in this together, and will collaborate as a group." Finally, both activities encourage participants to let down their boundaries, allowing themselves to be silly and to participate in activities outside of their respective habitual comfort zones. Through the warm-up, one of the most important expectations can be addressed which is that everyone participated in the warm-up. The facilitators specify that is all that is being asked of participants throughout the process: to be engaged, whether interacting or listening, and to do the best you can. These expectations are significant and are reinforced throughout the experience, especially when interventions occur and there is perhaps the desire or participants to "perform" for their peers and to get a laugh.

The audience is then introduced to the theatre portion of the training. The theatre scene entitled "Here She Goes Again" was created by [redacted for blind review] through work with female-identifying engineers and is based on the many stories and experiences they shared. Some common threads of these anecdotes included being continually interrupted and having something they proposed repeated by a male-identifying member and then credited to that person. Additionally, many described an unforgiving environment in which they felt unable to make mistakes. The scene, which was written, tested out in live interventions, and then edited through several iterations over time, consistently had a strong impact on viewers. In many cases, female-identifying participants stated (either during, or after the event) that they had experienced a similar situation.

The ten-minute theatre scene "Here She Goes Again" includes two male-presenting characters (Ben and Jason), and one female-presenting character (Cilia) who are part of a study team. The three meet to work on a homework assignment, but the meeting goes wrong due to Ben's aggressive and misogynistic behavior. Moreover, the group did not do well with a previous assignment due to a common error that Cilia is

blamed for despite the assignment being a group project. After various tense moments, Cilia finally confronts Ben's behavior towards her. This leads to a confrontation which ends with Cilia leaving. Fig. 1 shows the in-person scene in a classroom.

The scene was created with purpose and all the characters have a backstory. The role that each character contributes to the group dynamics is important. There is one male identifying character who is the instigator (Ben), there is another male identifying character who is a potential ally (Jason) and then there is a female identifying character (Cilia) who is being repeatedly shut down during the scene. The creation of the characters are purposeful, intentional, dimensional and relatable. For example, Ben's story is that he is pressured to be in engineering and excel in engineering even though it is not necessarily a discipline he wants to study. Cilia is not only



Fig. 1. In-person Scene in classroom setting.

experiencing the challenges of this study group but also of being the female identified person in the sciences without a lot of adequate support at an institutional level. The character Cilia is bringing in a cumulative impact to the situation. Jason's character is caught in the middle. He is caught off guard by Ben's intensity and wants to help Cilia. Jason is also a character that can support the efforts of participant's interventions.

The audience is purposely left in a state of unease and discomfort. The facilitators, then, nudge the audience to discuss how they feel and how they might have reacted had they been sitting in the Empty Chair as the fourth team member. Initially, audience responses to the characters and the situation are reactive around liking or not liking one or more of the characters. As a means to encourage empathy for the individual characters, facilitators guide the audience to explore what more might be happening for the characters within this situation. The facilitators lead the audience to realize that the situation cannot be just one character's fault or issue, but the issues need to be addressed from a team building perspective.

The facilitators urge the audience to further discuss with the people sitting near them and come up with three strategies regarding how they might have dealt with a similar situation. This exercise allows the participants to delve deeper

into the stories of the characters beyond the behaviors they witnessed and explore possibilities for an intervention to present to the larger group. Once the audience is ready, the facilitators move on to the next, and largest portion of the event: They surprise the audience by informing them that they will have the opportunity to come onstage and try out their strategies. The scene is presented again, with the audience participant or "*spect-actor*" (coined by Augusto Boal [10]) given the power to stop action, fast forward action and/or rewind action to any section they wish, in order to come on stage and try out an intervention for their chosen portion of the scene. Each intervention is then briefly discussed and cheered on by the audience. This section of the evening can often last 30 minutes or longer, with 8-10 interventions. The idea is to have as many interventions explored as possible with an emphasis on there not being one answer but a multitude of possibilities. Furthermore, audiences are prompted to give appreciations for what they just witnessed after each intervention. This takes the group out of a critical analysis and brings them more into a collaborative exploration of what could work in a potential situation. It is important that each session ends with participants feeling empowered and activated to make change.

The actors are trained to stay in character, but also to help stir up some of the issues if the audience is not picking up on them. For example, the character of Jason, who finds himself in a "bystander" role, is also the key person who can help diffuse Ben (if no one else is able to do so.) The actor is trained to show reluctance in taking sides. However, if there is no progression on the issues during an intervention, he can bring the scene back on track in many ways. For example: a) he can acknowledge his discomfort with some of the things that Ben said and did; b) he can encourage the group to get back to the homework assignment; and c) He can show support for Cilia. Since the character of Ben cares how he is seen by Jason, this can lead Ben to back down, at least partially. This engagement allows the audience participant to feel successful in their intervention, even if they were not able to fully solve the situation at hand.

Because the actors playing Ben, Jason, and Cilia are trained to strike a fine balance between staying believable in their reactions to the spect-actors' interventions while allowing those same participants to have some success, a large component of the rehearsal process between the theatre director and actors is spent, not just working on the written scene, but also on practicing the improvisational component of the work. The goal is to keep the stakes high: If the scene is too easy to fix, it doesn't feel like a real situation; however, if it feels impossible, some audiences will feel discouraged. Furthermore, the intervention segment from participants is a time when actors are both their characters and themselves. The actors are coached to be mindful during interventions as it is not easy to get up in front of peers in this way. If someone is very nervous, the actors need to take that into consideration in how they respond. If a participant comes into the scene sharing emotion, that also needs to be taken into consideration. Essentially, once

participants enter into the scene to try and improve the outcome, actors are coached to understand that the participant is now the main focus. All of this emphasizes the importance of expertly trained facilitators and theatre directors/coaches, who, from the casting process to performance, need to be tuned into all the nuances of the event. For instance, from a director's point of view, Ben's aggressiveness is an important consideration in the casting process. In many situations, given the time factor of the sessions, we might opt not to cast Ben as a person of color, whereas we would do so for Jason and Cilia.

From a facilitator's perspective, there are other considerations. When is it important to resolve the scene fully, and when is it okay to leave certain questions unanswered? At times, it can be effective for audiences participating on different days to have different outcomes. An unresolved scene can engage audiences in continuing to discuss, try, or rethink the events over and over again as they explore their own solutions during the event. Thus, the facilitator's job is to help the spect-actors work through their attempted interventions so that the experience feels like a group brainstorm and no one feels that they have failed.

While every actor performs the role slightly differently, we have discovered that there are some effect skills in communicating with Ben. These include: a) Direct questions and/or confrontation. When Ben's words and actions are directly repeated back to him, he tends to realize that he went too far; b) The empowering of Cilia by including her or taking her side to even the balance; c) Bringing the focus back to the work; d) Empathy. Sometimes, when audiences, facilitators, or even Jason actually reach out to help Ben in the guise that "we know you aren't usually like this, so what's going on?" this can help Ben become more open and vulnerable. (This action works particularly well during the live "Forum Theatre" intervention); e) Cilia's reactions. While Cilia's reactions tend to trigger Ben, her emotions can sometimes impact Jason (and thus, the audience). If Jason begins to feel bad after seeing Cilia so upset, Ben may begin to back down. Like Jason, Cilia can also call out Ben's sexism if neither the audience nor the facilitators bring it up. While this will not lead to an instant retreat from Ben, it can help open up the discussion for facilitators and audience to focus on this issue; f) Polls. In the digital "character interviewing" version, the addition of polls has been a great discovery (and will be elaborated upon further). It helps engage virtual audiences who may tend to hide in the background, by asking them direct questions and then showing the rankings. For example, polling the audience on whether they think Ben is sexist is very effective. Once the rankings come in, and Ben sees that more than 70% of the audience think that he is, he often realizes he has gone too far.

Once the interactive component comes to an end, actors are de-roled (a process by which they cast away their characters and introduce themselves to the audience) and then leave, so that the facilitators and audience can engage in a deeper discussion without their presence. It is now up to the facilitators to help the

audience process everything they have discovered over the events of the evening. Although brief (perhaps 5-10 minutes) this section of the evening where issues such as sexism, being a bystander, gender, racism and any other topics that came up may be discussed more at length. The facilitators and audience then brainstorm some tools that the audience can use if they find themselves in a similar situation in the future and the evening comes to a close.

C. Modification for Online Scene

A digital format provides challenges and opportunities. Some of the opportunities that were discovered include the following: a) Already trained and seasoned actors and facilitators with the project could still participate even if they had graduated, moved, or changed roles within or out of the university setting; b) The live digital format provides more opportunities for people to incorporate the session into a busy schedule and still have an engaging group learning experience; c) There is something also about the movie aspect of a live digital performance that enhances actors' expressions for participants to focus not only on what is said but can also see what they are experiencing non-verbally in the moment.

When the pandemic unfolded, we had to evolve to a digital model. Affinity Arts once again modified the scene and proposed a "character interview" or the question and answer technique [10]. In this iteration, the evening is once again presented to a (now digital) audience by two facilitators, who lead the discussion, react to the scene and engage them. However, in the digital format, the facilitators serve as an intermediary between the audience and actors, who do not speak to each other directly. Instead, upon watching the scene, the audience is invited to react through a Q & A (which is set up similarly to a chat). The actors stay on Zoom (as their characters) and the facilitators check in with them and ask them the questions proposed by the audience through the Q & A.

This arrangement allows for an improvised discussion that happens immediately after the scene ends. The questions and comments change with each production, which, accordingly, changes the trajectory of the discussion and keeps the spontaneity of the moment. The characters are still rattled and upset and react from how they feel in the moment. The facilitators are the ones responsible to help steer the conversation and tackle some of the issues within. Just as the spect-actors' interventions comprise the largest portion of the live Forum Theatre event, the Q & A is often the longest section of the virtual Character Interview event. In the latter, it is important that the characters do not speak directly to each other. They can listen and react physically to what the other characters are saying, but all discussion goes through the facilitators. In addition to voicing the audience's questions, the facilitators are tuned into the characters and react to them. For example, if Ben makes an offensive comment and Cilia rolls her eyes, the facilitator may reach out to her, noting that she appears upset by what Ben said and asking for her to explain.

D. Looking Behind the Scenes of the Online Scene

Here are some samples of the Online Scene and tools used for the in-person to online pivot. This format uses the Zoom Webinar platform.

Cast & Facilitator members (shown L-R, T-B):
 Cilia (student actor, target of aggression)
 Ben (student actor, aggressor)
 Facilitator 1 (from outside engineering- identifies as a man)
 Facilitator 2 (from inside engineering- identifies as a woman)
 Jason (student actor, bystander)

Fig. 2 shows the online scene during the unpacking by the facilitators with the student characters. We can see the spontaneity and body language that is presented to the audience. Next, we provide the closed captioned portion and transcript of the scene.

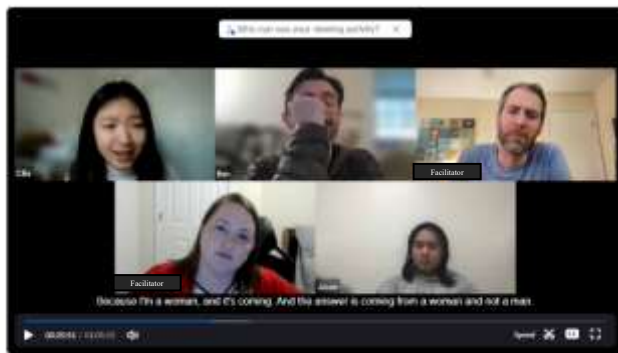


Fig. 2. This image captures the unique impact of the live event, as facilitators (top right, bottom left) unpack the content of the scene with the characters and contextualize the audience feedback (provided through the Q&A).

Audio Transcript:

Cilia: (closed caption) “Because I’m a woman, and it’s coming. And the answer is coming from a woman and not a man ...”

Cilia: “I feel like I’m being targeted like I have done nothing wrong like I just want to know why you have to be treated like this every single time?”

Facilitator 1: “Yeah.

Yeah. And and it’s, I think it important to note this this thing you just said about folks not listening to you, and I know from my perspective that was something that jumped out.

Lot seems like a lot of times you were. You were being interrupted. Maybe you. You said something like the correct ...”

Table 1 is an example of the timing sheet used by the zoom facilitator to keep the online production on track with the appropriate queues and timings. The facilitators focus on the audience and character interactions while the zoom facilitator focuses on the technology portion. The dynamics of the online scene in the virtual discussion stage become overwhelming for the facilitators to manage while staying focused on the training experience goals. At times, the zoom facilitator supports the entire process by following the facilitators’ lead, making sure the polls are ready and available to the audience, and clearing of the Q&A interface as needed and appropriate

to ensure the questions relevant to the current discussion are visible. The zoom facilitator also addresses any connectivity issues, attendance questions, or technical difficulties.

TABLE 1. ONLINE VERSION TIMING SHEET

Timing	Role	Action/Task
5:20 PM	Zoom Facilitator	Begin webinar practice mode; virtual background for curtain; enable Q&A, UpVote, Anonymous
5:30 PM	Actors, Actor Trainer, Facilitators	Join as panelists and co-hosts; audio & video check (centering, lights, size)
	Zoom Facilitator	Rename actors in zoom
5:35 PM	All	Dress rehearsal warmup begins
5:57 PM	Zoom Facilitator	Cameras & Mics off; virtual background for curtain displayed; begin broadcast for webinar; start recording; enable attendee chat to panelists
5:59 PM	Zoom Facilitator	Have one student post favorite color in Q&A then remaining attendees UpVote response to test Q&A
6:00 PM	Facilitators	Warm-up audience with X-Os
6:05 PM	Facilitators	Introduce “Here she goes again”; Actors on standby
6:06 PM	All	ZFac disable attendee chat; Fac camera/mic off; “ACTION” via chat; Actors appear Ben, Jason, Cilia
	Actors	Begin scene
6:12 PM	Actor Cilia	“Leaves” (camera off)
	Actors Ben, Jason	“Leave” (camera off)
	Facilitators	Camera & mic on; Begin to unpack what happened with audience feedback in Q&A with UpVoting similar responses, self check poll

	Facilitators	In chat and audio “Now it is your turn to ask our characters some questions using Q&A”
	Actors	Camera & mic on; Ben, Jason, Cilia
	Facilitators	“Just want to check in with our characters. How are you feeling?”
	Facilitators, Actors	Exchange to unpack scene
	Audience	Q&A - Answer live: read question/comment and direct to character as needed
	Actors	Answer questions in character
	Facilitators	Any discussion?; Rinse & repeat Q&A, response, discuss
	Facilitators	Use poll(s) to guide/solicit audience engagement allowing 15-30sec or 75% responses, share results live, discussion
	Actor: Jason	When it feels right, call out Ben on sexist remarks
6:40 PM	Actor: Cilia	Bring up SEXISM if not brought up by this point
	Facilitators	Use Sexist poll to unpack more
6:48 PM	Facilitators	Announce the introduction of the actors
	Actors	De-rolling and introduce themselves (60sec)
	Facilitators	To audience, "Raise Hand" to thank our actors for the performance
	Actors	“Leave” (camera & mic off)
	Facilitators	Use poll(s), Q&A, Discussion to support “lessons learned”
6:50 PM	Facilitators	share tools & engagement of bystanders by chat and audio; Title IX: https://diversity.wvu.edu/equity-assurance/title-ix Code of Ethics for Engineers: https://www.nspe.org/resources/ethics/code-ethics

		Carruth Center: https://carruth.wvu.edu/
	Facilitators	Wrap up the session; Take away “Do Something!” “I hear you, I see you, I am your ally”
	Zoom Facilitator	To audience, "Raise Hand" to thank our facilitators for their guidance
7:00 PM	Zoom Facilitator	Lock Webinar; ask audience to disconnect; boot as needed; stop recording
	Audience	Exit Survey
	All	After audience has exited, open discussion for team to reflect (very important)

Sample Q&A audience responses:

“Ben make sure you convert your units my man”

“That was really intense. I can relate to this in some ways”

“Why didn’t she correct them at the start? She let them get too far and it rolled downhill”

“Yo Jason, how you feel about them fighting like that?”

“Jason, you seemed uncomfortable with Ben instigating an argument, why didn't you step in?”

“Ben convert the units”

“Why are you deflecting when confronted about the situation Ben?”

“Jason the way you are stuttering makes you sound guilty.”

“Tell them Cilia, you are right”

Table 2 shows the online poll questions that Facilitators had at their disposal. These were used to stimulate audience discussion or guide the audience towards a point to unpack and reflect upon. The results of the polls were shown live so that audience could see how their perspective compared to their fellow engineering peers. The Exit Survey provided the training team with feedback from the audience on the impact of the event.

TABLE 2. ONLINE VERSION POLL QUESTIONS

Poll Title	Question	Responses
Students	- Have you been one of these students, which one? - Which character do you most identify with? - Which character do you least identify with? Who do you trust the most?	Cilia, Ben, Jason
Bystander	Have you been a bystander and watched a situation like this unfold?	Yes or No
Reactions	How will you react now to this type of scene?	- Directly address the conflict and the problem behavior - Create a distraction from the problem behavior - Delegate problem to someone else who can help - Talking with other classmates about the problem behavior - Walk away
Responsible	Which character is most responsible for the conflict?	Cilia, Ben, Jason
Sexist	- Do you think that what Ben said was sexist? - Do you think that Ben is a sexist person? - Do you think sexism is hurting the group's ability to work together?	Yes or No
Self Check	How did you feel while watching the scene?	Tense; Uncomfortable; Angry; Sad; Frustrated

Exit Survey	- How would you rate the performance? - How would you rate the facilitator feedback? - Was this event helpful to better handle situations like this?	5 - Excellent; 4 - Good; 3 - Fair; 2 - Poor; 1 - Very Poor
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E. Roles for Each Technique

Implementing the theatre scene in the first-year engineering curriculum required significant organizational effort to facilitate “buy-in” from several groups across campus, including from faculty, staff, and students from the engineering, theatre, and education departments and the office of Diversity, Equity, and Inclusion. Faculty from the three departments collaborated to plan the implementation, each addressing specific activities. Theatre students were recruited, trained, and coached for the performance; engineering faculty required Theatre scene attendance as part of the “Out of Class Experience” requirement for first-year engineering students and strongly encouraged students to attend; and the Education faculty member recruited and trained facilitators who guided student attendees through the experience. Specific concerns addressed included: finding a neutral space (not in an engineering or theatre-controlled building) where both the student actors and the engineering student audience participants felt safe for the live performances and identifying and training technical facilitators for the Zoom performances. Each performance was the result of effort from a team of individuals. The specific roles of each member are identified in Table 3.

TABLE 3. DESCRIPTION OF ROLES

Role	Description
Actor	Student actors who study theatre ($n = 3$)
Actor Trainer	Theatre Faculty member who identifies, invites, and trains the student actors as well as serves as the acting coach during the performance
Facilitator	Faculty or staff member who “warms up” the audience, sets the stage for the performance by explaining the scene and inviting students to view themselves sitting in the “empty chair” (in the live performance). The facilitator also engages students, provides insight and guides the discussion between performances and following the experience. If

	possible, we recommend at least one facilitator be a trained engineer ($n = 2$)
Facilitator Trainer	If the activity is going to be led by facilitators that are university faculty or staff, then those facilitators need training. The facilitator trainer literally trains the facilitators. Typically, these trainings need to occur every two to three years due to attrition, job changes, etc. This trainer needs to be skilled in leading groups in difficult discussions. We recommend additional expertise in issues of gender, conflict resolution, diversity, equity, and inclusion.
Attendees	Students taking first-year engineering courses who attend, participate in, and reflect upon the theatre scene experience
Attendance Recorder	Staff member or Graduate Teaching Assistants who take attendance to report on student participation in theatre scene
Zoom Facilitator	Faculty/Staff member who provided technical support for the Zoom webinar environment, teaching and encouraging the students to put questions in the chat space, to “up vote” to support a question asked by a peer. Followed the “timing sheet” and kept actors and facilitators aware of time, student questions, or other relevant issue through the chat seen by only the “panelists” of the webinar, managing whatever technical issues may arise for actors, facilitators, or students, and closed out and saved the event following its completion. Generated reports for exit survey, attendance, and recording.
Engineering Faculty	Faculty who teach first-year engineering courses which require student participation in the theatre scene and who provide a small amount of class credit for completing the experience and a written reflection of it.
Overall Coordinator	Fundamentals of Engineering leader who manages the multiple people and moving parts related to this production and experience, answers questions, and invites interested visitors to observe.

F. Facilitator Training

Although the facilitation and implementation of an interactive theatre scene might appear to be easily replicated, training in all aspects is necessary and imperative. Facilitation, specifically, is an important skill that takes time and practice and is an ever-evolving form. Being a teacher or professor

does not necessarily make one a good facilitator. Facilitation is about not only navigating the important subject matter but also working the group to create the best environment for learning and growth in addition to managing the unknowns of what interventions might take place or comments that will be made. [11]. The more controlled the facilitator is of the session the less effective— so there is a letting go and improvisational aspect that needs to be found and embraced. These skills develop with deliberate practice.

The facilitator training typically occurs over two days. The training not only involves practice with the skill but also reflecting what each facilitator’s identity brings to the conversation, practicing noticing and appreciating what students do well, and supporting students to reflect on their own behavior.

The facilitator training for this project occurred over two days and consultants Rebecca Brown Adelman and Trent Norman were brought in to conduct it. The ability to pack information and practice into two days was due to the amount of collaboration and cooperation that occurred between the Theatre Department and the Fundamentals of Engineering Program. The theatre scene was prepared and rehearsed. The first day of training was primarily focused on Diversity, Equity, Inclusion content such as Learning Foundations, Identity, Exploration of Privilege and Oppressed Dynamics, in addition to information about allyship and triggers. On the first day of the training, future facilitators participated in a facilitated version of the scene and were taught the breakdown of the program. The second day emphasized the importance of practice and getting facilitators light on their feet. There was also a public performance in the early evening so that members of the university and community could learn more about this innovative project. Moreover, facilitators switched one pair taking the opening, another pair introducing theatre portion, another the intervention, and another the closing.

G. Institutionalization

The live, in-person theatre scene activity, initially supported by an NSF-funded grant, was introduced within the existing “Out of Class Experience” structure in the Fundamentals of Engineering Program (FEP) in the WVU Statler College. Each term, students taking the first engineering problem solving course are required to attend a specific number of engineering related activities external to the classroom environment. This requirement comprises 5% of the course grade. Some specific activities, including the theatre scene, are required; other activities may be selected from a list of many options. The online version, developed during the COVID-19 pandemic, was adopted during and following the pandemic as the preferred format due to the efficiencies gained related to the ability to accommodate many more students per performance, accessibility for students, and continued high level of student participation. The online performances attracted and accommodated 250 - 400 participants per performance, compared to the 40-50 students

who attended the previous on-campus, in-person performances. Following the grant funding expiration, the FEP opted to continue the online activity and assumed the costs related to the performances.

H. Lessons learned and practical tips on how to initiate similar efforts at other institutions

Participants have an opportunity to practice conflict management and communication tools in a real-life setting and are encouraged to engage gender identity, bystander, and leadership roles to make a challenging situation inclusive. These trainings give participants an opportunity to practice skills around diversity and inclusion in a way that a slide presentation, video, or a computerized training does not. With the help of trained actors and facilitators, participants are able to engage in the conversation in a way that brings more depth and practice allowing them to feel more empowered on how to handle challenging situations as they come up in the fast-paced environments of everyday life.

Not only were we intentional about matching an Engineering or STEM faculty with a facilitator from outside STEM, thought was also given to gender. It was important to have a male facilitator to model behavior for students, but two male facilitators would be too skewed toward one gender for the scene. Having a female facilitator was also important (particularly for the STEM facilitator) as their participation added reality to the scene, but two female presenting facilitators would make it feel as though this was only a problem that women in STEM face as opposed to everyone having a role in preventing interactions like the scene in the future. After the actors de-role and leave the room, having someone from the STEM community of any gender allows the experience to seem more genuine to the Engineering students during the debriefing process after the scene ends.

I. Conclusion

After doing these scenes and facilitations for several years and adapting them for COVID-19 into virtual formats, we have learned a lot about how to make this training experience successful. First, buy-in from the leadership in the colleges and departments is essential. Having an engineering faculty member serve as a facilitator helps student see that inclusion issues are not addressed only by those outside of engineering, but inclusion is important within engineering as well. Second, we have found in our other work [13] that perhaps engineering faculty are more comfortable addressing how to promote healthy behavior on teams (e.g., make sure all team members' voices are included in decisions) and perhaps less comfortable teaching students how to address issues of inequity, bias, and misogyny when they arise in teams. This activity allows students to practice what to do when team dysfunction surfaces. Third, we want to note that in years of doing these activities with students, we rarely have students who make inappropriate suggestions, and even in those rare cases the facilitators have been able to redirect the conversation to healthy ways to address the dysfunction.

By providing an improvisational theatrical experience rather than a lecture, we strive to create a state of presence in which everyone is breathing and witnessing the scene unfold together without knowing what will happen next. This may allow participants to absorb and engage with material differently and thus deepen their learning. It is our desire that this interactive model provides an opportunity to learn and grow as a community without shame and blame—giving the student audience an opportunity to explore how to create an inclusive environment together. Our future work will directly compare student experiences in both formats to assess whether this more feasible format is as effective as the in-person format.

REFERENCES

- [1] National Science Board, "Science and Engineering Indicators 2014", Arlington VA, National Science Foundation. (NSB 14-01), 2014.
- [2] Stuppard, C. M., Diversity benchmarking report for underrepresented groups in engineering, 2021.
- [3] Society of Women Engineers, <https://swe.org/research/2023/employment/#:~:text=The%20percentage%20of%20female%20engineers,informati%20research%20scientists%20are%20women,2023>.
- [4] National Science Board, National Science Foundation, Science and Engineering Indicators 2022: The State of U.S. Science and Engineering. NSB-2022-1, Alexandria, VA, <https://nces.nsf.gov/pubs/nsb20221,2022>
- [5] Frehill, L. M., "Why do people give up engineering? Surveys of men and women engineers tell an unexpected story,". IEEE-USA today's engineer online, February 2010.
- [6] Mozahem, N. A., Ghanem, C. M., Hamieh, F. K., & Shoujaa, R. E., "Women in engineering: A qualitative investigation of the contextual support and barriers to their career choice" In Women's Studies International Forum (Vol. 74, pp. 127-136), Pergamon, May 2019.
- [7] Singh, R., Zhang, Y., Wan, M., & Fouad, N. A., "Why do women engineers leave the engineering profession? The roles of work-family conflict, occupational commitment, and perceived organizational support," Human resource management, 57(4), 901-914, 2018.
- [8] Dewsbury, B., & Brame, C. J., "Inclusive teaching," CBE—Life Sciences Education, 18(2), fe2, 2019.
- [9] Leutenegger, S. T., Gauthier Dickey, C., Adelman, R. B., Norman, T., Atadero, R., Rambo-Hernandez, K. E., Paguyo, C. H. (July, 2022). *Using An Interactive Theater Intervention To Promote Gender Inclusion in Computer Science*. ITiCSE '22: Proceedings of the 27th ACM Conference on Innovation and Technology in Computer Science Education, 1, 186-192, <https://doi.org/10.1145/3502718.3524803>
- [10] Rambo-Hernandez, K. E., Roy, A., Morris, M., Hensel, R., Schwartz, J., Atadero, R. A., & Paguyo, C. (April 2018). Using interactive theater to promote inclusive behaviors in teams for first-year engineering students: A sustainable approach. Paper presented at the American Society for Engineering Education Collaborative Network for Engineering and Computing Diversity. <https://peer.asee.org/29592>
- [11] Boal, A. (1992). *Games for actors and non-actors*. Routledge.
- [12] Rohd, Michael, "Theatre for Community, Conflict, & Dialogue. The Hope is Vital Training Manual," Heinemann Publication, Exercise adapted in a training with Rohd in Summer of 2009, 1998.
- [13] Rambo-Hernandez, K. E., Atadero, R. A., Paguyo, C., Morris, M., Park, S., Casper, A. M., Pedersen, B. A., Schwartz, J., Hensel, R. (2021). Valuing Diversity and Enacting Inclusion in Engineering (VDEIE): Initial Validity Evidence for a New Scale. *International Journal of Engineering Education*. www.ijee.ie/latestissues/Vol37-5/19_ijee4112.pdf

Acknowledgement: The authors would like to acknowledge the contributions of the late Dr. Christina Paguyo who made it her life's work to elevate and promote diversity. Without her inspiration, this collaboration and work would not exist.