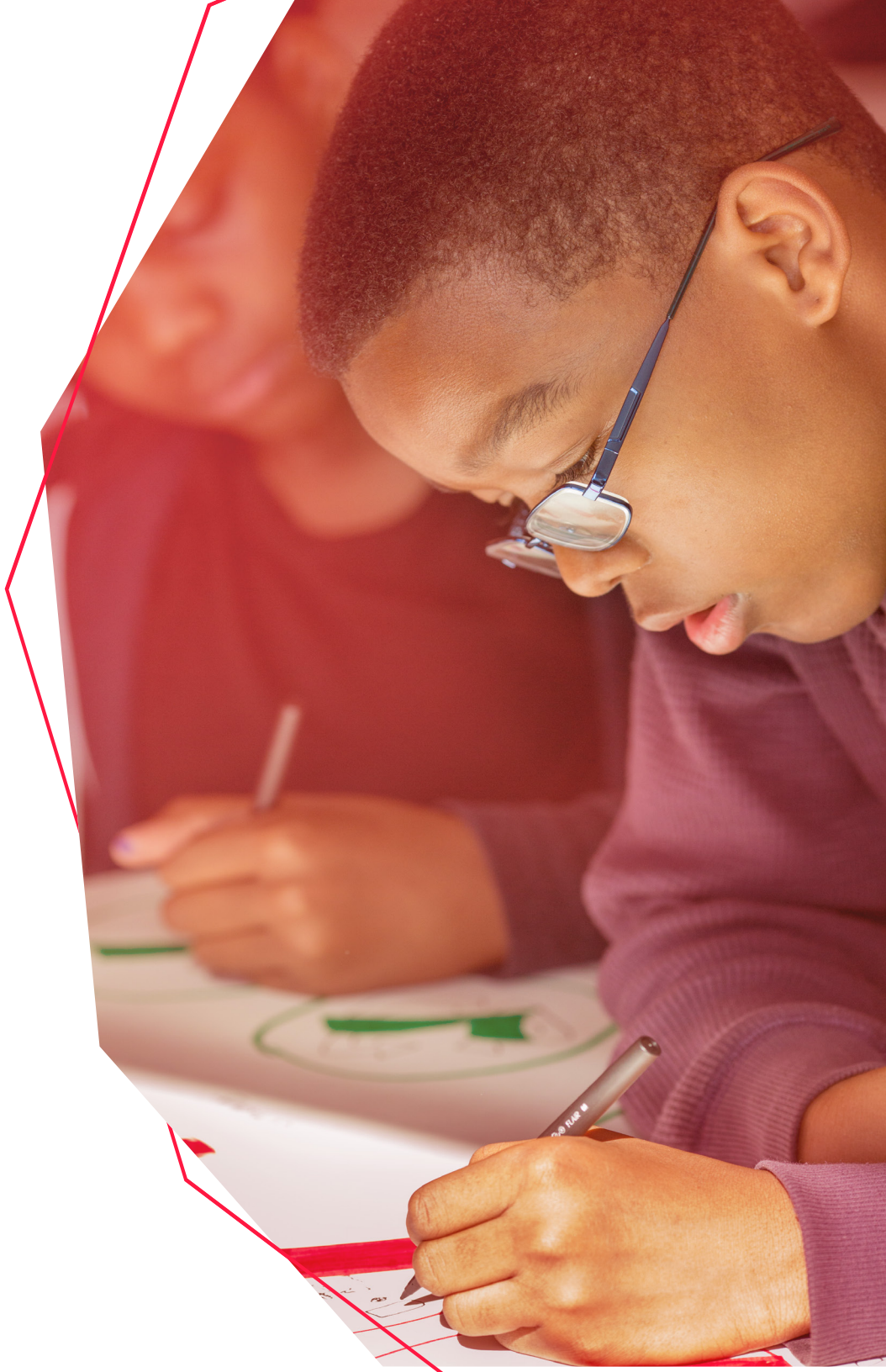
Target Product Profile—

Balance the equation

Grand Challenge for Algebra 1



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BILL & MELINDA GATES *foundation*

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Universal goals can be achieved through targeted approaches.

Introduction

The K-12 team at the Bill & Melinda Gates Foundation has a focus on Algebra 1 as a critical milestone in adolescent academic achievement. However, this current reality of mathematics, laden with internalized negative beliefs, behaviors, patterns, and values, is not for lack of student assets* or efforts; but rather something much weightier and systemic.

Through Balance the Equation, the first Education Grand Challenge in the United States, the team aims to radically shift the culture of a traditional Algebra classroom* in order to increase students positive experiences*, their identity* as mathematicians, and support mathematical growth and proficiency.

This Target Product Profile (TPP) was developed to provide specific guidance to reviewers on key areas of intervention for Algebra 1 to inform grade-level (7th–9th grade) solutions*.

About the challenge

Balance the Equation: An Algebra 1 Grand Challenge is a call to disrupt the deeply imbalanced forces against this generation—and previous generations—of priority students* as it relates to their Algebra 1 experience in 7th, 8th or 9th grade, in-class or online. Through this Grand Challenge, our goal is to not only bring balance to an exclusionary system that has by design, stratified these students and tarnished the beauty of key mathematical concepts, but rather overshoot and stack the Algebra system in favor of their unique gifts and boundless capabilities. By focusing intentionally on priority students' math experience–and we acknowledge there is no prototypical student–we are aligning to our belief that 'universal goals can be achieved through targeted approaches'. Our improvements designed for priority students might unlock wide-reaching and transformational for all Algebra 1 students.

* Please view Glossary of Terms on page 25 for terms with an asterisk (*)

[1] "Targeted Universalism: Policy & Practice," May 08, 2019, https://belonging.berkeley.edu/targeteduniversalism

Target Product Profile

A Target Product Profile (TPP) has typically been an external facing set of conditions to support a Grand Challenge – historically within Global Health and Development problems– that outlines minimum requirements. The TPP usually covers key dimensions such as cost, quality, features, and implementation criteria.

This TPP version was developed by a small team at Substantial, in partnership with the Bill & Melinda Gates Foundation's K-12 team with contributions from over 50 different stakeholders, including students, teachers, and subject matter experts (SMEs). It was also supplemented with landscape and market analysis provided by our partners at EdSolutions.

The previous dimensions of a typical TPP did not align with our target audience and the goals of the Balance the Equation Grand Challenge. In order to rework the TPP framework to serve the needs of our priority students, we completed:

1. PRIMARY RESEARCH WITH PRE-INTERVIEW CULTURAL PROBES AND USER INTERVIEWS VIA ZOOM
2. DIGESTED EXISTING LITERATURE AND REFERRED RESEARCH DOCUMENTATION
3. FACILITATED MULTIPLE SESSIONS OF A PROBLEM DEFINITION WORKSHOP
4. CONDUCTED LANDSCAPE AND MARKET ANALYSIS ON ALGEBRA 1

We interviewed 18 priority students in either 8th, 9th, or 10th grade attending public, charter, or magnet schools in California, Connecticut, Florida, Georgia, New York, Texas, and Washington and 6 Algebra 1 teachers from California, Illinois, New York, Oklahoma, Virginia, Washington. We had participants complete pre-interview cultural probes, creative exercises that allowed them to express their feelings about math, school, and life. For our 60-90 minute interview sessions, we enlisted the help of a cultural moderator to ensure we were participants. In our conversations we learned about students Algebra 1 experience, and the positive and negative factors that shaped their thoughts, feelings, and actions. From these dialogues, we captured a snapshot of the conversation into a digital postcard, highlighting key quotes and themes to carry over into our problem definition workshops.

Either mentioned during interviews with SMEs, referred to by our partners at the Gates Foundation, or via individualized desktop research, we consumed existing documentation as it pertained to Algebra 1curriculum, priority student research, equity*-based practices, targeted universalism, and other educational components to comprehend the complete ecosystem for students and the systemic barriers in place. This additional information rounded out our knowledge, vocabulary, and understanding of the current landscape.

Additionally, we held multiple sessions of a problem definition workshop with 54 participants who generated over 600 digital sticky notes.The output from the workshop, besides generative conversation and meme creation, was a distillation of key

stakeholders and their effect on priority students, overarching assets* and supports and barriers and challenges for students, and organized pillars for possible intervention opportunities.

After synthesizing the interviews, literature review, workshop outputs and market analysis, we were able to identify the appropriate factors that contribute to an 8th or 9th grade priority students classroom experience. These insights serve as the new conditions around which we have structured our TPP. Our objective was to clearly outline where the most need and chance for impact within Algebra 1 is to be had, how that might look—strategically and through implementation— and provide a sample of current in-market solutions.

It is our intent that this document be reserved for internal K-12 team members and those partaking in the application review process. A slimmed down version has been produced for external consumption by applicants to provide visibility on evaluation criteria and as a sorting mechanism for submissions.

How to use this TPP

This document is a tool to aid the internal K-12 team and those involved in the application review process for the Balance the Equation Grand Challenge. It is our hope that this document sits alongside the submissions rubric to empower reviewers in their decision-making endeavors to more efficiently determine which applications can elevate and transform the experience of Algebra 1 for priority students.

Organized by Areas of Focus

Through primary research, we distilled five key opportunity spaces, which we have labeled Areas of Focus, that the K-12 team believes have the biggest chance for impacting priority students' Algebra 1 experience. Each Area of Focus is detailed with a:

Definition

Based on research and intent in order to facilitate universal understanding and alignment on desired outcomes.

Impact Strategies

These reflect the fundamental aspects that support the Area of Focus under which they are listed.

Impact Implementation Examples

Examples to demonstrate breadth and range of approach but are not exhaustive. Applicants should not be disqualified if their execution is not listed within this space.

In-Market Solutions

To provide competitive benchmarking against today's climate of solutions through price, type, category, audience, and overall rating based on a scale developed by EdSolutions.

Overall Market Analysis

August 2020 interpretation (provided by EdSolutions) of market attractiveness for solutions through the lens of our Areas of Focus for Algebra 1.

The subsequent tables illustrate each Area of Focus and the specifications detailed above. The Area(s) of Focus are intended to:

1. COMMUNICATE THE SPIRIT OF EACH KEY AREA OF IMPACT
2. LEAD TO THE OUTCOMES IDENTIFIED LATER IN THE DECK;
3. AID THE DEVELOPMENT OF A RUBRIC TO EVALUATE THE EXTENT TO WHICH A PROPOSED SOLUTION ADDRESSES AN AREA OF FOCUS

Areas of Focus

We acknowledge the interconnectedness of these areas on a student experience level, but have separated them for application purposes.

1 ## Builds Out Support Systems

Facilitates the creation and maintenance of inclusive mathematics communities–in person or virtual–between students and adults to build relationships.These supports build critical consciousness among educators and an understanding about sharing power with students in co-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. (S2S, T2T, S2T, S2Adult, T2SFamily)

2 ## Improves Relevance of Algebra 1 Content

Increases the relatability by using real-world examples that connect to student interests and increasing the focus on making sense of Algebraic concepts.

3 ## Elevates Understanding of Math Language

Improves linguistic awareness and practices by tackling math vocabulary, syntax, morphology [changing word forms], argument structure, or feedback for students (in a manner that especially prioritizes emerging multilingual students, but also benefit monolingual English speakers) and/or teachers. Leverages linguistic and other assets of emerging multilingual students. Takes care not to create avoidable linguistic barriers to mathematical concepts.

4 ## Empowers and Strengthens Teacher Practices

Offers new materials, tools, and strategies that empower, support, and expand teachers' knowledge and use of instructional practices that meet individual student needs, develop proficiency, and create positive class experiences on a daily basis.

5 ## Develops New or Better Feedback Mechanisms

Explicitly applies assessment or progress monitoring data for instructional purposes to enhance access to core Algebraic content.

1 Builds Out Support Systems

Facilitates the creation and maintenance of inclusive mathematics communities–in person or virtual–between students and adults to build relationships. These supports build critical consciousness* among educators and an understanding about sharing power with students in co-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. (S2S, T2T, S2T, S2Adult, T2SFamily)

Impact Strategies	Impact Implementation Examples
Leverages tools that enable local (within school, district, or 50 mile radius from school) or non-local (state, national, or international) connections between student(s) and caregiving adults.	— After school programs — Facilitate caregivers motivation to support students in their math work outside the classroom
Supports multiple methods and modes of interacting.	— Texting — Video calls — 1:1 or group sessions — AR/VR — Games
Advances mathematical abilities for student and/or teacher.	— Collaboration — Completing Tasks — Receiving Feedback
Combats teacher bias.	— Builds out pedagogical content — Builds out anti-racism knowledge and practices to shift teacher believes
Provides social-emotional support.	— Provides opportunity to voice struggles/successes — Helps reduce math anxiety — Disables harsh or non-asset based language — Rewards participation — Nourishes interest in math

1 Builds Out Support Systems

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IN-MARKET EXAMPLES	**MBTOS: T2T Twitter communities**	**Math Circles**	**Remind App**
PRICE	Free	Free	Free
TYPE	Twitter community	Open website	Free app
CATEGORY	Social	Social	Social
AUDIENCE	Math	Math	General
OVERALL RATING	3	1	2

ANALYSIS: *Market solutions are strong outside of math, but not embedded within a platform or curricula inherently.*

2

Improves Relevance of Algebra 1 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.

Impact Strategies	Impact Implementation Examples
Shifts the balance of in-class instruction to be more conceptually-oriented to elevate the core mathematical ideas.	— Promotes more project-based learning — Promotes more 'low-floor, high-ceiling' tasks
Increases the adaptiveness of content to the uniqueness of student's many assets so Algebra feels more personal.	— Inquires or surfaces student interests (i.e. what are they reading, watching, how do they spend their time, what do they do with friends/family, etc.) — Inquires or enables student-driven motivators (internal or external)
Increases the adaptiveness of content to the uniqueness of student's many assets so Algebra feels more personal.	— Students design or create word problem or projects (individually or in groups) — Recruited or involved in the formation of standardized test
Elevates peer-to-peer instruction and promotes cooperative learning.	— Utilizes socratic seminars — Creates or uses In-person or virtual games — Promotes symbolic representation through kinesthetic or hands-on learning with manipulatives, and/or pictorial representation or modeling.
Increase the authentic concentration of math concepts to a larger narrative through story building, global, cultural, or historical contexts.	— Creates significance or explanatory stories on the social-cultural circumstances of math — Uses science practices, or tries to create a deeper link to the sciences or humanities, etc.
Enables materials and/or programs, to be extremely localized to a community or creates a standardization for localization.	

2

Improves Relevance of Algebra 1 Content

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IN-MARKET EXAMPLES	Illustrative Math	NearPod	Agile Mind
PRICE	Free	Freemium (up to 40 students per session for free)	Algebra 1 license: $20 per student; 1 yr intensified algebra: $114/student
TYPE	Core Curriculum	Cliker based interactive program. Nearpod is both a teacher-led authoring system and a fully aligned and comprehensive content library.	Core Curriculum
CATEGORY	Core	Supplemental / Formative Assessments	Core
AUDIENCE	Math	Math	Math
OVERALL RATING	1	1	1

→ ANALYSIS: *Market solutions are strong for Core, but not for practice or intervention.*

3

Elevates Understanding of Math Language

Improves linguistic awareness and practices by tackling math vocabulary, syntax, morphology [changing word forms], argument structure, or feedback for students (in a manner that especially prioritizes emerging multilingual students, but also benefit monolingual English speakers) and/or teachers. Leverages linguistic and other assets of emerging multilingual students. Takes care not to create avoidable linguistic barriers to mathematical concepts.

Impact Strategies	Impact Implementation Examples
Builds in prompts and routines to expand mathematical discourse through the five practices standards.	— Analyze mathematical writing — Co-create and construct question — Student conversations — Team-based games
Elevates the development of math vocabulary and syntax in teacher instruction and allows teachers to understand their effectiveness.	— Utilizes spiraling practices — Provides guidelines for instructional language — Provides access to grade-level content for English learners*
Addresses the gap between informal class conversation and the language of math testing.	— Informs a new way to write/develop mathematical assessment — Focus strongly on opportunities for students to communicate in non-evaluative spaces
Creates tasks that build students executive functioning abilities.	— Tasks include prioritizing actions, planning for future events, and dealing with unfamiliar situations
Leverages linguistic and other assets of emerging multilingual students.	— Builds out math language beyond standard American English

3

Elevates Understanding of Math Language

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IN-MARKET EXAMPLES	Math Language Routines	Flocabulary
PRICE	Free	Teachers: $10/month
TYPE	Framework and Teaching strategies (designed for ELL, works for all)	Video, practice language of math through hip hop
CATEGORY	Instructional Support	Language Practice
AUDIENCE	Math	Math
OVERALL RATING	1	2

→ ANALYSIS: *Market solutions for math needed!*

4

Expands Standards and Practices for Teachers

Offers new materials, tools, and strategies that empower, support, and expand teachers' knowledge and use of instructional practices that meet individual student needs, develop proficiency, and create positive class experiences on a daily basis.

Impact Strategies	Impact Implementation Examples
Evaluates teachers readiness to teach Algebra 1.	— Addresses qualifications and standards for teacher accreditation — Reflect on their own biases and have ways to better position students as intellectual leaders in the classroom
Empowers educators to feel increased comfort and confidence while teaching multiple and/or rigorous Algebra 1 concepts.	— Builds out scaffolding techniques — Practices that skeptically interrogate students for deep-thinking — Practices that elevate all student voices — Practices that addresses the inequity of homework and aims to close the gap — Understand how/why big data rarely provide instructionally relevant and actionable information and how to better leverage the data they get day to day from existing sources
Supports deep and integrated ongoing professional development.	— Specific to the curriculum taught and math work students produce — Programs that are embedded and cyclical — Practices that expand classroom management techniques and contextual planning — Addresses teacher assumptions (reflect on their bases) and how their responses shape student learning

4

Expands Standards and Practices for Teachers

Offers new materials, tools, and strategies that empower, support, and expand teachers' knowledge and use of instructional practices that meet individual student needs, develop proficiency, and create positive class experiences on a daily basis.

Impact Strategies	Impact Implementation Examples
Equips school admin and other staff to better support teachers by working together.	— Creates opportunities to observe or learn from other teachers (cross-pollinate) — Expands creativity and collaboration of instructional material — Environmental supports that create a safe and optimal classroom conducive to students learning and focus
Strengthens the relationship between students and teachers.	— Develops classroom norms and safety through activities not content — Educates and expands social-emotional knowledge and practices — Practices that break down the traditional hierarchy or boundary between teacher and student for a greater sense of equality — ways to better position students intellectual leaders in the classroom — Take into account that their prior experiences with mathematics contribute to their views of their own identity, agency and belonging
Strengthens the relationship between teachers and parents.	— Allows parents are to give feedback on what is working and what is not in class or for solutions, etc.

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IN-MARKET EXAMPLES	Math Language Routines	EdPuzzle
PRICE	Freemium; $100/yr per teacher for detailed reports, parent portal, etc.	Freemium; $11.50/month per teacher for analytics
TYPE	Standards aligned formative assessments for student practice; benchmarking; data to drive instruction	Interactive video lessons
CATEGORY	Formative Assessment	Supplemental — lessons and formative assessments
AUDIENCE	Math	General
OVERALL RATING	1	3

5

Develops New or Better Feedback Mechanisms

Explicitly applies assessment or progress monitoring data for instructional purposes to enhance access to core Algebraic content.

Impact Strategies	Impact Implementation Examples
Equips students to succeed by today's assessment practices.	— Provides feedback (who, what, why) for students, classroom, or school/district — Creates a system of continuous assessment improvements at district or building level — Alters testing language — Informs test preparedness for students or teachers
Informs educator decision-making within daily workflow and/or intervention practices leveraging diagnostic assessments and/or data on student understanding.	— Enables adaptive feedback on student learning gaps, pacing, and progress — Enhances students perception of their ability to do and succeed in mathematics — Be creative about how people are invited to support educators in leveraging more nuanced forms of data
Promotes student-driven self-assessment and meaning-making.	— Develops competency-based assessment — Encourages students to construct new knowledge/ principles in math — Creates connections between standardized or statewide assessments and students long-term goals — Affirms students in their own way based on culture and/or community

5

Develops New or Better Feedback Mechanisms

Explicitly applies assessment or progress monitoring data for instructional purposes to enhance access to core Algebraic content.

Impact Strategies

Impact Implementation Examples

Creates a market mechanism that evaluates assessments quality.

- Provides students or teachers with more of a choice or set of options in selecting testing material
- Ranks or promote higher quality vs lower quality testing or evaluation materials
- Develops wide-spread/universal assessment template

Encourages a mistake-making mindset as a vehicle for growth (academic or social-emotional).

- Helps students seek out strategies, scaffolding, or supports to take on new challenges
- Bolsters intrinsic motivations and not as oriented around 'grade' output

5

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Explicitly applies assessment or progress monitoring data for instructional purposes to enhance access to core Algebraic content.

IN-MARKET EXAMPLES	Classkick	Mathematics Assessment Product	Flipgrid
PRICE	Freemium; $5.99/month unlimited assignments	Free	Free
TYPE	Classkick is an app for teacher to push out content, receive student responses, and provide real-time feedback:	Lessons, practice, and assessments	Video discussion platform
CATEGORY	Formative Assessments	Formative Assessments	Practice, Differentiation
AUDIENCE	General	Math	General
OVERALL RATING	3	2	2

5

Develops New or Better Feedback Mechanisms

Explicitly applies assessment or progress monitoring data for instructional purposes to enhance access to core Algebraic content.

IN-MARKET EXAMPLES	Seesaw	Mathia Carnegie Learning	iReady
PRICE	Freemium; $120 per year for Premium (Teachers); get a quote for district (analytics)	$26 per student	$30 per student
TYPE	Communication (parents, students, teachers) and Portfolio tool that captures student work and provides teachers with student progress dashboards and libraries of content activities to supplement student work	Personalized, adaptive learning software that is part of their broader math solution	comprehensive assessment and instruction program. Connects Diagnostic data and Personalized Instruction.
CATEGORY	Practice, Differentiation	Practice & Support, Formative Assessments	Diagnostic & Instruction
AUDIENCE	General	Math	Math
OVERALL RATING	2	1	1

Implementation Considerations

The 3 W's and How

What

A table used to evaluate the current state/fidelity of an applicant's solution and the level of support needed from the Gates Foundation to successfully implement the solution.

When

During first phase (planning) of application review and assessment.

Who

To be used by internal triage and review Individuals and AIR, the evaluation partner.

How

As a side-by-side reference guide to other review documentation.

Community

Student Involvement

Applicants must involve a cohort of Priority students (15+ individuals based in the United States) throughout the duration of the grant period and pay them for their time and co-creation of solution development. (i.e., primary research, testing, vetting prototypes, etc.)

Local Partnership

Applicants should consider how they would collaborate with a local organization or specific school/district for the duration of the grant period (i.e., small class pilot groups to evaluation solutions feasibility/ scalability, and secure relevant data sharing agreements with partners.)

International Partnerships

Applicants may consider how their solution can integrate with organizations based outside the United States in an effort to create a more universalized approach to education.

Pedagogy & Instruction

High–Quality Curriculum*

Solutions must align to a high-quality Algebra 1 course and be able to provide a 3rd party review, either by EdReports, Instructional Materials Evaluation Toolkit (IMET), or Equip rubrics (K8 math units).

Teacher Onboarding and Professional Learning

Applicants must provide initial support, demonstration, and best practices of their solution within the classroom context (i.e, product tutorials, learning guides, customer support, training session, etc.) This is to ensure that teachers/educators are able to self-sufficiently use/ implement the solution effectively in a classroom setting. They should also be able to provide ongoing support or mid-way check-in to ensure solution is positively impacting the classroom environment and to provide learnings.

Multilingual Communication

Solutions must address how they would leverage the linguistic and cultural assets of students coming from families speaking a language other than English [ELSF Guidelines].

Multi–Modal Delivery

Solutions should use multiple modes–channels of information– in order to provide a well-rounded learning experience (i.e., an educational video might include speech, images, music, and text.)

Integrated Feedback

Solutions should have a plan for a feedback loop that enables teachers/ students to voice their experience and progerss and for applicantant to adjust/make improvements during the duration of the grant.

Technical

Blended Learning
Solutions must be adaptable for physical and virtual classrooms (i.e some offline availability/sub-set of features, available across multiple-devices, etc.)

Accessibility
Solutions must meet guidelines in terms of accessibility for those with disabilities (i.e., color blindness, hearing impairment, limited motor functionality, etc. [Please see W3 guidelines.

Equity of Access
Solutions should consider how they can garner a wider reach of accessibility, agnostic of geographic or socioeconomic constraints.

Integration Standards
Solutions should ensure interoperability across SIS, LMS, etc. as applicable using existing data. (i.e. any of the following LTI Advantage, OneRoster, The CASE Registry, CALIPER, X/API, Ed-Fi or providing an open and clearly documented API

Data Storage and Organization
Solutions should consider a data structure aligned to ongoing R&D/ learning engineering (i.e., Insight, Commvault, G Suite Education).

Business

Purchasing Decision and Price Point
Solutions should consider how the cost will impact a school/districts ability to utilize it. Is the price point equitable?

In–School Maintenance
Solutions need to consider how schools could sustain/maintain it over time i.e. financially, technologically/hardware, teacher support/training, etc.)

Title 1 Funding
Solutions should align with Title 1 School Wide Funding Program requirements.

Desired Outcomes

Student

Increased postive experience in math classrooms:

- Increased sense of belonging
- Increased engagement* in Algebra
- Increased enjoyment in Algebra
- Increased experiences that encourage deep mathematical thinking, exploration, and collaboration

Increased Positive Identity as Mathematicians

- Increased positive math identity*
- Increased understanding to Algebra's relevance to their lives (current and future)

Increased Math Growth and Proficiency*

- Increased growth in Algebra
- Increased proficiency in Algebra
- Increased understandinding on path to proficiency in Algebra

Teacher

Increased Positive Mindsets/Beliefs about Priority Student Math Learning*

- Increased critical consciousness
- Increased belief in priority students as mathematicians (therefore providing access to rigorous mathematics)
- Increased view on the expansiveness of math (i.e. it's history, participants, application and therefore how to increase relevance to students' lives)

Increased Skills in Adapting Curricula and Instruction to Meet Student Needs

- Increased efficacy in addressing unfinished learning
- Increased ability to build from students' own language in math lessons, especially EL students
- Increased ability to use data/assessment/feedback to inform instruction

Increased Use of Effective Math Instructional Practices*

- Increased ability to develop an inclusive learning environment in math
- Increased ability to support students in deeply engaging with the content (i.e., through discussion, connect to their lives, problem solving, etc.)
- Increased ability to assess understanding and math processes (i.e., problem solving)

*Mathematical proficiency as defined by the National Academies' field consensus: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition (Adding It Up, 2001).

Glossary of Terms

To estable a mutual understanding of terminology used throughout this challenge, The Bill & Melinda Gates Foundation has provided definitions based on research and intention.

Algebra 1

The course is historically situated between pre-Algebra and Geometry and the last truly general-purpose-college/career-ready mathematics course that most students are exposed to in the 8th or 9th grade. "Algebra moves students beyond an emphasis on arithmetic operations to focus on the use of symbols to represent numbers and express mathematical relationships."[2] Algebra provides the language in which we communicate the patterns in mathematics so its foundation for students (including English Learners) is critical for continuing mathematical comprehension. Each topic within Algebra should be experienced as an integration of procedures, concepts, and applications. Algebra typically covers: seeing structure in expressions, arithmetic with polynomials and rational functions, creating equations, and reasoning with equations and inequalities.[3]

Assets

Strengths and interests that a student possesses and brings to the mathematics classroom. Assets can include skills, knowledge, connections/ relationships, cultures, dreams, passions, etc.

Critical consciousness

We adopt the definition from the Mindset Scholars Network: educators must understand how marginalization and bias are expressed in mathematics environments and work to actively counter these processes via their instructional choices and interactions with students. Examples of what educator critical consciousness can look like in practice include: confronting microaggressions, employing complex instruction, explicitly praising the contributions of students who have a minoritized identity in mathematics, or incorporating students' uses of mathematics outside of school into their classwork. Learn more at Mindset Scholars Network.

Designed for use together with a high-quality core curriculum

This opportunity envisions developing innovative supplemental resources that can be used as a support that expands access to core content while addressing a variety of student learning needs, and harnessing students' identities, interests, and creativity. To maximize student impact and expand access to challenging content that is too often withheld from priority students, successful proposals will identify a specific core mathematics curriculum or course with which the new solutions are meant to be paired. Core curriculum may be a standalone Algebra 1 course, or a middle school math curriculum that includes algebraic concepts in 7th and 8th grades. Solutions should set forth clear use cases: e.g., differentiation for group or individual practice; formal intervention), including potential setting (e.g., in general education classroom; in intervention settings; for

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[2] "Teaching Strategies for Improving Algebra Knowledge in Middle and High School Students," July, 21, 2020, https://ies.ed.gov/ncee/wwc/Docs/practiceguide/wwc_algebra_summary_072115.pdf

[3] "High School: Algebra » Introduction," September, 2020, http://www.corestandards.org/Math/Content/HSA/introduction/

use at home leveraging virtual supports).

Effective math instructional practices

The IES Practice Guide Teaching Strategies for Improving Algebra in Middle School and High School Students offers recommendations. In addition, we emphasize:

- Increased ability to develop an inclusive learning environment in math.
- Increased ability to support students in deeply engaging with the content (i.e., through discussion, connecting to their lives, problem solving, etc.)
- Increased ability to assess understanding and math processes (i.e., problem solving.)

Engagement

Students that currently hold a growth mindset about their mathematical abilities, actively seek challenges, exhibit a willingness and confidence to participate in-class or help other classmates work through tasks, have extended periods of uninterrupted focus on a task or instruction, or have an enduring interest in pursuing math or math-related fields based on their academic goals or future aspirations despite poor instructional practices from unsophisticated educators, low-quality teaching materials, disruptive learning environments, emotional blockages, and systemic assessment pressures.

English Learners

Federally defined, "English Learners (ELs)," or Emerging Multilinguals, are students from homes where languages other than English are primarily spoken. ELs are a rich and heterogeneous group of learners who bring significant intellectual and cultural assets to the mathematics classroom, which is not always designed with their success in mind. Providing math content that is designed to build the language of mathematics will be important to serve the nation's growing population of EL students, in ways that are culturally relevant to their linguistic assets as well as mathematically rigorous and appropriate per grade level. Please see the Migration Policy Institute or ELSF for further information.

Equity

Universal exposure so individual student goals can be achieved. "This requires all stakeholders:

- Ensure that all students have access to a challenging mathematics curriculum, taught by skilled and effective teachers who differentiate instruction as needed;[4]
- Monitor student progress and make needed accommodations; and
- Offer remediation or additional challenges when appropriate."

High-quality curriculum

Evaluated and ranked in the top tier from a third-party reviewer based on a set of rigorous standards and alignment for instructional materials. Examples of reviewers include: EdReports, Instructional Materials Evaluation Toolkit (IMET), or Equip rubrics (K8 math units).

Inclusive math communities

Foster a sense of belonging and help all students to develop their identities as competent and capable learners, and to feel a sense of cultural continuity in that context. Inclusive math communities recognize that some student identities have been marginalized within mathematics and actively work to move to deeper inclusion and value of all students as mathematicians. Curricular materials, assessment practices, and classroom

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[4] "Access and Equity in Mathematics," April 18, 2014, https://www.nctm.org/Standards-and-Positions/Position-Statements/Access-and-Equity-in-Mathematics-Education/

interactions contribute to each student's experience of a math community as inclusive or exclusionary. For more details, view Mindset Scholars Network's Five Guiding Principles for Creating Inclusive Mathematics Environments.

Mathematical proficiency

We adopt the National Academies' field consensus from Adding It Up (2001), on what it means for a student to be proficient. Mathematical proficiency has five strands:

- **Adaptive reasoning:** capacity for logical thought, reflection, explanation, and justification
- **Conceptual understanding:** comprehension of mathematical concepts, operations, and relations
- **Procedural fluency:** skill in carrying out procedures flexibly, accurately, efficiently, and appropriately
- **Productive disposition:** habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.
- **Strategic competence:** ability to formulate, represent, and solve mathematical problems

Positive math identity

Mathematics identity specifically relates to an individual's sense of being a "math person," feeling empowered to engage in mathematics.[5] Through this challenge we also endeavor for students to understand Algebra's relevance to their lives today and in the future.

Positive experience in math classrooms

This Grand Challenge seeks to increase the positive experiences our priority students are having in math classrooms. Four key outcomes for students include:

- Increased sense of belonging
- Increased engagement in Algebra
- Increased enjoyment in Algebra
- Increased experiences that encourage deep mathematical thinking, exploration, and collaboration

Positive mindsets/beliefs about priority student math learning

Positive mindsets/beliefs about priority student math learning can take a variety of forms, but three key outcomes for educators/adults include:

- Increased critical consciousness (understand how marginalization and bias are expressed in mathematics environments and work to actively counter these processes via their instructional choices and interactions with students)
- Increased belief in priority students as mathematicians (therefore providing access to rigorous mathematics content and pathways)
- Increased view on the expansiveness of math (i.e.: it's history, participants, application and therefore how to increase relevance to priority students' lives)

Priority students

Black, Latino/a, English learners, and/or students experiencing poverty in the United States.

Solution

[5] Miller-Cotto, Dana and Lewis, Neil A. (2020). Am I a "Math Person"? How Classroom Cultures Shape Math Identity Among Black and Latinx Students. Working Paper.

A solution can be a program, practice, instructional model, platform, or tool supporting priority students (and their teachers) in Algebra 1 in grades 7-9. A solution could be a new solution (that does not exist) or it could be an existing, "operable" solution. A solution could also be built through partnerships with multiple organizations. A solution must align to at least one Area of Focus and be usable explicitly with a full course Algebra 1 program that meets minimum requirements for coverage of algebraic content in grades 7-9. All solutions must be designed to support access to mastery by the end of 9th grade of the content standards typically associated with Algebra 1 courses. We also encourage you to reflect on what other components of a coherent math instructional system (independent practice, intervention, and assessment to inform instruction), your solution could cover. Examples of solutions might include:

- An online independent practice tool that pairs with an existing high-quality Algebra 1 core curricula, with culturally responsive education and embedded English Learner supports.
- An after school, summer, or community-based program focused on building positive math identity in Black or Latina girls in Algebra 1, in ways that tie back to the Algebra work happening in the classroom.
- An in-school tutoring intervention for 7-9th grade students that supports priority students in mathematics through both mentoring and academic rigor.

For more solution ideas, please refer to the earlier section, ***Why Balance the Equation, Why Now?*** As you innovate and create your new or existing solution we encourage you to have an eye towards (1) scalable innovations that could be equitably implemented and (2) innovations that will support systems change. If selected for Phase 2, your solution would need to be ready to be implemented with priority students by Fall 2021.

Traditional math classroom

The integrated sum of our inherited and internalized assumptions, values, and beliefs of what it means to be 'good at math' – a "naturally" talented individual as opposed to a collective of adept and dedicated problem solvers, quickly completing arithmetic problems through a procedural orientation (acquisition of a skill through repetition of tasks and practice) and working towards a binary right or wrong solution.