Resettled Burmese Refugee Youth's Identity Work in an Afterschool STEM Learning Setting

Abstract: Youth from non-dominant racial and linguistic backgrounds often have limited access to school science learning opportunities. Afterschool settings may provide learning environments in which they improve science knowledge and construct positive science identities. With this premise, our research team designs and provides a community-based afterschool program that engages resettled Burmese refugee youth in STEM learning. In this paper, we seek to understand how refugee youth utilize their funds of knowledge and what identities were foregrounded in the program. We adapt a micro-ethnographic perspective in our research and review video recordings of participants' engagement through multimodal discourse analysis. Our analysis suggests that youth crafted creative ways to participate in the science discourse such as: 1) blending joking and laughter with science discourse to negotiate their identities with each other and with an otherwise intimidating discourse, 2) utilizing place-based ethnic practices and knowledge in participating in science discourses, and 3) coordinating turn-taking and responding to others' ideas that makes the learning environment safe and inviting to all. We discuss insights that can potentially advance our understanding of refugee youth identities and transform our ways of supporting their science learning.

Keywords: Science discourse, funds of knowledge, identity, resettled Burmese youth, informal STEM program

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Introduction

With the increasing number of refugees resettled in the United States, research to examine and support refugee youth's learning of various science disciplines has become a high priority in both formal (Banner, 2016) and informal education environments (Tan & Faircloth, 2017). Many school-aged refugee youths are emergent multi- or bi-linguals, labeled as English learners (ELs) in school settings. ELs are often marginalized in classrooms and school (Gutiérrez, Larson, & Kreuter, 1995). Refugee youth have limited access to high-quality science classes because of tracking that prioritizes remedial English language development over rigorous disciplinary learning (Kanno & Kangas, 2014). Moreover, many resettled refugee youth's formal schooling experiences are interrupted in the process of migration, yet upon resettlement, young refugees are often enrolled to grade level on the basis of age rather than academic competency or join newcomer programs where they learn basic literacy and mathematics skills with other newly arrived immigrants and refugees (Capps, et al., 2015; Ruiz-de-Velasco & Fix, 2000). Thus, there is a critical need to provide better support for disciplinary instruction that offers resettled refugee students opportunities for learning science.

Here, we pose a question in operationalizing this seemingly obvious educational aim as to what specific goals in science education for refugee youth should be pursued and how to prioritize these goals. Science education reform documents (e.g., Next Generation Science Standards) set two different but important goals: increasing literacy among all students and educating young students to pursue science majors in postsecondary education which lead to careers in the science workforce. While acknowledging the importance of developing future workforce and potential financial benefits that science (or STEM- Science, Technology, Engineering, and Mathematics- fields) would bring to resettled refugee youth, we are also concerned about those who do not necessarily intend to pursue science as post-secondary careers, are marginalized in and alienated from science discourses, and may see science as irrelevant to their own lives. Thus, in science education for resettled refugee youth, we are interested in pursuing ways to engage them in science discourse that is relevant to them, has an impact on their present and future lives, and contributes to changes toward social justice in the immediate and larger society. In what follows, we elaborate on our theoretical framework building on the ideas of *funds of knowledge* (Moll, Amanti, Neff, & Gonzalez, 1992). Then, we show our analysis of data collected from a community-based afterschool STEM program that is designed to pursue aforementioned goals and demonstrate how resettled Burmese youth engaged in such science discourse drawing on their unique and various funds of knowledge. Based on the findings, we aim to provide implications for best practices in STEM education for disadvantaged populations more broadly.

Theoretical Framework

Science has been taught traditionally in a "mono-methodological" manner in that its objectivity and empiricism are over-emphasized over creativity and subjectivity (McFarlane, 2013). Teachers are the ones who decide what knowledge is legitimate and relevant and who has agency and authority in each instructional moment. In this science teaching tradition, students are inhibited from agentively deciding what is relevant to their learning, but expected to acquire knowledge selected by the teachers and constrained to limited opportunities in their participation in classroom decisions (Calabrese Barton, Basu, Johnson, & Tan, 2011). This tradition has marginalized students particularly from racially, culturally, and linguistically non-dominant backgrounds (Aikenhead & Jegede, 1999). Practices, discourses, and knowledge science teachers employ in the teaching of science often mismatch with what non-dominant students bring to bear to science learning contexts. Thus, their experiences, values, and ideas are not appreciated as valuable resources for learning science and are even penalized as impeding new learning.

Recently, many science educators have challenged this conventional view of science teaching and learning and strived to incorporate students' everyday experiences, practices, and values to foster their science learning and the construction of positive identities as science learners. By employing students' *funds of knowledge* as valuable assets for new learning, educators have designed classroom learning environments in which racially and linguistically non-dominant students can achieve robust science learning. While funds of knowledge were originally understood as home-based knowledge (Moll, Amanti, Neff, & Gonzalez, 1992), recent research has expanded its scope into the broader public sphere. These individuals bring a fund of complex experiences to our public environments, such as transnational experiences of immigrant students and youth pop culture (Moje et al., 2004), skills and talents in various activities such as storytelling that are not often sanctioned in traditional science classes (Tan & Calabrese Barton, 2008), knowledge learned from the streets and students' ethnic communities (Calabrese Barton, Tan, & Rivet, 2008), and their non-scholastic labor experiences (e.g., working in a barber shop, drum playing; Seiler, 2001). What is common in all of the studies cited here is the realization that teachers, rather than being the sole transmitters of knowledge, are actually interacting with students already adept at a range of skills and discourses to which the teachers would be novices. Thus, learners are positioned as "important and powerful participants in their own learning and that of their peers and teachers, and also as members of a larger global society who can leverage their lives in schools towards making a change" (Calabrese Barton et al., 2011, p. 6-7).

Afterschool and community-based programs constitute middle grounds where learners can engage STEM subject matters with fuller utilization of the funds of knowledge they bring with them (O'Neill, 2011; Rahm, 2013). The free use of non-school practices and knowledge along with school-based knowledge can afford democratic education aimed at mitigating the existing asymmetric power relations in school science. Examples are numerous: an urban afterschool science program that has expanded funds of knowledge to include student's visions for their futures, social relationships, and their own purposes and use of science (Basu & Calabrese Barton, 2007); a program offered for Latino youth that draws on the culture, language, and practices of the Latino community and advocates for investigating these funds by engaging the community in the dialogue about the education in their schools (Fairbanks et al., 2017); a community-based program that engaged learners of indigenous communities in the learning of climate change that combines traditional stories, climate change science instruction, and performances (McGinty & Bang, 2016); and an after-school video project that advanced learners' perception of science to incorporate their neighborhoods' and everyday knowledge from the people who lived there (O'Neill, 2011). Informal learning opportunities gain more attention not only as an auxiliary site for science learning but also for advancing critical and democratic science learning experiences of students who are underserved in school science (Hodson, 2003). These afterschool programs are successful because they offer sites where students can blend a wide range of their out-of-school practices with the practices and knowledge they acquire in the afterschool space.

Our study builds on this line of research that aims to foster science learning of youth who are minoritized in school due to their racial, cultural, and linguistic affiliation. In particular, this study focuses on a community-based afterschool program that serves high school youth of resettled Burmese refugee backgrounds. Utilizing interviews collected from the Burmese youth (Authors, 2018) and building on existing literature on resettled Burmese refugee backgrounds (Barron, et al., 2007) and practices (Duran, 2016), we designed and implemented an afterschool program that engages the youth in learning and talking science regarding the topic of weather, climate, and climate change. We hoped the youth participants leverage their funds of knowledge to the maximum extent possible in both the doing and the discourse of science. We agree that teachers who explicitly invite student's home knowledge are successful in incorporating funds of knowledge into the classroom setting (Calabrese Barton & Tan, 2009). In particular, we believe that funds of knowledge in a broader sense include learners' previous and current experiences in the wider public sphere (e.g., Calabrese Barton, Tan, & Rivet, 2008; Moje et al., 2004; Seiler, 2001; Tan & Calabrese Barton, 2008). To encourage youth participants to bring various funds of knowledge, we provided opportunities to share their experiences and stories, draw on youth culture, and use their home languages. By engaging with familiar discourses in science settings, students can incorporate familiar experiences and examples from their lives to make science relevant and accessible to them (Lin & Wu, 2015). Especially for ELs, home languaging practices in conjunction with science allow them to develop new science discourses by accessing the knowledge they have developed in all of their language repertoires.

In doing this work, we were not motivated by the economic argument for science education that defines primary goals of science education as economic growth and global competence of the country (Hodson, 2003). Rather, we were interested in fostering critical science literacy (Tan, Calabrese Barton, Gutiérrez, & Turner, 2012) wherein youth construct purposes and use of learning science, potentially to transform discourses and practices of science (e.g., Upadhyay & Albrecht, 2011), their identities (e.g., O'Neill, 2011), and the world around us to build democratic and just societies (e.g., Emdin, 2011). During the implementation of this program, we collected data through ethnographic means to examine how the participants engage in collaborative scientific sense-making and in doing so, how they utilize various funds of knowledge and negotiate identities. Specifically, we asked:

- What kinds of funds of knowledge did the Burmese youth utilize in STEM afterschool program?
- Through discursive participation in scientific sense-making, how did they negotiate identities?

Methods

This study is situated within a large research project, PROJECT A, which was offered as part of a community-based afterschool program offered for Burmese high school youth in Midwestern City. The afterschool program is provided by a Burmese community organization with aims of educating Burmese youth to increase college enrollment rates, skilled position job placement, and integration of the Burmese community into the local community in the long run. The afterschool program met in a classroom of a high school in which roughly half of the youth participants attended for their public schooling.

An average of 10-20 teens, who were sophomores and juniors in high school at the time, attended each session of PROJECT A. Most youth participants were ethnically Chin, one of the major ethnic groups in Myanmar. However, as the Burmese youth came from various sub-ethnic groups, they spoke multiple Chin languages (e.g., Hakha, Falam, Zophei) that were not mutually intelligible. The length of time spent in the United States at the time of the program varied greatly as did their English language proficiencies. Prior to their migration to the United States, participants migrated to an initial asylum country and spent anywhere from a few months to several years there. At the time of the program, some participants recently migrated to the United States while others had resided in the United States for up to ten years.

In 2015-2016 one of every three afterschool sessions were designed and implemented by the PROJECT A team (21 PROJECT A sessions overall, one-and-half hours per each session). Learning activities included whole-group and small-group discussions, poster presentations, online research, essay writing, and experimentation. In designing and implementing the curriculum, we drew on a responsive curricular approach (Hammer, Goldberg, & Fargason, 2012) wherein facilitators accessed and built upon learners' contributions, allowing them to pursue their interests within broader curricular goals. This approach enabled us to draw from and build on learners' everyday experiences and funds of knowledge (Moll, Amanti, Neff, & González, 1992). We used English to communicate materials in the program, but encouraged students to use their home languages. Learners were encouraged to use their full linguistic repertoires to make sense of STEM ideas collaboratively with peers who speak different home languages and were provided authentic reasons to produce more extended output (Swain, 1985).

The first and second authors facilitated each session and collected data. In our data collection, we take a micro-ethnographic approach that "focus[es] on specific behavioral interactions in specific institutional settings, and do not attempt to describe a whole way of life" (Moll, Diaz, Estrada, & Lopes 1992, p. 341). Our focus was on how resettled Burmese youths collaboratively made sense of STEM ideas in an afterschool STEM program. Accordingly, we collected data that include video- and audio-recordings of sessions, interviews, screencasts of participants' computer use, participant-generated artifacts, and field notes. Two video cameras were installed at two corners of the classroom to capture each session in its entirety. When the participants were engaged in group activities, we placed voice-recorders on a table close to participants' groups to capture the small group discussions. We also collected videos of participants' computer usage through screencasting using Open Broadcaster Software when they were engaged in online research. Finally, we digitized artifacts that youth generated in each session, such as chart paper and worksheets, by taking digital photos or scanning them.

Our numerous data sources provided material for rich and multi-layered analysis of the patterns and practices of the afterschool setting (Baker, Green, & Skukauskaite, 2008). In analyzing this large archive of data, we draw on video analytic techniques suggested by Derry and colleagues (Derry et al., 2012) and Knoblauch and Schnettler (2012). The three authors of this paper individually watched unedited video-recordings to understand the flow of each session, segmented each session based on activity structures (e.g., small group discussion, whole group discussion, presentation) and topics and created a video log file, and selected *events* – an analytic unit that is composed of several discursive turns, deals with a coherent topic, and has its own flow (i.e., start-development-end or switch to another topic) – for a close analysis. After watching each week's video individually, we met as a group to discuss individual sense-making. In this meeting, we determined the segmenting of each session and co-watched individually-chosen events to discuss emerging interpretation with respect to the funds of knowledge and discursive negotiation of identities. After each meeting, we constructed a video log file using Microsoft Excel that documents each segment, its start and end time, and a brief description of each segment including its activity structure and topic. Each session consisted of 5-10 segments. We then developed a separate word document for analytic notes of selected events. In the analytic notes, we described the details of the selected events including utterances, paraverbal and nonverbal features of discourses, and arrangement of material resources (e.g., paper, computer), wrote interpretations of each event, and recorded emerging keywords (e.g. joking, word play, power dynamics, giving space, Chin practices). To situate selected events within the larger context of the program, we inserted the selected events (e.g., title, keywords) under corresponding segments in the video log file. The analysis process was dynamic and iterative in that we constantly revisited our interpretation as new insights came up and challenged each other's interpretation by suggesting alternative interpretations and providing evidence from our other data sources. Simultaneously, we looked across the emerging keywords to determine how consistently they show up in our analytic notes and identify upper-level themes.

In this paper, we analyzed classroom video- and audio-recordings collected in Weeks 1 through 5, roughly the first quarter of the one-year program. In the early weeks of a learning setting, learners have not yet developed participatory norms of a setting (Mercer, 2008; Yackel & Cobb, 1996). Instead, they bring their expectations and practices from other similar settings and test them to negotiate norms of this new learning setting. Thus, we believe that this early period is especially useful for observing learners' diverse funds of knowledge and identity negotiation that has not yet been settled and is still rough. In addition, this early period is critical to planning how to maximize the use of identified funds of knowledge for the rest of the program. Thus, in the Findings section, we present three themes that we identified in the analysis of the multiple events selected from the first five weeks' data.

Findings

Throughout the first five weeks, we observed that participants perceived PROJECT A to be an extension of school science as evidenced by the ways they participated in various learning activities. For instance, they utilized practices, knowledge, and norms that seemed to be learned in school science classes to participate in and contribute to the discussions. When explaining variables to describe weather phenomena, a couple of participants mentioned "water cycle" or "water cycle thing-y" by drawing it on the chart paper or with a finger circling in the air. Despite the use of this scientific term, they did not clearly articulate how water cycle is related to the phenomena discussed in the moment. In addition, students called on each other for not being "scientific" and at times obliged peers to use school-sanctioned terminology or offer logical evidence to support their claims. Use of incorrect terms was readily noticed and fixed by peers as well (e.g., condensation, hurricane, tsunami). When the youth presented their ideas, they stood up and walked to the front of the room to present their group's ideas even when they were not prompted to do so. When presenting in his or her own seat, the speaker would turn towards the facilitator (Author 1) as if to seek approval of their ideas. Some participants appeared to invoke their science and/or academic identities that have been established in school in positioning themselves within PROJECT A. One participant, who seemed to be less engaged in the program's learning activities and had a relatively lower English proficiency, said "Science is so hard. … I don't have idea. … I got always a D or a C… I think this is not my subject."

We believe that these behaviors were due to the students' association of the after-school programming with conventional norms of schooling in general. They were, after-all, in the classroom space in which they learned these models and seated in school classroom tables. In other sessions of the afterschool program, the youth obtained help in school homework and college application from other volunteers. In addition, we also employed typical school class activities, such as the use of Powerpoint slides and worksheets as learning activities. While the youth brought these norms and perceptions about science learning from school spaces, we did see students begin to adapt to the more fluid opportunities offered by the researchers to engage outside classroom conventions. Youth crafted creative ways of participating in and contributing to the science discourse. In the following episodes, we summarize three salient ways in which the youth engaged in science discourse: 1) blending joking and laughter with science discourse to negotiate their identities with each other and with otherwise intimidating discourse, 2) utilizing place-based ethnic practices and knowledge in participating in science discourses, and 3) coordinating turn-taking and responding to others' ideas that make the learning environment safe and inviting to all.

Theme 1: Youths blended joking and laughter with scientific discourse.

From the early weeks in the program, joking and laughter were prevalent. Joking fosters solidarity and group membership through the establishment of a shared understanding (Davies, 2003). Joking involves a transition in the interpretive frame from a "world of the ordinary conversation into a world of play or non-seriousness" (p.1367, Davies, 2003). Davies argued that joking can be utilized to relay ideas that can easily be denied ("But I was only kidding; can't you take a joke?" p.1367, Davies, 2003). Thus, joking can afford learners a way to share ideas they are uncertain of without fear of embarrassment. In PROJECT A, the youth participants frequently interweaved jokes and scientific discourse. By doing so, the youth seemed to accomplish at least two discursive goals: crafting space to communicate ideas with less fear about embarrassment and challenging each other's ideas in a less threatening way. Thus, the youth negotiated their identities (e.g., funny person) with each other and engaged in science discourse that may potentially be intimidating especially when they are uncertain about their ideas.

Here, we describe an example of how youth participants engaged in collaborative joking. In Week 5, the youths were trying to answer Neo's question on whether dew would form on a flying airplane. The youths spent about 15 minutes discussing possible answers in their self-selected small groups. They then sat in a circle and took turns sharing their ideas. Several groups had already shared their ideas and it was Tom and Paul's turn to share their ideas:

Excerpt 1 ((Paul and Tom are seated next to each other)) [1]1 Paul: (***), man ((Paul pats Tom's shoulder and leaves his hand there)) 2 Tom: This is my uncle Bob and brother= ((Tom places left hand on Paul's right shoulder and Paul places right hand on Tom's left shoulder)) ((All laugh)) 3 Tom: =He will now (***) this one for me. ((Tom and Paul remove their hands from one another's shoulder)) 4 Paul: Alright ((Paul places his hands on the desk and clears his throat)) (1) ((From his "ready" position, Paul opens his body to address the group)) Here's the Tom-Paul Theory ((All laugh. Paul looks towards Chit who is seated by his left. Chit has her head thrown back in laughter. Nanda and Tom are laughing hard and even Bo who is usually stoical is smiling in the corner))

[1] Transcription conventions are adapted from the Jeffersonian Transcription Notation (Jefferson, 1984)

Symbol	Use
[text	Indicates the start point of overlapping speech
=	Indicates the break and subsequent continuation of a single interrupted utterance
(# of seconds)	A number in parentheses indicates the time, in seconds, of a pause in speech
(.)	A brief pause, usually less than 0.2 seconds
-	Indicates an abrupt halt or interruption in utterance
ALL CAPS	Indicates shouted or increased volume speech
underline	Indicates the speaker is emphasizing or stressing the speech
:::	Indicates prolongation of an utterance
(***)	Speech which is unclear or in doubt in the transcript
((text))	Annotation of non-verbals and contextualization commentary

All youth are referred to by pseudonyms and facilitators are referred to by initials.

5 Author 2: Tom-Paul Theory? ((Utterance spoken laughingly.))
((Chit is laughing and excitedly tapping on her legs. Chit then nudges Paul))
6 Paul: We believe (1) WE STRONGLY [BELIEVE - ((in an exaggerated booming voice))
7 Chit: [We hypothesize ((Utterance spoken laughingly to Paul. Paul looks at her.))
8 Paul: We strongly believe that it will not form a dew. (1) Ah:: (.) Because (.) ((Paul clears his throat and then laughs))
((Nanda chuckles and Chit and Inzali smile))
9 Paul: ((Paul's gaze is directed towards Author 1)) Yeah, as the rest have said it, ah (.) there should be (.) it's gonna be colder (.) at the (.) outer part of the atmosphere. Because the sun (.) the heat from the sun is radiate ah (.) away from the uhm surface (.) as it goes (.) it loses the heat (.) and then since the airplane is so high out so high (.) it would (.) instead of forming a dew it will form (1) ice. (1) ((Paul raises his eyebrows))
((All laugh.))
10 Paul: And then ah::: we also believe that dew doesn't include ice in its definition (.) because dew is a liquid form of the ((Paul makes a semi-circular motion with two fists put together))

Tom and Paul are close friends and their supportive relationship is evident in their bodily movements that seemingly support each other in Turns 1-2. In Turn 2, Tom sets the stage for Paul's performance by introducing Paul as his "Uncle Bob and brother." This moment was interpreted as a playful moment, marked by the youths' loud laughter. In Turn 4, Paul cleared his throat as part of his performance of the scientist character but this was not yet obvious to the whole group. In the same turn, Paul's utterance of "The Tom-Paul Theory" coupled with his bodily movement as if he was waiting for the audience's reaction indicated that Paul was framing his performance of a scientist character as a joke. His naming of their idea as "The Tom-Paul theory," emulated scientific theories named after contributing scientists (e.g., Darwin's theory of evolution), elicited group laughter and everyone got in the playful frame Paul has set. In Turn 6, Paul elaborated his performance of the scientist character by saying "we strongly believe," instead of more typical response, such as "We think" and by embellishing his speech with a voice that other participants understood to be a self-assured, but comically wrong, voice of science. In Turn 7, Chit corrected Paul's use of "believe" with "hypothesize." Her comment seemed to draw on the dominant science discourse they must have learned in school (Tan & Calabrese Barton, 2008). Yet, she simultaneously exhibited her understanding of Paul's joke and showed her support to keep the joke going, rather than genuinely criticizing him. This is evidenced by her laughing tone in Turn 7.

In this excerpt, Paul stated his and Tom's idea that dew would not form because it would be too cold at a high altitude where the airplane flies and thus ice will form instead. While providing this causal explanation, Paul blended a science register and joking by performing himself as a scientist, linguistically, para-verbally (e.g., clearing his throat, laughing at the end of his statement, dramatic pauses and intonation), and non-verbally (e.g., raising eyebrows, and changing direction of his body to face other youths and Author 1). By this blending, Paul was able to communicate his ideas in a less threatening environment. By laughing at the frame Paul has set, his peers communicated their understanding of the moment and offered a supportive environment for Paul to freely share his ideas and engage in the science discourse. Furthermore, framing his discursive participation as a joke allowed Paul to enact his identity that was readily recognizable, such as a joker and/or a funny person, as indicated in the group's immediate and loud laughter and to effectively manage the scientific activity and share his ideas (participating in the science discourse) (Kamberelis & Wehunt, 2012).

Theme 2: The youth utilized place-based Chin practices and shared knowledge in participating in science discourses.

In school, students are introduced to the unique discourse patterns of science and expected to acculturate to these patterns (Lemke, 1990 as cited in Brown, 2004) both in what themes are delivered and how discourse is delivered. For example, experiences and knowledge minoritized students bring and share with classmates may be viewed as irrelevant or not interesting to students from dominant backgrounds (Duff, 2003). Students from non-dominant language backgrounds tend to use "lengthy, repetitive, redundant talk that includes personal experiences and emotional reactions as well as science-related ideas" (Lee & Fradd, 1998). As a result, minoritized students' discourse patterns may be undervalued or even perceived as disruptive as they are incongruent with mainstream science discursive patterns (Brown, 2006). In such contexts, students' engagement with science discourse can be problematic as it may ask them to give up cultural affiliation and assimilate to the dominant science classroom culture.

Youth in PROJECT A negotiated new ways of participation by leveraging topics that are often in conflict with what is valued by the teacher and the institution (Brown, 2004; Lee & Fradd, 1998) and created a space in which they can talk about their personal experiences as they engaged in the science discourse. Thus, the youth collectively made it possible to talk about their Chin practices, experiences, and knowledge and challenged each other to negotiate meanings. We note that since the PROJECT A curriculum focused on weather and climate change, the youth's experiences of living in Burma and the first asylum countries prior to migration to the U.S. provided important resources for the youth's engagement in the science discourse.

In the following episode from Week 1, the youth participants talked about the Burmese practice of using *Thanakha*. The discussion was prompted when youth were asked about the differences in weather in Midwestern City and other places they have lived in:

Excerpt 2
1 Author 1: Anything else that you notice that is different between living here and living in Burma?
2 Chit: We don't put sunscreen. We put the tha[nakha= ((Chit makes circular gestures to her face))=
3 Author 1: [Oh yeah.
4 Chit:=to cool ourselves.
5 WW: Put what?
6 Author 1: Thanakha.
7 Chit: It's kind of like [clay=
8 Paul: [It's like a dirt-like
9 Chit: =You know like
10 Daisy: ((Whispers to Chit)) It's not clay
11 Chit. It's not clay and it came from the tree and we do like this= ((Chit makes a stirring gesture))
12 WW: Uhuh, you mix it up?
13 Chit: =and we put it on our face.
14 Jaimie: It's from Thailand.
15 Author 1: Thailand?

16 Jaimie: Yeah.	17 Paige: No, you don't mix it. We put water ((Paige makes a stirring motion))
	18 WW: What color?
	19 Paige: Cream color.
	20 Byn: This color. ((Byn points to her face with her pointer finger))
	21 WW: Same color?
	22 Byn: Skin color.
	23 Daisy: It's cream.
	24 WW: Cream.
25 Chit: It cools us down.	
26 Jaimie: It's skin whitening and sun radiation proof.	27 Paige: It's like that ((pointing to the wall)), that wood.
28 Author 1: Really?	
29 Jaimie: Yeah. It's sun radiation proof. And then it's very good for your acne and stuff.	
((All laugh.))	
30 Author 1: Oh!	

In Turn 1, Author 1's question prompted Chit to say that "we" (Burmese or Chins) use Thanakha instead of sunscreen. It is evident that Chit positioned Chins as distinct and different from the three facilitators, Author 1, WW, and Author 2, who are not Chins. In this episode, the youths juxtaposed different ideas that they have developed through diverse experiences with Thanakha. Disagreement seems to be expected here, evidenced by the lighthearted arguments and overriding of each other's ideas (Turns 7, 8, 10, 11). In the process of reaching a consensus, they positioned themselves as experts about this topic and tried to inform the three facilitators. In addition, animated gestures, overlapping utterances, and frequent laughter throughout this episode suggest that the youth had a lot to contribute to this discussion. Humor and laughter is likely an idiom of their mastery of knowledge that allows them to mediate the relationship between themselves and scientific adults.

Starting in Turn 14, the discussion was split into two threads and the youth held two simultaneously occurring conversations. Jaimie's statement about the benefits of Thanakha in Turn 29 elicited laughter from the whole group. This indicates that despite the split in the conversation the youth were fully engaged in most ideas being offered in both threads. This laughter also allowed the split in conversation threads to converge. This kind of discussion, in which learners engage in multiple simultaneous conversations, is not often practiced in school classrooms. Rather, a teacher implicitly or explicitly coordinates students' speech turns and only one person speaks at a given time. Unlike school science practices, through these two parallel discussions, the youth freely added to the discussion by leveraging their heterogeneous experiences and expertise and demonstrated their excitement and engagement. In this moment, rather than privileging one experience, the youth negotiated the discursive space to allow multiple ideas and knowledge that build on individual's unique experiences and interpretation of Chin practices. Through humor, they advanced their own modalities of knowledge that are often undervalued in many dominant school sciences. By doing so, they enacted an identity as experts of Chin culture, practices, and technology, and as individuals who are more knowledgeable than adult facilitators, who are perceived to be more scientific than themselves, and can teach them.

Theme 3: The youth coordinated turn-taking and responded to others' ideas in a way that makes the learning environment safe and inviting to all.

In school classrooms, not all students have opportunities to participate in or contribute to the classroom academic discourse. For instance, students' social status, popularity, and racial, socioeconomic, and linguistic backgrounds influence who gets the floor and how their utterances are taken up by others (Bianchini, 1997; Kurth, Anderson, & Palinscar, 2002). These interactional dynamics further determine what and how well students learn (Goldberg, Welsh & Enyedy, 2009). Carlone, Haun-Frank, and Webb (2011) argued that learners can be agents who make participation opportunities equitable to all when they "buy in and contribute to [the] development and maintenance" of equitable practices (p. 465). In PROJECT A, youth participants cultivated various social interactional norms that shaped the learning setting to be more accessible and inviting to everyone. Specifically, they provided participation opportunities for peers who do not often get the floor and/or speak English with limited proficiency. The youth achieved this by policing those who dominate the conversation, giving reassurances and allowing wait time, and showing respect for each other's ideas by giving proper credit.

An illustrative example of this theme occurred after Paul stated that dew does not include ice in its definition in Turn 10, Excerpt 1:

Excerpt 3

1 Chit: Zag ((Chit points towards Neo and herself. Earlier, the students decided to do "zig and zag" to determine their turn-taking order))

2 Neo: Alright ((Neo claps his palm to his fist))

3 Paul: And ah ((Paul scratches his neck)) okay
((Win Shwe raises her hand))

4 Author 1: Oh you (***)

5 Paul: (***)

6 Chit: She has a question ((Chit points to Win Shwe. Author 1 points to Win Shwe))

7 Tom: ((Tom points to Win Shwe)) You can ask

8 Paul : Ask (***) ((Paul's gaze is on Win Shwe))

9 Win Shwe: (***) Ice has to be liquid first

10 Paul: Yes it has to be liquid first (.) ((Paul makes an open palm gesture. Chit's gaze is on Win Shwe)) but then since (.) it's so cold (.) it (.) is

11 Chit: No::: ((She looks at Paul on her right)) [she is=

12 Paul: [It's <u>not</u> HOT enough to-

13 Chit: =She is right ((Chit wags her pointer towards Win Shwe who is seated on her left)) Okay (1) Water vapo:: vapor ((Chit makes a square in the air with both of her hands)) cannot turn into <u>ice</u> like tha::t. It has to be: in liquid form first

14 Paul: No ((Paul turns slightly towards Chit)) I think it can ((puts his hand on his chin)) [because hail- ((makes a counting gesture with his pointer finger))

15 Neo: [Wha:::::t? ((in a singsongy voice)) ((Neo chuckles))

16 Chit: Water vapor is [gas= ((She puts her thumbs and pointer finger together and she turns towards Paul))

17 Paul: [No because like how ((Paul faces Author 1))
18 Chit: =invisible gas
19 Paul: No, no, how they combine (1) ((He turns to Chit))
20 Nanda: What? ((Nanda, Chit, Neo, then Tom laugh))
21 Neo: What combine?
22 Paul: Okay ((Paul laughs. The group laughs)) Okay (***) alright a small particles (.) of the air (.) of the ah (***) group dense to get it to form a cloud [and then=
23 Chit: <u>Dense</u>?
24 Paul: = yeah (.) and then that cloud, when it's too dense it falls into water right? But then sometimes it falls as in snow, hail, which is basically ice, so
25 Chit: Snow and hail are liquid first ((Chit moves her cupped hand)) [before=
26 Win Shwe: [Yeah in the air
27 Chit: =They are water
28 Nanda: They're water first and then fall ((Nanda moves her middle and pointer finger in a falling motion))
29 Chit: They turn into liquid first and then ((Chit moves her inverted cupped hand))

In Turn 1, Chit said "Zag" to announce the next person to share his/her ideas. This turn-taking practice was decided by youth earlier to ensure that everyone shares their ideas. We recognize that such mechanical turn-taking may have been learned from school science classrooms and limit learners' productive and dialogic exchange of ideas (Carlone, Huan-Frank, & Webb, 2011). We have observed instances in which the youth took their turn, shared ideas, and moved onto the next person without engaging in the ideas shared by the speaker. However, we argue that this turn-taking practice was utilized to ensure equitable opportunities for sharing ideas of all learners by allotting everyone time to hold the floor. This can be particularly helpful for those whose English proficiency is low and/or who have difficulties in getting the floor. In Turn 6, Chit noticed Win Shwe's intention to present her idea while others did not. We note that Win Shwe had a lower English proficiency than some other youths like Chit and typically spoke in a quiet voice. While carrying out the "zig-zag" turn-taking practice, instead of adhering to the practice, Chit (and other participants) negotiated the floor in each interactional moment to ensure everyone's, especially quiet ones', ideas are heard.

Furthermore, this episode shows how the youth participants credited each other's ideas and built on them in scientific sense-making. When Win Shwe pointed out a loophole in Paul's argument, Chit explicitly called the attention of all participants to Win Shwe's idea by saying "she is right" (Turn 13) and further elaborating it (Turns 16, 18, 25, 27, and 29). Win Shwe agreed (Turn 26) and Nanda also supported Win Shwe's idea (Turn 28). Chit's follow-up encouraged Paul to articulate his idea and engaged other participants in a scientific discussion regarding phase change, how clouds form, and how precipitation occurs. Thus, without Chit's efforts to help Win Shwe speak hear ideas and co-construct the ideas, the learners would not have entertained Win Shwe's different and scientifically-sound reasoning. The youths' practices (e.g., turn-taking, yielding the floor for peers who are reticent or speak English with limited proficiency, crediting and building on others' ideas) not only supported an equitable learning environment but also everyone's science learning. In this episode, the youths, especially Chit, enacted an identity as someone who supports peers' participation and learning opportunities, cares about their ideas, and genuinely builds on them for her own and others' learning.

Discussion and Implications

Our findings shed light on how resettled refugee youth crafted space for participation in community-based STEM program. They resisted how science discourse is commonly understood as something not for them and employed their own humor, indigenous knowledge, and processes of collaboration to make a space for themselves within it. In particular, we showed how the youth validated their funds of knowledge from home and/or youth culture (e.g., humor) as important assets and valued themselves and others as individuals who are situated with histories and cultural experiences (Calabrese Barton & Tan, 2009). Science discourse was blended with Chin experiences and joke-making while providing equitable participation opportunities for all members. Their engagement in laughter, joking and playfulness reflects how they felt at ease in the learning environment (Aikenhead & Jegede, 1999). In this process, they enacted and blended multiple aspects of their identity in a seamless way; Such as a humorous teen, capable science learner, Chin who is knowledgeable about Chin practices, and an individual who helps peers' ideas to be heard and valued. Through these practices, they supported and challenged themselves as well as each other for new learning.

The youth's practices resonate with what Upadyahay and Albrecht (2011) argued are components of a deliberative democratic classroom: 1) evidence-based argument or reason-giving; 2) equity in participation and decision making; and 3) respect and value for other's knowledge. The youth participants in our program engaged in these three components and further incorporated joke-making and playfulness, which may be a characteristic of youth culture. We argue that through creating and participating in these discourse practices the youth crafted and participated in critical science literacy practices.

We draw implications of this work in global contexts of narratives that demoralize and marginalize refugees (Steimel, 2010) and what educators and researchers can learn from these youths' local practices of science discourse to disrupt a deficit perspective on marginalized youth (Taylor & Sidhu, 2012). Based on the findings, we call for implementing informal STEM enrichment programming and research that empower refugee youth by building on the rich and diverse funds of knowledge they bring to learning settings. Resettled refugee youth, perhaps more broadly migrant youth, may develop diverse place-based knowledge that can be used in many subject areas, such as science (e.g., weather, climate, geology, natural resources) or social studies (e.g., culture, politics, history). Youth who have experienced inequity in their home country and/or in the process of migration may bring strong dispositions to equity, both at a local and global level. When encouraged and valued, these youth would contribute rich knowledge and disposition to the learning settings, which in turn leads to their own empowerment as valued members and all students' development of knowledge and disposition.

In the context of science teaching, the transformation of the notion of science learning should begin with the recognition of values that refugee youth bring and how conventional science discourse fail to recognize those values. As the students in this study intuited, it is part of the gated community of science identity that is often subtly closed off to them. If science learning is defined only as an acquisition of canonical knowledge and practices, teachers may not recognize experiences, knowledge, and disposition that refugee youth can contribute nor the ways in which students' performance is linked to the degree to which they can identify with and become comfortable in science discourse itself. If science learning is viewed more broadly as engaging with various experiences and knowledge, collaborative sense-making, and aiming for a democratic society, their resources can be more meaningfully drawn into science discourse. Additionally, science does not have to be taught as an isolated subject, but rather integrated with other subject areas, such as social studies. In such an integrated learning context, science can be framed as a human endeavor that involves culture and societal concerns and values, rather than a culture- and value-free discipline that is irrelevant to human lives.

Without the many constraints of state-mandated standards, informal learning settings may better support these research and instructional approaches. Informal education settings can move beyond providing remedial help and provide space in which youth can share their values and experiences freely, perform their various identities, and be empowered. We note that the resources our program had (e.g., stable support from a community organization, space provided by the school, governmental and/or university funding) are crucial to helping students who would otherwise be alienated from science discourse to enter the STEM arena. Moving beyond informal education settings, we call for changes in in-school education settings. In-school teaching practices should present science as well as other subjects to be more relevant to individuals' experiences, and various youth practices and culture such as playfulness and laughter. Furthermore, this presents science as open to all learners rather than those who are positioned as competitive students. Teachers should also focus on inviting students into the discourse of science by acknowledging the implicit and explicit assumptions and biases in the way science is perceived, projected, and embedded in broader societal discourses. In this environment, use of diverse learners' funds of knowledge can be maximized for all learners' learning.

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References

Authors (2018).

Aikenhead, G. S., & Jegede, O. J. (1999). Cross-cultural science education: A cognitive explanation of a cultural phenomenon. *Journal of Research in Science Teaching, 36*(3), 269-287.

Baker, W. D., Green, J. L., & Skukauskaite, A. (2008). Video-enabled ethnographic research: A micro ethnographic perspective. *How to do educational ethnography*, 76-114.

Banner, I. (2016). Valuing difference in students' culture and experience in school science lessons. *Cultural Studies of Science Education, 11*, 1071-1079.

Barron, S., Okell, J., Yin, S., VanBik, K., Swain, A., Larkin, E., . . . Ewers, K. (2007). *Refugees from Burma: Their backgrounds and refugee experiences.* Washington, DC: Center for Applied Linguistics

Bianchini, J. A. (1997). Where knowledge construction, equity, and context intersect: Student learning of science in small groups. *Journal of Research in Science Teaching, 34*(10), 1039-1065.

Basu, S. J. & Calabrese Barton, A. (2007). Developing a sustained interest in science among urban minority youth. *Journal of Research in Science Teaching, 44*(3), 466-489.

Brown, B. A. (2004). Discursive identity: Assimilation into the culture of science and its implications for minority students. *Journal of Research in Science Teaching, 41*(8), 810-834.

Brown, B. A. (2006). "It isn't no slang that can be said about this stuff": Language, identity, and appropriating science discourse. *Journal of Research in Science Teaching, 43*(1), 96-126.

Calabrese Barton, A., Tan, E., & Rivet, A. (2008). Creating hybrid spaces for engaging school science among urban middle school girls. *American Educational Research Journal, 45*(1), 68-103.

Calabrese Barton, A., Basu, J., Johnson, V., & Tan, E. (2011). Introduction. In S. J. Basu, A. Calabrese Barton, & E. Tan (Eds.), *Democratic science teaching: Building the expertise to empower low-income minority youth in science* (pp. 1-20). Rotterdam, The Netherlands: Sense Publishers.

Calabrese Barton, A. & Tan, E. (2009). Funds of knowledge and discourses and hybrid space. *Journal of Research in Science Teaching, 46*(1), 50-73.

Capps, R., Newland, K., Fratzke, S., Groves, S., Fix, M., McHugh, M., & Auclair, G. (2015). The integration outcomes of U.S. refugees: Successes and challenges. Retrieved from https://www.migrationpolicy.org/research/integration-outcomes-us-refugees-successes-and-challenges

Carlone, H. B., Haun-Frank, J., & Webb, A. (2011). Assessing equity beyond knowledge- and skills-based outcomes: A comparative ethnography of two fourth-grade reform-based science classrooms. *Journal of Research in Science Teaching, 48*, 459-485.

Davies, C. E. (2003). How English-learners joke with native speakers: An interactional sociolinguistic perspective on humor as collaborative discourse across cultures. *Journal of Pragmatics, 35*, 1361-1385.

Derry, S. J., Pea, R. D., Barron, B., Engle, R. A., Erickson, F., Goldman, R., . . . Sherin, B. L. (2010). Conducting video research in the learning sciences: Guidance on selection, analysis, technology and ethics. *Journal of the Learning Sciences, 19*(1), 3-53.

Duff, P. A. (2003). Intertextuality and hybrid discourses: The infusion of pop culture in educational discourse. *Linguistics and Education, 14*(3-4), 231-276.

Duran, C. S. (2016). *Language and literacy in refugee families.* Springer.

Emdin, C. (2011). Citizenship and the Three C's. In S. J. Basu, A. Calabrese Barton, & E. Tan (Eds.), *Democratic science teaching: Building the expertise to empower low-income minority youth in science* (pp. 103-114). Rotterdam, The Netherlands: Sense Publishers.

Fairbanks, C. M., Faircloth, B., Gonzalez, L. M., He, Y., Tan, E., & Zoch, M. (2017). Beyond commodified knowledge: The possibilities of powerful community learning spaces. In P. Portes & S. Salas (Eds.), *Latinization of K-12 communities: National perspectives on regional change*. Albany, NY: SUNY Press.

Goldberg, J. S., Welsh, K. M., & Enyedy, N. (2009). Negotiating participation in a bilingual middle school science classroom: An examination of one successful teacher's language practices. In K. R. Bruna, & K. Gomez (Eds.), *The work of language in multicultural classrooms: Talking science, writing science* (pp. 117-138). New York, NY: Routledge.

Gutiérrez, K.D., Larson, J., & Kreuter, B. (1995). Cultural tensions in the scripted classroom: The value of the subjugated perspective. *Urban Education, 29*(4), 410-442.

Hodson, D. (2003). Time for action: Science education for an alternative future. *International Journal of Science Education, 25*(6), 645-670.

Jackson, P. A., & Seiler, G. (2013). Science identity trajectories of latecomers to science in college. *Journal of Research in Science Teaching, 50*(7), 826-857.

Jefferson, G. (1984). Transcription notation. In J. Atkinson, & J. Heritage (Eds.), *Structures of social interaction.* New York: Cambridge University Press.

Kamberelis, G., & Wehunt, M. D. (2012). Hybrid discourse practice and science learning. *Cultural Studies of Science Education, 7*, 505-534.

Kanno, Y. & Kangas, S.E.N. (2014). "I'm not going to be, like, for the AP": English language learners' limited access to advanced college-preparatory courses in high school. *American Educational Research Journal, 51*(5), 848-878.

Knoblauch, H., & Schnettler, B. (2012). Videography: Analysing video data as a 'focused' ethnographic and hermeneutical exercise. *Qualitative Research, 12*(3), 334-356.

Kurth, L. A., Anderson, C. W., & Palincsar, A. S. (2002). The case of Carla: Dilemmas of helping all students to understand science. *Science Education, 86*(3), 287-313.

Lee, O., & Fradd, S. H. (1998). Science for all, including students from non-English language backgrounds. *Educational Researcher, 27*(4), 12-21.

Lin, A. M. Y., & Wu, Y. (2015). 'May I speak Cantonese? - Co-constructing a scientific proof in an EFL junior secondary science classroom. *International Journal of Bilingual Education and Bilingualism*, *18* (3), 298-305.

Lundqvist, E., Almqvist, J., & Östman, L. (2009). Epistemological norms and companion meanings in science classroom communication. *Science Education, 93*(5), 859-874.

McFarlane, D. A. (2013). Understanding the challenges of science education in the 21st century: New opportunities for scientific literacy. *International Letters of Social and Humanistic Sciences, 4*, 35-44.

McGinty, M. &. Bang, M. (2016). Narrative of dynamic lands: Science education, indigenous knowledge and possible futures. *Cultural Studies of Science Education, 11*, 471-475.

Mercer, N. (2008). The seeds of time: Why classroom dialogue needs a temporal analysis. *The Journal of the Learning Sciences, 17*(1), 33-59.

Moje, E. B., Ciechanowski, K. M., Kramer, K., Ellis, L., Carrillo, R. & Collazo, T. (2004). Working toward third space in content area literacy: An examination of everyday funds of knowledge and Discourse. *Reading Research Quarterly, 39*(1), 38-70.

Moll, L. C., Amanti, C., Neff, D. & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory Into Practice, 31*(2), 132-141.

Olitsky, S. (2007). Facilitating identity formation, group membership, and learning in science classrooms: What can be learned from out-of-field teaching in an urban school? *Science Education, 91*(2), 201-221.

O'Neill, T. (2011). Improvisation with/in science: Expanding worlds and lives. In S. J. Basu, A. Calabrese Barton, & E. Tan (Eds.), *Democratic science teaching: Building the expertise to empower low-income minority youth in science* (pp. 41-54). Rotterdam, The Netherlands: Sense Publishers.

Rahm, J. (2013). Afterschool and community programs' role in supporting immigrant youth: Stories of opportunities for youths' identity work and learning for life. In N. S. Trépanier, *Making the case for community schools* (pp. 95-117). Montréal: Éditions Nouvelles.

Ruiz-de-Velasco, J., & Fix, M. (2000). Overlooked & underserved: Immigrant students in US secondary schools. Washington, DC: Urban Institute. Retrieved from https://eric.ed.gov/?id=ED449275

Seiler, G. (2001). Reversing the "standard" direction: Science emerging from the lives of African American students. *Journal of Research in Science Teaching, 38*(9), 1000-1014.

Shanahan, M.-C., & Nieswandt, M. (2011). Science student role: Evidence of social structural Norms Specific to School Science. *Journal of Research in Science Teaching, 48*(4), 367-395.

Steimel, S.J. (2010). Refugees as people: The portrayal of refugees in American human interest stories. *Journal of Refugee Studies, 23*(2), 219-237.

Swain, M. (1985). Communicative competence: Some roles of comprehensible input and comprehensible output in its development. In S. Gass & C. Madden (Eds.), *Input in Second Language Acquisition*. Rowley, MA.: Newbury House.

Taylor, S., & Sidhu, R.K. (2012). Supporting refugee students in schools: What constitutes inclusive education? *International Journal of Inclusive Education, 16*(1), 39-56.

Tan E., &. Calabrese Barton A. (2008). Unpacking science for all through the lens of identities-in-

practice: The stories of Amelia and Ginny. *Cultural Studies of Science Education, 3*(1), 43-71.
Tan, E., Calabrese Barton, A., Gutiérrez, M.V., & Turner, E. (2012). *Empowering science and mathematics education in urban schools.* Chicago: University of Chicago Press.
Tan, E., & Calabrese Barton, A. (2008). From peripheral to central, the story of Melanie's metamorphosis in an urban middle school science class. *Science Education*, *92*(4)*,* 567-590.
Tan, E. & Faircloth, B. (2017) "I come because I make toy": Examining nodes of criticallity in an afterschool science and engineering (SE) club with refugee youth. In Marx, S. (Ed.). (2016). *Qualitative Research in STEM: Studies of Equity, Access, and Innovation*. (p. 55-93) Routledge.
Upadhyay, B., & Albrecht, N. (2011). Deliberative democracy in an urban elementary science classroom. In S. J. Basu, A. Calabrese Barton, & E. Tan (Eds.), *Democratic science teaching: Building the expertise to empower low-income minority youth in science* (pp. 75-87). Rotterdam, The Netherlands: Sense Publishers.
Yackel, E. & Cobb, P. (1996). Sociomathematical norms, argumentation, and autonomy in mathematics, *Journal for Research in Mathematics Education, 27* (4), 458-477.