

Balance the Equation Phase 2 Study Plan: HUPCS

This template provides a structure for the Balance the Equation (BTE) grantees' Phase 2 study plans and supporting documents. Phase 2 studies should be designed to address learning questions that correspond to grantees' solutions and align with the overall BTE Learning Questions.

The Phase 2 study template includes six sections, corresponding to each of the six meetings you have with your AIR learning partners:

1. Description of the solution
2. Theory of action and learning questions
3. Design and sampling
4. Measures and data collection
5. Analysis
6. Phase 2 study timeline

We will discuss the content of each section during AIR's meetings with you, although we encourage you to look ahead and do some thinking about the upcoming section before we meet. After we discuss the section during a meeting, you will draft (or revise) your response in this template prior to the next meeting. Your AIR learning partners will review each section, providing feedback and support along the way. Our goal is to complete this template by the end of April so that you can use it to support your Phase 2 application (which may be submitted between May 3 and May 14).

For which cohort are you applying?

- 1
 2

If you are applying for cohort 1, tell us about your stage of development.

- Solution is fully developed - all materials, tools and resources have been created
 Solution is partially developed - materials, tools and resources are ready for launch in fall 2021, but more development is needed on the latter half of the solution
 Other, please explain

1. Description of the Solution

Please provide a detailed description of your solution by addressing the following questions.

Resources related to this section of the plan are located [here](#).

Articulate the Problem

- What problem is your solution designed to address?
Black girls are frequently overlooked in the mathematics classroom, which contributes to their

ambivalence towards learning mathematics, an attitude that tends to persist throughout their academic careers. While middle-grade black girls consistently demonstrate resilience generated from the emotional and physical transformations that they undergo as adolescents, they often experience unmet academic needs and their identities are not validated in the classroom where their teachers focus more on their behavior and social-emotional concerns. The results from NAEP in 2015 suggest that only 16% of Black girls were considered proficient by 8th grade in mathematics. Proficiency means that they are able to synthesize their understanding of mathematics concepts (Young et al., 2017, 71). Black girls do not feel empowered and are often dehumanized in the mathematics classroom because the Algebra curriculum does not relate to their specific experiences. The inability to connect with the Algebra content prohibits the girls' development of an appreciation of mathematics.

Black girls are being left behind in mathematics due to the lack of intersection between mathematics curriculum and their identities resulting in fewer pursuing degrees in mathematics and careers in STEM. By creating and implementing a curriculum that addresses who Black Girls are at a micro level, a curriculum that incorporates their interests and concerns, the results will be that Black girls will have a more inclusive experience with mathematics that will have long-term results.

Solution abstract

Describe your solution in one paragraph

Add a one-paragraph solution description here.

Our solution is a 21-week Algebra program, delivered daily during one hour block Algebra class, designed to provide Black girls with an inclusive instructional experience that affirms their identities and engages them more deeply in mathematics. The solution is instructional modules, that include warm-ups, practice, assessments, reflections and teacher training, that address Black Girls' interests and concerns including but are not limited to Black Hair, Colorism, race and gender equality. The solution will align to the Illustrative Math Algebra 1 (IM) curriculum and will improve mathematics efficacy and engagement through an intersectional focus on Black Girls' experiences, interests, culturally focused issues, and Algebra concepts

Activity Description and Focus

- **How do you characterize the key student and teacher activities for your solution (for student activities, please specify independent practice, intervention, and/or assessment)? The key activities should be those that you think are most critical to occur in order for the solution to have the impact you intend.**

- o *The key student and teacher activities that will drive the solution content will include*
 - *Survey to determine specific interests that will drive the curricular changes as part of our solution.*
 - *Empathy interviews with teachers and students to determine their attitudes about mathematics*
 - *Teachers develop lesson plans, activities and assessments, facilitate group discussions, provide guided practice, administer assessments*
 - *Students will complete the activities, guided practice, independent practice, and assessments*
- o *The developed solution activities will affect 3 units in Algebra 1 as follows:*
 - *For our phase 2, we will work with the Linear Equations, Inequalities, and Systems in the fall (October-November), the Functions unit in the winter (January), and the Two Variables Statistics unit in the early spring (March). Developed activities will include a daily warm-up, learning activity, practice activity, and an occasional lesson synthesis. Cool-downs, portfolio problems, exercise sets, Socratic seminar discussions, Projects, and End-of-Unit Assessments Within each unit, the activities will contain applications that, based on student and teacher input (through interviews and surveys), relate specifically to Black girls’ identities and experiences. They include but are not limited to the following topics: Black women in music, identity, attitudes towards Black women’s hair, the pandemic and the Black community, Skin tone and racial advantage, being a Black Female influencer.*
- **How is each activity implemented, by whom, and over what timeline? Try to characterize the experience of the solution from the perspective of participants. What do students do and experience? What do teachers do and experience? What other participants or staff are critical? How do their activities and experiences relate to each other?**
 - o *The timeline for implementation is as follows*
 - *10/1/2021 - 11-15/2021 Linear equations and inequalities*
 - *01/4/2022 - 01/25/2022 Two-Variable Statistics*
 - *02/28/2022 - 03/31/2022 Functions*
 - o *Students will experience the solution every day in the timeline outlined above because students have mathematics 5 days per week.*
 - o *The following is a sample learning day detailing what students, teachers and parents experience.*

<p>Sample Activity and Application Total Time: 50-60 minute class period</p>	<p>What do students experience?</p>	<p>What do teachers experience?</p>	<p>What do parents experience?</p>
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Day 1 (50-minute lesson) – Attitudes about Black Women’s Hair	Warm-up (5 minutes) – Notice and Wonder where students discuss how there can be several quantities in a given situation about a black girl who is getting hair extensions	Open the discussion about attitudes that Black girls have about their hair. Guide students on representing quantities from the warm-up and the relationships that exist between them	Connect life experiences with work
	Activity 1 (20 minutes) related to the warm-up. Students notice quantities and relationships through an activity that has a girl planning to get her hair extensions and her experiences in the salon and the beauty supply store relates to their experiences	Revisit the discussion on attitudes about hair. Begin to formulate an Action plan for the girls to implement. Facilitate the activity by encouraging conversation around how the activity relates to the students’ life experiences. Girls will connect quantities to variables	Contribute to the activity while speaking to the child about it and how it relates to their life
	Activity 2 (15 minutes) The Students practice identifying the different quantities in the situation where the girl is making decisions about her extensions situation that relates to their experiences	Facilitate the activity by encouraging conversation around how the activity relates to the students’ life experiences, synthesizing the lesson	Contribute to the activity while speaking to the child about it and how it relates to their life
	Cool Down (10 minutes) Students synthesize the learning from the day and apply it to their lives	Review Cool down to assess student mastery	Discuss what child learn during the day

- **What resources (ex. instructional materials, teacher guides, technology supports or requirements) do you use to enable these activities?**

- o *We will use the Illustrative Mathematics curriculum which provides the basis of the instructional materials and teacher guides.*
- o *All students will use their school-provided technology and other instructional materials to access the course materials.*
- o *The solution will be accessed through the Summit Learning Platform for the Phase 2 Study*
- o *The solution can be accessed with a variety of Learning Management Systems including Canvas, BlackBoard, and can be used on Google Classroom.*
- o *The solution can be implemented as a stand-alone curriculum.*
- o *Product development includes the following:*
 - *The following components will be developed as part of this solution of the Unit Plan for each of the 3 units that are a part of this study*
 - *Lesson Plan*
 - *Notice and Wonder (Warm-Up)*
 - *Student Synthesis Activities*
 - *Cool Downs (Exit Tickets)*
 - *Student Reflection*
 - *Each of these components will be developed to focus on specific Black Girls' experiences and identities*
- **Which priority student groups and grade(s) will use the solution (e.g., Black students, Latino students, English learners, students from low-income families)?**
 - o *Priority student groups are 8th-grade Black girls in Title 1 schools*
 - o *Demographic is typically low income, recipients of Free and Reduced priced lunch programs*
- **To what BTE Area(s) of Focus does your solution align?**
 - o *The solution aligns with the following:*
 - ***Builds out Support Systems:*** *Facilitates the creation and maintenance of inclusive mathematics communities in person or virtual - virtual between students and adults to build relationships. These supports build: critical consciousness among educators, an understanding about sharing power with students in constructing the mathematics learning community; a more expansive view of mathematics among adults and students; and promote meaningful collaboration, deep mathematical thinking and exploration among students and adults.*
 - ***Improves Relevance of Algebra Content:*** *Increases the relatability by using real-world examples that connect to the interests of students in the mathematics community (e. g. classroom) and increase focus on making sense of Algebraic concepts.*
 - ***Empowers and Strengthens Teacher Practices:*** *Offers new materials, tools and strategies that empower, support and expand teachers' knowledge on a daily basis.*

Alignment to Existing, High-Quality Curriculum

- **To what existing, high-quality core curriculum does your solution align? Please be specific in title and grade level(s) or course(s).**
 - *The solution aligns to Algebra 1, Illustrative Mathematics*
 - *Curriculum Description:*
<https://curriculum.illustrativemathematics.org/HS/teachers/1/index.html>
 - *EdReports review:*
<https://www.edreports.org/reports/overview/kendall-hunts-illustrative-mathematics-traditional-2019>
- **Is your solution designed to be implemented as part of core instruction (tier 1), targeted small group instruction (tier 2) or intensive individual intervention (tier 3)? Explain.**
 - **Is your solution designed to be used by individuals, in groups, or both? Explain.**
 - **Is your solution designed to be used in the classroom during the regular school day, after school, at home, or some combination of these environments? Explain.**

Our solution is designed to be implemented as part of core instruction, in the classroom during the regular school day. As part of instructional practice, teachers will also implement small group instruction to differentiate and accommodate students at all learning levels.

- **What is a specific example that illustrates the way in which your solution aligns with the math content addressed in the core curriculum named above? Be sure to describe a specific lesson, or series of lessons, from the core curriculum; a specific activity in your solutions; and how the solution complements or supports students in further understanding the content in the core curriculum.**
 - *The following is a specific example that demonstrates the alignment of our solution with the math content of Illustrative Mathematics Algebra 1.*
 - *The unit in IM Algebra on Linear Equations, Inequalities and Systems Unit has following learning objectives:*
 - *This is an example of all the Day 1 of this unit as developed for our solution:*

Day 1 - Linear Equations, Inequalities and Systems**OBJECTIVES**

Student will be able to:

- *Describe in words the relationships expressed by algebraic expressions.*
- *Represent relationships expressed in words using algebraic expressions.*

Student-level language

- *Let's use operations and variables to describe culturally relevant situations.*

STANDARDS

Addressing: 6.EE.A.2.a

Building Towards: HAS-CED.A., HAS-CED.A.1., HAS-SSE.A.1

Warm-up: *Notice and Wonder Party Planning (Student Activity #1) (5 minutes)*

Instructional Routines: *Notice and Wonder*

The purpose of this warm-up is to elicit the idea that there can be several quantities in a given culturally relevant situation. This will be useful when in a latter activity, students practice representing quantities and the relationships that exist between them. While students may notice and wonder many things about the culturally relevant situation, known and unknown quantities are the important discussion points.

Activity 1: Notice and Wonder: Operation Hair (20 minutes)

What do you notice? What do you wonder?

“Renee is helping her aunt and mom plan hairstyles and outfits for all of the girl cousins in the family. Her family has a big family reunion coming up very soon.”

“Renee’s aunt suggests that they give everyone braids. She tells Renee that she plans to use 1 pack of hair for every four braids. There will be 2 beads per braid for every person.”

“Renee’s mom is getting outfits for each female cousin. She plans on buying one skirt per person, plus 5 extra skirts in a different style just in case. She’s going to buy one pack of t-shirts that has 10 total shirts in each pack but they will only need $\frac{1}{2}$ of the pack.”

Operation Hair: Student Activity #2

The goal of this activity is for students to continue to notice quantities and relationships in written culturally relevant situations. And connect them to operations on variables. Students can use the notice and wonder strategy to help them connect to the context. During the synthesis, you will draw out how students connected each culturally relevant situation to the operation that made sense to perform, so encourage students to think about this. They can write in words how they calculate the amount of hair needed for the braids. This might also help them see patterns in calculations and generalize it to an expression.

Monitor for students who develop incorrect expressions, especially expressions using the wrong operation. Ask students to put their information in a table but write out each calculation in the table.

Student Task Statements

Activity 2: Operation Hair! (15 minutes)

A beautician is preparing for a full day at her hair salon. For each question, write an expression representing the supplies needed.

- 1. She needs one pack of hair for every four braids, plus two beads per braid. How many packs of hair are needed if the number of the braids are:*

a. 10

b. 6

c.

2. She needs 4.5 ounces of gel to style the edges for each girl. How many ounces of gel is needed if she styles this many girls:

a. 10

b. 6

c.

3. For every 2 beads, she needs 1 rubber band to keep them in place. How many rubber bands are needed if the number of beads is:

a. 10

b. 6

c.

4. There are five packs of beads. Each pack has 100 beads. She needs $\frac{1}{2}$ a pack to complete one head of braids. How packs does she need if the number of heads she has to complete is:

a. 10

b. 6

c.

Packs of Hair	Number of Braids

Important Quantities – Student Activity #3

Instructional Routines: Aspects of Mathematical Modeling

The purpose of this activity is for students to practice identifying the different quantities involved in a culturally relevant situation, both known and unknown. This activity allows students to reason abstractly and quantitatively when they think through a culturally relevant situation and describe the quantities so that they know what to represent in their expressions.

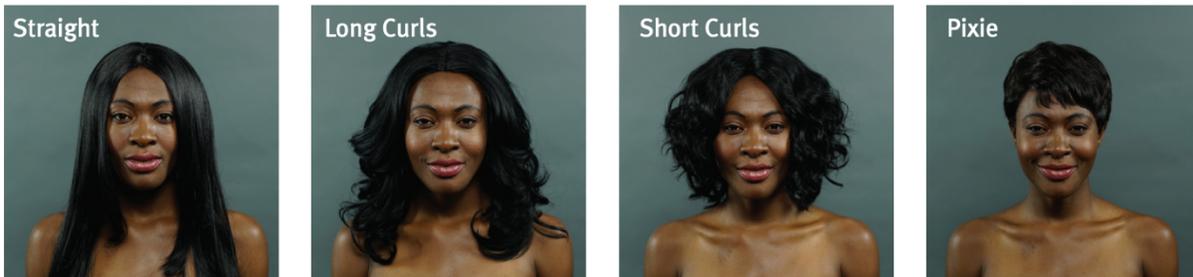
Day 1 – Closing Socratic Seminar – Teacher Guide (15 Minutes)

In this Socratic Seminar students are asked to look at pictures of different hair styles and they are to determine which hairstyles they are most comfortable wearing themselves and the one they are least comfortable wearing. Students can circle and put a star next to the one they are most comfortable wearing and an x next to the one they are least comfortable wearing.

IMAGES OF TEXTURED STYLES



IMAGES OF SMOOTH STYLES



Reflection Discussion: Why did you make the selection that you made?

The teacher will read a statement about hair bias in black women. The teacher will clarify any unfamiliar words for the students. Read the following text that discusses bias against black women's textured hair.

- ***On average, white women show explicit bias toward black women's textured hair. They rate it as less beautiful, less sexy, less attractive, less professional than smooth hair***
- ***Black women perceive a level of social stigma against textured hair and this perception is substantiated by white women's devaluation of natural hairstyles***

Vocabulary

Bias – to favor or be prejudiced about one thing

Textured hair -is where strands create shape, like curves, spirals, zig zags or waves; **hair** is kinky, coily, curly or wavy.

Explicit – state clearly

Social Stigma – discrimination against someone based on a social characteristic like hair, skin color

Substantiated- provide evidence

Devaluation – the lowering of worth or importance of something

As students to develop questions about these statements. They then discuss those questions as well as other questions posed by the teacher. After all students have had a chance to share, the teacher may conclude the activity with a whole-class discussion.

Responding to Priority Student Communities and Changing Existing Practice

- How does your solution respond to the needs and interests of priority students and the community?
- How does your solution differ from existing practice?

Based on prior survey and interview responses, Black girls feel marginalized in their mathematics classes. The common theme from their responses, is that there is no intersectionality between the mathematics being taught and the identity of Black girls. Algebra classes support gender isolation because application of concepts rarely relates to issues or topics that speak to the identity of Black girls. Our solution will be different because we are looking specifically at the application of the concepts and taking the input from the Black girls and their experiences and interests and incorporating these interests into the curriculum.

For example, in the introductory activity for the Illustrative Mathematics Linear Algebra Unit, the second activity talks about the feeding operation that a zookeeper has to prepare for feeding a snake. Our solution would instead be an activity to correspond with the notice and wonder activity where a young girl is considering changing her hair and she is going to add micro-braids. She is preparing to make the necessary purchase and with a parent, choose a stylist. She has to determine how much she needs to buy based on the style she wants. This developed activity will create conversation between the girls because they can all relate to each other. It is a lead in conversation to a discussion around implicit biases towards Black women's hair.

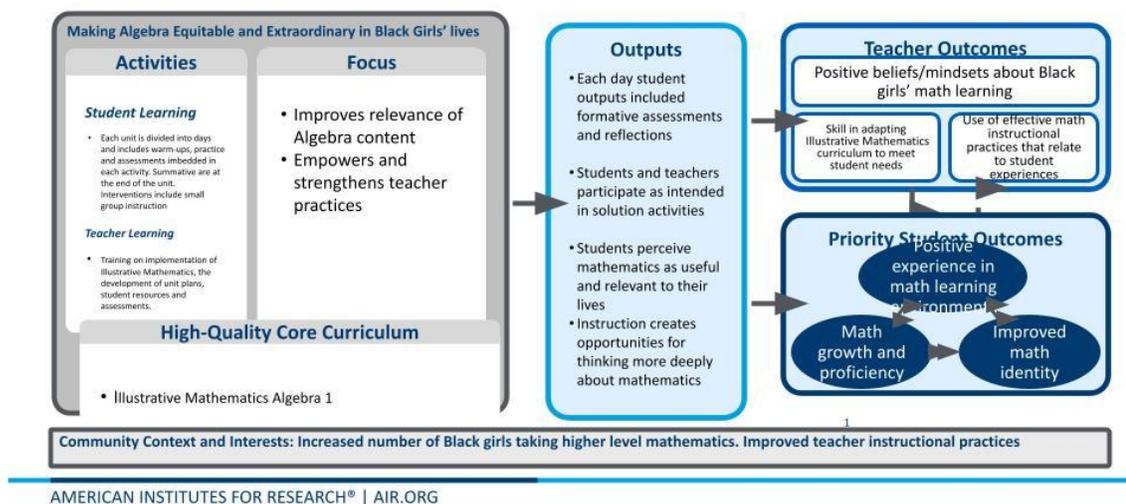
2. Theory of Action (ToA) and Learning Questions

Please provide a detailed description of your ToA and learning questions by addressing the following prompts and questions. Be sure to use the Grantee ToA Tool and the Grantee Learning Questions Tool and other resources [here](#) as suggested to craft your responses.

ToA and Evidence for Your Solution

- Using the BTE Grantee TOA tool, create a customized version that captures your solution and identify research studies that support your theory for why your solution will lead to the specified outcomes
- Insert a copy of your customized ToA below and use the description of your solution that you provided in Section 1 as a basis to summarize your ToA. Make sure to describe how the activities and their intended BTE Area(s) of Focus produce the intended outputs, and teacher and student outcomes.

Balance the Equation Theory of Action



- Complete the tables in [Appendix A](#) to document existing positive or mixed evidence for your solution. Make sure to differentiate between direct evidence for your solution (i.e., tests done on your solution) and ties to related evidence bases (e.g., studies that provide evidence that your solution is likely to work and why). Add information for 3-5 studies, adding more tables as needed.

Learning Questions

- Using the Grantee Learning Questions Tool and the structure below, state the specific learning questions that your phase 2 study will answer. Be sure to delete all text in *italics* as described in the tool as you fill in your phase 2 study learning questions.

1. Utilization Learning Questions

- Questions about whether each solution activity was implemented in the specified timeline
 - To what extent is the solution implemented as planned on the intended timeline?*
 - Was the initial and ongoing teacher training implemented on the specified timeline? Was all content covered?*
 - Were the assessments implemented on the specified timeline? Were all assessments administered?*
- Questions about whether teachers and/or students participated in the solution activities as intended
 - To what extent do students and teachers participate in the solution activities?*
 - To what extent do students participate in curricular activities?*
 - To what extent do students participate in assessments?*

2. Usability and Usefulness Learning Questions

a. Usability question(s):

- *To what extent do teachers and students find the solution activities and materials easy to use?*
- *Do all participants (students, teachers, trainers) find the solution interface (Summit Base Camp, Google Suite, etc.) easy to navigate?*

b. Usefulness question(s):

- *To what extent do teachers and students find the solution activities and materials useful?*
- *To what extent do participating students and teachers report that the solution improves student motivation and learning in math class?*

3. Cost Learning Questions

- *What is the average cost of the solution?*
- *What is the total cost and the total cost per student to implement the solution during the Phase 2 study?*

4. Scalability Learning Questions

- *What are the necessary conditions for another school or district to successfully implement the solution?*
- *What would a district or CMO need to implement the revised curricular activities and teacher training?*

5. Student Outcome Learning Questions

- *To what extent is the solution associated with the following student outcomes:*
 - *Experiences in mathematics class?*
 - *Identity as a mathematician?*
 - *Mathematics growth and proficiency?*

6. Teacher Outcome Learning Questions

- *To what extent is the solution associated with the following teacher outcomes:*
 - *Beliefs and mindsets about priority students?*
 - *Teachers' ability to implement effective instructional strategies?*
 - *Teachers' ability to adapt curriculum to make it more inclusive and engaging for priority students?*

Design and Sampling

In the space below, please provide a detailed description of your proposed study design and sampling plan by addressing the following questions. Resources related to this section of the plan are located [here](#).

- What is the phase 2 study design?

The Phase 2 study design will be a one-group correlational study. We will use data at the beginning of the school year to assess student academic levels in algebra using student growth norms from NWEA Measures of Academic progress, and we will correlate growth measured by the spring administration of the assessment with solution dosage or student engagement with the solution.

If the phase 2 study includes a comparison group, what will participants in the comparison group experience (e.g., business-as-usual or an alternative version of the solution)?

N/A

- How will the group who experiences the solution and the group who does not experience the solution (i.e., the comparison group, if included in the study design) be identified?

N/A

- Approximately how many students and teachers will be in each study group? (Note: the exact sample size for the phase 2 study will depend on recruitment results and participant consent).

The study will involve 70 girls and 4 teachers.

- In which district(s) and schools will the phase 2 study take place?

The study will take place in the Howard University Middle School

- (If schools have already been identified for the phase 2 study) What are the enrollment size and demographic characteristics of students in participating schools?

The current school enrollment is 288 students. Student demographics are as follows:

92.1% African American students

6.4% Hispanic/Latino students

.35% Two or more races

41% Female, 59% Male

53% At-Risk

98% qualify for Free or Reduced Lunch

3. Measures and Data Collection

In Exhibit 4 below, please provide a detailed description of your proposed measurement and data collection plan. Resources related to this section of the plan are located [here](#). As you complete the table, be sure to address the following questions:

- How will you measure student outcomes, particularly mathematics growth and proficiency? (please refer to the BTE Outcomes Measures for survey measures of positive experience in mathematics classrooms, positive identity as mathematicians, and proficiency and growth)

Student outcomes will be measured in the following ways:

- *Before and after surveys will measure student identification as mathematicians and their experiences in mathematics*

- *NWEA Measures of Academic Progress will measure student proficiency in mathematics. Students will take the MAP assessment in the fall, winter and spring and their growth in Algebra will be assessed.*

- How will you measure teacher outcomes?

Teacher outcomes will be measured in the following ways:

Before and after surveys will measure teacher beliefs about teaching culturally relevant mathematics particularly to Black girls. The Danielson Framework for Teaching Domain 3: Instruction, Component 3c: Engaging Students in Learning will be used to measure teacher outcomes. The elements of this domain include activities and assignments, grouping of students, instructional materials and resources, structure and pacing (Danielson, 2007, 83-85).

- How will you measure implementation of the solution? Will you conduct interviews and/or focus groups? With teachers and/or students? Will implementation data be collected from external providers? Will you be able to collect user data from technological platforms?

Solution implementation will be measured in the following ways

Student focus groups will participate in empathy interviews before and after the implementation. Students will meet with the Dean of School Culture and discuss their experiences within their mathematics class, discuss their aspirations and expectations from school and in particular their mathematics classes. Data will be collected from the interviews. Teacher focus groups will also participate in empathy interviews before and after implementation of the solution. Teachers will discuss their expectations in mathematics class, their experiences with the solution, and their suggestions for improvements. Data will be collected from these interviews. Focus groups will be videotaped and the qualitative data analyzed. Surveys will be conducted using SurveyMonkey to assess student and teacher experience with the implemented solution.

- What components of your ToA will be measured? Which will not and why?
 - *All components of the TOA will be analyzed and measured with this solution.*
 - *Teacher beliefs and mindsets about Black Girls in mathematics class*
 - *Black Girls' experiences in mathematics class*
 - *Improved relevance of Algebra content*
 - *Improved math identity in Black Girls*
 - *Improved mathematics/Algebra proficiency in Black Girls*
- How will your measurement and data collection activities incorporate the Bill & Melinda Gates Foundation's [Equity Principles for Data and Research Investments](#)? Provide specific examples.
 - Evidence from Communities impacted by the work - measurement framework

Justification of the Approach

Research shows that the identities of Black girls in the mathematics classroom are affected by instruction that is relevant to their experiences and through treatment by teachers that validates who they are as people (Duffy et al., 2016).

Our solution is based on research done on Black girls in urban settings in their mathematics classes. When curriculum content encourages social interaction and finds ways for Black girls to interweave their own personal stories, they will feel valued and engage more actively in learning mathematics (Joseph, N. 2019)

Authentically represent and understanding the communities that we serve

When students feel that they are a part of the learning community, and that their voices are heard, they are more engaged in the community. Black girls often feel invisible in their mathematics classroom feeling like mathematics is being done to them instead of with them. (Fredericks, J. A. et al, 2018)

Exhibit 4. Data Collection

Learning question	Data type (survey, etc.)	Frequency/timing of data collection	Analysis
Utilization			
To what extent is the solution implemented as planned on the intended timeline?			
Was the initial and ongoing teacher training implemented on the specified timeline? Was all content covered?	Training Activity Logs from Facilitators Training deliverable from teachers	Collected every day of the training	Descriptive implementation
Were the curricular activities implemented on the specified timeline? Was all content covered?	Activity Logs and Data Analytics from Students Student Progress Reports	Collected for every day of instruction during the units	Descriptive implementation
Were the assessments implemented on the specified timeline? Were all assessments administered?	Formative assessments Summative assessments	Weekly during the units 3x annually in fall, winter, and spring	Descriptive implementation
To what extent do students and teachers participate in the solution activities?			

To what extent do teachers participate in the initial and ongoing teacher training ?	Sign-In Sheets	Collected every day of the training	Descriptive implementation
To what extent do students participate in the curricular activities ?	Daily attendance Summit user data	Collected for every day of instruction during the units	Descriptive implementation
To what extent do students participate in the assessments ?	Assessment participation/results	Weekly during the units 3x annually in fall, winter, and spring	Descriptive implementation
Usability			
To what extent do teachers and students find the solution activities and materials easy to use?			
Do all participants (students, teachers, trainers) finding the solution interface (Summit Base Camp, Google Suite, etc) easy to navigate?	Teacher survey Student survey Trainer survey	Collected quarterly Collected 3x annually, after each training event	Descriptive implementation
Usefulness			
To what extent do students and teachers find the solution activities and materials useful?			
To what extent do participating students and teachers report that the solution improves student motivation and learning in math class?	Teacher survey Student survey	Collected quarterly	Descriptive implementation
Cost			
What is the average cost of the solution?			

What is the total cost and the total cost per student to implement the solution during the Phase 2 study?	Grantee records	Collected annually	Descriptive implementation
Scalability			
What are the necessary conditions for another district/school to implement the solution?			
What would a district or CMO need to implement the revised curricular activities and teacher training?	District or CMO interview	Conducted once in spring 2022	Descriptive implementation
Student Outcomes			
To what extent is the solution associated with student outcomes?			
To what extent is the solution associated with students' experience in math class?	Student survey	Beginning and end of school year	Pre-post, correlation with program dosage (i.e., student platform use during relevant units throughout the year)
To what extent is the solution associated with students' math identity?	Student survey	Beginning and end of school year	Pre-post, correlation with program dosage (i.e., student platform use during relevant units throughout the year)
To what extent is the solution associated with students' math proficiency?	Formative assessment End-of-course grades State test scores	Weekly during the units 3x annually in fall, winter, and spring	Pre-post, correlation with program dosage (i.e., student platform use during relevant units throughout the year)

Teacher Outcomes			
To what extent is the solution associated with teacher outcomes?			
To what extent is the solution associated with teachers' beliefs and mindsets about priority students?	Teacher survey Teacher focus groups	Mid-year and end-of-year	Descriptive outcome
To what extent is the solution associated with teachers' ability to implement effective instructional strategies?	Teacher survey Teacher focus groups	Mid-year and end-of-year	Descriptive outcome
To what extent is the solution associated with teachers' ability to adapt curriculum to make it more inclusive and engaging for priority students?	Teacher survey Teacher focus groups	Mid-year and end-of-year	Descriptive outcome

4. Analysis

After reviewing sections 1-4 of your phase 2 study plan, your AIR learning partners will briefly describe a recommended analysis plan, including the design type and the comparison group (if applicable), to address implementation learning questions as well as learning questions focused on student and teacher outcomes.

Implementation analyses will consist of descriptive analyses of data from training logs, participant attendance, exit tickets, participant surveys, HUPCS leadership records, and a school administrator interview. These analyses will address learning questions associated with the utilization, useability, usefulness, and scalability of the solution. To address cost learning questions, we will calculate the total cost of implementing the solution and the cost per student and per teacher receiving the solution during the Phase 2 study. To address learning questions about student outcomes, we will conduct correlational analyses that measure the relationships between the level or dosage of the solution that students experience (as measured using data on the utilization of the solution) and student outcomes at the end of the implementation year. We anticipate dosage will vary naturally given the nature of the solution as students engage with the revised curriculum on the Summit Learning Platform. In addition, we will conduct pre-post analyses that descriptively examine changes in student outcomes during the year of

implementation. Finally, we will descriptively analyze teacher survey and focus group data to describe the association between the solution and teacher outcomes.

5. Phase 2 Study Timeline

In the table below, map out your phase 2 study timeline. Resources related to this section of the plan are located [here](#). Please note that the collection of baseline data (e.g., student and/or teacher surveys, baseline student achievement) should occur prior to the implementation of the solution. Next to each activity, please provide the month and year in which the activity will be completed, what evidence will be provided to show that the activity was completed (e.g., report of survey response rates, report of the number of focus groups conducted), and a description of how equity and community voice will be considered during the phase 2 activity (if applicable).

Exhibit 6.1. Phase 2 Study Timeline

Activity	Timeline 2021-22	Evidence of Completion	Responsibility
Secure agreement from participating teachers	Jun 2021	Signed participation forms from teachers	HUPCS
Collect 8th grade class rosters	Aug 2021	Rosters in secure location for AIR to access	AIR/HUPCS
Implement initial trainings on revised curricular units	Aug 2021	Completed facilitator logs and attendance forms collected	HUPCS
<i>Checkpoint: If we do not have enough teachers participating, or fewer than 25 8th grade girls who are eligible to participate, we need to decide whether to continue recruitment to include additional schools or pause implementation and the study for one year.</i>			
Secure consent from parents of participating 8 th grade students	Sep 2021	Signed parental consent forms	AIR
<i>Checkpoint: If we do not have enough parent consent forms, we need to decide whether to continue recruitment or pause implementation and the study for one year.</i>			

Implement revised linear functions unit	Oct-Nov 2021	Attendance records, exit tickets, Summit platform data	HUPCS
Administer baseline student outcomes survey	Oct 2021	Completed student surveys for over 80% of consented students	AIR
Administer participant perspectives survey	Oct 2021	Completed surveys for over 80% of participants	HUPCS
Administer mid-year teacher survey and/or conduct focus group	Dec 2021	Completed surveys for over 80% of teachers and/or robust participation in focus group	AIR
<i>Checkpoint: If the solution is not being implemented as intended or participation is lower than 80% consider how to improve implementation and improve participation. If needed, consider the number of revised curricular units.</i>			
Implement revised curricular units	Sep 2021 -May 2022	Participant logs, attendance records, exit tickets	HUPCS
Administer participant perspectives survey	Jan 2022 and May 2022	Completed surveys for over 80% of participants	HUPCS
Collect HUPCS leadership records	May 2022	Summary data held in secure location for AIR to access	HUPCS

Conduct school administrator interview	May 2022	Transcript held in secure location for AIR to access	HUPCS
Administer end-of-year student outcomes survey	May 2022	Completed student surveys for over 80% of participants	AIR
Administer mid-year teacher survey and/or conduct focus group	May 2022	Completed surveys for over 80% of teachers and/or robust participation in focus group	AIR
Collect demographic and achievement data	Summer 2022	Data files held in a secure location for AIR to access	AIR/HUPCS

Though the funding period for grantees ends July 31, AIR will continue data collection, data analysis, and reporting through December 31, 2022 (for grantees in Cohort 1) or December 31, 2023 (for grantees in Cohort 2).

Appendix A: Existing Positive or Mixed Evidence for Your Solution

Study 1 - Field Test of Our Solution

<p>A. Did this study test your solution? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p>									
<p>B. Describe which priority student groups (Black, Latino/a, English learners, and/or students experiencing poverty in the United States) were represented in the study? The student group in this study is Black middle school girls who attend a Title I Middle School in Washington DC. They are considered At-risk, they are experiencing academic difficulty testing at least 1 grade-level below in either mathematics or English. The majority of the girls are from single family homes.</p>									
C. Type of study				D. Type of outcomes			E. Outcome Findings		F. Did someone outside of your organization conduct the study? (Specify) No. The study was conducted inside the organization
Implementation	Single Group Pre/post	Correlational	Comparison group	Teacher (Specify) Mindset and beliefs	Student (Specify) Identity, Positive Experience, Growth and Proficiency		Positive	Mixed	
<input type="checkbox"/>	<input type="checkbox"/>	XX <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	XX		XX	<input type="checkbox"/>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<p>G. Please briefly describe how the study listed above supports your solution’s theory of action: <i>This study was the field test of the solution. The theory of action is that priority student groups, particularly Black Girls struggle in mathematics because the content does not relate to their experiences. During this study, our solution addressed the Algebra curriculum, and the teacher implemented activities and reflections that specifically related to the experiences of Black Girls. Black girls demonstrated a deeper understanding of mathematics and displayed a positive disposition toward learning. The</i></p>									

teacher was able to facilitate deeper discussions in mathematics with the girls through the implementation of the solution.

H. If published - Study citation (authors, year, title, publication information) and URL link to the study*: This was our solution field test so the study was not published.

*If a URL link is not available, please send a copy of the findings as an attachment with your proposal materials.

Study 2

A. Did this study test your solution?
 Yes
 No

B. Describe which priority student groups (Black, Latino/a, English learners, and/or students experiencing poverty in the United States) were represented in the study? 97% Black, 2% Latino, and .79% White. Eighty-five percent of the students received free or reduced lunch.

C. Type of study				D. Type of outcomes		E. Outcome Findings		F. Did someone outside of your organization conduct the study? (Specify)
Implementation	Single Group Pre/post	Correlational	Descriptive	Teacher (Specify)	Student (Specify) Identity, Positive experience	Positive	Mixed	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	XX <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> XX	<input type="checkbox"/>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

G. Please briefly describe how the study listed above supports your solution’s theory of action: *This study described supplemental math programs designed in the context of high-stakes accountability that were counterproductive to students' conceptual learning and construction of a positive math identity. This study supports our theory of action because when students experience mathematics programs that are not relevant to their experiences and don't affirm their identities, they fail to gain mathematics proficiency and do not develop a productive disposition to mathematics. In this study, the students felt that in their math class they mostly reviewed old material instead of learning anything new. This often led them to feel bored and disconnected from the learning process. This supports our solution’s theory of the importance of relevant mathematics content for Black children to promote their engagement in class.*

H. *If published* - Study citation (authors, year, title, publication information) and URL link to the study*:

Davis, J. (2014). The mathematical experiences of black males in a predominately black urban middle school community. *International Journal of Education in Mathematics, Science and Technology*, 2(3), 206–222.

*If a URL link is not available, please send a copy of the findings as an attachment with your proposal materials.

Study 3

<p>A. Did this study test your solution? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p>								
<p>B. Describe which priority student groups (Black, Latino/a, English learners, and/or students experiencing poverty in the United States) were represented in the study? Title-1 funded schools, with more than 50% of the student population receiving free or reduced-price lunch. Each of the participating schools is also composed of student populations that include more than 50% priority (mainly African American) students. Approximately 90% students participating in the project were African American students.</p>								
C. Type of study				D. Type of outcomes		E. Outcome Findings		F. Did someone outside of your organization conduct the study? (Specify) This study was conducted by Tori K. Flint , Peter Sheppard, and Nii A. Tackie through the HEAT project which is one of several subgrants of the federally funded Gaining Early Awareness and Readiness for Undergraduate Programs (GEAR UP) project led by a local school district. This project was conducted in Louisiana
Implementation	Single Group Pre/post	Correlational	Descriptive	Teacher (Specify) Mindset and Beliefs	Student (Specify) Identity, Positive Experience	Positive	Mixed	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> XX	<input type="checkbox"/>	<input type="checkbox"/>	XX <input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

G. Please briefly describe how the study listed above supports your solution’s theory of action: The authors contend that the most important finding revealed in this study is in the ways that the participating teachers were able to change their deficit focused views of students and to then support students as they became successful in sharing their knowledge and learning of algebraic concepts. As students were called upon to share and build upon their knowledge and learn together, teachers saw a boost in participation, motivation, and understanding. This supports our solutions theory that when students are engaged and can identify with the mathematics that they are learning, teachers are able to facilitate deeper learning and will experience shifts to growth mindset with regards to students and their capabilities.

H. *If published* - Study citation (authors, year, title, publication information) and URL link to the study*:

Flint, T., Sheppard, P., & Tackie, N. (2018). “How you like me now?”: Exploring teacher perceptions of urban middle schoolers’ mathematical abilities and identities. *Education and Urban Society*, 51(8), 1029–1050. DOI: 10.1177/0013124518785017

*If a URL link is not available, please send a copy of the findings as an attachment with your proposal materials.

Study 4

A. Did this study test your solution?
 Yes
 No

B. Describe which priority student groups (Black, Latino/a, English learners, and/or students experiencing poverty in the United States) were represented in the study: 1,284 stUdents as they progressed from grades 6 to 8. Approximately 85 of the participants were priority students; 64 African American, 16 Hispanic, 4 Asian, and 1 Native American. Male and female students are almost evenly distributed.

C. Type of study				D. Type of outcomes		E. Outcome Findings		F. Did someone outside of your organization conduct the study? (Specify)
Implementation	Single Group Pre/post	Correlational	Descriptive	Teacher (Specify) Instructional practice	Student (Specify) Growth and proficiency	Positive	Mixed	This study was conducted by Stephen Hwang, Jinfa Cai, Jeffrey Shih, John C. Moyer, Ning Wang, Bikai Nie The LieCal project was conducted in 14 middle schools of an urban school district serving a diverse student population
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	XX <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	xx	<input type="checkbox"/>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

G. Please briefly describe how the study listed above supports your solution’s theory of action: This study found that improving the relevance of math content will increase student growth and proficiency in math for Black and Hispanic students. Use of a standards-based curriculum combined with

teacher emphasis on conceptual understanding in the classroom shrank reduced differences among ethnic groups for sixth graders, although students continued to show lower performance on open-ended items. This study supports our solution's theory of action because it affirms our contention that when mathematics is relevant to students, their engagement and proficiency significantly improves. When teachers change their instructional practices, students gain proficiency in mathematics and teachers mindsets productively change also.

H. *If published* - Study citation (authors, year, title, publication information) and URL link to the study*:

Hwang, S., Cai, J., Shih, J., Moyer, J. C., Wang, N., & Nie, B. (2012). Longitudinally investigating the impact of curricula and classroom emphases on equity in algebra learning. North American Chapter of the International Group for the Psychology of Mathematics Education.

*If a URL link is not available, please send a copy of the findings as an attachment with your proposal materials.

Study 5

A. Did this study test your solution?
 Yes
 No

B. Describe which priority student groups (Black, Latino/a, English learners, and/or students experiencing poverty in the United States) were represented in the study? The sample included 1065 adolescents who self-identified as African American (n = 618; 58 %), White (n = 331; 31 %), or as bi-racial or a member of another minority group (n = 105; 10 %). The sample contained more male (n = 336; 54.4 %) than female participants (n = 282; 45.6 %).

C. Type of study				D. Type of outcomes		E. Outcome Findings		F. Did someone outside of your organization conduct the study? (Specify) This study was conducted by Matthew A. Diemer, Aixa D. Marchand, Sarah E. McKellar, Oksana Malanchuk
Implementation	Single Group Pre/post	Correlational	Comparison group	Teacher (Specify) Instructional practices	Student (Specify) Growth, proficiency, identity	Positive	Mixed	
<input type="checkbox"/>	<input type="checkbox"/>	XX	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	XX	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

G. Please briefly describe how the study listed above supports your solution’s theory of action: This study suggests that when teachers make math content relevant by incorporating connections between math content to the real world, emphasizing how math lessons are applicable to everyday tasks, and/or making math more interesting to students, African-American students’ math self-concepts, as well as math task value, may increase. Self-concepts of ability (math identity) are predictive of seeing the value of math tasks, and these beliefs play a role in achievement over time. This study supports our theory of action because it emphasizes the positive effect of relevant mathematics curriculum has on student identity and the long term effects on student proficiency. This study also supports our theory that teacher mindset and instructional practices have a direct effect on student

identity and engagement.

H. *If published* - Study citation (authors, year, title, publication information) and URL link to the study*:

Diemer, M., Marchand, A., McKellar, S., & Malanchuk, O. (2016). Promotive and corrosive factors in African American students' math beliefs and achievement. *Journal of Youth & Adolescence*, 45(6), 1208–1225. <https://doi.org/10.1007/s10964-016-0439-9>

*If a URL link is not available, please send a copy of the findings as an attachment with your proposal materials

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