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Abstract

In these field notes, we examine the integration of the arts into a 20-person honors biology seminar at UC Riverside “Beyond Science: Being Humane Amid Human Rights Crises.” We held a four-hour workshop to examine the ways in which performance and theatrical storytelling can enhance science learning. The workshop provided a unique avenue for exploring how human activities result in downward consequences including refugee displacement, one of the course objectives. In addition to the workshop, we conducted surveys and a focus group with the students to better understand their experience incorporating the arts into their science class. A key concept that arose in the focus group was how engaging with theatre contributed to students’ empathy.

Keywords

theatre, science, interdisciplinary, empathy

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Cover Page Footnote

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How theatre and embodied performance can enhance science learning

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Introduction

This article discusses our interdisciplinary initiative that holds promise for employing a STEAM approach to college science instruction. In 2020, we received a grant from our university's interdisciplinary research center to explore what it means to "Be Human." The "Being Human" initiative serves as an "incubator for innovative thinking between the disciplines and colleges" by "promot[ing] experimental research formats" (Center for Ideas and Society, 2020). Our project was one such experimental format; it used Echeverria's historical play text *Picasso Presents Gernika* to discuss performance and to examine how incorporating theatre into a non-performance STEM class can shape learning.

With biology professor Richard Cardullo and acting professor Bella Merlin, we hosted a workshop in May 2021 for students in Cardullo's course, "Biology of Human Problems." Subtitled "Beyond Science: Being Humane Amid Human Rights Crises" this course explores how human activities result in downward consequences, including refugee displacement. Prior to the workshop, students attended a screening of Echeverria and Speer's docudrama film *Picasso Presents Gernika*. The film intersperses a staged reading of Echeverria's play with primary source material including archival images, art, news footage, and historical material. Echeverria's script addresses the child refugee crisis resulting from Hitler's 1937 bombing of Gernika (Basque spelling) and Picasso's artistic response (*Guernica*). The workshop explored how incorporating theatrical storytelling into the science classroom can promote new insights into the experience of "being human". It also engaged science students in the *process* of participating in artistic documentary-based work to examine our history and our humanity. We found the workshop allowed students to viscerally feel how human actions can lead to downward consequences like displacement, enhancing students' empathy for refugees and migrants. We also found the importance of communicating scientific knowledge to non-scientists resonated among participants. Both empathy and communication skills, we argue, can develop scientists committed to mitigating suffering endured and caused by humans. Embodied performance and fact-based theatre may be particularly useful pedagogies to develop such qualities among university science students and enhance science learning overall. Integrating theatre into science courses has holistic learning benefits, reaching students' hearts as well as their heads.

Research design

A collaboration across disciplines, this project examined how engaging with documentary-based theatre might enhance learning among science students, particularly important to examine at University of California Riverside, among the most diverse universities in the United States. Designated as a Hispanic and Asian-American, Native American and Pacific Islander Serving Institution, UC Riverside also enrolls a high number of first-generation college students (UC Riverside Institutional Research, 2022). The undergraduate population at UCR, in other words, enrolls precisely those groups that continue to be under-represented in the sciences. Given this, as well as the continued under-representation of women in the field, we administered an online anonymous survey to gather information about participants' racial/ ethnic and gender identities; we also asked participants to indicate if they were first-generation college students, and which language(s) they spoke at home. The survey included questions about the

extent to which respondents participated in the arts in general, embodied performance in particular, and whether they were familiar with the *Guernica* mural – a focal point of Echeverria’s script.

Students also participated in a four-hour Zoom workshop, divided into four sessions, in which they engaged in embodied performance and storytelling exercises and then applied these concepts to their biology course texts.

Session 1: With a mission of psycho-physical coordination connecting the outer world with the inner self (and vice versa), Acting Professor Bella Merlin first led students through a series of physical and psychological acting exercises, i.e., standing still with eyes closed imagining moving through different spaces as she set the scene, or adjusting their physical positions and considering the circumstances for those actions. Merlin helped the students connect with their relationship to space, considering their body in a specific set of circumstances, and imagining going somewhere out of force or choice. The exercises built towards physically embodying specific positions from Picasso’s *Guernica* and then denoting in the chat box short responses about how they felt or what they imagined. They engaged in creative, embodied exercises to tie their thinking with their feeling, showing the science students – who rarely experience activities like this in their coursework – how such embodiments could enhance their learning and deepen their perspective taking. As psychologist Kahneman has noted, “Cognition is embodied. You think with your body, not only with your brain” (2011, 51).

Session 2: Echeverria asked students to read excerpts from her script silently, keeping in mind a guiding question; to put their response in the chat, and; to build upon someone else’s comment in the chat. The guiding questions were: *In what ways, if any, does this excerpt parallel your own family’s journey to this country? In what ways does this excerpt resonate with contemporary refugee or other human rights crises? And, in what ways does this explore the intersections between gender and war?* The play follows the story of young siblings, Andrea and Aitor, being evacuated to England after Gernika’s bombing. The mother eventually calls for Aitor, the son, to return, so Andrea spends the rest of her life wondering why her mother left her in the UK. The script is inspired by a comment Echeverria’s British neighbor, Manuela, made when she was living in Donostia (San Sebastian) in Gipuzkoa in the 1990s. As children, Manuela’s father Alejandro and his brother had been evacuated to England during the Spanish Civil War (1936–9). Eventually, the boys’ mother requested that Alejandro’s brother be returned to her in Spain; but she did not ask for Alejandro. He lived the rest of his life in England, never learning why his mother had not also sought for his return. Echeverria shared both the script and its backstory with the students. Although none of the students were previously familiar with the bombing of Gernika and the evacuation of the Basque children, they easily made connections between the script, their own lives, and the current refugee crises. Students shared moving stories about their parents or grandparents fleeing violence in Egypt and Central America.

Session 3: Speer divided the group into breakout rooms to answer the prompt: “Tell us about your name”. Students shared their names’ backstory (family legacy, if it was altered, if they use nicknames, etc.). In the main Zoom room, they were instructed to introduce the name of a peer and recap only one or two details about that person’s name. Speer led a discussion about storytelling construction and the editing, arrangement, and selectivity involved in such decision making. Were the two pieces of information the peer shared the same ones the student would have highlighted? If not, what got cut? Which aspects from people’s stories stood out for their theatricality? This exercise helped students think through the craft involved in constructing theatrical story from interviews or primary source material and that narratives about science are also constructed. They felt what it was like to have a portion of their own identity told as a story or synthesized by someone else. They also learned how theatre can be

a vehicle for social justice, allowing them to think critically about the ethics involved in theatricalizing the stories of others as well as the creative process involved in crafting story.

Session 4: Cardullo sent students into breakout rooms to collaborate on an artistic project through which they should highlight a scientific concept from their honors seminar; in the main Zoom room, they explained the artistic choices they made to teach their lesson. The texts used for the course included: Barnosky and Hadly's *Tipping Point for Planet Earth*, Kolbert's *Under a White Sky*, and Quammen's *The Tangled Tree*. The students proffered ideas like developing a performance where the temperature crept up to symbolically physicalize discomfort from climate change so that audiences may experience or feel with their bodies an otherwise seemingly abstract concept. Here, students revisited the course materials with the expressed mission of incorporating an artistic framework into their engagement with the material. They were drawing on the physical embodiment of emotions and the technical elements of storytelling introduced in the three prior sessions to explain science concepts and readings in ways they had not previously thought to communicate. They were thinking creatively about how they could disseminate these ideas to audiences who do not share their expertise. Engaging in theatrical play has been shown to enhance development for individuals in areas such as empathy and communication (Stutesman et al., 2022).

Two weeks after the workshop, Speer and Echeverria conducted a Zoom focus group to better understand how incorporating theatre and performing history shapes student learning. We asked students to share their workshop experiences as well as how it informed their understanding of how science impacts human life—in particular human rights crises—and whether the workshop affected their understanding of the connections between the arts and science.

Results

This section reports our findings on the two components specifically designed for research purposes: the survey and the focus group.¹ Students were required to view the film and participate in the workshop as part of their coursework, so we do not evaluate those domains. We discuss the film and workshop above and throughout the article only insofar as they provide context for the survey and focus group data, or when students mentioned them specifically.

The Survey

Fifteen of twenty enrolled students responded to the survey. Six identified as men, and nine identified as women. Five identified as Chicano/Latinx, six as Asian, one as White, and three as Other (two Egyptian, one Armenian). Nine students were the first generation to attend college, and twelve reported speaking languages other than English (Spanish, Korean, Hindi, Arabic, Armenian). Twelve majored in biology, three in neuroscience. Only two had some arts experience: one in dance and another in choir. Three had some knowledge of *Guernica*.

Finding 1: Embodied performance enhances science students' empathy.

Research notes how embodied performance contributes to empathy (Goldstein & Winner, 2012; Verducci, 2000), enhances student development (American Alliance for Theatre Education, 2018), and contributes to our humanity (Greene, 2015, and Merlin, 2018). We found incorporating performance activities into the science classroom deepened students' investment in applying knowledge to alleviate the harm humans inflict on each other, other species, and the planet. We share below some illustrative focus group quotes.²

Jin for instance, viscerally reacted to the acting exercises:

[Merlin] made us copy one of the poses of the painting where we looked up in fear . . . I felt so sad and so much grief in that short amount of a moment, even though I wasn't in that painting, in that moment, I just was acting like I was. . . that was a really powerful moment that really resonated with me.³

Students also expressed compassion when responding to Echeverria's script. One scene portrays the mother only calling for her son's return to Spain, feeling her daughter will suffer more under Spain's dictatorship (Speer & Echeverria, 2021). Elizabeth noted the scene's relevance to her own family:

The feeling of abandonment . . . when [Andrea's] mother never came back for her. I definitely heard that a lot from my mom growing up. Her mom was around but she was constantly working, constantly, trying to make ends meet that in a way she had to make (sic) responsibility for herself and for her siblings . . . my mom and her siblings feel kind of that sense of abandonment as well.

Elizabeth elaborated on the film's alignment with contemporary events:

. . . history just repeats itself. . . And it's really interesting to feel like this is a story that I've never heard of, a place I've never really heard of, and yet, in a lot of ways, it really resonated with stories of people that I know and my own story.

Juice's compassion for the fictional characters extended to adolescents experiencing displacement today (NB: These comments were made a year before the displacement caused by the US withdrawal from Afghanistan and the war in Ukraine, to name but two examples):

. . . in the real story it was two brothers.⁴ And [Echeverria] changed one to be a girl and . . . we've all been . . . teenage girls and teenage boys before, and I feel . . . to just like remember what it feels like at that age.

These quotes suggest that theatrical engagement from the workshop allowed students to consider how human activity affects vulnerable populations, a course objective. The script, film, workshop, and focus group employed theatre to consider their science course's impacts on human beings in real life, not only on paper or in the laboratory.

Finding 2: Embodied performance enhances science students' communication skills.

The embodied performance also afforded students an opportunity to practice communicating scientific knowledge to non-experts, a goal consistent with Communicating Research to Public Audience grants, supported under the Informal Science Education (ISE) program of the National Science Foundation (National Science Foundation). Specifically, this grant sponsors initiatives that "increase public interest in, understanding of, and engagement with science, technology, engineering, and mathematics (STEM)" (www.nsf.gov). We argue that embodied theatre is an under-utilized pedagogical tool that can be used in formal science education – in this case, a university honors seminar – to foster future scientists' abilities to communicate their knowledge to the public.

Indeed, several students remarked on the importance of scientists being able to convey their findings to non-scientists, and this is an issue of import that is frequently discussed in the public sphere by scientists (Mooney & Kirshenbaum, 2009; *National Public Radio*, 2010). Ivy stated she "struggled" to

explain scientific terms to others; Trevor concurred that “communication is important for interdisciplinary work” and that the arts could be used as one mode of expression.

Juice noted the lack of communication between science majors and other students paralleled their physical separation on the UCR campus itself:

We have CNAS [College of Natural and Agricultural Sciences] and CHASS [College of Humanities Arts and Social Sciences] on opposite sides of the campus, so we don't meet each other because of that distance. It decreases the opportunity to communicate in different ways.

Indeed, we were struck that such communication skills were seldom a focus in our student's science education. Natasha shared:

Cardullo's course was a big preface for the workshop going so well. In my other classes where there's over 100 students with students' cameras off, I don't think people would be willing to listen and engage and share their own stories. The sense of vulnerability and comfortability we'd been so consistently doing that in class . . . by the time we got to workshop, we trusted each other to open up more.

Natasha added that most science discussion sections focus only on content review, worksheets, and quizzes. But she “gained the most” from a physics class requiring students to teach each other— which necessitates strong communication skills.

Ivy also commented on the power of the arts to enhance learning:

Cardullo's class and workshop helped me express myself and engage with creative, art and theatre, especially class where we're reading books and encouraged to research topics we're interested in and explore interests and not just memorize lecture material.

Elizabeth noted that creativity in communicating scientific knowledge was especially crucial during a global health crisis:

In Dr. Cardullo's exercise, we got to think creatively about science, which is important especially in a pandemic. We have to connect with those who don't share our background knowledge.

Other students made similar comments. Trevor shared that “real people with real problems need to be reached,” while Natasha noted that the workshop taught her “how to use the arts to communicate, describe other subjects.” Echoing the verbiage from the Communicating Research to Public Audience grant, however unwittingly, Juice opined:

[We need] people skilled to translate complicated information to wider public. It's important that we are communicating. Arts are there to communicate information. Theatre, documentaries shape people, simple drawings in the textbook aren't gonna do that.

These excerpts lay bare a fundamental problem, particularly evident during the COVID -19 pandemic's early stages, when we conducted this research. The scientific community still lacks the ability to communicate their expertise to the public clearly and convincingly, in accessible language. And students feel they are not often getting this training. Even as the United States and other nations transition out of the pandemic phase, the messaging about medical protocols is still subject to the whims of political leadership, the caprices in personal belief, and trends on social media. The same is likely true for countries still suffering in the pandemic phase. By focusing on “just the facts,” science education misses out on the opportunity to make crucial connections to and consequences for real human beings.

Discussion

We have explored how embodied performance can enhance university science students' empathy and communication skills. For these students to become scientists invested in using their knowledge to lessen suffering endured and caused by humans, science education must provide them with opportunities to embody what they learn and communicate with others outside their discipline. The UN reported 2020 had the greatest number of refugees since World War II (UNHCR 2021), including a record number of minors crossing the US border unaccompanied. Yet nurses describe assisting these children as "an honor," stating the kids' stories "melt [their] hearts" (Stephens, 2021). "Melting hearts," while not a scientific concept, can change minds and generate action. Given art's ability to speak truth to power, to motivate resistance and resilience, and to enhance community and communication, the benefits of incorporating art into the science classroom cannot be understated. Incorporating the arts into science education can situate students' learning as not just informative, but transformative.

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