October 2016

Strengthening Persistence in Math and Beyond

Accelerating Learning for Overage, Under-Credited Adolescents

A School Redesign Model based on the work at North Queens Community High School

NYC Department of Education

An initiative of the
New York City Transfer School Common Core Institute

Strengthening Persistence in Math and Beyond: Accelerating Learning for Overage, Under-Credited Adolescents describes a set of practices and tools designed to build students' persistence tackling challenging math tasks. The lessons and insights described here, however, extend beyond the math classroom and can be applied across content areas. When educators use a consistent, structured approach to supporting student persistence— fostering a growth mindset and providing instruction on independent problem solving, metacognition, and strategies for improvement—students become not only confident in their ability to learn but indeed hungry to learn. The practices and tools described in this monograph worked successfully for North Queens Community High School, and were developed while the school participated in the Transfer School Common Core Institute, an innovative New York City professional development institute for high schools serving overage, under-credited students who have struggled to find success in school.

Overview of This Monograph

Strengthening Persistence in Math and Beyond describes the practices and tools implemented at North Queens Community High School.

Chapter 1 provides a rationale for using persistence-building and instructional scaffolding as key levers to support student mastery of Common Core skills in preparation for postsecondary success. Chapters 2 through 4 provide a selection of persistence-building practices and tools developed at North Queens, as well as the key steps for using them: Creating a Culture of Engaged Improvement in Chapter 2, Scaffolding Independent Problem Solving with Math Habits of Mind in Chapter 3, and the *Productive Persistence Rubric* and *Conferring Protocol* in Chapter 4. The last chapter closes the monograph with an overview of the key elements needed to lay the groundwork for successfully putting these practices in place.

An appendix provides blank copies of the tools for modification or use in other schools.

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Based on the practices of the professional educators and counselors of North Queens Community High School:

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The New York CityTransfer School Common Core Institute

The New York City Transfer School Common Core Institute is a unique professional development model. It was launched in 2012 to build the capacity of teachers and schools to help students who have struggled in public schools to master the Common Core standards. From 2012 to 2015, all participating schools exclusively served students who are overage, under-credited and had fallen behind in high school in the past. Schools were selected through a competitive process that involved identifying clear goals, crafting action plans, and creating teacher and administrator teams to support the work.

Once admitted, schools were provided three years of job-embedded coaching and technical assistance by the Department of Education and its professional development partners, reDesign and Eskolta School Research and Design. Together, this team of partners collaborated to simultaneously strengthen instructional practices and transform systems and structures to support these new practices. This occurred through two core components:

- **Job-embedded coaching and capacity-building.** The work launched with site-based strategic planning to support individual schools as they refined their Common Core focus and created a plan for participation in the Institute for the year. Teachers, principals, and instructional teams at each school then worked with partners on their Common Core alignment efforts, collaborating for approximately 20 days, over the course of each year.

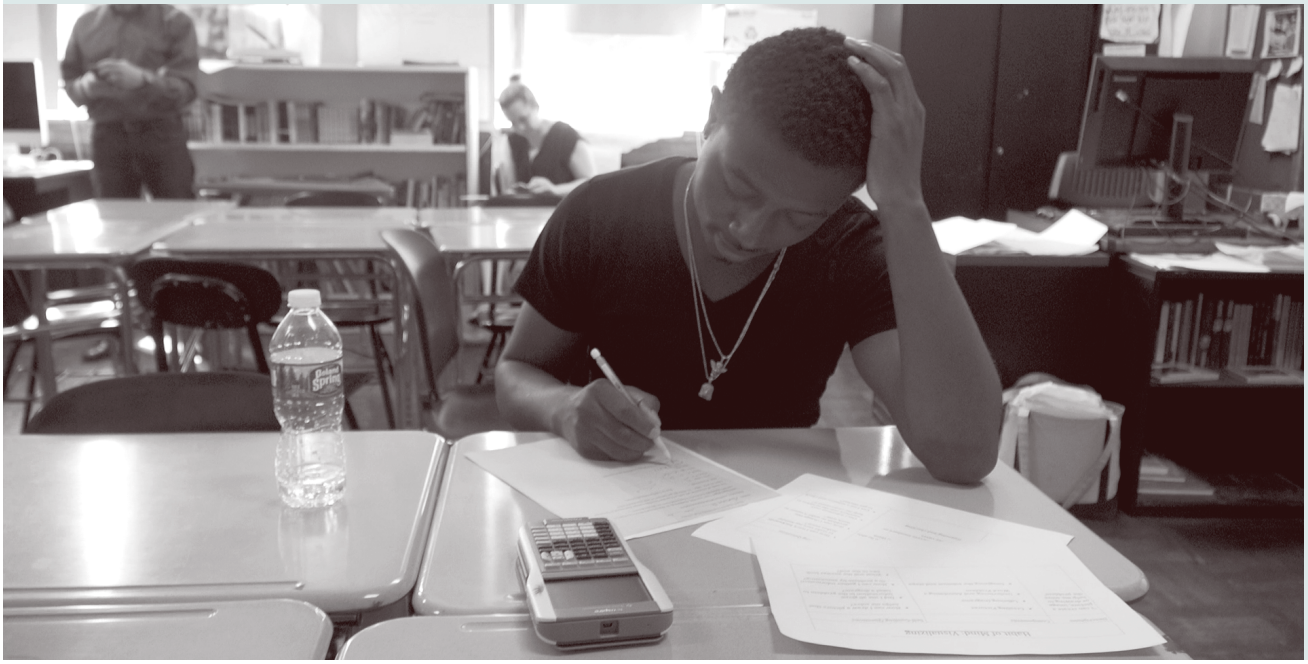
- **Communities of practice.** Inter-school collaborative opportunities that enable school teams to learn from one another occurred throughout each year of involvement in the Institute, through a mix of hosted site visits, full-day Saturday Symposiums for cross-school sharing and planning, and Leadership Sessions for school principals.

A Customized Approach: North Queens's Focus on Persistence in the Math Classroom

At the heart of the institute's success is its commitment to customizing and tailoring support to individual school participants through a synergistic approach of transforming educators' practices at the same time as reshaping school structures that form the context within which those practices occur. Each school defines its own goals and pathway, with partners providing targeted support. At the center of this effort at North Queens Community High School was the process of building students' persistence by explicitly discussing their own mindsets alongside developing their strategies for persisting through challenging math work by building their conceptual understanding of math.

How do you turn around math scores?

In the summer of 2012, staff at North Queens Community High School looked at their students' low math exam scores and decided they needed to try something new. Based on research from cognitive psychology, they believed that increasing student persistence and arming them with a few key strategies for tackling problems would yield deeper engagement, which, in turn, would result in higher exam scores. Three years later, their effort had paid off: student passing rates on the statewide math Regents exams had more than doubled, from 31 percent to 70 percent. Average exam scores had skyrocketed by more than twenty points.



Indeed, after explicitly addressing students' academic and personal mindsets and integrating new independent problem-solving strategies in math classes, staff at North Queens saw student effort and capacity improve dramatically. Word problems that had paralyzed students in the past now motivated them to derive solutions. Quizzes that were once reviewed and forgotten instead became sources of learning as students began submitting revisions at unprecedented rates. And when students were allowed to choose between easier and more challenging problems, they began opting to be challenged.

North Queens Community High School

North Queens Community High School enrolls approximately 190 students in the Kew Gardens Hills neighborhood of Queens. The student body is largely made up of students who are eligible for free or reduced-price lunch by federal poverty guidelines.

North Queens is designated as a transfer school: a New York City high school in which every student who enrolls is transferring from another high school where they struggled and fell behind for any of a variety of reasons. Students arrive at North Queens with a record of academic struggle, typically including repeated failures. But when they walk into the building, they meet educators who greet them warmly and use class time and hall-passing time alike to let students know they care not just about the work they do but also about their well-being. The school has built a culture in which students feel they belong and are there to take on challenges that, as one student put it, "strengthen your brain."

Since Principal Winston McCarthy and Director Lainey Collins opened North Queens in 2007, they and their staff have closely collaborated to support students with a "wraparound" approach that addresses their academic and personal growth in tandem. To the North Queens staff, test scores and credits are what follow effective wraparound support of each student.

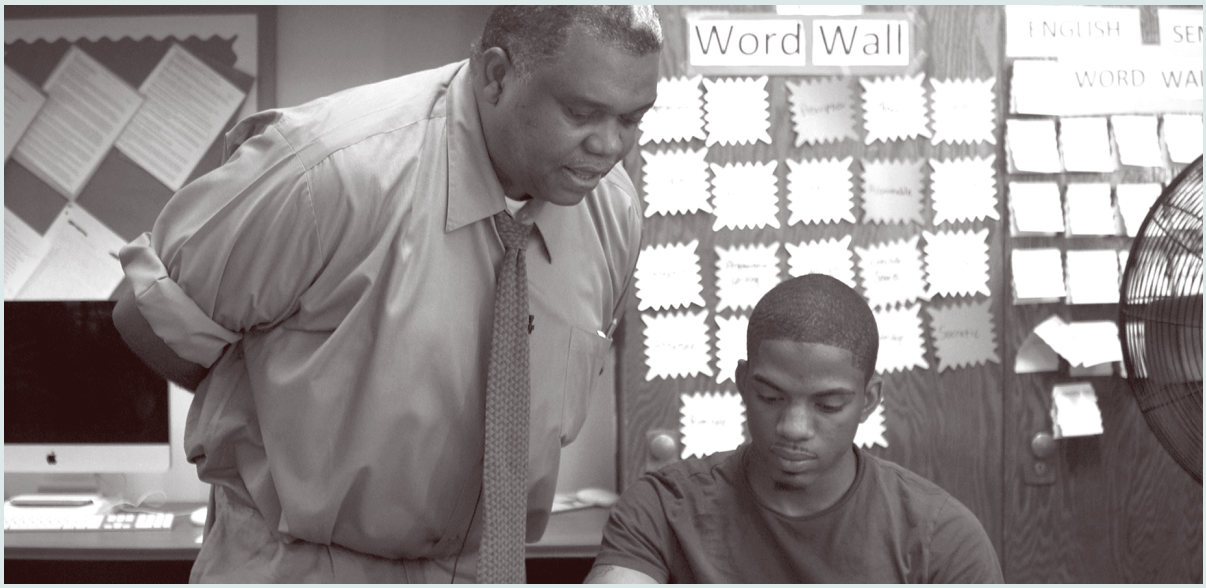
The Impact of Strengthening Persistence

Math is one of the most challenging classes for many students who have fallen behind in school. Years of frustration boil over into blanket phrases like "I am not a math person," or a student's complete shutdown when confronting an unknown problem. Not surprisingly, failure on math exams is common. But by the third year of North Queens's persistence-building work in math, student passing rates had doubled, and individual scores had jumped more than 40 percent.

Test scores, however, offer only a narrow glimpse into the changes that North Queens fostered.

The story of one counselor captures the gradual impact of the school's effort. Lindsay Avrutine used the *Productive Persistence Rubric*, a tool that helps students reflect on research-based behaviors and beliefs that underlie success in school, along with the *Conferring Protocol*, a series of steps for conducting supportive conversations with students about their habits. She explains her progress with one student in particular:

"I worked with [Deena] consistently around her Integrated Algebra Regents prep course. She started out the cycle with a defeatist attitude toward the work because she had sat for the Regents twice before and hadn't been able to pass. On the *Productive Persistence Rubric* that we talked through



weekly, she consistently rated 'Proficient' in *growth mindset*, but was 'Developing' in *value* and the *belief that she could succeed*, and so we decided that this *success* component was the one that we should focus on. We worked hard to remain consistent in terms of her habit-forming positive behaviors, which included attending extra help, being vocal about asking questions, reviewing her completed work, and working with other students productively. As she continued to see the success that these habits were bringing her, her success rating rose to Proficient as well. She was continuously proud of her hard work, and ultimately she was able to pass the Regents."

Erick Delcham, a veteran math teacher who was part of the project, reflects on the changes he saw in students after introducing a series of tools and strategies rooted in the Math Habits of Mind. "We did a study in which we gave students problems before even talking about Habits of Mind," Erick explains, "and the students' scores weren't great." But, he continues, "after lessons on Habits of Mind, we saw a big difference in the responses."

These changes can also be heard in the words of individual students. When one young man recalls his first days in his math class, he says, "I didn't know if I was going to be able to do math. I'm not good at math." At the beginning of the term, he consistently struggled to complete his work. But he explains that he, his math teacher, and his counselor met repeatedly and "talked about how I was going to improve. … They kept telling me, 'You can do it.'" This message that every challenge is an opportunity to grow, along with strategies that developed his confidence to move forward on his own when he felt stuck, allowed him to make progress he had never imagined before. He has not only learned, he learned to love learning. "And," he reflects, "math is my favorite subject now."

1 Strengthening Persistence in Math and Beyond

"What do academically tenacious students look like? First, they believe that they belong in school academically and socially.… Second, they are engaged in learning, view effort positively, and can forego immediate pleasures for the sake of schoolwork… Third, difficulty, be it intellectual or social, does not derail them. They see a setback as an opportunity for learning or a problem to be solved rather than as a humiliation."

GRIT. RESILIENCE. PERSEVERANCE. PERSISTENCE. The rise in usage of these terms in recent years reflects a growing understanding among educators and educational researchers that students' capacity to persist in the face of challenges is one of the main determinants of their success (Farrington et al., 2012). The belief that one can grow more intelligent with effort (the "growth mindset") can have a dramatic effect on academic achievement. More importantly, interventions to address this belief can substantially improve student outcomes (Yeager & Dweck, 2012).

So how, exactly, does an educator foster the growth mindset and strengthen student persistence?

Transparency is crucial at every step. With persistence-building work, as with a single lesson, teachers and students alike must know what they are working toward and why. In their work to **create a culture of engaged improvement**, North Queens math teachers created classrooms in which the belief in the value of productive struggle and malleable intelligence was internalized by students. How they did this is in detailed in Chapter 2.

This culture was then tied to specific skill-acquisition targets from the Common Core, with "perseverance in math problem solving" (Mathematical Practice Standard 1) identified as the central skill the school would focus on. A team of math teachers cross-referenced the Common Core math standards with the **Math Habits of Mind**, identifying four strategies for tackling math problems: visualizing, pattern detecting, tinkering, and conjecturing (each expanded upon in Chapter 3). This is essential to persistence-building work: students must not only be supported to believe that they can grow toward specific goals, they must also be given specific strategies that enable them to take on the challenging work ahead of them. How they did this is explained in Chapter 3.

Feedback and counseling to students offer a further opportunity to guide reflection on persistence and assist them in strategizing for improvement. During student conferences, teachers and counselors at North Queens use a ***Conferring Protocol*** and a ***Productive Persistence Rubric*** (detailed in Chapter 4) to engage students in discussions about their own beliefs in malleable intelligence, their ability to succeed, their sense of belonging, and the value of a given class. The conferences thus provide a platform for discussions that connect students' level of persistence with specific improvement steps they can take in their coursework and deepen their value and sense of belonging—influential factors for students previously stigmatized in academic settings (Walton & Cohen, 2007). Multiple adults in the school thus collaborate to support students at a key intersection in their personal and academic growth.

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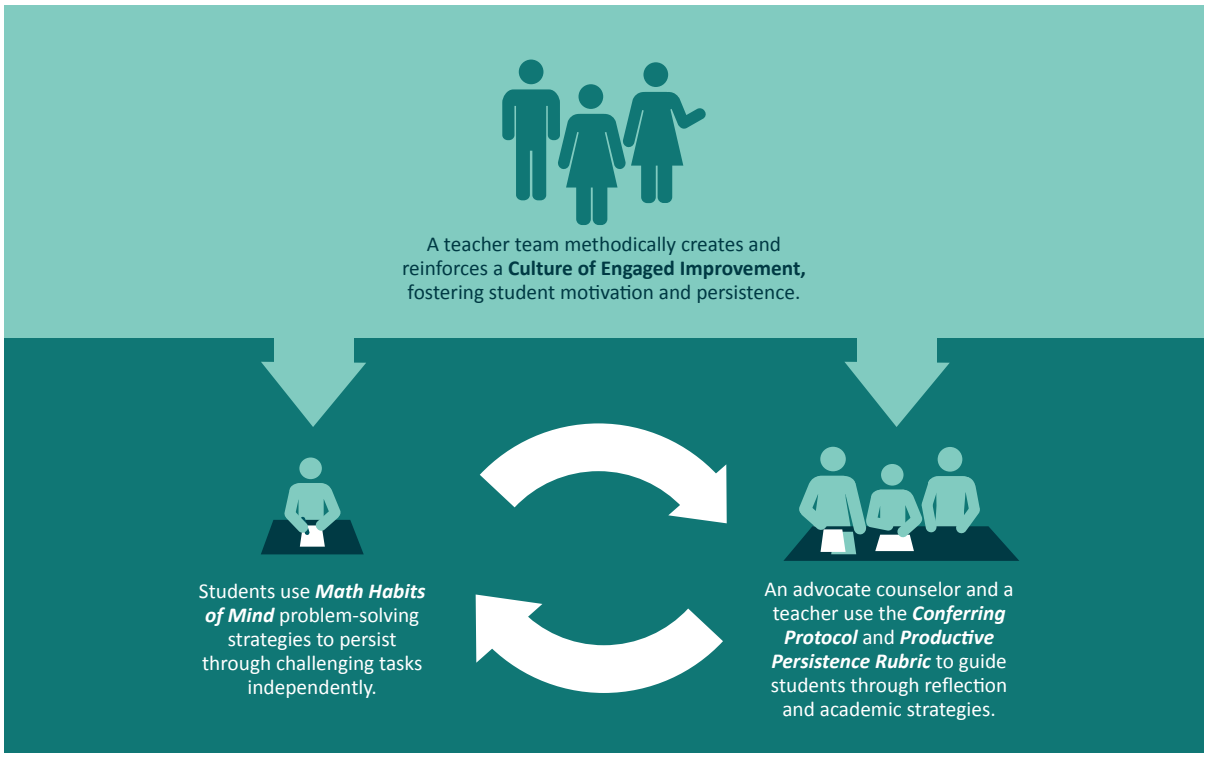
Strengthening Persistence in Math and Beyond

A series of inter-related practices enable the work described in this monograph.



2

Creating a Culture of Engaged Improvement

Overview of the Practice

Purpose:	Help students develop the mindset that their effort matters and persistence will lead to learning
Who uses it:	Teachers
When is it used:	Up to many times per class period, depending on the intervention

ONE POWERFUL WAY TO HELP STUDENTS develop stronger Common Core–aligned skills is to support the "noncognitive" factors that underpin work on those skills: students' value of a given subject, their belief in their ability to learn, and their persistence through difficulty. Educators often recognize that emphasizing these fundamentals is not a "distraction" from content but in fact central to its acquisition. Mindset-building work deepens student skill acquisition and gives them the self-confidence necessary to succeed. In particular, in math class, where many students get frustrated with work they feel they cannot complete, building these mindsets can be critical to success. Despite recognizing their importance, teachers often do not have access to a repertoire of practices they need.

The practices to create a culture of engaged improvement outlined below help students prize growth toward skills over achievement alone. Before this work, many students at North Queens would give up partway through their assessments in math class. Afterward, nearly every student consistently answered all assessment questions.

Recounting his classes' experience with malleable intelligence activities and discussion, teacher Erick Delcham reported that "students who were typically not into math got into this. They read and answered questions." In follow-up group discussions, they began, Erick says, to "undo the idea that if you have to spend time working on a problem, you're not intelligent." Rather, the need to put forth effort is a sign that you're growing.

A culture of engaged improvement can exist only after certain groundwork has been laid. Language and strategies reminding students that effort is valuable will feel futile to students unless they have opportunities for guided practice, independent problem solving, and reflection on learning. Rooting learning in a concrete skill with attendant learning targets enables teachers to emphasize student persistence and growth by helping students develop the strategies, conceptual understanding, and Habits of Mind to tackle challenging problems. An approach to emphasizing these is discussed in more detail in Chapter 3, Scaffolding Independent Problem-Solving with Math Habits of Mind.

Creating a Culture of Engaged Improvement

Starting a unit: Introduce research & poll interests → **In every class:** Convey high expectations → **When giving feedback:** Emphasize process and progress → **After returning work:** Request revisions

1 When starting a unit, introduce brain research.

When students are shown neurological research demonstrating the brain grows stronger through effort, they themselves become more likely to see the value of expending effort on hard work. Indeed, many teachers who have devoted time in class to introducing the idea of malleable intelligence—that intelligence can grow with effort—describe it as an eye-opening moment for their students.

In any subject, you can start a new unit by providing students with an article or video that shares the biological underpinnings of how the brain grows with intellectual effort, and then engage in writing and discussion prompts to review it. Such readings and videos have been developed by Mindset Works, Khan Academy, Character Lab, and other organizations. Consider the following resources:

- "You Can Grow Your Intelligence": an article on malleable intelligence by Mindset Works (**https://www.mindsetworks.com/websitemedia/youcangrowyourintelligence.pdf**)
- Brainology Program Introduction Video: an introductory cartoon on malleable intelligence by Mindset Works (**http://ow.ly/ZjW16**)
- Growth Mindset Lesson Plan: a multipart lesson plan and resource list by Khan Academy and PERTS (Stanford University's applied research center on academic motivation) (**https://www.mindsetkit.org/topics/teaching-growth-mindset/growth-mindset-lesson-plan**)

Follow the introductory reading or video by engaging students in a discussion about their reactions to these ideas. When doing so, teachers at North Queens found it important to underscore four points:

- **Embrace challenges:** If work were not challenging, it wouldn't be interesting, and it wouldn't help you grow. That feeling of it being hard is the feeling of your brain growing.
- **Mistakes are part of learning:** Making mistakes as you learn is a sign that you're trying. After all, do professional basketball players start out making every shot they take?
- **Strategies are central:** Since everyone has the capacity to learn with effort, if you're struggling, it's a sign that you need to find the right strategy to move forward.
- **Effort over achievement:** Since challenges are necessary for growth, if you're having an easy time, it's a sign that you need to push yourself further.

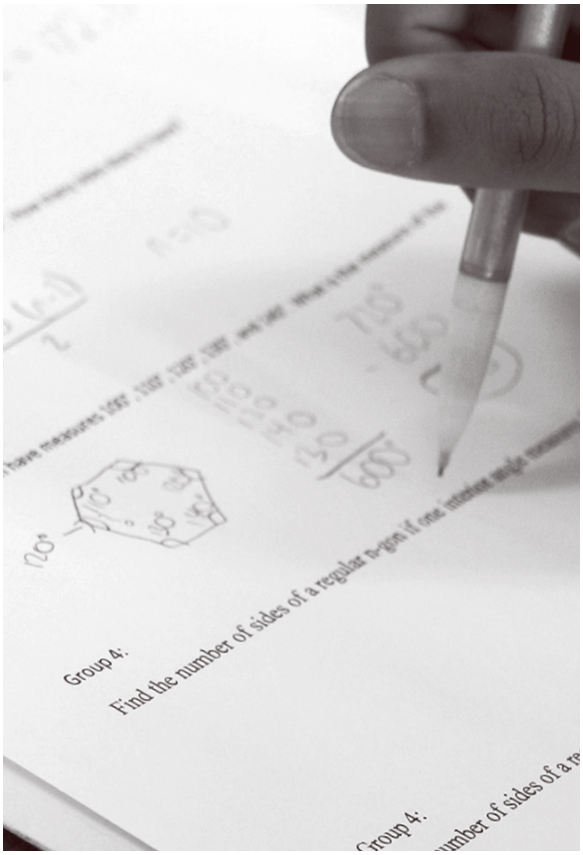
2 In one of the first classes, poll students for their interests and values.

Assignments that draw on authentic interests do more than simply engage, they foster value: for that work specifically, for the particular class, and indeed for school in general. They also activate students' neural connections to encourage deeper learning. When designing curriculum and classroom activities, poll students about their areas of interest outside of school, and incorporate these areas into classroom content. Students who understand that educators care about them personally—not just as cogs in the test-score machine—develop a deeper sense of belonging in school.

At North Queens, math teacher Erick Delcham polled his students on their top areas of interest outside of school and then incorporated those areas—video games and social media—into new word problems. Students who previously put forth minimal effort on practice problems, especially as the problems grew more challenging, began to engage as never before. In the process, creative and analytical dialogue about approaches to the problems grew substantially.

3 In every class, convey high expectations.

A single class period is not enough to change a long-held fixed mindset. In further lessons, keep using consistent language with students. One important way to do this is to remind students that you have *high expectations* of them, meaning that you both *set challenging learning goals* and that you *believe* each student can achieve them with the right supports and effort. Teachers at North Queens personalized these messages so that students would not see them as platitudes. They did this by making note of individual progress and reframing mistakes as a chance to continually improve. (For more on improvement strategies, see Chapter 3.)



4 When giving feedback on work, emphasize process and progress.

As you review student work, give feedback aloud and in writing indicating to students that they *can always* improve their work and clarifying precisely *how* they can do so. When students have success, instead of saying things like, "You're great at math," which can discourage students from taking on challenges that might risk losing that status, use feedback that praises effort, progress, and use of math skills. Make feedback as concrete and actionable as possible, reinforcing the math habits and strategies that a student is using effectively as well as those that could be employed to take the work to the next level.

For example, at North Queens, one teacher consistently noted to students upon their receiving a low score, "It doesn't mean you can't do this. It means you can grow." Another teacher wrote comments that prompted specific improvements, such as: "Your explanation was great. I'd like you to build on that by showing one other reason why…" The team saw a sharp increase in test-revision efforts after employing such persistence-encouraging feedback.

5 After each assignment, ask for revisions.

Revision of work is an important opportunity to build the skill of persevering through a challenge. Yet in many schools, revision is an afterthought or, still worse, the subject of a makeup policy that is perceived as a second chance. Offering the opportunity for students to revise work on a routine basis communicates that continuous growth is both the teacher's and student's goal rather than a single static score. Once you have set the expectation that effort leads to growth and mistakes are part of learning, ask students to submit revisions on a regular basis. Use these as an opportunity for them to demonstrate growth and persist in the face of challenges.

3

Scaffolding Independent Problem Solving with *Math Habits of Mind*

Overview of the Practice

Purpose:	This practice enables students to use multiple entry points to math problems based on a hierarchy of independent problem-solving habits
Who uses it:	Math teachers and students
When is it used:	During introduction to the concept and then many times per math work session

MATH HABITS OF MIND provide students with the means to persist independently as they tackle challenging math problems. The self-questioning techniques embedded in this approach—summarized in the *Math Habits of Mind Chart* on the following page—help students break problems into their constituent parts, making them both more "decodable" and approachable while building students'. In this way, the practice supports students as they build the level of conceptual understanding demanded by the Common Core standards that ask for such skills as making sense of math problems, constructing arguments, persevering through problem, and justifying solutions. Such an understanding of math moves beyond the details of individual algorithms that often trip up students and enables them to see the "forest for the trees" that gives them greater appreciation for, and agility in addressing, any math problem.

What are Math Habits of Mind?

The Math Habits of Mind are fundamental modes of thinking that high-functioning people across disciplines employ to solve math problems. There are many Math Habits of Mind, but several prominent ones focused on here include:

- **Primary Habits:** gathering and organizing information; visualizing (the act of turning elements of a problem into a visual representation); pattern detecting (noticing similarities and themes within a problem).
- **Secondary Habits:** tinkering (deliberately "playing with the numbers," trying out different ideas based on experience and research); conjecturing (making an informed prediction about what the final answer will be).

"Much more important than specific mathematical results are the habits of mind used by the people who create those results" (Cuoco et al., 1996).

These approaches to math go hand in hand with the culture of engagement described in Chapter 2. As students employ the Math Habits of Mind and internalize their strategies, they go from believing that they can persist and succeed in the abstract to using concrete strategies to actually persist and successfully solve problems. Central to the Habits is experimentation: as students employ the Habits, they come to understand that they have the ability to dissect, manipulate, master, and ultimately learn from whatever math challenges they are given.

Math Habits of Mind Criteria

North Queens Community High School

Habits of Mind	Components/Skills	Prompts/Questions
Visualizing *"I can create a picture, image, or drawing to help me solve the problem"*	• Creating pictures • Labeling diagrams • Underlining and annotating a word problem • Imagining the solution and steps	• How can I draw a picture that helps me solve? • Did I use all given information in the problem to label a diagram? • How can I gather information in a problem by annotating? • What will the answer look like in the end?
Pattern Detecting *"I can notice and describe patterns to help me understand and solve the problem"*	• Recognizing repetition and sequence • Describing similarities between numbers and problems • Comparing and contrasting • Noticing structure	• What patterns do I notice? • Does this problem relate to anything I have done in the past? • How is this example similar to or different from another problem? • What do I notice about the structure of this problem?
Tinkering *"I can play around with problems to help me solve the problem"*	• Working backwards/checking answer • Manipulating problems to be able to work them or make them easier • Trying concrete numbers or simpler cases • Guessing and checking	• How can I work backwards to make sure my answer makes sense? • How can I change this problem to make it easier to work with? • Can I substitute easy numbers into the problem to help me understand it? • Can I try a solution and check to get started?
Conjecturing *"I can use information I have gathered to predict or hypothesize about math"*	• Making a prediction about the solution and justifying • Creating a rule based on a pattern or investigation • Revising conjectures based on evidence • Connecting to prior knowledge or skills to solve a new problem	• What might be a reasonable answer? • Is this pattern a rule I can apply to other problems? • Is there any evidence that negates or changes my conjecture about the rule? • What background knowledge can I connect to this problem?

Developed by North Queens Community High School in collaboration with reDesign

How to Scaffold Independent Problem Solving with *Math Habits of Mind*

1 Set up a word problem with a progression of questions.

Teachers at North Queens Community High School emphasized four math strategies in the Habits of Mind: *visualization*, *detecting patterns*, *tinkering*, and *making conjectures*. One of the Habits' great strengths as an instructional practice is that students—and indeed all of us—already use them in daily life, for math work and beyond: we visualize our world, we find patterns around us, we tinker with all sorts of problems and challenges. To prepare students to better understand the Habits, make it easy for them to recognize that they already use them.

Provide students with a word problem broken into discrete steps that demand the use of one or two Habits of Mind. When creating this word problem, scaffold a progression from more basic primary Habits (e.g., gathering and organizing data, visualizing) to more complex *secondary* Habits (e.g., pattern detecting, tinkering, conjecturing). The "Sample Introductory Problem" on the following page offers a window into how to do this. Instead of simply asking for a final answer (e.g., How many marbles are in one of Chris's bags?), the problem is broken into six steps that prompt students to use primary Habits to understand the basic arrangement of the problem (the physical distribution of each person's marbles and the relationship between the different sets of marbles) before using secondary Habits to approach a solution for the problem (to make educated attempts to isolate the number of marbles in each of Chris's bags.

2 Make space for independent struggle.

Students should work through the introductory phase of the problem individually to experience using each Habit. When introducing and guiding students through the scaffolded word problem, consider the following three points:

- **Highlight differences.** If the scaffolded work is significantly different from the students' regular math work, highlight how this work is different from what they normally do, and note that this difference is intentional. Emphasize that students should not feel anxious about getting the right answer because making mistakes while taking on challenges is essential to the learning process (as discussed in Chapter 2).

- **Stay patient and give students space.** Be patient with student struggles, providing time for silence as students are thinking. Avoid the temptation to help when there is silence or a pause. Let students work through that space instead.

- **Stay engaged.** While patience is critical, it is equally important to offer just enough support to enable further independent effort. For example, in reference to the sample problem below, if a student has misinterpreted a key term in the problem, and is thus unable to complete a diagram that makes sense to them, it may be important to ask the student about the term they are struggling with and to help them understand its meaning.

Sample Introductory Problem

Prompt: *Victor has 23 marbles sitting on a table. Chris has 2 bags filled with the same number of marbles, and 9 additional marbles sitting on the table.*

Instruction/Question	Process and (in bold) Math Habit of Mind
1. *Draw a representation of the marbles Victor and Chris have.*	Students **organize their data** in order to **visualize** the problem and draw a representation. Students might draw the physical objects noted in the problem or symbolic representations. Be prepared to provide more guidance and support here than in subsequent steps to ensure the student has an effective setup for the problem.
2. *What is the relationship between the marbles Chris and Victor have?*	Students assess their drawn **visualizations** of the problem to **detect the symmetry (the pattern)** in the relationship between Chris's and Victor's marbles. Here, as in all equations, the two sides must be equivalent.
3. *How many marbles does Chris have in total?*	This is **information gathering**, and it reinforces students' understanding that although the exact distribution of Chris's marbles is unknown, he must still have 23 marbles in total. This sets up their ability to **tinker** with the problem in the next steps.
4. *What is known and what is not known from the problem?*	Here again, **information gathering** helps students to begin the process of translating word problems into algebraic equations as students learn to assign variables to the unknown values. Provide minimal to no assistance and allow students to **tinker** with this question.
5. *How can you determine how many marbles are in both of Chris's bags in total?*	At some point, students will begin to understand that in order to determine how many marbles are in the bags, they must isolate the bags. In order to do so, they must remove Chris's nine additional marbles from the picture. Allow students to **tinker** with this part of the problem, and observe the strategies they use. Consider asking guiding questions such as, "How can you get the bags alone to figure out how many marbles are in the bags?" Doing this will allow students to form **conjectures** about what will isolate the total number of marbles in Chris's bags.
6. *How can you determine how many marbles are in one of Chris's bags?*	Students might directly **tinker** or **experiment** to reach possible answers, or they might first **gather the information** that Chris's bags must each have the same number of marbles and **recognize the symmetry (the pattern)** between each of Chris's bags. Students **conjecture** that by dividing the total number of Chris's bagged marbles by two, they will find out how many marbles are in one of Chris's bags.

3 Have students discuss what they did.

After students have worked on the problem, have them discuss what they did at each step, either in small groups or as a class as a whole. This begins the process of metacognition, as the discussion will force self-reflection and help students become aware of their thinking. In providing this opportunity, teachers are helping students connect their concrete work to the more abstract strategies that make up the Habits of Mind, a crucial step in internalizing them.

With the full class, ask students to share their descriptions of each key step in their thinking. As they do, make a list of the key phrases they use. Do not expect them to use the Habits of Mind terminology (bolded for reference in the sample problem above). Rather, listen for phrases that *relate* to specific Habits. For instance, you might record a student's description of "thinking about what the marbles and bags looked like" or "drawing a picture" as visualization when you summarize them on your list.

4 Introduce Habits of Mind.

A small but crucial next step is the explicit naming of the Habits of Mind. Once you have reached the end of the problem, go back through students' phrases and label them with the Habit of Mind that are most closely related.

Having started from the students' own thinking, now hand out the *Math Habits of Mind Chart* to students, noting that the chart will be a reference for them as they work through future problems. Remember, students have only just begun explicitly using Habits. They will still need further practice to master their use. Referencing the chart will help them to gain that comfort.

5 Scaffold more word problems with Habits of Mind.

As you plan additional lessons, continue to use word problems as a focal point for learning. Break these problems into three parts—*the entry* during which visualizing and pattern detection are key, *the middle* when tinkering is valuable, and *the end* when conjecturing is needed. For example, an entry point to a complex problem can be as simple as "What do you notice?", "Can you create a picture in your mind's eye of part or all of this problem?", or "What numbers are in this problem?" Students in the habit of using pattern recognition can approach problems by building from the strength of identifying readily visible—yet foundational—details in the problem.

Breaking a problem into steps helps students transform what may seem like a large, daunting challenge into several approachable challenges. This approach can also help teachers move away from directing students to instead concentrate on facilitating, observing, and providing feedback on student learning. Students can likewise more readily collaborate with each other and engage in analytical discussion of the content.

While there are many Math Habits of Mind, the North Queens math team emphasized four, featured in the *Sample from North Queens High School* chart at the beginning of this chapter. Details below are drawn from "Habits of Mind: An Organizing Principle for a Mathematics Curricula" (Cuoco et al., 1996), which also describes additional Habits worth considering as you plan your approach.

- **Visualizing** is the act of turning elements of a problem into a visual representation. This tends to occur at the beginning of a problem as an "on-ramp" allowing students to envision all the different components of the problem. It can involve envisioning elements that are typically considered visual as in answering a question about the number of items in a physical space, or when creating visual analogues, such as using a model to visualize the multiplication of two numbers.

- **Pattern Detecting** entails noticing similarities and themes within a problem. This can also occur as an initial step when students parse out the components of a problem. Cuoco et al. explain that "students should always be on the lookout for short-cuts that arise from patterns in calculations." Pattern detecting can mean, for example, seeing five triangles within a pentagon or understanding the symmetry of two sides of an equation.

- **Tinkering** refers to trying out different ideas and making guesses. This may take some more pushing for students to articulate. Students who get to the stage of figuring out a problem and deliberately "playing with the numbers" are exhibiting this habit. "Tinkering really is at the heart of mathematical research. Students should develop the habit of taking ideas apart and putting them back together. When they do this, they should want to see what happens if something is left out or if the pieces are put back in a different way" (Cuoco et al., 1996).

- **Conjecturing** is the act of making a prediction about what the final answer will be. It generally occurs as students are getting toward the end of a problem and is revealed in two places: their efforts to make educated attempts at a solution and their attempts to check to see if their solution is correct. After experimentation is done in prior steps of a problem, students should use the evidence gained as well as their existing understanding of mathematical principles to make informed conjectures.

6 Foster language of the Math Habits of Mind continually.

After the introductory lessons, embed the Habits into class culture and practice in multiple venues. Do this in four ways:

- ❑ Place the Habits on posters in the classroom to provide students with consistent visual reminders. Include brief descriptions like those found in the *Habits of Mind Chart* (on page 12).

- ❑ Push students to use the self-questioning prompts included in their own copies of the Habits of Mind Chart as they work individually and in groups.

- ❑ Provide word problems with multiple entry points that invite the use of the Habits, as in the sample problem earlier. Whereas an unfamiliar problem without such scaffolding can leave students daunted, scaffolding helps students begin the problem with an opportunity to productively engage.

- ❑ Prompt reflection on the Habits even in non-scaffolded problems. Even when you give students problems "all at once," or not broken into steps, ask them to describe which Habits they would envision using. As they work through problems, guide them with questions that prompt them to use a Habit, such as, "Can you draw a representation of this equation?" At the end of the problem, ask students to describe which Habits they used at various points and whether they used other Habits that seem distinct from those you have emphasized in your materials and discussion.

These approaches help underscore for students the continuity of Habits of Mind throughout their work, further connecting concrete problems to the Habits as broader behaviors.

4

Student Conferences Using the Productive Persistence Rubric

Overview of the Practice

Purpose:	Conferences—guided by a protocol and rooted in the rubric for academic behaviors and mindsets—help staff work with students to evaluate and plan their own growth
Who uses it:	Teachers and counselors
When is it used:	With a particular student, up to once per week

TEACHERS USE THE *PRODUCTIVE PERSISTENCE RUBRIC* AND *CONFERRING PROTOCOL* to help students reflect on their levels of persistence and strategize ways to improve their work. During conferences, teachers and counselors engage students in discussions about their belief in malleable intelligence, their ability to succeed, their sense of belonging, and the extent to which they value a given class. The conferences allow adults in the building to show students they authentically care about their growth, while explicitly connecting students' level of persistence to tangible improvement steps they can take in their coursework. Multiple adults in the school thus collaborate to support students at an intersection of their personal and academic growth. These discussions build off classroom culture (detailed in Chapter 2) and instructional scaffolding (in Chapter 3).

As a result of this work at North Queens, students who previously doubted that they would ever succeed in math found new success in the subject and, most importantly, new confidence in their ability to grow with effort.

Protocol for Talking to Students about Progress/Persistence

North Queens Community High School

Name of student: [redacted] **Date of meeting:** 2/4/15

Class: Global 20th Century - she wants to focus on global understanding material - writing is primary difficulty (essays)

1. Explain the purpose of the conversation. Give the student some details about why you want to focus on this class with them (difficulty passing in the past, do not like or feel like they can understand the subject, etc.) and talk about what it would mean to be successful in the particular class you are focusing on.
   - success would mean passing, a wall to break down
2. Discuss how the class is going so far. Focus on what the student feels is going well and highlight anything you have noticed that is going well.
   - sometimes material is interesting - class work + attendance - Lavas tries to push her to do work
3. Look at most recent benchmark data, if available, and talk about what is happening in the class. Ask the student where they feel like they are making good progress and where they feel like they are struggling.
   - classwork is good, essay writing is a struggle
4. Look at the productive persistence rubric and ask the student to self-assess how they are performing on the rubric in each category. Record the answers here:

   Growth Mindset: proficient

   I can succeed at this: capable

   I belong here: capable

   I value this: developing

5. Ask the student where they feel like their biggest challenge is in the class related to the productive persistence rubric. Set a goal for next week to change one of the areas on the persistence rubric where they are struggling (for example, move from *Emerging* to *Developing* in Growth mindset).

Challenge:	**Goal:**
	C → P

* thinking + doing is 2 different things *

6. Identify strategies that will help with the change that the student wants to make. Pick one strategy to try in the next week. If this is a strategy that was suggested in previous meetings and not tried, discuss why it was not tried and any additional supports needed to try the strategy this week. Record the strategy here and any follow-up notes:

   Monday 2/9/15 meet w/ Lavas + Lindsay w/ rubric
   Friday 2/6/15 compile info + put together basic outline

7. Set next meeting and restate goals. Use a growth-mindset phrase and record.

   GM Phrase: _____

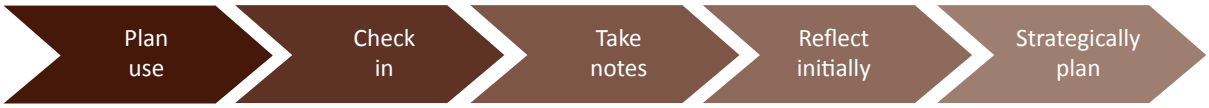
8. Thank the student for their time.

Developed by North Queens Community High School in collaboration with Eskolta School Research and Design and NYCDOE Office of Postsecondary Readiness

2/4/15 Global 20th Century

Academic Mindsets/Productive Persistence						
Category	**Emerging**	**Developing**	**Capable**	**Proficient**	**Mastery**	**Evidence**
Growth Mindset *I believe that I can learn and achieve.*	*I believe that intelligence is like eye color- you are smart or not smart and can't change that fact.*	*I believe that you can get better at some things if you work at them but a person's basic intelligence can't be changed.*	*I believe that I can get better at things that I've failed at in the past if I work hard enough.*	*I believe that intelligence is changeable— if you work hard you can get smarter*	*I believe that intelligence is change and if you work hard you can get smarter. I seek out challenging things as ways to increase my intelligence.*	
I can succeed at this. *I do things that show that I believe I can succeed.*	*I won't try something if I think that I will fail, even just at first. I know the proof that you are good at something is when you catch on right away and I don't want anyone to know that I'm not good at things. I don't ask for help when I am stuck.*	*I will sometimes try things that I'm not sure I will quickly do well. I can handle making one mistake and will try doing it a different way before giving up. Sometimes I will ask for help, but not in front of other people.*	*When I start making mistakes I don't immediately give up. I try a couple of different strategies before giving up, including asking for help from my teacher.* 	*I know that making mistakes is part of learning. When things get hard I try as many new strategies as necessary until I accomplish my goal. I will often ask my peers or teacher how I can improve. I Know that you aren't learning if you aren't failing.*	*I know that making mistakes is one of the biggest parts of success. While I might get discouraged or take a break after I make a mistake, I always return to the problem and try it a different way. If I can't think of the next thing to try I will ask my teachers or peers to get their ideas. I know that if I keep trying to understand I will eventually succeed.*	- ask for help - showing up - pressure from mom - wanting to graduate
I belong here. *I belong in the learning context*	*I really don't feel like I belong here. None of the adults know who I am and I don't always feel safe.*	*I don't always feel like I belong here. Very few adults know who I am and I only have a few friends, but I usually feel safe.*	*Most of the time I feel like I belong here. A few adults know who I am and I have some friends. If I ask them for support, they will give it to me.*	*I feel like I belong here. Lots of the adults know who I am and I have some good friends. I try to offer support to my peers and help other people feel like they belong.*	*I belong here. I have good relationships with a lot of the adults at school and offer support to my fellow students. I try to make sure that new students feel like they belong too.*	- AC support - Mian support
I value this. *I believe the learning material has value*	*I don't really see the value of this class. It isn't interesting or useful and I don't see how doing well would benefit me in the real world.*	*I see little value in this class. I know that doing well in school is good for me, but this class isn't interesting or useful. I don't see how the information would benefit me in the real world.*	*I care about how I do in this class. I find the content either interesting or useful and I can see how doing well in this class would benefit me in the real world.*	*I care about how I do in this class. I think doing well in school is important, I see how this class is relevant to my future success*	*I really care about how I do in this class. I think doing well in school is important, I find this class useful and interesting and I work hard to make connections between this class and my life and dreams outside of school.*	- is beneficial for graduation but will not apply to real life experience

How to Use the *Student Academic Skill Chart*



Adult-student conferences offer ripe opportunity for mindset-altering discussion. Before delving into the conference itself, one important decision is who will be involved. While a two-person student-counselor or student-teacher conference can be highly productive, holding a three-person conference including both counselor and teacher can more deeply integrate discussion of skill-specific challenges and strategies related to that class. At North Queens, specific efforts were made for counselor and teachers to hold conferences together with students, building this bridge between academic mindsets and academic strategies.

1 Open with a focus on growth.

The first time you confer with a student about the mindsets underlying their persistence in class, it may feel awkward. Students who have spent much of their academic lives struggling might be confused to hear their teachers and counselors suddenly focusing on struggle as a good thing. Start out by explicitly bringing this up with students: you are meeting with them to help them develop their immense potential for growth. This involves helping them understand their different beliefs about their work in school—their mindsets, their persistence—and working with them to strengthen their belief in themselves, guiding them to the best strategies to persevere as they struggle through difficult work.

After this initial framing, bring the student into the discussion. Ask him or her how work in the target class is going and have the student to describe what is going well in the class—as students tend to be more open and receptive after discussing positive aspects of their performance. Then note your own positive observations in terms of specific skills and behaviors.

2 Guide student self-assessment.

Next, provide students with the *Productive Persistence Rubric* with the goal of hearing and noting their own self-evaluation on each rubric category. The first time you discuss persistence evaluations with students:

- ✓ Use the anchor text on the left-hand side of the rubric to outline what each row—each mindset—of the rubric means. For example, explain that a Growth Mindset is your belief that you really can learn and achieve in school.
- ✓ Have students read one of the "Emerging" and one of the "Mastery" boxes for each row in order to reflect on the spectrum that each mindset in the rubric spans.
- ✓ Ask students to note how they rate each of their mindsets and why. Check or circle the box related to each rating, and then record several of the reasons for each rating in the right-hand "Evidence" column.

3 Choose growth targets.

Ask students to describe their biggest challenge in class with respect to the *Productive Persistence Rubric*—that is, when they think of their recent work in class, which single row of the rubric (*Growth Mindset, Growth Action, Sense of Belonging*, or *Sense of Value*) seems like the biggest struggle for them? For example, consider a student who rates herself "Proficient" in the first row on "Growth Mindset"—i.e., she believes in the power to grow in the abstract. She still may doubt her own ability to succeed, rating herself "Emerging" in the second row of the rubric. After discussion, she may decide her goal is to advance to "Capable" in the second row as she aspires to do more to act on her belief that she can learn.

4 Strategize for improvement.

Help the student choose two strategies for growth, and note these on the protocol with a specific time to use them. The mere act of noting the strategies helps students become more reflective and aware of their own mindsets. The specific approach to strategizing for growth in persistence depends on the rubric focus area. The chart below provides an overview of possible strategies based on the mindset targeted:

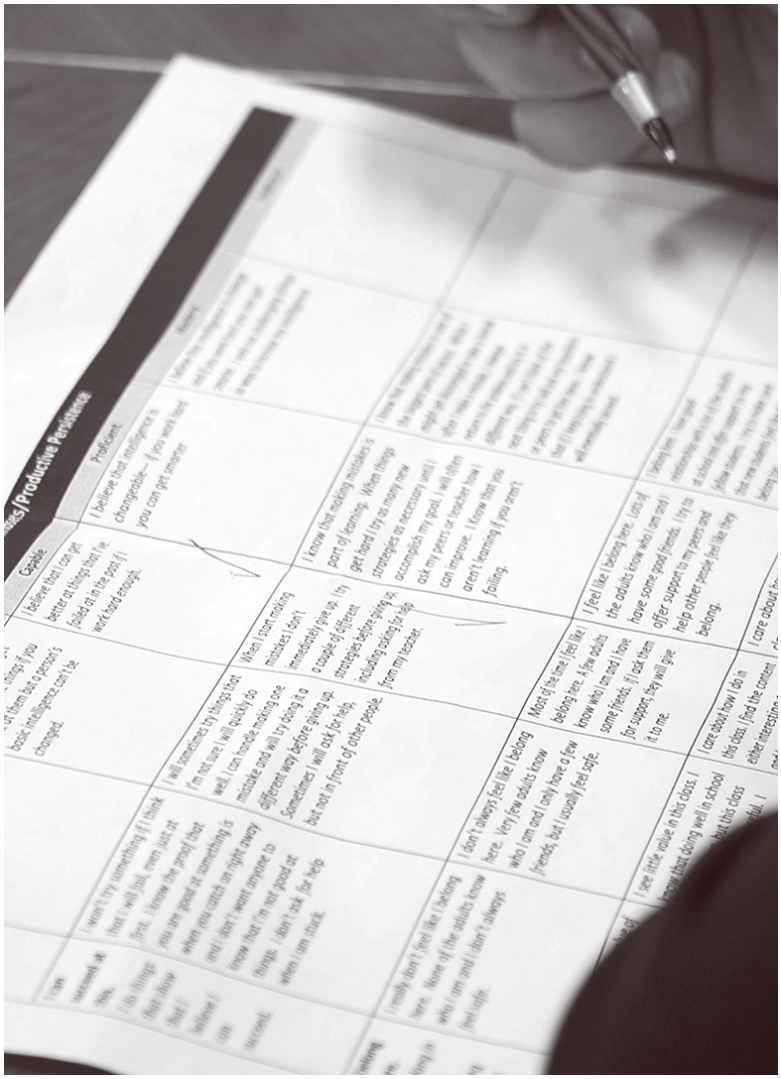
Mindset challenge	Possible strategies for student	Source
Student sees her mistakes as a sign she is not "smart" and can't **grow** despite effort	Read an article or watch a video about how the brain grows (see Chapter 2, Creating a Culture of Engaged Improvement for examples). When something feels difficult, visualize the neurons in your brain making new connections.	*Based on the practice of mental contrasting developed by Gabriele Oettingen, University of New York University and the University of Hamburg.*
	Add the word "yet" to the end of your sentences: I don't understand this yet.	*Based on the practice discussed by Carol Dweck in "The Power of Believing You Can Improve."*
	Take on a challenge that you think you will fail at. Find your favorite mistakes and use them to teach a classmate what you learned.	*Based on the work of Leah Alcala featured in "My Favorite No: Learning From Mistakes," Martin Luther King Middle School, Berkeley CA*
Student doubts his *own* **ability to succeed**	Don't just work harder, work smarter. Learn and practice using new strategies (see Chapter 3 for ideas). Reflect on which strategies work for which situations, and share your strategies with your classmates.	*Based on work by Lisa Blackwell of Mindset Works*
	Know that with practice and the right support, everyone can master challenging material. Try out different ways of getting help, from peers, classroom resources, teachers, and counselors.	*Based on the practice of giving "wise feedback" discussed by David Yeager, University of Texas at Austin*
	Have a conversation with the counselor/teacher about a time when they doubted their ability but then discovered that there were steps they could take to improve.	
Student feels she doesn't **belong** in the learning environment	Make a pact with your classmates that you will all come to school each and every day because you are all here to graduate and you are all in this together. When someone is missing, send them a message to find out what's going on. Help them know they matter to you.	*Based on the Group Noticing Routine developed by the Carnegie Foundation for the Advancement of Teaching Community College Pathways Productive Persistence Network*
	Conduct an interview with a student like you in the school, asking them whether they were sure they belonged here when they started, and how they now know this is a place they can succeed. Then write a letter to an incoming student about how this matches your own experience.	*Based on the social belongingness intervention of Gregory Walton and Geoffrey Cohen of Stanford University*
Student doesn't see the **value** of the class	Brainstorm the different ways what you are learning connects to your own life or the lives of others who matter to you. Talk with your teacher or classmates about the different ways they see value in learning.	*Based on a relevance intervention developed by Chris Hulleman of the University of Virginia*
	Identify a long-term goal for yourself and research what you need to know and be able to do in order to achieve it. Then make a plan that takes you backward from there to today in order to think about how the choices you make today will set you on a path toward your goal.	*Based on the Possible Selves research of Daphna Oyserman of the University of Southern California*

5 Close with a growth phrase.

Close out the conference by setting a time for a follow-up conference and by using a phrase that communicates that struggle and effort are part of learning. For example: "Keep up the hard work," or, "Remember, struggling is part of learning," or, "I like seeing the effort you are putting into growing."

6 Keep records for follow-up.

Be sure to make records of ratings and plans available to students, counselors, and teachers. This may be done as a shared online digital record or simply with photocopies of the records left in individualized folders. Most importantly, bring these records to the subsequent conference to discuss progress and the efficacy of chosen strategies. As you continue trying strategies, be willing to supportively challenge students if you feel that they are simply complying. If the strategies you are attempting now are not working, try something else. There is no single right answer for every student.



Conditions that supported success

"It's important to make educators feel challenged but safe—not saying, 'You go find the answer,' but rather, 'Let's find this together; let's figure out how this works, how it will work.' It's important to be open and give educators space to make mistakes and recover."

—North Queens Community High School principal Winston McCarthy

Changing the ways adults talk to students about their own beliefs and thinking is no easy task. Yet that is exactly the work that North Queens Community High School undertook over three years, from 2012 to 2015, leading to a seismic shift in students' success in math class. While much of that work took place over the course of those three years, it is important to note that two crucial conditions were in place beforehand that enabled the work to happen: collaborative planning structures and the active involvement of school leadership.

Collaborative Planning and Roundtables

This work depended in part on a strong culture of collaboration that had already been established in the school. Such collaboration is modeled from the top at NQCHS: the school is jointly led by its co-founders, Principal Winston McCarthy, who is responsible for student academic development and oversees the teaching staff, and Director Lainey Collins who is responsible for students' social-emotional development and oversees the counseling staff. In addition to this collaboration in leadership, three collaborative structures were also key to the project's success:

- **Daily common planning periods** enabled math teachers to repeatedly refine and try out new approaches to introducing skills and Habits of Mind to students.
- **Weekly roundtable discussions** brought counselors and teachers together to refine their approaches to student social-emotional considerations and academic growth. These provided opportunities for common understanding of the mindsets that were helping or hindering student growth.
- **Weekly full-staff meetings** allowed leadership to share research on academic and social-emotional development for teaching staff to integrate into classroom practices.

Active Involvement of School Leadership

In addition to collaboration, active support from school leaders enabled the gradual development of this work. Support from school leadership was particularly critical in two areas:

- **Research and initial design**. Initial design of the work was led by a team that included school leadership. Leadership both reviewed what the team was testing out as the project progressed and actively guided its direction.

- **Department meetings**. Much of this work came to be developed and planned in departmental meetings. Crucially, each meeting produced brief reports to the principal to keep the teams accountable. To distribute this management work without overwhelming any one person, the meetings were facilitated on a rotating basis.

Appendix

Math Habits of Mind Criteria

North Queens Community High School

Habits of Mind	Components/Skills	Prompts/Questions
Visualizing *"I can create a picture, image, or drawing to help me solve the problem"*	• Creating pictures • Labeling diagrams • Underlining and annotating a word problem • Imagining the solution and steps	• How can I draw a picture that helps me solve? • Did I use all given information in the problem to label a diagram? • How can I gather information in a problem by annotating? • What will the answer look like in the end?
Pattern Detecting *"I can notice and describe patterns to help me understand and solve the problem"*	• Recognizing repetition and sequence • Describing similarities between numbers and problems • Comparing and contrasting • Noticing structure	• What patterns do I notice? • Does this problem relate to anything I have done in the past? • How is this example similar to or different from another problem? • What do I notice about the structure of this problem?
Tinkering *"I can play around with problems to help me solve the problem"*	• Working backwards/checking answer • Manipulating problems to be able to work them or make them easier • Trying concrete numbers or simpler cases • Guessing and checking	• How can I work backwards to make sure my answer makes sense? • How can I change this problem to make it easier to work with? • Can I substitute easy numbers into the problem to help me understand it? • Can I try a solution and check to get started?
Conjecturing *"I can use information I have gathered to predict or hypothesize about math"*	• Making a prediction about the solution and justifying • Creating a rule based on a pattern or investigation • Revising conjectures based on evidence • Connecting to prior knowledge or skills to solve a new problem	• What might be a reasonable answer? • Is this pattern a rule I can apply to other problems? • Is there any evidence that negates or changes my conjecture about the rule? • What background knowledge can I connect to this problem?

Developed by North Queens Community High School in collaboration with reDesign

Protocol for Talking to Students about Progress/Persistence

North Queens Community High School

Name of student: _____ **Date of meeting:** _____

Class: _____

1. Explain the purpose of the conversation. Give the student some details about why you want to focus on this class with them (difficulty passing in the past, do not like or feel like they can understand the subject, etc.) and talk about what it would mean to be successful in the particular class you are focusing on.

2. Discuss how the class is going so far. Focus on what the student feels is going well and highlight anything you have noticed that is going well.

3. Look at most recent benchmark data, if available, and talk about what is happening in the class. Ask the student where they feel like they are making good progress and where they feel like they are struggling.

4. Look at the productive persistence rubric and ask the student to self-assess how they are performing on the rubric in each category. Record the answers here:

   Growth Mindset: _____

   I can succeed at this: _____

   I belong here: _____

   I value this: _____

5. Ask the student where they feel like their biggest challenge is in the class related to the productive persistence rubric. Set a goal for next week to change one of the areas on the persistence rubric where they are struggling (for example, move from *Emerging* to *Developing* in Growth mindset).

Challenge:	**Goal:**

6. Identify strategies that will help with the change that the student wants to make. Pick one strategy to try in the next week. If this is a strategy that was suggested in previous meetings and not tried, discuss why it was not tried and any additional supports needed to try the strategy this week. Record the strategy here and any follow-up notes:

   _____

   _____

7. Set next meeting and restate goals. Use a growth-mindset phrase and record.

   GM Phrase: _____

8. Thank the student for their time.

Developed by North Queens Community High School in collaboration with Eskolta School Research and Design and NYCDOE Office of Postsecondary Readiness

Productive Persistence Rubric

North Queens Community High School

Academic Mindsets/Productive Persistence						
Category	**Emerging**	**Developing**	**Capable**	**Proficient**	**Mastery**	**Evidence**
Growth Mindset *I believe that I can learn and achieve.*	I believe that intelligence is like eye color- you are smart or not smart and can't change that fact.	I believe that you can get better at some things if you work at them but a person's basic intelligence can't be changed.	I believe that I can get better at things that I've failed at in the past if I work hard enough.	I believe that intelligence is changeable— if you work hard you can get smarter	I believe that intelligence is changable and if you work hard you can get smarter. I seek out challenging things as ways to increase my intelligence.	
I can succeed at this. *I do things that show that I believe I can succeed.*	I won't try something if I think that I will fail, even just at first. I know the proof that you are good at something is when you catch on right away and I don't want anyone to know that I'm not good at things. I don't ask for help when I am stuck.	I will sometimes try things that I'm not sure I will quickly do well. I can handle making one mistake and will try doing it a different way before giving up. Sometimes I will ask for help, but not in front of other people.	When I start making mistakes I don't immediately give up. I try a couple of different strategies before giving up, including asking for help from my teacher.	I know that making mistakes is part of learning. When things get hard I try as many new strategies as necessary until I accomplish my goal. I will often ask my peers or teacher how I can improve. I Know that you aren't learning if you aren't failing.	I know that making mistakes is one of the biggest parts of success. While I might get discouraged or take a break after I make a mistake, I always return to the problem and try it a different way. If I can't think of the next thing to try I will ask my teachers or peers to get their ideas. I know that if I keep trying to understand I will eventually succeed.	
I belong here. *I belong in the learning context.*	I really don't feel like I belong here. None of the adults know who I am and I don't always feel safe.	I don't always feel like I belong here. Very few adults know who I am and I only have a few friends, but I usually feel safe.	Most of the time I feel like I belong here. A few adults know who I am and I have some friends. If I ask them for support, they will give it to me.	I feel like I belong here. Lots of the adults know who I am and I have some good friends. I try to offer support to my peers and help other people feel like they belong.	I belong here. I have good relationships with a lot of the adults at school and offer support to my fellow students. I try to make sure that new students feel like they belong too.	
I value this. *I believe the learning material has value.*	I don't really see the value of this class. It isn't interesting or useful and I don't see how doing well would benefit me in the real world.	I see little value in this class. I know that doing well in school is good for me, but this class isn't interesting or useful. I don't see how the information would benefit me in the real world.	I care about how I do in this class. I find the content either interesting or useful and I can see how doing well in this class would benefit me in the real world.	I care about how I do in this class. I think doing well in school is important, I see how this class is relevant to my future success	I really care about how I do in this class. I think doing well in school is important, I find this class useful and interesting and I work hard to make connections between this class and my life and dreams outside of school.	

Developed by North Queen Community High School in collaboration with Eskolta School Research and Design and NYCDOE Office of Postsecondary Readiness