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Transformational learning and engagement on climate action for students attending a climate negotiation

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When Greta Thunberg addressed world leaders at the United Nations Framework Convention on Climate Change (UNFCCC)'s 24th Conference of Parties (COP24), it highlighted how young people including Indigenous youth are seeking to influence international climate change negotiations. However, young people face barriers to effectively engaging in the COP processes with few opportunities to learn about the structure and practices for COP Observers. In this paper, we describe and evaluate a structured learning experience developed to support students conducting research related to climate change and their engagement with international climate negotiations. Before attending the COP24, students were given in-person and online training about the UNFCCC, its processes, and major issues under negotiation. They also developed and presented their work during a COP side event. Through pre- and post-surveys and in-depth interviews, we asked students about their expectations and degree of engagement and agency at the COP and more broadly on climate action. Students reported that the academic scaffolding before and during the COP provided most of the students with tools for navigating the complexities of the COP. For all of the students, learning through engagement with the COP24 process supported greater self-efficacy and literacy in relation to climate change action.

INTRODUCTION

Sitting in the back row of an opening session was a handful of students from three U.S. universities who were provided with accreditation as Observers to the United Nations Framework Convention on Climate Change's Conference of Parties (COP24). They were observing a heated debate on December 3, 2018, during a meeting of the Subsidiary Body for Scientific and Technological Advice (SBSTA). The cause of this debate was whether to 'welcome' a newly released report from the IPCC, called the Special Report on Global Warming of 1.5 °C (SR1.5)[1], which assessed the impacts, vulnerability and adaptation needs of a world faced with a 1.5 °C versus a 2 °C increase in global mean temperature. At odds were the delegates agreeing to welcome the report versus Saudi Arabia, the United States, and Russia, who insisted that the report only be 'noted,' signaling that they did not want the contents to have as large an influence on the COP24 negotiations. One of the students snapped a photo of a gathering huddle of negotiators working through the language to pass the SBSTA, resulting in a blogpost presenting the event to the wider university audience[2]. As the meeting dragged on, the chair was forced to suspend the meeting.

According to the IPCC, an individual born in the 2000s or later will inherit a planet that is 0.8–2.6 °C warmer with sea levels from 5 to 32 centimeters higher[3,4]. Generation Z and those that follow will feel the brunt of multiple and interlinked existential crises of climate change, biodiversity, persistent inequality, inequity, and economic precarity in their lifetimes. The variance of these changes will be determined by humanity's action to fulfill the Paris Agreement's (Article 1) and remain below a 1.5 °C rise in global temperature, a scenario that depicts a significantly better future as per the SR1.5[1]. The pathway to achieving this goal is currently under debate at the UNFCCC COPs.

Developing more integrated and transformative learning that responds to the climate crisis is a challenge for higher education[5].

The confounding SBSTA policy debate exemplifies the 'wicked' and disorienting nature of policymaking for the climate problem. Wicked problems are akin to "…ill-structured and authentic problems… with no clear goal or path to the goal" (6: 311) and escape prescriptive causal network that dominate most pedagogies[6,7]. Observing the SBSTA debate and considering its implications has transformative potential in educational praxis but is not as easily taught as experienced. To help students engage productively with uncertainty and complexity of these types of climate policy debates as well as the foundational knowledge, such as climate literacy, education would benefit from a more integrated approach of classroom and transformational, real-world experiences[8–11]. In the months prior to their participation in the COP24, these students completed an online course designed to equip them with the terminology, the structures, the history, and the issues under consideration at a climate negotiation. However, could anything in the classroom prepare them for the exchange described above?

We sought to understand how engagement at a climate change negotiation holds potential to contribute to a sense of empowerment, agency, and personal growth for university students by organizing a course that would bring students to the center of the climate negotiations. The motivation for this course stemmed from a responsibility to 'liberate'[12] students in ways that permit them to interact (directly) with these existential crises, gain climate literacy, and support the broad range of salient climate actions[13]. Through this research, we evaluated how student participation at the COP24 supports transformational learning and engagement on climate action, described in more detail in the conceptual section that follows.

Engagement with climate change inside the classroom has often resulted in experimentation with alternative teaching models[11,13]. The classroom becomes a political space where students can "practice" their identities and formulate critical

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positions on social issues in a relatively safe environment. (12: 493). Yet, while students purportedly gained much from the classroom-based activities including climate negotiation simulations[13], students did not learn specifically about the functioning of international negotiations.

Experiential learning models have the potential to bring about self-awareness and personal change by empowering students as active participants in social change[14,15]. A foundational part of this experimentation draws on experiential education models that have long been used to bring real world experiences into the study of natural resources and sustainability[16–18] as a situational and active process of being roused from the role of passive listener to that of active listener or engaged with the subject[19–21].

Transformational learning involves critical reflection on a problem as well as validation through trusted relationships and collaborative inquiry[22]. Problems often must take the form of situations or events that diverge from one's prior understanding, such as the SBSTA huddle of negotiators trying to resolve a contentious issue. The critical thinking and deliberation with one's peers that follows has the potential to empower responsibility and activism amongst students. However, such learning is more impactful when there is a safe and trusting environment that allows for participation, collaboration, exploration, critical reflection, and feedback[14,22]. In transformational learning, values, beliefs, and assumptions are made legible and result in more autonomous and reflexive thinking[23].

By moving outside of the classroom, students *experience* wicked problems and their derivatives. To establish this nontraditional and sometimes chaotic learning environment, professors must also shift their idea of control, hierarchy, and outcomes in the learning process while providing appropriate boundaries to the experience. By combining ideas from transformational learning[14] building safe and solid foundations for learning[22], the professor's role is to create flexible boundaries without prescribing or giving too much guidance to students. In the process, professors relinquish some authority to allow students to express views and deliberate more naturally about process and outcomes[12,24].

To support students in this effort, and more specifically in navigating a stochastic and challenging environment (as the climate negotiations tend to be), we engaged with the concept of academic scaffolding[25,26]. Scaffolding is defined as "interactive support that leverages what students already know to help them meaningfully participate in and gain skill at tasks that are beyond their unassisted abilities" (6:5). Stemming from the theories of transformational learning, this scaffolding includes pre-departure training that prepares a student while handing control and the ability to make mistakes over to the student[27].

In this way, the intention is that students gain a high degree of self-efficacy. Self-efficacy refers to an individual's belief in his or her capacity to handle situations that would otherwise seem intimidating by reflecting confidence in their ability to succeed[28]. When embarking into an international negotiation, high levels of uncertainty as well as the need to cope with stochasticity must be understood as a part of the learning process. Some have found that student's empowerment and agency is enhanced through participation in international negotiations[10,29,30]. Students become "self-regulated learners" and feel confident about engaging in the more complex aspects and uncertainty that will emerge in the context of an international meeting.

In this paper, we describe the development and structure of a coupled classroom and real-world experience and evaluate the effect on the knowledge, engagement, and expressions of self-efficacy for the students. We theorized that by engaging university students in the climate negotiations in the context of a classroom and experiential com-ponent that students would gain the confidence that they were better able to tackle complex, wicked problems and thus, generate increased agency and empowerment. The point of departure for the experience is that graduate students and early career researchers who engage in environmental research have few meaningful opportunities within academia to gain the knowledge and training that prepares them for the nuances of environmental careers. We relate student expressions of agency to literature on transformational learning, highlighting how such an experience develops literacy of climate negotiations, empowers, and inspires action and calls for more systemic change on global environmental issues, and develops confidence in a student's visions of their future work. The following sections explain and justify experiential learning at the UNFCCC COP and elaborate our methodology.

RESULTS

We first review the components and the effectiveness of each element of scaffolding provided to the students. Second, we discuss and evaluate the learning outcomes. A basic understanding of the COP and the negotiation topics was provided as part of the scaffolding, but it was each students' individual choice about what different action and agenda items to observe, how they engaged with them, and what best supported their individual research and personal growth. Third, to understand key challenges and student learning about the climate negotiations, we highlight a mixture of outcomes and observations shared through the survey and during the qualitative interviews.

The components of academic "scaffolding" provided before and during the COP

The core components of the training and the experience at the COP centered around the development of a "side event". By contrast to the country delegates who represent Parties to the UNFCCC, Observer organizations only rarely speak in the plenaries and negotiations. The key activity for Observers is to propose and present at side events. Side events are held concurrently with the negotiations as a platform for Observer organizations "to engage with Parties and other participants for knowledge sharing, capacity building, networking, and exploring actionable options for meeting the climate challenge."[31].

Preparing for and presenting at this side event provided the students with an immediate way to engage as an Observer at COP. They had to establish the focus of their side event, including what information or research was needed to support this topic, and who should present and how information should be presented. As most of the students had not previously attended a COP, they did not have a clear model for the structure or content of such an event. The students collectively chose to highlight climate research and action on their campuses and present the viewpoints of their peers and faculty in a multimedia format. While the professors were there to support and provide feedback, it was also made clear that this was a student-led event. In this way, this side event provided a platform for the students to engage in the COP process and supported the main innovation of this course of allowing students to experience how information from climate change research interfaces with the UNFCCC process.

The COP presents challenges from navigating the venue to identifying and gaining access to events. Hence, the students were provided with recommendations for activities that could structure their schedules and provide support if there were any periods of uncertainty. This was achieved by establishing several "home bases" and ways to check-in. First, the students were strongly encouraged to attend the daily Research and Independent Non-Governmental Organizations or RINGO meeting. This meeting provides an opportunity for the Observer organizations classified as a RINGO to convene, learn about what others across the independent, research, and NGO sectors had experienced the day before, secure "tickets" that were allocated to RINGOs for that day to enter the limited-access plenaries and negotiations, and

Table 1. Pre- and post-survey responses related to climate negotiation literacy.

Question/ Theme	Summary of Pre-COP Responses (# of respondents)	Summary of Post-COP Responses (# of respondents)
What do you think will be/were the main outcomes of COP24?	Paris Agreement Rulebook (PAWP) (4) Reference to PAWP (3) Set targets to remain below 1.5 °C (2)	Strong evidence of climate activism (2) 'Noting' of IPCC's SR1.5 (2) Networked across international borders (2) PAWP (1) Progress on Warsaw Agreement (1) Incremental progress on Rule 6 (1) Agreement on Biennial Reporting for 2024 (1) Recognition of youth and Indigenous Peoples (1) Santiago Network established (1)
What do you expect to learn/did you learn?	How main negotiations function (6) Relevant workplans at the COP (1) Intercultural communication (1) Hear peoples climate change (CC) stories (1)	How negotiations function and don't function (5) Vast array of resources being used to address CC (2) Intersectional ways in which adaptation/mitigation impacts various groups (2) How to navigate international conference (1) I have a voice here (1) I am interested in policy work (1) Inspired by attendees I met (1)

share any observations or learnings about the meeting. After the RINGO meetings, the group met to discuss potential activities for the day, including how to adjust schedules based on the new information conveyed at the RINGO meeting. Individuals, however, were encouraged to establish their own schedules as well as be able to recognize and adapt to the changes in the events that are the hallmark of the COPs. Second, the students used the booth as a place of convening and resting; students would gather in the small space and talk about their COP experiences.

Professorial and teaching assistant support was critical for setting up the structures before the COP to support the students at the meeting. The teaching assistant, who also attended the COP, was essential to the execution of the course. For instance, she created an internet-based group chat—WhatsApp group—early in the pre-departure period to alert students about new information and open a forum for asking and answering questions. The transparency and openness of this virtual collaboration tool were intrinsic to overcoming certain barriers, such as housing challenges and information incongruities. The group also allowed for self-organized information sharing by the students, who also answered each other's questions about everything from badges to flight itineraries to interesting events to engage with. During the COP, the group used WhatsApp to plan, share ideas, and sometimes collectively reflect about the plenary process or other salient issues to reach an agreement at the COP (e.g., the strong presence of Poland's coal industry).

Professorial support extended from the course through the COP. Students expressed that the professor's role and the RINGO meeting was essential in accessing and understanding the negotiations. Both the professor's leadership and the RINGO meetings provided time and space to digest and analyze what had happened the day before during the negotiations. Talking through observations was highly instrumental in the transformational learning process for the students, as it both empowered them to participate in the plenaries, but also to engage with the RINGO network and listen to others' observations.

An important logistical challenge is ensuring that the students have the necessary credentials to access the COP. Prior to the setting up of the course, all universities had secured what is known as "Observer Status" to the UNFCCC process. This designation allows for the organization to send observers to the COPs. This is done through a process of nominations submitted by the organization and then the UNFCCC Secretariat allocates a specific number of badges to each organization. Observer organizations are restricted in the number of badges that they

are allocated, which generally does not cover the full request in the nomination stage. Only those with "badges" are ultimately able to enter the part of the COP where the negotiations take place—referred to as the "blue zone". Generally, COPs also have a "green zone" where the public may attend, although the capacity may still be monitored. Students experienced challenges related to planning to attend due to the uncertainties of the process of credentialing as well as scheduling of the events.

Evaluating learning outcomes

Knowledge of the diverse content of the COP expanded in the post-survey from a focus on the Paris Agreement Rulebook to multiple components of the agreement (e.g., Warsaw Agreement), recognition of multiple forms of activism and evidence of the challenge of negotiations (e.g., the 'noting' of the SR1.5). The main learnings also naturally demonstrated how students gained greater understanding and respect for the processes taking place during the COP, from the negotiations to the vast array of resources being used to address climate change (Table 1). Along with this, students expressed how they were inspired, have a voice, and see a career pathway in environmental policymaking (Table 1).

The qualitative interviews with the students reveal a more nuanced experience of the COP. These experiences highlight how the COP can provide opportunities for personal growth by inspiring and building intercultural understanding, yet can also be a source of discouragement due to the inaccessibility of the COP. A key part of the overall experience was mediated by the students' ability to access the negotiations at the COP. In our opening paragraphs, we illustrated a formal diplomatic protest observed by our students during the SBSTA discussion on December 3, 2018. Accessing the high-level negotiations was possible by obtaining a specific ticket from the universities' constituency group (RINGO). These tickets were announced at the morning RINGO meetings, which most of the students attended, and were in limited supply. Those who did not receive a ticket to these meetings could only access plenaries remotely. Sitting in that plenary became a cornerstone of their COP, and the students came back to this experience in their interviews noting both an increased sense of agency and engagement as well as understanding and respect for the process.

"I really value the access to the plenary because being in that room is kind of symbolic that I don't feel like an outsider. Like, I'm not watching it on television; I'm not

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Table 2. Pre- and post-survey responses related to empowerment and engagement.

Question/ Theme	Pre-COP (# of respondents)	Post-COP (# of respondents)
What do you believe that you will contribute/ contributed?	Knowledge based on side event (3) Express hope and urgency about climate (2) Share with friends/family my learnings (2) Encourage negotiators to be transparent (1) Evidence that US students care about climate change (CC) (1)	Knowledge based on side event (8) Evidence that US students care about CC (3) Networked with other students (1)
In what ways will/are you able to engage/ influence?	Not able to influence (4) Share knowledge at side events (4) Contribute to collective youth voice (2) Provide new perspective to negotiators (1)	Not able to influence (4) Shared knowledge at side events (3) Share perspectives about how CC impacts my life (2) Establish strategic relationships (1)

standing outside the door, I'm inside the room, with all these really cool people who've done amazing things, and I'm not on the outside. That's a really important feeling for me, because sometimes you get this feeling of – I'm young, I can't do anything, or I have to wait until I have a certain level of ability" (#12).

"That was good to see a formal protest in that way…There has to be compromise or you're not going to move forward on anything… I don't really have a formulated opinion on whether I wish the majority of parties had been willing just to accept [the SR1.5 by] or 'take note'… But I get why they strongly push for 'welcome' because of the implication it has in terms of how they base the future of their work" (#3).

"[I]t's neat to just to think about these negotiators…that you know they're clearly talented and capable individuals… well educated and they could be spending their efforts probably really anywhere else, but this is where they've ended up and so even if you don't agree with them at least there's still you know like this is still what they're spending their time on and mostly a positive manner" (#2).

While the students found that the COP brought salience to the issue of climate change and the challenges of achieving progress in the international setting, students also found that the technical information or the sheer complexity of the issue at hand could be confusing and frustrating. This resulted in lower overall understanding of what the goals and objectives were at the COP and how they were accomplished.

"…I really think the list of how climate change is going to impact our world is kind of endless. It's very daunting to get into this subject. And I think you also see this at the UN, right, there are these huge international players, so it's hard to make any steps of real progress because it's such a big thing…" (#14).

"I didn't follow the negotiations closely… So I'm not very familiar with the outcomes of the COP other than the drive change together, the pact that the COP president was spearheading, which was interesting, but I found it to be a Band-Aid solution to a huge problem that we're having" (#15).

"…some of the things they were talking about were very technical and I didn't quite have the background

knowledge I felt like I needed to completely grasp what they were saying" (#9).

Even with the scaffolding such as badges, home bases, communication, and the side event to support students during the COP, students encountered multiple uncertainties about how to be a delegate, including difficulties in navigating, finding access to negotiations, and understanding information presented during negotiations. Some students overcame these challenges through a high reliance on the scaffolding of the course, while others implemented their own coping mechanisms, such as tracking the daily schedule of side events, visiting booths in the Pavilion area or observing direct actions. Given the small group size, we are not able to make any meaningful distinction in learning outcomes between these two approaches and both groups described strong learning outcomes. However, the students who were able to forge their own pathways may have achieved more of their personal learning outcomes and gained a larger sense of empowerment in navigating complex information and settings.

"Yeah, honestly, it's been it's been just really overwhelming because there's so much happening and it's difficult to distinguish what it's about to distinguish what's physically designed for us and what's not" (#11).

"You have no idea what to expect…no matter how much preparation you've gone through you cannot prepare yourself for what happens. It took me three days to figure out how to just get through a day's worth of events. Because [something] would be happening under a certain theme…and you don't even know where to find [it]" (#2).

The students were also asked about their perceptions of participation and contributions during the COP. Several students in the pre-COP period perceived that they might be able to 'encourage negotiators to be transparent' and 'express urgency about climate change.' In the post-survey, these more idealistic contributions were not stated, representing both greater literacy on what being a delegate at the COP allows one to contribute and a more realistic perspective about the student's ability to engage with delegates (see Table 2). Students perceived their contributions both at their side event and at other youth events to be especially important considering the US government's decision to pull out the Paris Climate Accord and the resulting 'We're Still In' movement of US States and universities, which one student noted had been 'reduced' since their last observations of that movement at the COP in Bonn. These engagements contributed to post-survey responses that students' voices were 'heard' and that they 'could influence' negotiators through the side event and their presence at the delegations.

A key component of the structure of experience engaged with the side event. Overall, students' sense of agency was amplified by their preparation and presentation of a side event at the COP. Attended by around 50 participants, the side event was recorded and shared through multiple online fora via the students' social media accounts as well as through the online portal of the COP24. After the side event, the professor informed the students that they were invited to give a press conference, which all were able to attend and during which many of those who had not yet spoken shared their thoughts with the press. In their reflections shared after these events, five of the students mentioned the side event as their main accomplishment and point of engagement at the COP

"I think the side event that we did together and having our own youth event – so that gave youth a space to share research and network and how to move forward with the progress and how to get youth to take away something from the youth events. I think there is space to apply this thinking" (#14).

"My view is already somewhat almost biased, but we just came through a lens of already youth having a role since our whole side event was focused around youth… And there's so many youth giving different side events or even in the U.N. Pavilion…the U.S. Pavilion had an event targeted just at youth…And so I think all those things are great" (#14).

Some expectations of the students, however, were not met as far as the role of and the constraints on Observers at the COP. While students were pleasantly surprised about the access to the plenaries, high-level negotiations, and the country delegates themselves, students found that their expectations about the type of access they would have to their country delegates and the negotiations were not met. One student (#15) expected to be observing round table discussions, to have access to descriptions of negotiations taking place and to be at the actual table working and listening to the delegates. More generally, the students shared a desire to have more connection to the delegations and negotiations, as part of youth engagement at the COP. We return to these elements in Section 3.2.4 on youth engagement.

"I thought…we'd be able to see more of the plenary sessions. I thought we'd be more involved with high level officials which isn't the case…[yet] I've done amazing things and was able to ask questions and run up to [delegates] after and try to gain an interview" (#11).

"…[W]hen I meet with the other delegates from the other countries like Mexico, Israel, it's really nice. I mean it's nice to watch the exchange, what they are thinking. Probably we are not going in the super right direction… But even so I'm very enthusiastic about being here" (#8).

Students also identified how to situate themselves in the COP along the many intersectional pathways of – youth, researcher, nationality, and gender. Two international student participants stated that they found it hopeful and heartening that they could talk with their country delegates and network with them. US-citizens spoke more about their ability to network with US students as well as individuals from all over the world as an important part of the intercultural experience of the COP. This intercultural learning gained transcended the expectations of what many believed they would contribute and gain from the COP.

"Yeah, well we don't play a direct role in the negotiations or anything… it's more like networking and getting ideas for how to be involved and observing and trying to figure out what to do next" (#9).

"I think that's the coolest part of the COP is that you have people from all over the world, and you get lots of different narratives about the best way to mitigate [climate change]" (#14).

The COP provided a variety of ways for youth to engage, with youth speakers at the plenaries, a designated day for youth climate action, side events, events hosted by various governments or nongovernmental organizations with Pavilion space, protests, RINGO and YOUNGO – the children and youth constituency to the UNFCCC. We summarize the pre- and post-COP experiences in Table 3.

Table 3. Survey responses in relation to youth engagement in the COP24.

Question/ Theme	Pre-COP (# of respondents)	Post-COP (# of respondents)
What are your views on youth inclusion?	Youth are well-placed to contribute to negotiations (6) These is moral urgency to slow impacts of climate change (CC) (2) Youth will be most impacted by CC (5)	Youth presence is critical to the COP (3) Youth are being heard at the COP (3) Youth are not being heard at the COP (3)
What are your impressions of how the COP engages/ed youth?	Civil society/side events (5) YOUNGO[a] (2) Youth Ambassadors/delegates (2) No inclusion of youth (1)	Civil society/side events (5) Youth as delegates (2) Youth-led protests (2) YOUNGO[a] (2) RINGO[b] (1) It's only lip service (1)
What do you recommend in relation to youth engagement?	More inclusive of youth in delegations (7) Scholarships and logistic support to youth (3) Youth-related side events (2) Engage schools to view COP event (1) More access to youth activists (1)	Give youth a seat in delegations (5) Scholarships for youth (2) Youth-related side events (1) More courses like this one (1) Better pre-departure training (1)

[a]YOUNGO is the official UNFCCC constituency of Youth Non-Governmental Organizations.
[b]RINGO is the official UNFCCC constituency of Research and Independent Non-Governmental Organizations.

Table 4. Quotations in response to the question: What is the importance of youth engagement in the COP?.

Generational Burdens	A lot of the issues being talked about directly impacts the younger generations. So why shouldn't we be a part of these negotiations? This is our reality and our future. So, it seems almost criminal to keep the young people out of it when we're the ones who are likely to face the brunt of these issues (#15).
	…we're going to be the ones dealing with the decisions that are made or not made. And it's pretty important that we're a part of that whether that be like directly or indirectly (#5).
Youth as Advocates	…there's not youth at every level…I feel more like we're the intern that gets to sit by and have coffee while the adults speak, which I think is a big detriment because we're the ones who have to be living with the choices or made in some cases not the choices here and we're the ones who are pushing hard (#1).
	…it's youth who ultimately going to bear these burdens and that you know among some people really want to see youth involvement and hear youth voices because these are the people that you know are going to be really, ultimately facing and dealing with these issues later down the road (#4).
	Obviously, everyone says that we'll be the next policy makers, so it's better to get involved now because we'll be making the decisions later. However, I find it is frustrating because the youth have hope, but we don't only need good policy makers in the future, we need it now (#14).

There is some support in the survey responses and interviews for effective youth engagement at the COP. However, while the students generally reported high levels of personal engagement, the reactions to the knowledge they were gaining about how the COP is run, the slowness of action, and the difficulties of diplomacy were met with emotional responses from the students and some discouragement of their level of agency within this process. The slowness and inaction they observed caused several to point out how their pessimism about the issue of climate change was validated by their observation of the climate negotiations.

"There were a lot of youth, a lot more than I thought would be there. So, it's a nice change to see that they are trying to get youth involved" (#14).

"I heard the YOUNGO group talking about system change. I know the Sunrise movement, [and] some representatives from that were there. There is a well-known speaker from Sweden named Greta…But other than that, at the side events or the Pavilion events, it seems like a faux politic, people didn't really talk about capitalism or any sort of economic system being problematic or a better solution" (#15).

They also echoed desires shared by other youth activists to give youth more of an opportunity to engage at the COP. This was especially highlighted in statements that emphasized the unequal generational burdens of climate change impacts on youth and, consequently their appropriateness as advocates for specific policy (Table 4).

Interestingly, the students were split in their responses about the ability of young people to be 'heard' in the COP – expressing that youth presence was sufficient or a reformative need towards more youth inclusion in delegations.

"[If I were a delegate], my mindset would be changed if I came out of the negotiation or walked to the back of the room, and I saw a bunch of youth. It makes their decision feel more important because they have people supporting them even young people" (#5).

Several students reported that their experiences and interactions with other youth and students at the COP reinforced notions that youth do not have a voice in this negotiation (stated by 5 participants) and the belief that their contributions are, as one respondent put it, 'paying lip service' to young people. Similarly, they are mixed in their responses in how students and youth should be engaged going forward. While several of the students echoed Greta Thunberg's call for 'system change'[32], others called for youth having a 'seat in the delegations' and recognized the importance of the youth presence at these negotiations that so impact their future.

DISCUSSION

Developing more integrated and transformational learning is difficult to do in a classroom. Our goal was to evaluate a virtual classroom and experiential model of learning to discover what types of scaffolding best support transformational learning in the context of the climate negotiations as well as build self-efficacy and empower students towards climate action. What we observed is that transformational learning is based in the relationships derived through experience. The professor's role is to provide access to these experiences, but only prescribe loosely how the students navigate them. As students build trust through non-hierarchical relationships between professor, peers, and other stakeholders, learning evolves from critical reflection on a problem towards greater reflexivity, challenging of long-standing values, beliefs, and assumptions, and validation of new paradigms of thought[23]. This transformation could only be gained by moving outside of the classroom and into direct experience.

While professors and students generally recognize the benefits of more hands-on or real-world learning, this type of learning is also associated with a wider range of challenges than the conventional structure. Especially in the early phases of the learning process, students who are encountering novel ideas and situations for the first time may feel a high degree of frustration and uncertainty in how to match their experiences to the educational objectives. Thus, the primary goal of this learning experience was to develop a course to provide sufficient academic preparation on the history and issues under discussion as well as engage the students in efforts – namely, the development of a side event–to provide a structure for their activities in the COP and aid in building self-efficacy to face difficult situations[28].

The key approach employed in this course was 'academic scaffolding'[25–27] with pre-COP formal learning designed to provide a common ground before starting the participatory activities along with continued support that should be progressively withdrawn to allow students to weave their own path, even if that means experiencing confusion and frustration. While this led to some students becoming overwhelmed, it also contributed to opportunities for empowerment (through the Side Event and Press Conference) and building relationships across cultural and political boundaries, a key component of the COP emphasized in other research[33]. Our research contributes knowledge to the effectiveness of academic scaffolding to humanities and social sciences, building on past work in problem-based learning in STEM fields[27]. This approach recognizes that students cannot be

expected to immediately translate material learned in a classroom into engagement in complex problem, such as international negotiation, and need an opportunity to gain literacy in the social norms, experience with the process, and ways of situating themselves in and building relationships through that process. Along with this norm-setting, students also must grapple with uncertainty in the real-world setting, an element that could have been developed more during the pre-departure course to build more inclusive and open communication between the instructors and students during the international negotiation experience.

We found that students expressed self-efficacy most in relation to their experiences with what constitutes 'climate action' – hearing all perspectives beyond the Global North, broadening their understandings of the negotiations, observing factors that limit youth engagement. By participating at the COP, several students recognized their role in their home countries to engage more deeply in civil society as well as expect further engagement as young people. While the students reported some understandable frustration with the COP process and the lack of access to the negotiations and delegates, they, in turn, were able to build relationships across a diversity of cultures. They also gained a broader view of the wicked nature of the climate problem and were able to better express how youth are currently engaged in the climate negotiations and the potential for expanded opportunities for youth.

With the SR1.5 Report and Greta Thunberg's admonishment of the country delegates at COP24, young people have become increasingly galvanized behind the belief that politicians possess all the technical details to act but are not responding to the threats of climate change[32]. They are increasingly entering the political debates, carrying out youth climate marches, engaging in sit-ins and acts of civil disobedience, and declaring individual protests, such as stating publicly that they do not see that the world is safe to conceive children[34–36]. More generally, it has become increasingly apparent that university students feel the brunt of multiple and interlinked existential crises of climate change, biodiversity, persistent inequality, inequity, and economic precarity. Thus, providing learning experiences that equip students with the tools and attitudes to interact directly with these existential crises, gain climate literacy, and support the broad range of salient climate actions is critical to their engagement with these wicked problems.

Achieving this type of transformational learning entails shifting the ways in which professors have traditionally scoped the learning process as well as engaging with the responsibility to 'liberate'[19] students in ways that permit them to articulate, advocate and be leaders for solutions[12,24,37]. As found in other studies[38,39], the prestige of UNFCCC and opportunities to build relationships across generational and cultural boundaries has strong implications for empowering university students. By relinquishing some authority in both the pre-COP activity of developing the side event and then encouraging the increasing shift from professor as guide to interdependence at the COP that allows the students to thrive in its unpredictable environment, students are 'liberated' to express views and deliberate more naturally about process and outcomes. Establishing this nontraditional learning environment, professors must also shift their idea of control, hierarchy, and outcomes in the learning process, while permitting students to navigate the boundaries of the learning experience and grapple with the complexities of seemingly unsolvable problems.

Our evaluation of the effort shows that students enhanced their core competencies in 1) communicating science in diplomatic and multicultural settings; 2) analyzing the interactions and intersections of society, policy, and science through the lens of their own research; and 3) engaging with team-based learning and coordination using remote/virtual platforms. While we have all engaged with virtual platforms out of necessity throughout the

COVID-19 pandemic, the use of such platforms is already becoming more common in internationalized activities. When we developed this aspect of the course pre-pandemic, it was already recognized that this would become a core competency for international engagement. In the future, we would like to see more courses of this kind and recommend that the UNFCCC collaborate with universities to develop an online course that would support this type of engagement at high education institutions around the world.

METHODS
Description of learning experience and opportunities at the COP

The Conference of Parties or the supreme decision-making body of the United Nations Framework Convention on Climate Change is a two-week convening presided by a different country annually. Its aim is to implement the Convention through cooperation and negotiation amongst country delegates of climate change mitigation and adaptation goals as well as provide a platform to a variety of constituencies to enable discussion, convening, and exchange about all things related to climate change[33,38]. Youth participation has been growing, with the size of the UNFCCC constituency of youth nearly doubling from 2014 to 2021[39]. Youth are leading and contributing to multiple COP events from official side events[31] to press conferences to informal lobbying and demonstrations inside and outside of the various "zones" of the COP[38]. Zones within a COP determine specific activity. The Blue Zone is a UN-managed space where negotiations are hosted as well as the Pavilion for International Organizations, countries, and non-governmental organizations. Access to this zone is based on UNFCCC accreditation or "badges" defining types of access within the UNFCCC space and consisting of country delegations (pink badges), United Nations employees (blue badges), and Observers (orange badges). The Green Zone of the COP is often more widely accessible to the public and is open to non-accredited delegates. The process of obtaining badges is large and complex with accredited organizations requesting and sometimes arbitrarily receiving a certain number of badges prior to the COP. We restricted our course to what is accessible through an orange badge.

The course was conceptualized and developed across three institutions—Clark University, Colorado State University and Emory College—and engaged students at these institutions. The Caribbean Youth Environmental Network (CYEN) joined in the activities related to the development of presentations for a side event. As side events slots are highly competitive, organizations are encouraged to identify and merge applications with organizations that diversify the presenters and encourage developing country participation. The virtual classroom component of this course consisted of three concurrent activities. First, the students were provided with information about the UNFCCC and COP as well as a socialization into the activities and norms through with the professors sharing their experiences with translating their research into the COP environment along with lectures provided by individuals who participate in COPs, including previous negotiators, NGOs and advocacy focused organizations, and other researchers. Second, the students engaged in small groups to gain these skills progressively and collectively through an already accepted speaking event – a so-called Side Event. Finally, there was a focus on the logistics of attending the COP. These activities were designed to provide clear direction and clarify the purpose of the engagement so that students can understand 'why they are doing the work and why it is important' as well as 'providing pathways for the learners such that they can make decisions but remain focused on the designated tasks.' By establishing the virtual classroom as the setting for these activities, this course

Table 5. Demographics of student participants of the COP24 engagement research.

Demographic	Sample representation
Group (#)	Emory (7), CSU (5), CYEN (2), Clark (1)
Age Range	20–25 (8), 26–30 (7)
Genders	Female (13), Male (2)
Nationalities	US (10), Mexico (2), New Zealand (1), China (1), Argentina (1)
Degrees[a]	MA/MS (8), BA/BS (5), PhD (2)
# Yrs. Attending COP[b]	1st COP (12), 2nd COP (3)
Areas of study	Enviro Studies (9), GHG Accounting (4), Sociology (1), Water Management (1)

[a]Current degree the student is attaining.
[b]Number of years the student has attended the UNFCCC COPs.

aimed to reduce frustration, risk, and uncertainty as well as clarifying purpose and expectations for the experiential part of the course at the climate negotiations. While all students who participated in the virtual classroom component were eligible to attend the COP, some students did not attend due to funding deficits and prior commitments. Once at the meeting, students were expected to build off the scaffolding provided in the pre-departure course and their own individual projects and interests to drive their learning and exploration of various opportunities afforded at this type of engagement.

The names of the students who took this course were submitted for credentials as an Observer for the UNFCC COP. These credentials are needed to have access to the main meeting area, referred to as the "blue zone." Universities are one of the types of non-governmental organizations that can gain Observers Status to the UNFCCC process that include the private sector, environmental groups, farmers, Indigenous Peoples, labor unions, women, youth, and other research institutes[40]. The different observer organizations are grouped by function into constituency groups. Universities belong to the Research and Independent Non-governmental Organizations (RINGO). These groups serve as the main communication channel from the UNFCCC Secretariat to the observer organizations. We explained in the pre-departure course and encouraged students to attend daily meetings during that COP for the RINGOs constituency group. Their attendance at the morning RINGO meetings facilitated access to most of the negotiation sessions, which is delegated through the constituency organizations who are allocated seats from the Secretariat. The RINGO constituency also provides other functions of its members, including daily briefings with updates on emerging issues and opportunities at the meeting for RINGO members.

Side events provide an opportunity for the admitted organizations to present their work and engage with delegates and other observers[41]. The process of organizing and applying for these events is longer than the timing of a semester. As a result, the professors took this step. The description indicated that these were student-led presentations that would highlight the work of young researchers. In the classroom, the students were provided with guidance on possible formats and on best practices for communicating effectively. However, the topics and content were driven by the interests of the students. They were also encouraged to consider modes of communication that best allowed them to express themselves, including videos, blogs, and other social media content, as a complement to more formal presentations. The goal behind this side event was to also situate the students as civil society but specifically as researchers who are sharing their knowledge within the climate negotiation process. The students were signed up for press conferences to promote their work and

their perspectives and to actively engage in opportunities for speaking that can arise during the COP. Finally, the universities rented a booth in a section of the Pavilion area where there were other university booths to provide a venue where the professors and students could conduct outreach about their universities, programs, and research. It also operated as a gathering spot for the students.

Evaluative approach

The fifteen participants in this research were students from Emory College, Colorado State (CSU) and Clark University and the Caribbean Youth Environmental Network (CYEN) (Table 5). These students range in ages from 20 to 30 years old and were taking a collective pre-departure course as part of their undergraduate (5 people) masters (8 people), or PhD (2 people) studies. For the majority (12 people), it was their first year at a COP. Almost all the students were female and lived in the United States (10 people), with two male and three female students of non-US nationalities. Major areas of study included environmental studies (8 people), greenhouse gas accounting (4 people), sociology (1 person), and environmental health (1 person). Our group consisted of undergraduate and graduate students. Due to our small sample size, we were not able to elaborate on the relationship between the impact of the course and a student's educational background.

To understand how students were engaging and learning through their participation at the COP, three main activities were conducted and triangulated: 1) An anonymized survey of pre- and post-conference attendee experience; and 2) Recorded qualitative interviews regarding students' experiences at the COP and 3) Observations of students attending the COP. Interviews and pre- (8 respondents) and post- (9 responses) open-ended surveys were sent to the fifteen students who attended the COP before and after the experiential portion of the course. Along with the surveys, we carried out semi-structured interviews with all the students. Semi-structured interviews focused on the individual students' interests and motivations, feelings, expectations, and perceptions of the COP, and observations of youth engagement. Interviews were recorded and took place in a calm location at the conference or on the phone in the month following the conference. Observations of the students at the COP provided additional context to the surveys and interviews. All data were analyzed using qualitative data management software AtlasTi (v10).

The individual carrying out the interviews was a self-funded postdoctoral scholar affiliated with an institution that was not represented and from which the students would not be receiving any grades. By traveling with the students, she not only gained trust but was perceived by students as both an outside observer and guide during the experiential parts of the course. The close interactions of the lead researcher and students, combined with these three data collection activities provided necessary information to learn about student experiences and perceptions regarding international negotiations, climate change and youth advocacy. Written, informed consent was obtained from all subjects involved in the study. Ethics approval was received from the Institutional Review Board of Dartmouth College (STUDY00032115 on July 16, 2020) as well as the Institutional Review Board of Clark University (#2018–036) and was conducted in accordance with the Declaration of Helsinki.

DATA AVAILABILITY

In relation to data-sharing, the Internal Review Board approval (STUDY00032115) will not permit public sharing of data due to privacy considerations to protect study participants; however, the authors will make anonymized data available as requested in a timely manner.

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COMPETING INTERESTS
The authors declare no competing interests.

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