Project RESET

REFUGEE YOUTH ENGAGING IN CRITICAL STEM LITERACY AND LEARNING

August 2019

Final Evaluation Report

A summative evaluation report of project activities from September 15, 2016 to August 31, 2019.

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Project RESET

FINAL EVALUATION REPORT

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EVALUATION SUMMARY

Intellectual Merit

Project RESET utilized a responsive teaching approach to engage youth in critical STEM literacy on the topic of climate change. Video recordings of the afterschool program, artifacts from the program, and interviews with youth were analyzed to better understand how youth supported each other's participation in science discourse. The team outlined four themes of critical STEM literacy (CSL) and identified a "constellation" of knowledge, dispositions, and practices within each of those themes. Finally, Project RESET demonstrated the potential benefits of multi-modal analysis for studying students' engagement in afterschool programs.

The progress was supported by a particularly rich data set collected in Year 1; a systematic process for analyzing that data, developed and implemented in Years 2 and 3; an emergent distribution of expertise that allows team members to focus on particular research questions; and finally, a collective, intentional effort among the research team to elicit and value multiple perspectives during data analysis throughout the project.

Project RESET's work has been well-received, with 1 published peer-reviewed journal articles, 1 published peer-reviewed conference proceeding, 15 presentations at peer-reviewed national and international conferences, and 7 presentations at peer-reviewed regional conferences, including two Best Poster Awards at the Purdue University Annual Graduate Students Educational Research Conference. Project RESET received a Public Choice award in the National Science Foundation 2017 STEM Video Showcase.

Broader Impacts

Most youth interviewed (85%) said they would participate in Project RESET again. Youth reported that they learned more about climate change and developed positive relationships with the research team as a result of Project RESET. They also valued the opportunity to learn more about making and editing videos.

Project RESET has apprenticed two graduate students in the key phases of education research, including data collection and analysis, interpretation of results, and dissemination of findings. One of these students completed a Master's Thesis and the other will complete a doctoral dissertation in Chemistry Education Research.

Following Project RESET, the staff at the Burmese American Community Center plan to continue offering STEM programs for youth. Participating in Project RESET helped staff at the Center identify the most important elements of a STEM program for the youth they serve. The project team has curriculum materials, examples of youth-created artifacts, and illustrative video clips that can be used to develop classroom-ready tools for educators as part of a future project. Lessons from Project RESET are being incorporated into a newly-funded project, *Professional development for K-12 science teachers in linguistically diverse classrooms* (NSF DRL 1813937).

EVALUATION OVERVIEW

1.1 Problem Statement

In recognition of the need to better support the one million school-aged refugee youth in the United States, Purdue University, Vanderbilt University, and the Burmese American Community Institute (BACI) formed a partnership to create a model community-based afterschool STEM program for resettled Burmese youth in the greater Indianapolis region. The project is funded by the National Science Foundation under the Advancing Informal Science Learning (AISL) program, DRL 1612688, 09/15/2016-08/31/2019.

1.2 Objectives

As described in the NSF project summary (Ryu, 2016), the project objectives are:

1. To develop and implement a climate change-focused afterschool program, *Weather and Our Life*, for resettled Burmese refugee teen, in collaboration with Burmese American Community Institute,
2. To collect ethnographic data to examine refugee youth's repertoires for STEM learning and critical STEM literacy practices,
3. To build capacity for future Research in Service to Practice, and
4. To broaden participation in STEM among resettled refugee youth.

1.3 Institutional Partners

Purdue University

Purdue University serves as the primary awardee for this NSF-sponsored project. Purdue University is a large, public, land-grant university located in West Lafayette, Indiana. Purdue is ranked as an R1 "highest research activity" university by the Carnegie Classification of Institutions of Higher Education. In April 2017, Purdue was one of 60 universities that took part in "Project Welcome" to support the acceptance of immigrants and refugees to institutions of higher education (Holden, 2017).

Vanderbilt University

Vanderbilt University is a mid-sized, private (non-profit), R1 research university located in Nashville, Tennessee. Vanderbilt hosted a Refugee Awareness Week in 2016 and 2017 (Todd, 2016). In 2019, the Vanderbilt Student Government became the first in the state of Tennessee to pass a "refugees welcome" resolution.

Burmese American Community Institute (BACI)

BACI is a non-profit organization founded in 2011 to "proactively respond to the growing needs of the Burmese refugee population in central Indiana" (BACI, 2009). BACI has assisted more than 2000 individuals and their families with the resettlement process. BACI operates 8 distinct educational programs, including the Upward College Program for High School Students which hosted the Project RESET afterschool STEM activities.

1.4 Project Team

Principal Investigators

- **Minjung Ryu** of Purdue University oversaw all project activities, including award administration, training of GRAs, teaching the afterschool STEM program, research design, data analysis, preparation of project publications, and communication with the evaluator and advisory board.

- **Shannon Daniel** of Vanderbilt University oversaw award administration at Vanderbilt, as well as training of GRAs, curriculum planning, research design, data analysis, preparation of project publications, and communication with the evaluator and advisory board.

Community Program Leaders

- **Lian Sang** of the Burmese American Community Institute provided organizational support for the afterschool STEM program and participated in evaluation interviews.

- **Sui Tin Tial** of the Burmese American Community Institute co-taught the afterschool program and participated in the June 2017 Advisory Panel meeting.

- **Elaisa Vahnie** of the Burmese American Community Institute provided organizational support for the afterschool STEM program and served on the Advisory Panel.

Graduate Research Assistants

- **Mavreen Rose Tuvilla** of Purdue University coordinated data collection, data management, and data analysis. She developed curriculum for and co-facilitated the afterschool program, communicated with the advisory panel and evaluator, and prepared project publications.

- **Casey Wright** of Purdue University facilitated the afterschool program, participated in data analysis, communicated with the advisory panel and evaluator, and prepared project publications.

Advisory Panel

Lynsey Auman, World Relief Nashville
Angela Calabrese Barton, Michigan State University
Tamara Clegg, University of Maryland, College Park
Rogers Hall, Vanderbilt University
Melinda Martin-Beltran, University of Maryland, College Park
Shannon McManimon, State University of New York at New Paltz
Elaisa Vahnie, Burmese American Community Institute

Evaluator

Tiffany-Rose Sikorski, Assistant Professor, The George Washington University

2. EVALUATION SCOPE AND METHODOLOGY

2.1 Evaluation Framework

The evaluation consisted of implementation and outcome components. The implementation component considered the extent to which Project RESET carried out the activities described in the project proposal. The outcome components examined the immediate research and practice results of Project RESET. A range of data sources and types were collected and analyzed. The evaluation was phenomenographic, aiming to highlight similarities and differences among participants' views and experiences in the project. Phenomenography is appropriate for evaluation when an important variation is expected between, for example, researcher, youth, and community-based staff experiences (Jones & Asensio, 2001).

During the grant proposal preparation process, the evaluator and Principal Investigator met to discuss the goals of the proposed project and draft an evaluation plan. The evaluation questions and initial metrics were drafted in the proposal phase of the project. Adjustments to the metrics occurred when new data became available that had not been anticipated during the proposal phase. For example, the inclusion of the project in the 2017 STEM Video Showcase allowed the evaluator to collect data about the geographic distribution of visitors who viewed the Project RESET video. The project team had an opportunity to review and respond to evaluation results each year of the project.

2.2 Logic Model

Project RESET is a *Research in Service to Practice* project. As shown in Figure 1, the evaluation must consider not only how the project directly impacts the youth who participate in the program (c.f., Allen et al., 2008; CAISE, 2011), but also how the project extends knowledge about science learning in informal settings.

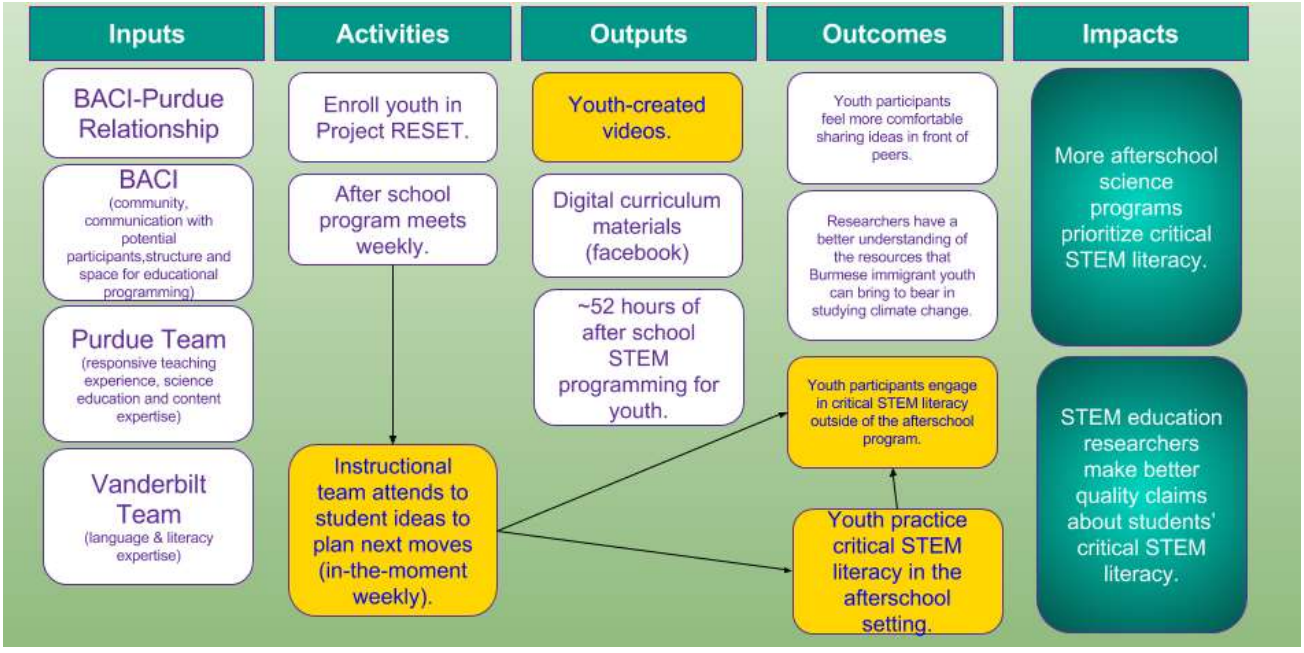

FIGURE 1. LOGIC MODEL

2.3 Evaluation Questions

Three questions bound the data collection and analysis for the evaluation:

EQ1. How is the responsive curriculum approach adopted and adapted to meet the goals of the project—engaging refugee youth's engagement in critical STEM literacy?

EQ2. How are data collected and analyzed in a way in which the PI and co-PI can answer the proposed research questions?

EQ3. What are supports and barriers are encountered in this project's effort to (a) broaden participation in STEM learning practices and (b) build capacity to conduct research in service to practice?

2.4 Evaluation Timeline

Project RESET contained two major phases: program implementation with data collection (Year 1; Project Objectives 1 & 4), followed by data analysis, dissemination, and sustainability (Years 2 and 3; Project Objectives 2 & 3). The evaluation plan mirrored these phases.

Year 1: Evaluate progress on Project Objectives 1 & 4.

Fall 2016	Spring 2017	Summer 2017
• 1st advisory panel meeting	• Evaluation kick-off call • Observe afterschool program planning meeting • Revisit EQs, metrics, and logic model	• 1st site visit • Collect and analyze data for EQ1 and EQ2 • 2nd advisory panel meeting • Year 1 evaluation report

Year 2: Evaluate progress on Project Objective 2.

Fall 2017	Spring 2018	Summer 2018
• Update data and analysis for EQ1 and EQ2.	• Observe research team meeting • Update data and analysis for EQ1 and EQ2	• Round 2 Interviews • 2nd site visit • Begin EQ3 data collection • Year 2 evaluation report

Year 3: Evaluate progress on Project Objectives 2 & 3.

Fall 2018	Spring 2019	Summer 2019
• Collect data for EQ3	• Update data and analysis for EQ1 and EQ2	• Final evaluation report

2.5 Data Sources and Metrics

Evaluation Question 1

How is the responsive curriculum approach adopted and adapted to meet the goals of the project—engaging refugee youth's engagement in critical STEM literacy?

Project RESET is utilizing the responsive curriculum approach to science teaching. Alternatively referred to as "responsive teaching" or simply "responsiveness," the approach is perhaps best associated with Eleanor Duckworth, Gertrude Hennessey, and David Hammer. In contrast to pure "discovery" methods of instruction, responsiveness entails teachers paying close attention to the substance of student thinking, and selecting "next moves" based on the disciplinary substance of that thinking. Thus, to ***adopt*** the responsiveness approach, the Project RESET team will need to avoid following a "scripted curriculum," and instead select ideas and activities to help students build on and refine ideas shared in prior moments. As the project progressed, the team began to orient to the description of **responsive teaching** in Hammer, Goldberg, and Fargason (2012): "A responsive approach…is to adapt and discover instructional objectives responsively to student thinking" (p. 55).

While student agency and voice are frequently mentioned in responsiveness literature, authors primarily describe selecting "next moves" based on disciplinary criteria (i.e., clarity, coherence, mechanism). Thus, Project RESET will also need to ***adapt*** the responsiveness approach so that next moves are shaped by the disciplinary substance of students' ideas, as well as students' engagement in **critical STEM literacy**, defined by the project team as:

> Agentive appropriation of knowledge for transformation of discourses and practices of STEM, learners' identities, and world around us, in order to build democratic and just societies.

To answer EQ1, the following data sources and metrics will be used:

- Mode(s) of responsiveness
  - ✓ Qualitative description of team curriculum planning session
  - ✓ Responsiveness analysis of select afterschool program videos.
  - ✓ Interview with the research team and youth participants
- Critical STEM literacy
  - ✓ Interview with the research team and youth participants
  - ✓ Youth video project (# of videos, topics addressed)

Evaluation Question 2

How are data collected and analyzed in a way in which the PI and co-PI can answer the proposed research questions?

Because Project RESET draws "on principles of ethnography, video ethnography, mediated discourse analysis, and phenomenological and ethnomethodological analysis of interviews" (Ryu, 2016), the project is expected to generate a very large, qualitative data set. The challenges of qualitative analysis are well-documented, and the team will have to make a number of thoughtful "analytic choices" (Namey et al., 2008) to manage the data set effectively. Thus, EQ2 will consider the organizational structures and analytic choices the team makes as they pursue the following **research questions**:

1. Refugee youth's resources
    a) What repertoires of knowledge, practices, and disposition do resettled refugee youth bring that can be leveraged to foster their critical STEM literacy?
2. Impacts of the project
    a) How do resettled refugee youth engage in critical STEM literacy through their interactions, practices, and goals within urban refugee youth programs (i.e., the RESET program)?
    b) How do resettled refugee youth practice critical STEM literacy beyond the afterschool learning setting?
3. Methodological reflection
    a) What are new or refined methodological and methodic approaches for investigating resettled refugee teens' practices of critical STEM literacy practices within and beyond the afterschool setting?
    b) How can we identify longitudinal development in learners' critical agency and critical STEM literacy practices?

EQ2 will address three aspects—research productivity, process, and quality---using the following data sources and metrics:

- Productivity
    - ✓ No. of research products (papers, conference presentations, videos, etc.)
    - ✓ Data collection metrics (hours of footage, etc.)
- Process
    - ✓ Qualitative description of research team meetings
    - ✓ Description of analysis process based on interviews with the research team
- Quality
    - ✓ Summary of feedback from reviews of proposals and manuscripts
    - ✓ Inventory of current work on CSL

Evaluation Question 3

What are supports and barriers are encountered in this project's effort to (a) broaden participation in STEM learning practices and (b) build capacity to conduct research in service to practice?

The third and fourth objectives of Project RESET are to "build capacity for future Research in Service to Practice" and to "broaden participation in STEM among resettled refugee youth." More specifically, the team hopes to develop a definition of and analytic tools for researchers to use in studying critical STEM literacy. In addition, the team hopes to sustain the afterschool STEM program at BACI following the end of the grant period, and share program materials with other community centers serving refugee/resettled youth. These objectives are aspects of project sustainability.

To gauge sustainability, the following data sources and metrics will be tracked for EQ3:

- Reach
  - ✓ Range of venues where project materials are shared (e.g., community venues, professional research venues)
  - ✓ Inventory of regional afterschool programs that offer activities aligned with Project RESET
  - ✓ View and download rates for published articles
  - ✓ Social media metrics
- Use
  - ✓ Citation rates and AMS scores for published articles.
  - ✓ Interviews with BACI staff
  - ✓ Interviews with the Research Team

2.6 Summary of Evaluation Data Sources and Analysis Tools

Evaluation Question	Metric	Data Sources and Analytic Tools
1	Mode(s) of responsiveness Critical STEM literacy (CSL)	▪ Qualitative description of team curriculum planning session ▪ Responsiveness analysis of select afterschool program videos ▪ Interview with the research team ▪ Interview with youth participants ▪ Youth video project (# of videos, topics addressed)
2	Productivity Process Quality	▪ No. of research products (papers, conference presentations, videos, etc.) ▪ Data collection and analysis metrics (hours of footage, etc.) ▪ Qualitative description of research team meetings ▪ Description of analysis process based on interviews with the research team ▪ Inventory of current work on CSL ▪ Summary of feedback from reviews of manuscripts
3	Reach	▪ Range of venues where project materials are shared (e.g., community venues, professional research venues) ▪ Inventory of regional afterschool programs that offer activities aligned with Project RESET ▪ View and download rates for published articles ▪ Social media metrics
	Use	▪ Citation rates and AMS scores for published articles. ▪ Interviews with BACI staff ▪ Interviews with the Research Team

3. EVALUATION FINDINGS

3.1 Evaluation Question 1

HOW IS THE RESPONSIVE CURRICULUM APPROACH ADOPTED AND ADAPTED TO MEET THE GOALS OF THE PROJECT—ENGAGING REFUGEE YOUTH'S ENGAGEMENT IN CRITICAL STEM LITERACY?

Finding 1: Most youth would participate in the program again.

Of the 7 youth interviewed, 6 were seniors and thus cannot participate in the program again. However, the one upcoming junior and 5 of the 6 seniors said they would participate again if they were eligible and had time. Overall, 6/7, or 86%, of participants said they would join the Project RESET afterschool science program again.

Finding 2: Youth learned about climate change through "research."

As shown in Table 1, most participants said they were not very interested in climate change *prior* to starting the afterschool program. However, all participants reported learning at least "a little bit" about climate change from the program. The youth felt that they learned the most from the "research" they did about climate change online, with one youth remarking, "We researched climate change and how we can make other people care more about climate change." One participant said that beyond just learning about climate change, she became more aware of what STEM is, noting, "I didn't even know what STEM was and now I do."

TABLE 1. YOUTH COMMENTS ABOUT CLIMATE CHANGE*

	Abstain	None/ not at all	A little bit	Very much
How interested were you in climate change prior to starting the program?	1	3	2	1
How much did you learn about climate change in the afterschool program?	0	0	4	3

*n=7 youth interview participants

As part of the evaluation, all youth videos were reviewed and a content analysis conducted to better understand the social and linguistic resources youth included in the video and what aspects of climate change they chose to address. The content analysis included 5 videos produced during Project RESET, and 3 additional youth videos produced during the pilot year prior to funding. Youth produced a total of 64 minutes of video. The videos ranged from 2 to 17 minutes in duration.

Coding for climate change topics was inductive. While watching each video, the evaluator kept a comprehensive list of all climate change topics mentioned in each video. Once the comprehensive list was compiled, the list was organized into categories (e.g., future impacts of climate change, current observable impacts of climate change, data on climate change). Then, all youth videos were viewed again and tagged for the topics they contained.

All youth videos addressed at least one core climate change topic, and most (7/8 videos) addressed two or more topics. As shown in Figure 2, the distribution among topics was fairly even. Almost all videos (7 of 8) addressed the causes of climate change or potential future impacts of climate change. Consistent with Project RESET's focus on Critical STEM Literacy, 5 of 8 videos specifically addressed the public understanding of climate change. Six of the videos explained the scientific consensus on climate change. Three of the videos contained clear evidence of youth utilizing their personal knowledge about climate change in Asia.

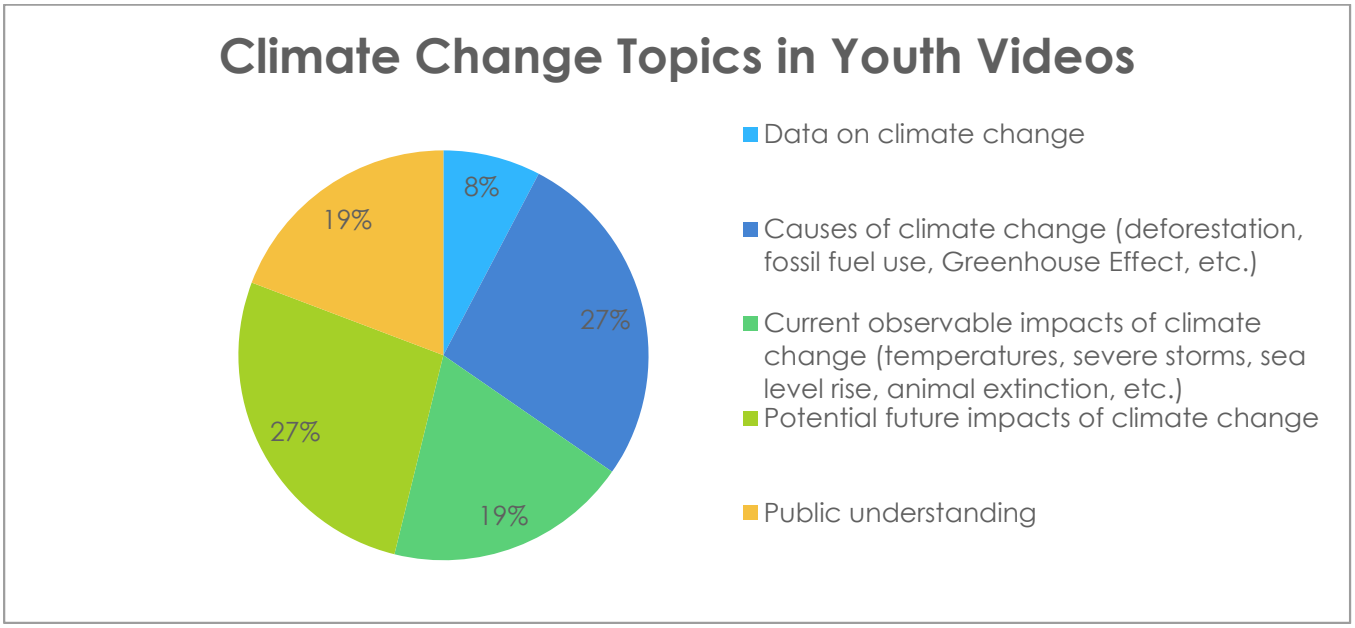

FIGURE 2. CLIMATE CHANGE TOPICS IN YOUTH VIDEOS

Finding 3: Youth practiced communication skills while producing the videos.

One of the Project RESET goals for youth learning is for youth to "develop their expertise in communicating about STEM within and beyond their participation in the after-school program" (NSF Project Summary).[1]

Three videos contained youth narrating information about climate change, with or without supporting visuals (3 of 8 videos). One video contained a series of images with a soundtrack, and no narration or interviews. In the remaining 4 videos, youth interviewed others about climate change topics.

The most common language spoken and written in the videos was English. One video contained speaking in a Chin language. All text shown in all videos was written in English. As this discovery was made after interviewing youth, the evaluator was unable to find out from youth why they chose to produce their videos almost exclusively in English.

[1] Project Summary obtained from https://www.nsf.gov/awardsearch/showAward?AWD_ID=1612688.

The NGSS contains five learning objectives for high school learners as part of the practice Obtaining, Evaluating, and Communicating Information. Seven of the eight youth videos produced during the pilot year and funding year of Project RESET showed evidence of at least one of these objectives, as shown in Table 2.

TABLE 2. COMMUNICATION SKILLS PRACTICES IN THE YOUTH VIDEOS

NGSS Practice Obtaining, Evaluating, and Communicating Information Learning Objectives, High School (9-12th grade)	No. of Videos
Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).	6
Compare, integrate, and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.	1
Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.	6
Source: National Science Teachers Association, *Science and Engineering Practices* https://ngss.nsta.org/Practices.aspx?id=8	

Six of the youth videos made connections to school and/or to their home communities in their videos. For example, in one video, youth interviewed teachers, fellow students, and neighbors about their beliefs about climate change. In another video, students asked one of their teachers to talk about her experience with flooding. Most of the videos (6 of 8) also featured youth or staff from the afterschool program.

TABLE 3. CONNECTIONS BEYOND THE AFTERSCHOOL PROGRAM IN THE YOUTH VIDEOS.

Video	Do afterschool program youth or staff appear in the video?	Do school teachers or classrooms appear in the video?	Does the video contain sites or people from youth's home community (e.g., outside of school or afterschool program)?
1	Yes	Yes	No
2	Yes	No	No
3	No	No	No
4	Yes	Yes	Yes
5	Yes	Yes	Yes
6	No	Yes	No
7	Yes	No	Yes
8	Yes	Yes	Yes

Retrospective Comment: The evaluation interviews could have asked youth who they imagined to be the audiences for their final products, and how the audience shaped their choice about which languages and community resources to utilize.

Finding 4: Youth valued learning how to make videos.

Five of 7 interview participants made videos (2 were absent during the video project). One participant was identified by the other interviewees as having the "winning video" which was "about how we can prevent climate change." The video was "very professional" and "in the style of [major television network] *News*." All youth spoke highly of the video project and thought that making videos was a valuable skill to learn. One youth said she was "nervous" about having a public audience for the videos. When asked if their videos could "have an impact on climate change," the interviewees said no, primarily because the videos were "not very professional," "not very good," and "it was their first time making videos."

Retrospective Comment: In future programming, the team might consider hiring videography professionals to assist youth with filming and editing.

Finding 5: Youth and adult accounts of the STEM program resonated.

When asked to describe the content and major activities of the afterschool program, youth, research team, and community center staff accounts were remarkably consistent:

Resonances in Youth and Adult Interview Responses

- Climate change and air pressure were the focal topics of the program.
- Youth learned something about climate change.
- Youth started talking more about climate change (in presentations, or at home) as a result of the program.
- All agreed that the final project allowed participants to develop a valuable skill: how to make a video.
- All agreed that youth were largely responsible for generating questions and formulating ideas.
- All agreed that the program facilitated students having an impact on the "microscale" (telling neighbors, etc.) but not larger local or macroscale.

Finding 6: Youth and adult perspectives on "answers" differed.

The major discrepancy between youth (Y) and adult (A) interview responses centered on the issue of "answers" and what students learned about climate change:

Discrepancies in Youth and Adult Interview Responses

- 4/7 Y said they learned "a little bit"; 3/7 said "a lot"; compared to adults who said they definitely learned a lot.
- Y did not think they/the videos could have any impact on climate change because the videos were not "professional" (except one group's video.)
- Y expressed dissatisfaction with the lack of teachers giving answers; Adults were pleased.
- Youth seemed to think that the program was less directed ("she just kept asking 'why'"), which contrasted with the very careful descriptions of the planning and facilitation process provided by the research team.

The evaluator conducted a 45-minute group interview with 7 former participants (3 girls, 4 boys) in June 2017. One topic dominated the conversation with youth during interviews—the fact that the facilitators of the program did not provide answers. According to the youth:

- We need more guidance from the teacher to know exactly what we were learning.
- We learned a lot from our own research, not from the teachers.
- She didn't really have the right answer.
- She kept asking, 'why?'
- Teach more.
- Give more information.
- Recommend that teachers have the right answer before they ask.
- Instead of letting us figure it out, we get stuck.
- Once in a while they should say, "That's correct."

However, when probed to further explain what kinds of answers they wanted, youth did not elaborate and instead returned to their overarching concern about the lack of answers, i.e.:

> **Interviewer:** Was there a specific question that you wanted an answer to?
> **Youth:** (pauses/no response/repeated they never gave us answers)
> **Interviewer:** Did they *ever* give you answers?
> **Youth:** Never! Not once!
> **Interviewer:** If they never gave you answers, then they were probably doing that on purpose. Why would Minjung and Mavreen not give you answers?
> **Youth:** (Long pause.) She wanted us to find out with a partner; Teamwork; If she keeps asking why we kind of have the feeling we don't have the right answer; We had to ask our own questions; We know she's a Ph.D. student so we thought she was going to share some information about climate change, but that didn't happen.

At the June 2017 advisory panel meeting, the team discussed possible reasons for students' concern about answers, as well as ways to manage that concern in future iterations of the program. The panelists wondered:

- How does Dr. Ryu's facilitation style compare to what students experience at school in Burma and in the United States?
- Are there other programs at BACI that have students take the lead in researching information, similar to what happens in the afterschool STEM program? If so, do students express concern about the lack of answers in those programs?
- What are the ways of easing students' concerns about the lack of answers?
- Is it necessary for developing critical STEM literacy that students learn to be comfortable not having an adult in the room who provides answers?

While cultural differences between schooling in Burma and the United States might partially explain students' concern about "teachers" not giving answers, panelists pointed out that the issue cannot simply be a matter of "cultural difference." First, viewing teachers as the source of knowledge is not unique to Burma, and in fact could still be the norm in many classrooms in

the United States. Students' experiences in the United States and/or Burmese schools could be shaping their expectations in the afterschool STEM program. Secondly, in a different educational program offered at BACI, the students do seem to respond positively to student-centered instruction. The interviews referenced in this report occurred at the University of Indianapolis, where students were meeting for the summer BACI Upward College Program. In the Upward College Program, youth "conducted research and formulated survey questions, which they will use to gather data about the local Burmese-American community" (Galer, 2017). Students work in teams under the guidance of an adult leader, but are responsible for finding out answers for themselves. In a newspaper article about the program, one student commented that "At school, we mostly do research online, but here, we get more personal experience by going out into the community and hearing from people face to face" (Galer, 2017). Thus, students' desire for the "teacher" to provide answers is effectively managed in the BACI Upward College Program via these interactions with community members.

Retrospective Comment: The advisory panel agreed that an important part of youth's engagement in critical STEM literacy could be shifting their expectations about the roles that adults/"teachers" and youth/"students" play in STEM learning. That shift could occur through (1) explicit discussions about roles and "answers," (2) role-playing activities that position youth as experts relative to the adult facilitators, (3) explicit acknowledgment of students' ideas.

Finding 7: The responsive approach was adopted and adapted.

An important goal of Project RESET is to create an afterschool STEM program that is responsive to students' ideas, reasoning, and experiences. In June 2019, the project team identified videos from the afterschool program that might be "good places to look" for evidence of responsiveness. The team recommended video from Weeks 4, 5, 7, 8, and 17 of the program.

Prior to viewing any of the afterschool program videos, the evaluator prepared a Google Form with a list of indicators of responsiveness drawn from existing literature (see Figure 2). Next, the evaluator watched a few minutes of whole group discussion from the Week 17 video, which was identified by all members of the project team as potentially containing the best evidence of responsiveness. While watching Week 17 video, minor modifications to the list of indicators were made in order to eliminate potential redundancy or confusion. For example, the indicator "confirm an idea was heard correctly" was removed/subsumed under "restate a youth's idea." With these minor modifications made, the evaluator viewed snippets from Week 17, Week 4, and Week 8, noting instances of any of the indicators along with the timestamp when the instance occurred.

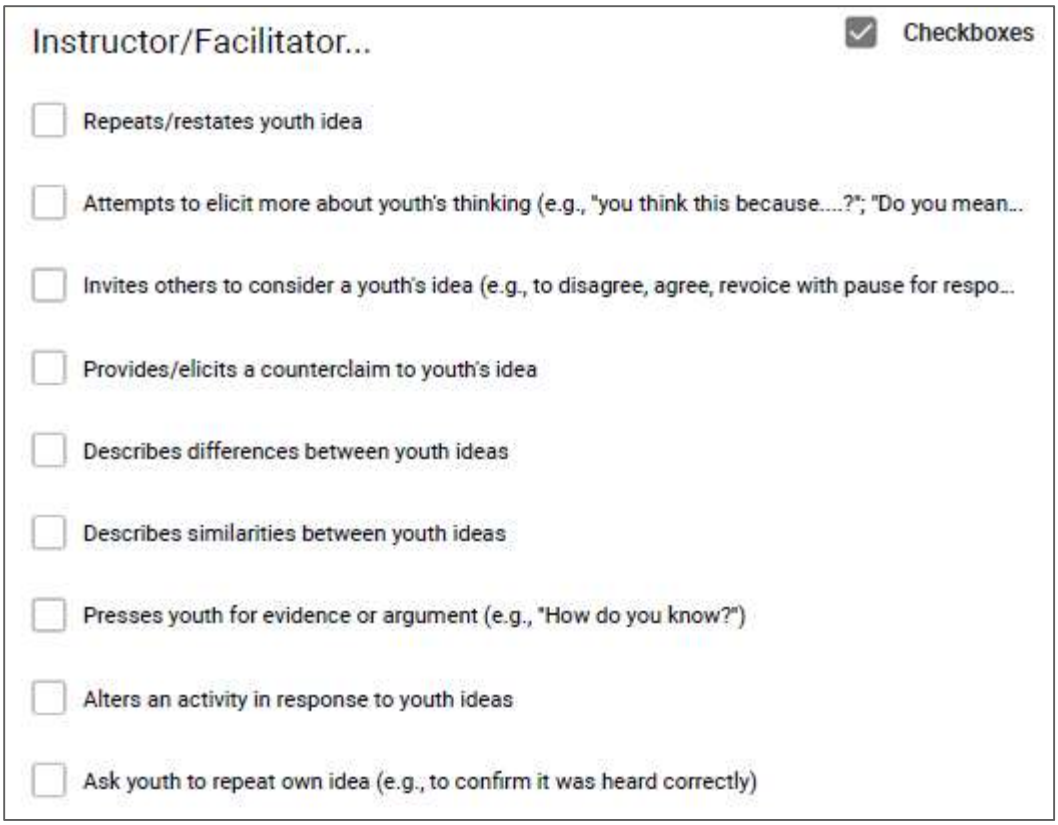

FIGURE 3. INDICATORS OF RESPONSIVENESS. DERIVED FROM PIERSON (2008), LEVIN & RICHARDS (2011), AND RICHARDS (2013).

The evaluator viewed 20 consecutive minutes of an experiment about the pressure that the youth conducted at the start of Week 4 of the program. During the experiment, youth fill a bottle with water, make a hole in the bottle using a pin, and then explore what factors (e.g., amount of water in the bottle, size of the hole, number of holes) might determine how quickly the water flows from the hole. From Week 17, the evaluator viewed 10 minutes near the start of the session, when youth work in small groups to research information about climate change online. The evaluator also viewed a 10-minute whole group discussion that occurred at the end of Week 17. In the discussion, the youth shared what they found out about climate change from their online research; what, if anything, worries them about what they found; and any new questions or concerns they have about climate change.

Within the approximately 40 minutes of video viewed, 57 indicators of responsiveness were noted. The club facilitators frequently repeated or restated youth's ideas (46% of the indicators) and attempted to elicit more about youth's thinking (37% of indicators). Both of these indicators are fundamental to the notion of responsiveness; instructors must attempt to hear and understand youth's ideas in order to shape instruction in response to those ideas.

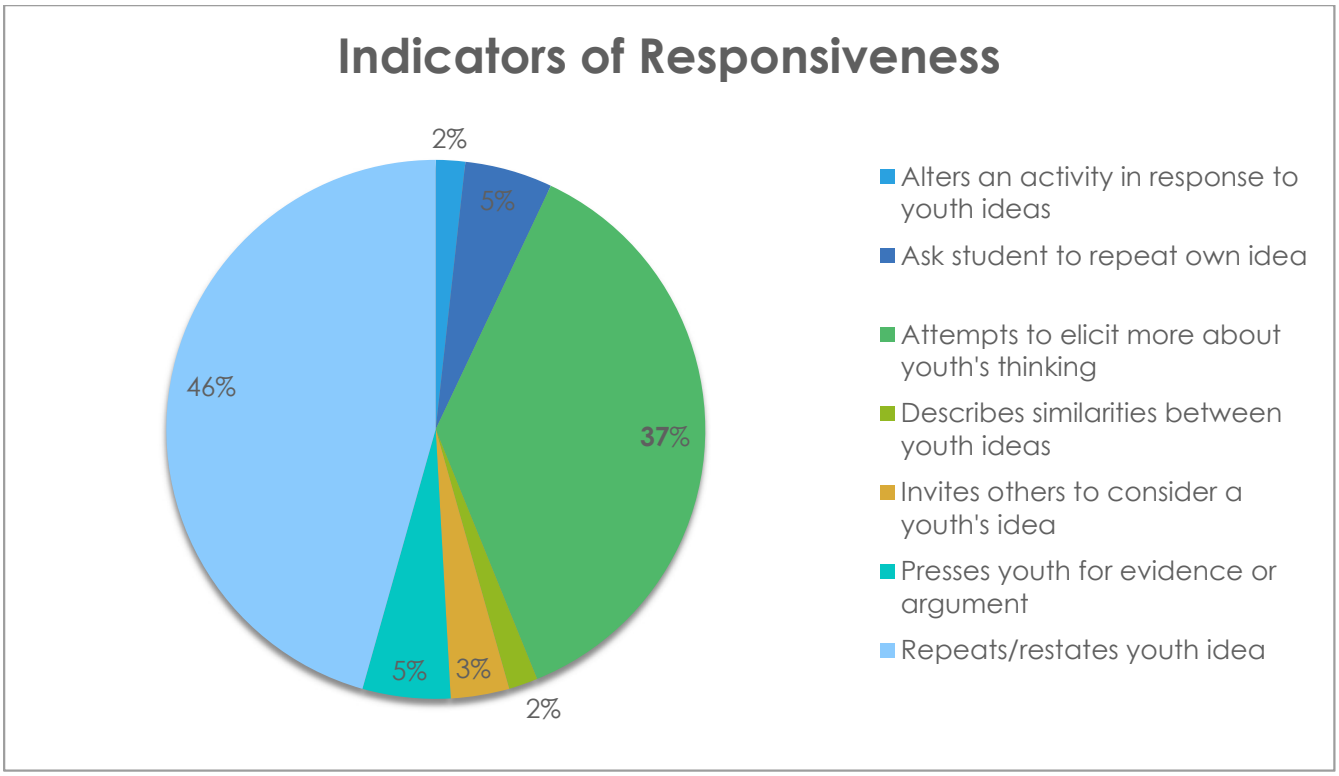

FIGURE 4. INDICATORS OF RESPONSIVENESS.

Indicators such as describing similarities between youth's ideas did not occur as often in the videos that were reviewed. However, Figure 3 should be understood as specific to the videos sampled, and may not be representative of the afterschool program as a whole.

In addition to reviewing video from the afterschool program, the evaluator asked questions about responsiveness during the Year 1 interviews with the research teams. In these interviews, the research team described several ways that they adjusted the afterschool program topics and activities in light of student ideas, reasoning, experiences, and interests.

The team used pilot implementations to make guesses about what student ideas and questions might arise during the afterschool program. Prior to NSF funding, Purdue University ran a pilot STEM program with BACI on climate change. The curriculum developed from that project, including the ideas and questions that students raised, was used as the basis for developing the curriculum during the current year of the project. Rachel Scherr's *Energy Project* (Notess, 2017) is one example of using *student ideas from past implementations* within responsive teaching (Frank & Atkins, 2015). This type of responsiveness is not easily identifiable to an outsider viewer, and therefore was not included in the responsiveness video screening.

The team asked follow-up questions to probe youth ideas. Youth and adults repeatedly acknowledged Dr. Ryu's using of probing questions (especially "Why?") to get students to elaborate on their ideas. Asking probing questions is frequently associated with responsive teaching (see for example Levin, Hammer, & Elby, 2012; Richards, 2013). This type of

responsiveness is captured in the indicators "attempts to elicit more about youth's thinking (observed 21 times) and "presses youth for evidence or argument" (observed 3 times).

The team changed the duration of an activity when realizing youth had more to say. One research team member provided a specific example of expanding a warm-up into a full activity because it was evident that students had more ideas and thinking regarding the idea of pressure. Jennifer Richards has explored adjusting activity timing as an indicator of responsiveness (Richards, 2013). In the video screening process, this type of responsiveness was observed once.

The team explicitly encouraged translanguaging.* As one research team member explained, rather than decided *a priori*, the decision to explicitly encourage translanguaging was made *in response to observations of student engagement*: "The students are free to speak in their L1. That was different from 2015. We never discouraged them in 2015, but we didn't explicitly encourage them. This year we did, and I think that made a big difference in their participation…We had one newcomer who came in the spring and attended every week. He said he couldn't speak English well and started speaking in his L1. And his peer translated for him…The setting is unique; the students may be from Chin State but they all speak very different languages (at least 5)…It creates this opportunity for them."

The team analyzed moments of high and low engagement to plan future sessions.* During planning sessions, the team identified moments of high and low engagement from previous sessions(s), analyzed those moments to identify what facilitated or inhibited engagement, and then plan future activities accordingly.

The final two items (marked with *) are potential adaptations of responsiveness in service of critical STEM literacy, as they are not explicitly mentioned in a recent text on responsive teaching in mathematics and science (Robertson, Scherr, & Hammer, 2015).

3.2 Evaluation Question 2

How are data collected and analyzed in a way in which the PI and co--PI can answer the proposed research questions?

Finding 8: The project generated relevant and useful data.

All research team members agree in interviews that the project generated a massive, well-organized data set during Year 1.

Year 1: Resonances in Research Team Interview Responses
• The massive qualitative data set is overwhelming, but very well organized. • The advisory panel meeting week was very helpful for bringing clarity to the group. • The group has a clear strategy in place for how to work through the data moving forward. • The project was "practice-focused" in year 1, but that was appropriate. • The working definition of critical STEM literacy: empowering youth to make an impact on the world (at multiple scales)

The generativity of the data is evidenced in part by the number of local, national, and international conference presentations, listed in the Appendix.

Finding 9: The team maintains norms, routines, and distributed expertise.

In Year 2, all research team members focused their commentary on different successes and challenges related to "working through the data."

Year 2: Resonances in Research Team Interview Responses
• The four themes of critical STEM literacy are reflective of the team's discussions. • The notion of "critical" in critical STEM literacy needs further refinement. • A multi-modal analysis is labor-intensive, but producing important results. • The generativity of the data can sometimes make it difficult to focus strictly on CSL. • Project team members have developed different areas of "expertise."

The research team indexes data by "week." The number indicates the week of implementation of the afterschool program, i.e., "Week 8" or "Week 24." Within a single "week," the data set includes the video footage from multiple cameras, planning materials, youth and program artifacts, and screen captures of youth's work on laptops. In the research team and writing retreats, all team members consistently use the "week" nomenclature in research team meetings. This naming system appears to allow the entire team to (1) easily keep communicating about the progress in analyzing different portions of the data (e.g., "We are done with Week 17?"), and (2) quickly locate relevant data in planned and spontaneous research discussions (e.g., "Let's look at our clips from Week 24").

There are 21 total weekly segments of data across 24 weeks of program implementation. The team intentionally decided not to videotape on Week 12. During Weeks 22 and 23, youth worked on making their videos at home.

Rather than start at Week 1 and move chronologically to Week 24, the team decided to strategically sample weeks from the beginning, middle, and end of the program. This decision was made in an effort to balance longitudinal analysis (seeing a change from Week 1 to Week 24) with fine-grained multimodal analysis (for example, of youth conversations on Week 17). Table 2 shows data analysis progress at the end of Year 2. In Year 3 interviews, researchers described two different levels of depth to the analysis. Level 1 analysis included summarizing and annotating the video, creating InqScribe™ with timestamps to key moments in the video, and identifying pivotal clips. By the end of Year 3, all data were analyzed to at least a Level 1. Level 2 analysis consisted of transcription, line-by-line analysis, and/or multimodal analysis. Level 2 analysis was reserved for weeks that the research team identified as particularly important relative to the project aims and research questions. As shown below, analysis of all weeks advanced between Year 2 and Year 3, during the no-cost extension period of the grant.

TABLE 4. DATA ANALYSIS COMPLETED, BY WEEK OF DATA, YEAR 2 VS. YEAR 3.

Week	1	2	3	4	5	6	7	8
Year 2	Level 1	Level 1	Level 1	initiated	-	-	-	-
Year 3	Level 2	Level 2	Level 2	Level 1	Level 1	Level 1	Level 1	Level 1

Week	9	10	11	12	13	14	15	16
Year 2	-	Level 1	Level 1	NA	-	Initiated	-	-
Year 3	Level 1	Level 2	Level 2	NA	Level 1	Level 1	Level 1	Level 2

Week	17	18	19	20	21	22	23	24
Year 2	Level 1	Level 2	-	-	-	NA	NA	Level 1
Year 3	Level 2	Level 2	Level 1	Level 1	Level 1	NA	NA	Level 2

The team felt the week of preparation for the June advisory panel meeting led to important insights. Thus, a "Writing Retreat" was scheduled in the summer of Year 2 to move from data analysis to manuscript preparation. Observations of discussions at that retreat indicated that a distributed model of expertise emerged. For example, two team members became "experts" on Week 17 data, having spent a significant amount of time analyzing conversation dyads in that data set. Two team members are taking responsibility for defining the four themes of CSL. The benefit of distributed expertise is that the team is able to sustain multiple lines of inquiry simultaneously (see Finding 9). However, the model requires continuous communication among team members to ensure (1) that data snippets are being used judiciously, and (2) that each line of inquiry supports the broader research agenda related to CSL. Further, in interviews with the research team, a concern as raised that some project team members may develop more ownership over the project than others.

Finding 10: The project generated three lines of inquiry related to CSL.

In Year 1, the major discrepancy within the research team interviews related to where team members pointed to evidence of critical STEM literacy. This discrepancy suggested a clear objective for Year 2 activities—to converge upon indicators and supports of critical STEM literacy.

Year 1: Discrepancies in Research Team Interview Responses

- The degree of ownership that folks feel over the work and the project.
- The degree of comfort with the methodology, particularly with the more emergent aspects of the process.
- The degree to which team members feel they are "focused" on the "big picture."
- *Where the team points to evidence of critical STEM literacy occurring.

When asked questions like, "What are you noticing in the data?", "What changes do you see in youth?", and "What evidence did you see of youth engagement in critical STEM literacy?" the research team members provided many different kinds of evidence:

- General Evidence:
    - Telling other people about climate change/feeling comfortable to do so
    - Questioning what science is and what it means to do science in a classroom.
    - Participating in ways other than just orally (post-it notes, joking/laughing).
    - Asking questions.
    - Translanguaging.
    - Students getting used to uncertainty, not pushing back as much when we don't give answers.

- Specific Evidence:
    - 100 years activity. Youth were very engaged in thinking about what the world will look like in 100 years with climate change.
    - There was a strong motivation about changing or finding a solution to an affected area. Last year it was about that time that the Philippines was hit by the storm and they were very affected by it.
    - On Facebook, students post specific small changes they make (i.e., using a timer when in the shower.)
    - We were looking at a weather app (Ventusky). I had a friend in Australia making a video and asking the students a question. "My husband and daughter are going to Malaysia in so and so months. Can you tell us what the weather will be like?" If you google it, the internet will say "here's what the climate is in Malaysia." The youth did not agree with what the website said, saying that "they lived there" and the website "cannot tell me what the weather is like."
    - Students interviewed people about climate change for their videos. (But, those interviews didn't make it into the video).

The aforementioned list of evidence suggests that there is a risk of conflating "critical STEM literacy" with "all things good science teaching" and/or defining critical STEM literacy in opposition to a supposed, but unverified form of "bad science teaching" that dominates science classrooms.

In Year 1, the team modified their working definition of CSL, a significant step forward:

> Empowers [youth] as science learners and citizens who make informed decisions about their lives and communities to which they belong. (Definition from Project IRB Application)
>
> Agentive appropriation of knowledge for transformation of discourses and practices of STEM, learners' identities, and world around us, in order to build democratic and just societies. (Definition as of June 2017)

In Year 2, the team began to converge on a conceptualization of CSL, through three distinct lines of inquiry: identity, multimodal analysis, and CSL themes.

The "identity" line of inquiry is a longitudinal analysis of a few focal youth from Project RESET. This line of inquiry addresses research questions 1a and 3b. In the paper, Wright et al. examine different ways that youth's engagement in Project RESET changes over time. Challenges to developing these longitudinal accounts include (1) finding ways to represent key events in the youth's participation over time, and (2) articulating how local shifts in participation constitute evidence of "transformation" as envisioned in CSL. Preliminary findings and analyses for this paper were presented at BCCE 2018.

The second line of inquiry, referred to as the "multimodal analysis" paper by the project team, emerged from a detailed analysis of conversational dyads on Week 17. The paper weaves together an analysis of students' utterances, gestures, gaze, body movements, expressions, and screen captures of youth's computer use to understand how youth create an equitable learning environment in Project RESET, addressing research questions 2a and 3b. A challenge of expanding this analysis from Week 17 to other parts of the data set is being "systematic" about when and how to invoke multimodal analysis. Developing a set of shared "heuristics" might be helpful (see Opportunities for Year 2). Tuvilla and Wright presented a preliminary version of this paper at ICLS. This line of inquiry is also the focus of Tuvilla's doctoral dissertation.

The third line of inquiry is an effort to organize the "constellation of knowledge, practices, and dispositions" into "four CSL themes." This line of inquiry primarily addresses research question 2a. The team submitted a proposal to AERA 2019 and will continue to fine-tune the language of the four themes as data analysis continues.

Finding 11: The "critical" component of CSL needs further refinement.

In interviews, multiple project team members articulated the need to further clarify the meaning of "critical" in critical STEM literacy. At least six different ways to conceptualize "critical" emerged from project team interviews and scan of literature (Scipio, 2018, Ryu 2015; Bodner, 2016, Bevan, Calabrese-Barton, & Garibay, 2018; Polman & Gebre, 2015; Gebre & Polman, 2016, Priest, 2013).

1. Critical as in *transforming themselves and the learning environment*. In this view, the goal of CSL is for youth to create a more inclusive learning environment and/or change how they view themselves in relation to the community and STEM.
2. Critical as in *transforming broader society.* In this view, CSL aims for youth to use STEM to tackle issues in their local communities. Further, rather than just work alongside scientists, youth actually shift the professional practices of STEM fields (Scipio, 2018)
3. Critical as in Critical Theory. In this view, CSL is envisioned as a process of challenging dominant narratives about what constitutes STEM and disrupting power hierarchies associated with who is viewed as defining, participating in, and benefiting from STEM.
4. Critical as "skeptical." In this view, CSL aims for youth to learn to critique STEM knowledge, practices, and/or representations.
5. Critical as in "important." In this more colloquial meaning of critical, programs aim for youth to develop an informed citizen understanding of science.
6. Critical as in "not typically valued." In this view, youth are encouraged to utilize their everyday knowledge, experiences, and languages in science class.

Further evidence of the need to refine the notion of "critical" is evident in comparing the frequency of search terms in Google Scholar. Google Scholar is the most comprehensive electronic bibliographic database available; it outperforms Web of Science and Scopus, because, in addition to locating published articles and book chapters, it indexes unpublished materials such as dissertations and theses (Gusenbauer, 2018; Martín-Martín et al., 2018). According to Google Scholar, The frequency of resources related to "STEM Literacy" and "Critical Science Literacy" has increased substantially since the start of Project RESET in 2016. In fact, 41% of the literature results for critical science literacy were published in 2016 or later. However, the notion of "critical" has not yet carried over into work on "critical STEM literacy," which has shown more modest growth.

TABLE 5. GOOGLE SCHOLAR SEARCH RESULTS AS OF JUNE 27, 2019.

Search Term	Total Results	Results since 2016* (% of total)
"Critical STEM Literacy"	8	3 (38%)
"Critical Science Literacy"	219	90 (41%)
"Critical Scientific Literacy"	282	65 (23%)
"STEM Literacy"	2,250	1,050 (46%)
"Science Literacy"	51,500	11,300 (22%)
"Scientific Literacy"	78,600	17,100 (22%)

*Project RESET began in 2016; results include the year 2016

Two of the three "Critical STEM Literacy" results since 2016 are publications by the Project RESET team. Thus, there is potential for Project RESET to make a significant contribution to the research base by further developing the notion of "critical" engagement in STEM.

3.3 Evaluation Question 3

WHAT ARE SUPPORTS AND BARRIERS ARE ENCOUNTERED IN THIS PROJECT'S EFFORT TO (A) BROADEN PARTICIPATION IN STEM LEARNING PRACTICES AND (B) BUILD CAPACITY TO CONDUCT RESEARCH IN SERVICE TO PRACTICE?

Finding 12: Regional demand exists for high-quality afterschool STEM.

According to the Indiana Afterschool Network,[2] there are 37 registered afterschool programs that offer STEM-focused and cultural enrichment activities for 9-12th grade learners.

TABLE 6. REGIONAL STEM PROGRAM OFFERINGS.

Type of Program	No. of Programs
Any afterschool program	904
Program offering STEM Activities	421
Programs offering Cultural Enrichment/Diversity Activities	372
Programs offering STEM and Cultural Enrichment/Diversity Activities	285
Programs for 9-12th grade learners offering STEM and Cultural Enrichment/Diversity Activities	37

In addition, the Burmese American Community Institute currently has 53,610 followers on Facebook and 122 followers on Twitter. Thus, any Project RESET curriculum materials disseminated through BACI have the potential to reach a large audience.

Finding 13: There is an impetus to sustain afterschool STEM programming as a result of Project RESET.

The afterschool program described in the Project RESET proposal ran twice, once as a pilot program in 2015-2016 and again with NSF funding in 2016-2017 (Year 1). In Years 2 and 3 of Project RESET, the afterschool program was not offered. However, the community center did continue to run afterschool programming for youth, including programs with research and STEM components.

In conversations about sustaining or continuing the Project RESET afterschool program, all stakeholders (university researchers, community staff, and youth) conveyed a desire for afterschool STEM programming to continue in some form. In interviews, all stakeholders were asked to describe what aspects of the program they valued and wanted to continue, as well as what aspects they might want to modify or add.

Though the decision to focus only on data analysis, and not run the afterschool program a second time, was consistent with the project proposal, the research team expressed concerns about not running the program in the later years of the project. In a third implementation, the research team imagined a stronger community presence, for example, by involving parents in the program or by engaging youth in a community project. The research team also expressed

[2] http://rac.iaccrr.org/ian_partners/out_of_school_care_search.php

a desire, in the future, to plan for sustained engagement with youth. Sustained engagement would allow the research team to better understand the impact of the program on youth, and simultaneously increase the benefits youth derive from their participation in research. For example, youth who have already completed the afterschool program might be invited to return as facilitators the following year, providing them opportunities for leadership and also reconnecting them with the community center staff and research team.

The community center staff mentioned in Interview 3, BACI staff expressed the intent to continue STEM programming for youth. BACI staff valued that the Project RESET afterschool program focused on leadership skills (communication skills, public speaking skills, and advocacy), research skills, classroom interaction, the creation of videos, and the topic of climate change. BACI staff felt the program could be stronger if direct links to STEM career pathways were addressed throughout the program. For example, staff suggested providing youth guidance about how to include the afterschool program in their college application essays. They also recommended helping youth identify which colleges and universities offer programs related to various aspects of climate change, and what the application requirements are for those programs.

As discussed in Findings 1 and 4, though most of the youth interviewed were upcoming seniors and thus not eligible for the program, most (86%) said that they would participate in the afterschool STEM program again if they were juniors. The youth valued the relationships they built with the research team, and creating the videos. They recommended "more answers" and also guidance on creating professional-quality videos in future afterschool programming.

Retrospective Comment: The framings of STEM as a career pathway vs. STEM as a tool for improving the local community were, at times, in tension. While planning an afterschool program, it is critical for university educators and community-based staff to openly discuss: *What are the most important outcomes for youth to achieve in an afterschool STEM program?*

Finding 14: Human and financial resources are the major barriers to program sustainability.

Community staff and research staff were asked about barriers to program sustainability in Years 2 and 3. Based on interviews with staff and the research team, as well as comments made during the June 2017 advisory panel, the following **challenges** will need to be addressed as part of a sustainability plan:

- The responsive curriculum approach requires facilitators who are trained in STEM, pedagogy, and the multiple languages spoken by BACI youth. As no single person is likely to have all of these areas of expertise, an instructional team is required for even a small group of students.
- University-based research teams' availability to run the afterschool program is constrained by their other professional responsibilities, and also their physical distance from the community center.
- Community centers need to establish credibility for their educational programs by partnering with, for example, prestigious institutions of higher education.

- Teens are busy; sports schedules and AP review sessions conflict with STEM program meeting time.

However, the following **resources and supports** can be part of a sustainability plan:

- BACI youth, as refugees, have unique experiences living in at least two locations with very different climates. BACI educational programming emphasizes engagement in the community.
- BACI youth want to make a difference.
- BACI staff sees value in students developing STEM skills, and advocate for its importance.
- Personal connections made with the research and instructional team during the project (Youth said, "We really like them.")

Retrospective Comment: In addition to a detailed research plan, future proposals might contain a detailed plan for program sustainability that addresses: (1) what core elements of the afterschool program need to be sustained, (2) what resources exist at each institution, in the absence of external funding, to sustain the core aspects of the programming, (3) each institution's tasks and responsibilities as part of that sustainability plan, (4) a timeline for transitioning to the sustainable version of the program.

Finding 15: Dissemination to research venues outpaced dissemination to practitioner-oriented and community-oriented venues.

As shown in Appendix G, most of the project publications target education researchers. However, the Ryu et al. (2018) article published in *Urban Review* has attracted attention from many audiences and has been cited in policy sources (Baker, 2019).

TABLE 7. CITATION RATES FOR PEER-REVIEWED MANUSCRIPTS.

Article	Views or Downloads	Shares	Altimetric/AMS Score	Citations
Ryu (2019)	132	unavailable	0	1
Ryu et al. (2019)	120	Unavailable	0	1
Ryu et al. (2018)	1,100	11	6	12
Tuvilla et al. (2018)	14	unavailable	0	1

*Statistics obtained from publisher websites, Google Scholar, ResearchGate, and Altimetric™ on November 4, 2019. When sources disagree, the greater of the results is reported.

REFLECTION ON THE EVALUATION

Phenomenology was a useful lens for identifying resonances and discrepancies among youth, research teams, and community center experiences in Project RESET. The evaluation tools and metrics did lead to insights relevant to the evaluation questions. The youth videos were an especially useful source of evidence for evaluating links between the project plan and its implementation. In retrospect, interviewing all stakeholders prior to the start of the afterschool program about their expectations for the project would have provided additional evidence to

interpret participants' post-implementation interview responses in Years 2 and 3. More frequent sharing of data with the research team in between end-of-year evaluation reports might have allowed the team to make adjustments more rapidly, particularly in Year 1 during the afterschool program implementation.

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IMAGE CREDITS

Cover Image. https://reset.education.purdue.edu/

APPENDICES

A. Community Staff Interview Protocols

Year 1

All interview protocols are meant to be adapted in the moment based on interviewee responses. Some questions may be omitted, or others added, in any given round of interviews.

1. How does the afterschool STEM program fit into the educational programming at BACI?
2. What is your role in the afterschool program?
3. How do you feel about the number of participants in the program (too few, too many, just right)?
4. How do you feel about the level of engagement of youth participants in the program? (not at all engaged, a bit engaged, very engaged)?
5. A focus of the afterschool science program is climate change. How is this topic relevant to youth and the BACI community?
6. What changes have you observed in the youth since they started participating in the program?
7. This is a research in service to practice project. How do you feel about the balance between research and practice (programming)? (too research-focused, too practice-focused, just right)
8. The central focus of the project is the learners in the program and their having an opportunity to transform their communities. What are some ways that you've seen that happen so far?
9. What are some ideas for how that could be even more evident in Year 2?
10. What was the biggest challenge you encountered with Project RESET this year?
11. Biggest success?
12. What are your hopes and aspirations for this project going into Year 2?
13. Is there anything else you'd like to share?

Year 3

1. Did you have a chance to interact with or observe the STEM program?
2. What were the impacts of the STEM program on youth?
3. As a result of this project, do you intend to continue offering a STEM Program?
4. Which of the following impacts on the research team have you seen as a result of Project RESET?
    a. They learned more about the needs of Burmese resettled youth.
    b. They learned more about the history of Myanmar.
    c. They learned to design activities that are of interest to resettled youth.
    d. They have identified new research questions and ideas.
    e. They are better able to communicate their research findings to a non-research audience.
    f. Project RESET had a positive impact on the researchers' reputation.
    g. Other?

5. What elements of the STEM Program that Purdue implemented would you like to see continue at BACI? (e.g., climate change focus, focus on talking/language, video presentations, lab activities)
6. What was missing?
7. Rank these elements as: Not very important, somewhat important, very important:
    a. Hands-on or experimental component
    b. Connections to future STEM careers
    c. Curriculum designed specifically for resettled Burmese youth (for example, using photos from Myanmar)
    d. Aligned with state standards
    e. Addressing gaps in state standards
8. Do you have any questions for me?

B. Youth Participant Interview Protocol

1. What was the topic of the STEM program?
2. How interested were you in climate change prior to starting the program?
3. What's a typical day like at the afterschool program?
4. How are activities decided upon?
5. I'm going to read a list of items. Please tell me how much you think you learned about each of these items in the afterschool program (not at all, a little bit, very much)
    a. Climate change
    b. How to design an experiment
    c. How to share your ideas in a conversation
    d. The weather and climate in Indiana
    e. The weather and climate in Burma
    f. What it means to be a scientist
    g. Researching about climate change online
    h. The scientific method
    i. Sharing information about climate change with the community
    j. Learning about each other
    k. Ms. Ryu's ideas about climate change
    l. Relationship between human life and climate change
6. Was there something you learned that I didn't mention in my list?
7. You said you learned a lot about ____. Can you say more about that?
8. I heard you did a video project. What was that about?
9. How interested are you in climate change now? (not at all, a little bit, very much). What interests you about it?
10. Do you believe that you and your peers at BACI can impact climate change? How?
11. Do you plan to participate again next year?
12. What changes would you recommend for next year?
13. Is there anything else you'd like to share?

C. Research Team Interview Protocols

Year 1

About roles and responsibilities…

1. How long have you been working on Project RESET?
2. What's your role in the project?
3. How would you describe the purpose of the project?
4. What's your confidence level regarding knowledge of climate change?

About the afterschool program…

5. The focus of the afterschool science program is Climate Change. How is this topic relevant to youth and the BACI community?
6. How do you feel about the number of participants in the program? (about 12 who attended every week? (too few, too many, just right)
7. How do you feel about the level of engagement of youth participants in the program? (not at all engaged, a bit engaged, very engaged)?
8. What's a typical day like at the program? How are activities decided upon?
9. What changes have you observed in the youth since they started participating in the program?
10. What major accomplishments this year in terms of the program/curriculum?
11. Challenges?
12. Do you think students feel have like they can make a difference? Or have started to?

About the Research…

13. What stands out to you in the data so far?
14. This is a research in service to practice project. How do you feel about the balance between research and practice (programming)? (too research-focused, too practice-focused, just right)
15. What are some of the major accomplishments for research this year?
16. Challenges?
17. From a research perspective, you hope to cultivate critical STEM literacy among youth participants. What are some ways that you've seen that happen so far?
18. What are some ideas for how that could be even more evident in Year 2?
19. What are your hopes and aspirations (priorities/improvements) for this project going into Year 2?
20. Is there anything else you'd like to share?

Year 2

1. What is the purpose of Project RESET?
2. So far, what have you gained personally from this project?

3. Last year's work really focused on implementation. This year, research was at the forefront. Would you say that your team's R&D work this year didn't meet, met, or exceeded your expectations? Because…
4. What progress have you made in terms of research? Ex...
    a. Working with data
    b. When you think about critical STEM literacy, how has your understanding or thinking about that changed through the work of this project?
    c. Have you "answered" your research questions?
    d. Graduate student training
    e. Dissemination
5. What makes this work difficult to do? What strategies has your team developed to make the work manageable?
6. Let's talk about the implications for researchers and practice.
    a. Are you at the point in the project where you can make recommendations for other researchers who may attempt similar kinds of work? If yes, what are those recommendations? If not, what more needs to happen for you to be ready?
    b. Are you at the point in the project where you can make recommendations for teaching practice? If yes, what are those recommendations? If not, what more needs to happen for you to be ready?
7. From a research perspective, what ONE thing MUST happen between now and the end of the project for you to feel that the project was a success?

Year 3.

1. Please review the NSF Project summary below (text copied from the NSF project summary page). This summary was written before the project began, so it's likely that some details have changed. Please highlight in GREEN what is STILL true about Project RESET. Highlight in RED what you think is no longer an accurate description of Project RESET.

2. If you had a chance at a "do over" for Project RESET, what would you have done differently?

3. What have you learned from Project RESET that you will use again in the future?

D. Indicators of Responsiveness Video Screening Form

Instructor/Facilitator…

- ☐ Repeats/restates youth idea
- ☐ Attempts to elicit more about youth's thinking (e.g., "you think this because…?"; "Do you mean X or Y?")
- ☐ Invites others to consider a youth's idea (e.g., to disagree, agree, revoice with a pause for response)
- ☐ Provides/elicits a counterclaim to youth's idea
- ☐ Describes differences between youth ideas
- ☐ Describes similarities between youth ideas
- ☐ Presses youth for evidence or argument (e.g., "How do you know?")
- ☐ Alters an activity in response to youth ideas
- ☐ Asks youth to repeat own idea (e.g., to confirm it was heard correctly)
- ☐ Other…

Additional Comments:

Video Name:

Timestamp:

E. Peer Review Analysis Form

This form utilizes the American Educational Research Association's six elements for conference proposal review (AERA 2019, p. 4).

Which of the following were identified as strengths of the proposal or manuscript?

- ☐ Objectives or purposes
- ☐ Perspectives or theoretical framework
- ☐ Methods, techniques, or modes of inquiry
- ☐ Data sources, evidence, objects or materials
- ☐ Results and/or substantiated conclusions
- ☐ Scientific or scholarly significance of the work
- ☐ Other…

Which of the following were identified as important areas for revision of the proposal or manuscript?

- ☐ Objectives or purposes
- ☐ Perspectives or theoretical framework
- ☐ Methods, techniques, or modes of inquiry
- ☐ Data sources, evidence, objects or materials
- ☐ Results and/or substantiated conclusions
- ☐ Scientific or scholarly significance of the work
- ☐ Other…

F. Project RESET Publications and Presentations

Dissertations and Master's Theses

1. Wright, C. E. (2019). The affordances of laughter in an afterschool STEM program for multilingual learners (Master's Thesis, Purdue University, West Lafayette, IN, USA).
2. Tuvilla, M. R. S. (to be completed by spring 2020). Multimodal Analysis of Minoritized Learners' Science Engagement in an Afterschool Program. (Doctoral Dissertation. Purdue University, West Lafayette, IN, USA).

Peer-reviewed Journal Articles

1. Ryu, M., Tuvilla, M. R. S., & Wright, C. E. (2019). Resettled Burmese Refugee Youths' Identity Work in an Afterschool STEM Learning Setting. *Journal of Research in Childhood Education*, *33*(1), 84-97.

Peer-reviewed Conference Proceedings

1. Tuvilla, M. R., Wright, C. E., Ryu, M., & Daniel, S. M. (2018). How Do Multilingual Learners Support One Another's Science Learning and Participation?. In Kay, J. & Luckin, R. (Eds.) *Rethinking Learning in the Digital Age: Making the Learning Sciences Count*, 13th International Conference of the Learning Sciences (ICLS) 2018, Volume 3. London, UK: International Society of the Learning Sciences.

Peer-reviewed Presentations at National and International Conferences

1. Ryu, M., Daniel, S.M., Wright, C.E., & Tuvilla, M.R.S. (2020, April). Analyzing translated data: Challenges and new possibilities. To be presented at 2020 Annual Meeting of American Educational Association.
2. Ryu, M., Daniel, S.M., Tuvilla, M.R.S., & Wright, C.E. (2020, March). Burmese youth's enactment of critical STEM literacy practices in an afterschool program. To be presented at 2020 Annual International Conference of the National Association for Research in Science Teaching.
3. Ryu, M., Tuvilla, M.R.S., & Wright, C.E. (2020, March). Methodological Challenges in Collecting and Analyzing Multilingual Data. To be presented at 2020 Annual International Conference of the National Association for Research in Science Teaching.
4. Tuvilla, M.R.S., Wright, C.E., Daniel, S.M., and Ryu, M. (2020, March). Investigating productive science engagement in an afterschool science program for resettled Burmese refugee youth. To be presented at 2020 Annual International Conference of the National Association for Research in Science Teaching.
5. Ryu, M., Daniel, S., Tuvilla, M., & Wright, C. (2019, April). Burmese Youths' Enactment of Critical STEM Literacy Practices in an After-School Program. Poster presented at the annual meeting of the American Educational Research Association, Toronto, Canada.
6. Tuvilla, M., Wright, C., Ryu, M., & Daniel, S. (2019, April). Multimodal Interactional Analysis in Analyzing Youth's Engagement. Paper presented at the annual meeting of the American Educational Research Association, Toronto, Canada.
7. Wright, C., Tuvilla, M., Daniel, S., & Ryu, M. (2019, April). Burmese Refugee Youth Enacting Critical Agency and Self-Authoring in an After-School STEM Program. Paper

presented at the annual meeting of the American Educational Research Association, Toronto, Canada.

8. Daniel, S., Ryu, M., Tuvilla, M., & Wright, C. (2018, September). Developing norms for scientific sense-making with resettled refugees. Paper presented at the TNTESOL Conference. Franklin, TN.
9. Wright, C.E., Tuvilla, M. & Ryu, M. (2018, July). Identity work of resettled Burmese refugee youth in an afterschool STEM program. 25th Biennial Conference on Chemical Education, Notre Dame, IN.
10. Tuvilla, M.R. & Ryu, M. (April, 2018). Multimodal Interactional Analysis of Youth Interactions in an Afterschool Science Learning Setting. Paper presented at the annual meeting of the American Educational Research Association, New York, NY.
11. Ryu, M., Sikorski, T. R., & Tuvilla, M. (2017, June). A multimodal analysis of group collaboration: What does equitable and inequitable collaboration look like? Paper presented at the Association for Visual Pedagogies Conference, Aalborg, Denmark.
12. Ryu, M., Tuvilla, M. R., & Wright, C. (2017, April). Burmese refugee youth's identity work in an after-school learning setting. Paper presented at the annual meeting of the American Educational Research Association, San Antonio, TX.
13. Tuvilla, M. R. & Ryu, M. (2017, April). Resilience in the moment: Refugee youth's resilience in science learning setting. Paper presented at the annual meeting of the American Educational Research Association, San Antonio, TX.
14. Tuvilla, M. R. & Ryu, M. (2017, January). What can K-12 teachers learn from minoritized youth's interactions in an afterschool science program?. Paper presented at Indiana STEM Education Conference, West Lafayette, IN.
15. Ryu, M. & Tuvilla, M.R. (2016, April). Critical STEM literacy practices among resettled Burmese refugee youth. Paper presented at the annual meeting of the American Educational Research Association, Washington, DC.

Peer-reviewed Presentations at Regional Conferences

1. Tuvilla, M. R., Wright, C. E., & Ryu, M. (2018, March). Analysis of Multilingual Learners Interactions in an Afterschool Science Program. Poster presented at the Annual Graduate Students Educational Research Conference, Purdue University, West Lafayette, IN.
2. Tuvilla, M. R., Wright, C. E., & Ryu, M. (2018, March). Analysis of Multilingual Learners Interactions in an Afterschool Science Program. Poster presented at the 3rd Annual Purdue Linguistics, Literature, and Second Language Studies Conference.
3. Wright, C. E., Tuvilla, M. R., & Ryu, M. (2018, January). Multimodal Interactional Analysis for Analyzing Participation in Informal Learning Settings. Paper presented at the 3rd Annual Indiana STEM Education Conference, West Lafayette, IN.
4. Wright, C. E., & Ryu, M. (2017, October). Laughter as a Lens for Participation in Afterschool Science Settings. Poster presented at the 2nd Annual Learning Science Graduate Student Conference, Bloomington, IN.
5. Tuvilla, M. R., Wright, C. E., & Ryu, M. (2017, March). Burmese Youth's Identity Negotiation in an Afterschool STEM Program. Poster presented at the Annual Graduate Student Education Research Symposium, West Lafayette, IN.

6. Tuvilla, M. R. & Ryu, M. (2016, October). Betty's resilience in the moment: Refugee Youth's 'Hidden' Resilience in an Afterschool STEM Program. Paper presented at Learning Sciences Graduate Students Conference, Chicago, IL.
7. Tuvilla, M. R. & Ryu, M. (2016, January). Responsive teaching: A way to engage transnational students in science talks. Paper presented at Indiana STEM Education Conference, West Lafayette, IN.

Awards and Media Mentions

1. 2019 NAED/Spencer Dissertation Fellowship Finalist. Mavreen Rose Tuvilla.
2. Best Poster. Tuvilla, M.R. & Wright, C.E. 2018 Annual Graduate Students Educational Research Conference, Purdue University, West Lafayette, IN.
3. Purdue University Graduate School Admissions Spotlight. Mavreen Tuvilla. https://www.purdue.edu/gradschool/documents/admissions/spotlight/Mavreen.pdf
4. Best Poster. Tuvilla, M.R. & Wright 2017 Annual Graduate Students Educational Research Conference, Purdue University, West Lafayette, IN.
5. NSF 2017 STEM Video Showcase Public Choice Award. Ryu, M., Tuvilla, M. R., & Wright, C. E. (2017, May 14). Creating Spaces With Resettled Refugee Youth [Video file]. Retrieved May 16, 2017, from http://stemforall2017.videohall.com/presentations/994%20