

## **BOARD # 197: "I Feel Very Good Speaking My Language": Supporting Middle School Youth's Multilingual Competencies in Engineering through Tech Journalism [WORK IN PROGRESS]**

### **L. Clara Mabour, Tufts Center for Engineering Education and Outreach**

Clara Mabour is a third-year STEM Education Ph.D. student at Tufts University. She is a former high school STEM teacher who has also developed after-school STEM and Invention education programming for K-12 students in South Florida. Her experiences as a Haitian immigrant and maker have shaped her teaching approaches and research interests. Clara researches how people's histories with materials influence their human-material interactions and STEM learning during informal engineering projects and maker spaces. Major themes of her work include the intersections of culture and making, material agency, and collaborations in K-12 informal learning spaces.

### **Dr. Greses Perez P.E., Tufts University**

Greses A. Pérez is a Ph.D. student in Learning Sciences and Technology Design with a focus on engineering education. Before coming to Stanford, Greses was a bilingual math and science educator at public elementary schools in Texas, where she served in the Gifted and Talented Advisory District Committee and the Elementary Curriculum Design team. As a science mentor at the Perot Museum, Greses locally supported the development of teachers by facilitating workshops and creating science classroom kits. She taught in bilingual, Montessori and university classrooms in Texas and in Dominican Republic. She earned a B.S. in Civil Engineering from Santo Domingo Technological Institute (INTEC) and a M.Eng. in Environmental Engineering from the University of Puerto Rico at Mayagüez (UPRM) as well as a M.Ed. degree in School Leadership from Southern Methodist University (SMU). Her current research interests are located at the intersection of science and engineering education, multilingualism and emerging technologies. Prior to starting her career in education, Greses was a project manager for engineering projects and hydrologic and hydraulic studies.

### **Dr. Kristen B Wendell, Tufts University**

Kristen Wendell is Associate Professor of Mechanical Engineering and Education at Tufts University. Her research efforts at the Center for Engineering Education and Outreach focus on supporting discourse and design practices among engineering learners from all backgrounds and at all levels.

### **Ms. Fatima Rahman, Tufts Center for Engineering Education and Outreach**

STEM Education graduate student at Tufts University

### **Dr. Chelsea Joy Andrews, Tufts University**

Chelsea Andrews is a Research Assistant Professor at Tufts University, at the Center for Engineering Education and Outreach (CEEEO).

## **“I Feel Very Good Speaking My Language”: Supporting Middle School Youth’s Multilingual Competencies in Engineering through Tech Journalism [WORK IN PROGRESS]**

In K-12 classrooms, students rarely have opportunities to draw on the richness of their backgrounds to critically analyze and communicate about climate technologies, nor do they engage in designing meaningful solutions to address large societal and environmental challenges. Yet, young people, who see the world through the lens of their community’s language and cultural resources, are at the forefront of these conversations. Through a design-based research study, our work seeks to explore *how 6th-grade students in an urban district in the U.S. Northeast utilize their community resources, language, and culture when learning about engineering through a climate tech journalism curriculum called Community Tech Press (CTP)*. During the unit, students created multilingual/multidialectal journalism pieces to inform their community about climate technology. Following a grounded theory approach, we documented the ways in which youth described access to learning in different languages as a way to (i) *expand the messages for diverse external audiences*, and (ii) *express their linguistic identities in and outside of engineering*. By engaging young people in understanding how societal choices about climate technologies and solutions affect their locale, we seek to inspire action in youth with and for their communities to craft critical journalistic messages for people like themselves.

**Keywords:** Design-Based research; Multilingual/Multidialectal Learning, Engineering communication, Pre-college, Climate technology design

### **Introduction**

Across geographies and time, young people have been active participants in vocalizing complex global challenges that impact their communities [1] and [2]. From youth civil rights activists in the Southern United States in the 1950s and 60s leaving school during the school day to protest racial injustices [3] to Greta Thunberg sounding the alarm and engaging in civil disobedience to raise awareness about climate change [4] and [5]. Although youth have been historically active and are sometimes taught climate science and engineering in schools while experiencing climate impacts in their communities, what youth learn in schools and how they experience it outside of the classroom rarely connect. Furthermore, a STEM education that includes community perspectives is rarely present in K-12 engineering and science curricula [6], further widening the gap between what learners know and how learners use what they know to tackle problems in their communities. Though many students fare through this type of education, a lack of connection between students' lived realities –culturally and linguistically– excludes youth from engaging in engineering and science [6] and [7].

Our work defines engagement in engineering design practices as a process of critically examining the building of technologies and solutions while developing collective knowledge [8]. In this process, youth, including those who are multilingual and multidialectal, are positioned as doers and knowers in both their communities and the disciplines [2]. We developed a 20-lesson climate tech and journalism curriculum called Community Tech Press to invite 6th-grade learners in a small city in a Northeastern state in the United States to bring in their community experiences and linguistic practices to learn about engineering practices and climate tech

knowledge to share with their communities. This work seeks to investigate *how youth perceive and use their cultural and linguistic practices to develop multilingual/multidialectal climate tech journalism artifacts for their communities.*

## **Conceptual Framework**

Through the lens of funds of knowledge, translanguaging and situated learning [13], [6], [19], [10], and [11], our work highlights youth cultural and linguistic practices in a community-based engineering and climate tech unit. Young learners have a multitude of ways to understand the world through language, culture, experiential knowledge, disciplinary knowledge, and their values. Youth come to engineering learning environments with practices and knowledge from their communities. Through their linguistic multi-competence [9], youth access and use their funds of knowledge [11]. By focusing on language as a competency [9], we highlight the learning opportunities of understanding the ways in which learners use language to design, make sense of ideas, and solve problems [12].

As an added layer, different competencies are activated in specific contexts. Therefore, designing for open use of language and community knowledge requires specific moves to make space for and understand youth's funds of knowledge. Translanguaging as a justice framework shapes the unit's design and implementation and the ways student interactions are analyzed. Coupled with rightful presence as a justice-oriented framework, Translanguaging shapes socially oriented and culturally relevant examinations of how youth are empowered to engage in engineering education as they are [13], [6], and [7]. Language norms that center standard academic English as the dominant language in classrooms may interfere with designing learning environments that encourage multilingual learners to engage as their full selves. Altogether, we see designing for translanguaging as a way to encourage and support learners to access their cultural and linguistic repertoires in spaces that do not typically allow them to do so.

## **Methods**

### ***Context***

The Community Tech Press is a 20-lesson multilingual and multimodal journalism, engineering, and climate tech curriculum for sixth-grade science classrooms in Pepperville. The lessons were designed with specific localized components to Pepperville, including interactive Geographic Information Systems (GIS) maps of Pepperville's, heat islands, pervious surfaces, flooding projects, and more. The curriculum was implemented in the Spring of 2024 across five sixth-grade classes at two different schools in a small urban city in the Northeast United States, which we call Pepperville. Mr. J taught the course at school A and Mr. S taught the curriculum at School B. Mr. J and Mr. S, both white male teachers, have students from ethnically and linguistically diverse backgrounds. Most of the students spoke English, and many spoke, understood, or were learning another language. At the end of the curriculum, learners made a video journalism artifact for specific audiences about climate tech in Pepperville. Both sites hosted a screening day to view the students' final journalism artifacts, which, for the Spring 2024 implementation, were journalism videos. This paper focuses on data from two of Mr. J's classes. In our project, in multilingual and multidialectal settings, like engaging with engineering and climate technology for their self-defined communities in Pepperville (pseudonym).

### ***Data Collection and Analysis***

Researchers were present at both sites every day of the curriculum implementation and collected data in the form of learner artifacts, video and audio recordings, field notes, and semi-structured student interviews. The data for this paper primarily come from student interviews as they worked on their final artifacts. Data were analyzed using a grounded theory approach, using open-coding of student interviews and elements of in vivo and line-by-line coding to identify over 200 unique codes. Researchers met together to look for themes across the codes, which were refined to a total of 4 codes (community, language, engineering communication, and identity), followed by analytic memoing [14] and [15].

### **Findings**

Initial findings show hesitation from multilingual students to use their full language resources, even though they use them at school and throughout the school day. However, the findings also show that students want to engage their multilingual competencies in community engineering and climate tech information to their self-defined audiences in their communities.

Junior is a native Portuguese speaker who speaks Portuguese with his friends throughout the school day and during class, shared his pride of being able to speak Portuguese. When asked about his comfort speaking Portuguese with other individuals who speak Portuguese, Junior described how he uses his Portuguese and English language resources to help others and then said, “I feel very good speaking my-my Portuguese, my language.” It is clear from his responses and his use of non-English language resources that Junior is comfortable communicating in non-English languages for everyday communication. During class, he sometimes asked Neymar, his friend, to translate words from Portuguese to English. However, he and his group, three of whom are multilingual learners who speak and read in Portuguese as well as English, did not use Portuguese for their final artifact even when this was expressed and encouraged.

**Interviewer** How much [Portuguese] do you speak here and at home? What's the difference in...?

**Junior** Here at school, I speak like 50% cause I have my friends that speak with them in Portuguese and like when I'm with the teacher, I speak in English.

**Interviewer** Yeah

**Junior** But at home, I usually just speak Portuguese with my family. So, I don't use too much English at home, I only use it for school.

**Interviewer** Yeah. Do you bring any Portuguese into your final project?

**Junior** Mmmmm, No.

**Interviewer** No. Why not?

**Junior** I don't know. We didn't think of that yet.

**Interviewer** Mmmm-hmmm

**Junior** But you know that mam over there, I forgot her name. She is helping us with the ideas for the project.

**Interviewer** That's good.

**Junior** And she said that maybe we can do it—some parts in Portuguese.

Junior's responses show his comfort speaking Portuguese at school and also show that at home he rarely speaks English. During class, he was observed speaking Portuguese often with multiple of his classmates for much of the class, including when working on the climate tech assignments and in-class engineering design projects. He has a well-formed bridge between his use of linguistic practices at home and at school, however, a gap emerges when he discusses the final artifact, a culminating public-facing climate tech journalism video. The main topic for Junior's group was how high temperatures make it difficult for Brazilian people who play soccer barefoot to continue that practice on local public soccer fields. While the group discussed their cultural experiences playing soccer barefoot in Brazil and continuing the practice in Pepperville, they did not incorporate the use of Portuguese into the final artifact. Junior mentions that they were invited to use Portuguese but says they had not thought about actually using Portuguese.

Students across Mr. J's two classes already have interests in new languages or even learning languages that their parents and ethnic groups speak. Multilingual and monolingual students in the class described excitement about learning other languages. Lynn said, "I don't know any languages other than English—I'm going to learn Japanese, but that's next year." Lynn described learning Japanese on her own with support from her parents and grandparents. Naomi said, "I don't speak another language, but I'm learning Spanish and I'm like learning a little bit of Portuguese." Naomi described picking up both Spanish and Portuguese language skills. Jade said, "I have a cousin in Germany and I'm trying to learn German to communicate with them and Mandarin is also kind of family related but also it's just like a language that I really want to learn." Jade's purpose for wanting to learn German is so she could communicate with her family who live in Germany and learn Mandarin as a way to connect more to her family roots. During his interview, Jake said "I feel like being able to speak different languages is something that you have – like other than other people...So let's say it could be like a unique thing." Jake, along with other students in Mr. J's classes, expressed how speaking other languages makes them feel "unique" and "proud." We provided English translation for some components of the lessons and even when they do not speak a particular language, learners described feeling comfortable or even unbothered by interacting with content in other languages. Overall, learners in Mr. J's classes are already engaging in language learning in their homes or in school settings. However, overt language interactions siloed from their STEM courses.

Few students attempted to use a language other than English in the final artifact across both sites. Among Mr. J's students, Autumn and Daniela described their plans to speak and write in both Spanish and English in their final artifacts. Autumn communicated in English and sometimes used colloquialisms in her everyday speaking during class time and Daniela is a bilingual Spanish and English communicator but spoke almost exclusively in English during our observations. For their final artifact, Autumn and Daniela's main message was about reducing carbon emissions in Pepperville. They described their plans for including Spanish and English in their final artifact.

**Interviewer** OK. What audience did you choose?

**Daniela** We want to do like Pepperville cause I could voice-over. Autumn is going to voice-over with like English, and I can voice-over Spanish.

**Interviewer** OK

**Daniela** So, our audience is really just people in Pepperville that are like sort of bilingual

**Interviewer** Ah

**Daniela** Yeah.

**Interviewer** Yeah, yeah, yeah, that's really cool. How did you decide on that audience?

**Daniela** I think we chose that because it was like, it would get to more people

**Autumn** Yeah

**Interviewer** Yeah— What were you going to

**Daniela** Because like if you have two languages, that's like two times the more people that can hear it

In a follow-up interview, Daniela added.

**Daniela** Yeah. — Some people don't speak or understand English, so we thought it would be better if we did two voice-overs like one in Spanish, one in English, so more people could get it. So, more people can be informed. So, I would do it in Spanish and she would do it in English so that way you know more people could hear and actually learn something.

Daniela and Autumn chose people who are “bilingual” Pepperville residents as their audience and decided to gear their communication towards Spanish-English speakers by proposing doing voice-overs in both Spanish and English. In their final artifact, Daniela and Autumn used written Spanish translations to English text on their visuals. They described climate change and the impacts of climate in both English and Spanish, however, for the audio component of their video, they only spoke in English. A preliminary analysis of their final artifact shows that they position the English writing above the Spanish writing. They included some images as an additional way of conveying their concepts in their video. An interesting part of their descriptions above is when Daniela says, “if you have two languages, that's like two times the more people that can hear it” and followed with “So that way you know more people could hear and actually learn something.” Daniela sees using more than one language as a way to expand the reach of those that learn from their climate tech journalism artifacts. Other students also reflected on this idea during their interviews, which shows that students are thinking about engineering communication expansively through the use of multiple languages.

## **Discussion**

We see translanguaging in action during the class activities, but there still seems to be a barrier for students to engage their full linguistic repertoire when producing engineering and climate tech journalism content. In a study about elementary school students' perceptions of language in an engineering course, researchers found that students saw their other languages as secondary to English in the engineering design context [16]. One difference between the works is that students in this group described feeling proud of their non-English languages. This further complicates our understanding of the phenomenon. Of the multilingual communicators in Mr. J's classes, Junior's group consistently spoke Portuguese with each other throughout the lesson during class time, however, they did not produce content in Portuguese. We consider the historical exclusion of minoritized languages in engineering learning opportunities, and powered language dynamics in and outside of the classrooms, as possible contributors to learners' hesitation to engage in the ways of speaking in their communities. However, more analysis is needed to better understand the findings.

Our work joins other scholars who call for socially oriented perspectives in science and engineering that prioritize communities by reflecting the lived realities of people in disciplinary knowledge and practices [6] [7]. This work aims to empower minoritized youth to critically analyze climate technologies and communicate their knowledge of technology design in their community while enhancing their capacity to participate in engineering design practices in culturally dignifying ways within science classrooms.

## References

- [1] H. Han and S. W. Ahn, "Youth mobilization to stop global climate change: Narratives and impact," *Sustainability*, vol. 12, no. 10, pp. 4127, 2020.
- [2] D. Morales-Doyle, "Justice-centered science pedagogy: A catalyst for academic achievement and social transformation," *Science Education*, vol. 101, no. 6, pp. 1034–1060, 2017, doi: 10.1002/sce.21305.
- [3] A. R. Marri and E. N. Walker, "'Our leaders are us': Youth activism in social movements project," *The Urban Review*, vol. 40, pp. 5–20, 2008.
- [4] G. Thunberg, *No One Is Too Small to Make a Difference*. London, U.K.: Penguin, 2019.
- [5] J. Jung, P. Petkanic, D. Nan, and J. H. Kim, "When a girl awakened the world: A user and social message analysis of Greta Thunberg," *Sustainability*, vol. 12, no. 7, pp. 2707, 2020.
- [6] A. Calabrese-Barton and E. Tan, "Beyond equity as inclusion: A framework of 'rightful presence' for guiding justice-oriented studies in teaching and learning," *Educational Researcher*, vol. 49, no. 6, pp. 433–440, 2020.
- [7] S. Costanza-Chock, *Design Justice: Community-Led Practices to Build the Worlds We Need*. Cambridge, MA: The MIT Press, 2020.

- [8] K. B. Wendell, C. J. Andrews, and P. Paugh, "Supporting knowledge construction in elementary engineering design," *Science Education*, vol. 103, no. 4, pp. 952–978, 2019. doi: 10.1002/sce.21518
- [9] V. Cook, "Premises of multi-competence," in *The Cambridge Handbook of Linguistic Multi-Competence*, V. Cook and L. Wei, Eds., Cambridge, U.K.: Cambridge University Press, 2016, pp. 1–25.
- [10] A. Johri and B. M. Olds, "Situated engineering learning: Bridging engineering education research and the learning sciences," *Journal of Engineering Education*, vol. 100, no. 1, pp. 151–185, 2011.
- [11] A. Wilson-Lopez, J. A. Mejia, I. M. Hasbún, and G. S. Kasun, "Latina/o adolescents' funds of knowledge related to engineering," *Journal of Engineering Education*, vol. 105, no. 2, pp. 278–311, 2016.
- [12] G. Pérez, M. González-Howard, and E. Suárez, "Bienvenidos a la conversación: Examinations of translanguaging across science and engineering education research," *J. Res. Sci. Teach.*, vol. 62, no. 1, pp. 3–14, 2025, doi: 10.1002/tea.22010.
- [13] O. García and L. Wei, "Language, bilingualism and education," in *Translanguaging: Language, Bilingualism and Education*. London, U.K.: Palgrave Pivot, 2014, pp. 46–62.
- [14] K. Charmaz, *Constructing Grounded Theory*. London, U.K.: SAGE, 2014.
- [15] K. Charmaz and R. Thornberg, "The pursuit of quality in grounded theory," *Qualitative Research in Psychology*, vol. 18, no. 3, pp. 305–327, 2021.
- [16] G. Pérez and S. Johnson, "When I learned science in Spanish, I had to switch to English": The stigmatization of non-dominant languages in engineering, in *The Interdisciplinarity of the Learning Sciences, 14th International Conference of the Learning Sciences (ICLS) 2020*, M. Gresalfi and I. S. Horn, Eds., vol. 2, pp. 741–744, Nashville, TN: International Society of the Learning Sciences, 2020.

## Acknowledgements

We wish to express our gratitude to teachers and students in our partner schools who are the main inspiration for this work. We also thank the Center for Engineering Education and Outreach (CEEEO) at Tufts University for their support. This work is supported by the National Science Foundation Award No. 2300726.