# Achievement First: Middle School Math Program Overview | 2013

## Overview

The purpose of this document is to clarify the core pillars of our mathematics program along with the key indicators of excellence.

## Alignment to our Mission

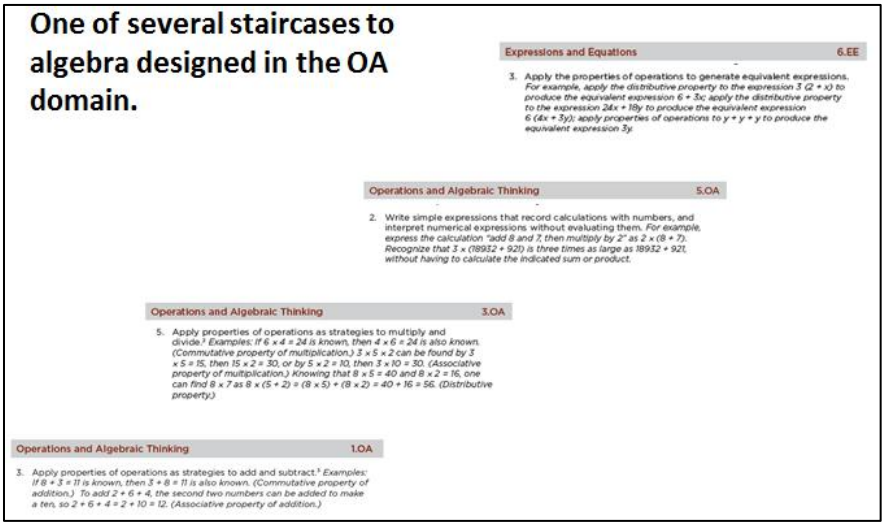
For students to thrive in the world they will face after college, they must understand mathematics, be able to reason about mathematics, and call-on appropriate math tools and algorithms as needed. They must be analytical thinkers and both fluent and flexible with numbers. In order to prepare students to have the career options they want in life, we must first prepare them for the rigors of middle school, high school, and college level work by aligning to the Common Core State Standards. To succeed, student's flexibility with mathematics must begin in kindergarten and continually evolve. In Mathematics classes, we do this by supporting students in understanding concepts, building fluency, and solving problems at a rigorous but developmentally appropriate level.

## Core Goals of Achievement First's Mathematics Program:

1. **FOCUS: Focus strongly where the standards focus**
   - Significantly narrow the scope of content and deepen how time and energy is spent in the math classroom.
   - Focus deeply on what is emphasized in the standards, so that students gain strong foundations.

| Grade | Focus Areas in Support of Rich Instruction and Expectations of Fluency and Conceptual Understanding |
|---|---|
| K–2 | Addition and subtraction - concepts, skills, and problem solving and place value |
| 3–5 | Multiplication and division of whole numbers and fractions – concepts, skills, and problem solving |
| 6 | Ratios and proportional reasoning; early expressions and equations |
| 7 | Ratios and proportional reasoning; arithmetic of rational numbers |
| 8 | Linear algebra; linear functions |

2. **COHERENCE: Across grades and linked to major topics**
   - Carefully connect the learning within and across grades so that students can build new understanding on foundations built in previous years.
   - Begin to count on solid conceptual understanding of core content and build on it. Each standard is not a new event, but an extension of previous learning.



3. **RIGOR: In major topics, pursue conceptual understanding, procedural skill and fluency, and application**
    - The CCSSM require a balance of:
        - Solid conceptual understanding
            - Conceptual understanding supports the other aspects of rigor (fluency and application)
        - Procedural skill and fluency
            - The standards require speed and accuracy in calculation

| Grade | Standard | Required Fluency |
|---|---|---|
| 5 | 5.NBT.5 | Multi-digit multiplication |
| 6 | 6.NS.1,2,3 | Fraction division<br>Multi-digit division<br>Multi-digit decimal operations |
| 7 | 7.NS.1-3<br>7.EE.4 | Operations with rational numbers<br>Solve equations |
| 8 | 8.EE.7 | Solve equations |

        - Application of skills in problem solving situations
            - Students can use appropriate concepts and procedures for application even when not prompted to do so
    - Pursuit of all three requires intensity in time, activities, and resources

## To achieve these goals, our Mathematics program needs to address the following:

- **THE WHAT**
    - **Vertical and Standards alignment:** In order to prepare scholars for the world they will face after college, we must first prepare them for the rigors of middle school, high school, and college- level work by aligning to the Common Core, AP, and College Readiness standards. Across the K-12 spectrum, the level of rigor and amount of independence must thoughtfully and consistently increase.
    - **Focus:** Our curriculum and the amount of time we spend on a given topic must align to the critical areas of each grade level.
    - **Coherence:** Our curriculum must connect the learning across a grade as well as from grade-to-grade. This is especially important as students move from elementary to middle school, from middle school to high school, and from high school to college.
    - **Rigor:** In the Common Core and our curriculum, rigor does not simply mean 'hard problems'. Rigor indicates the balance of learning- conceptual, procedural skill/fluency, and the ability to problem solve.

- **THE HOW**
  - **Teacher Planning and Preparation**
    - Teachers must internalize and customize unit plans, lesson plans, assignments, and assessments for their students. While the approach and outline is agreed upon, no two classes are the same, and thoughtful adjustments should be made by the teacher.
  - **Insist on Quality ORAL & WRITTEN Answers to Standards-Aligned Questions**
    - We must be relentless in insisting on quality answers – in oral thinking, in written work, in the justification of answers, in discussions. This will require intentional and sophisticated planning of multiple question types, as well as continued focus on building teachers' content knowledge. In planning, teachers must both ask the right questions and also include examples of acceptable answers so that they can insist on excellence in oral and written work.
  - **Keep Students Accountable**
    - College readiness standards require us to move beyond an I/We-You instructional approach. Our students will get better at math through tons of practice doing real "heavy lifting" in math, explaining their thinking about math, and writing about math.
    - We must have built-in accountability mechanisms for each part of our math program. This means that student work is graded daily in each component, and students must re-do work that doesn't meet the standard. This also means teachers are very clear about showing students what quality work looks like so that students can meet these expectations.
    - In order to make this level of accountability work, teachers will need clear systems for collecting, grading, giving feedback, and tracking completion for all assignments. Moreover, teachers should use the data they are gathering each day from grading homework, exit tickets, tests, etc. to create intervention groups and to modify questioning and scaffolding based on student needs.
  - **Different types of practice**
    - Students need to understand concepts and show us through writing that they understand concepts. Students need to work on building fluency with facts. Students need to work on building fluency with multiple algorithms. Students need to work on problem-solving situations. Students need to work with partners and groups to solve performance tasks. We want our students to develop intellectual flexibility and the ability to navigate different types of tasks in different environments. Our program – with cumulative review, fact practice, questioning, partner workshops, multi-faceted IP, and problem-solving – does that.
  - **Automatic Interventions:**
    - **Response to intervention:** In order for a mathematics intervention to be effective, the intervention must fill a deficit area in a student's math development. The student may need pre-teaching, re-teaching, fluency development, or conceptual development.
    - **Scheduled:** Intervention times and teachers should be built into the schedule.

| Intervention | How it Works |
|---|---|
| Accountability | Students are pulled after a class is taught because their work did not meet the expectation. They are held accountable for completing top-quality work. |
| Pre-Teach or Re-Teach | Students are pulled before the class (after class) is taught (same day or previous day) and are pre-taught (re-taught) the material or the pre-requisites for the material. Core curriculum resources can and should be used. |
| Fluency | Students are pulled and do work to develop fluency with math facts and operations. When this occurs, students should be given multiple at-bats with immediate feedback to ensure accuracy with computation. |
| Significantly Below Grade-Level | While conceptual understanding is a part of the math block, students with significant conceptual deficits who are well-below grade-level should receive additional practice. A visual, language-less or minimal language program, can and should be used (i.e. Khan Academy, Learn Zillion, ST math). |

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## Math Class – Core Instruction

| Scheduling | Purpose, Aims, and Assessment | Baseline Expectations |
|---|---|---|
| **G5-G8 Math**<br>M-Th<br>Math Class is 90 minutes, broken up into two parts:<br><br>**Core Instruction 60 min**<br><br>Cumulative Review or Targeted Re-Teach<br>30 min<br><br>F<br>**Core Instruction 50 min**<br><br>Cumulative Review<br>0 min | **Purpose:** Students develop strong conceptual understanding of math topics by making connections to previously learned content, applying mathematical practices and applying mathematical concepts and processes to solving real world problems. Students develop precision, flexibility and fluency of grade level specific Common Core fluency standards.<br><br>**Aims:** The aim of the math class is to instruct students using concrete, pictorial and abstract methods and to infuse problem solving to drive students towards mastery. Each math class is part of a logical sequence of aims that allows for students to make connections within a unit and across units and grade levels. Teachers use the best instructional techniques in order to drive student achievement.<br><br>**Planning & Preparation:** Lessons are standards aligned and data driven. Math teachers align enVision, Prentice Hall and Connected Math with the AF S&S. When appropriate, math planners pull from other resources to supplement their primary curriculum. The math planner creates lesson plans, using materials and approaches from primary curricula and pulling from other sources when necessary. Prior to planning, the math planner must read the appropriate CC Progression(s) to develop a thorough understanding of the content. The math planner submits lesson plans for feedback, adjusts plans based on feedback, and presents plans to other math teachers. Each plan includes an intervention and an extension.<br>While planning, teachers ensure that there is problem solving occurring in every math lesson. Teachers incorporate the following approach into their planning when appropriate:<br>*Understand, Plan, Solve, and Check*<br>Understand: Students will analyze the problem by asking what do I know and what do I need to know? They will then utilize another strategy from their toolkit to further understand the problem, such as an organized list, bar model, or picture.<br>Plan and Solve: Based on their understanding, students will create a plan to solve (such as determining the steps they will follow, writing an equation, making a table, etc.), and then find a solution to the problem.<br>Check: Students will then critically examine their solution, optimally by employing another strategy to solve the problem and ensuring they get the same answer. The check is also a check for reasonableness.<br><br>**Assessment:** enVision Topic Tests and Prentice Hall End-Of-Unit Assessments are used with additional IA standards and Prompt Features/Stimuli from IA Blueprints. Daily exit tickets designed to assess the day's aim are expected. Students take weekly or bi-weekly quizzes and/or unit assessments.<br><br>**Resources:**<br>- enVision, Prentice Hall, Connected Math<br>- Better Lesson: plans<br>- Common Core Progressions<br>*Items listed and referenced in this document are general, baseline expectations, although individual schools may choose to operate differently | **Tight, clear, aim and introduction:** The teacher focuses on a specific concept and introduces it in a clear introduction with deliberate scaffolded questioning to enable students to make connections, draw conclusions and identify the key points.<br><br>**Guided Practice:** Teacher provides just the right amount of direction through scaffolded questions.<br><br>**At-Bats:** The teacher chooses the right practice opportunities for students to get meaningful at-bats of the day's concept (Partner Practice and IP) for at least 30% of the lesson's time. The at-bats should vary in rigor and question type so that all students are appropriately challenged and are asked to apply, conceptually understand and fluently use math skills.<br><br>**Discussions:** Two daily discussions with students of their work, misunderstandings, and connections made, that connects to the day's aim, is essential for solidifying student understanding. Daily discussions occur after Guided Practice and after Independent Practice (before the Exit Ticket).<br><br>**Assessment:** The teacher assesses each day through written exit ticket and independent practice, and weekly on the weekly assessment.<br><br>**Planned and Rigorous Questioning:** Teachers ask questions of individual students as well as the whole group during the introduction, guided practice, independent practice and discussions. This questioning vaies in rigor so that all students are appropriately challenged. Teachers have expected responses and use scaffolded questioning to help students "get it."<br><br>**Effective Visual Anchors:** Visual anchors are created before a lesson or with students during the introduction, guided practice and/or discussion to illustrate core concepts, strategies, vocabulary and Criteria for Success. There is a permanent place in the classroom for the long-term visual anchors (i.e. a VA for UPSC should be in the front of class).<br><br>**Checks for Understanding:** During the every section of the lesson, teachers utilize whole class and individual CFUs to gauge student understanding of the content at multiple cognitive levels and adjust instruction using the data collected.<br><br>**Alignment of Time to Activity:** In a 5-8, 60 minute lesson, the Activator lasts no more than 5 minutes, the Introduction 15, the Guided Practice 15, the Discussion/Final CFU 8, the Independent Practice 20, and the Closing and Exit Ticket 8 minutes. |

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## Math Class – Cumulative Review

| Scheduling | Purpose, Aims, and Assessment | Baseline Expectations |
|---|---|---|
| **G5-G8 Math**<br>M-Th<br>Math Class is 90 minutes, broken up into two parts:<br><br>Core Instruction 60 min<br><br>**Cumulative Review** or Targeted Re-Teach **30 min**<br><br>F<br>Core Instruction 50 min<br><br>**Cumulative Review 0 min** | **Purpose:** Lessons are devoted to developing the necessary conceptual understandings and fluency expectations for success at their respective grade level. Lessons also focus on problems that require students to extend their understandings by making connections among standards, clusters and domains within and across grade levels. Students engage in on-going practice in a setting where the teacher can remind and/or scaffold the material and provide feedback on their success or failure with the concepts and applications.<br><br>**Aims:** The aim of cumulative review is to give students a chance to get more practice and build fluency with previously taught standards or standards that are particularly difficult as well as to attempt problems that require application of multiple previously taught standards. The teacher provides guidance and coaching through questioning, reminders about posted visual anchors, and specific feedback pertaining to errors occurring in the students' work. Please note that it is not the aim to re-teach standards that have not been mastered in regular math class.<br><br>**Planning & Preparation:** Teachers select standards for cumulative review based on data and the aims sequence. Data comes largely from quizzes, unit tests and IAs. Cumulative review focuses on questions where students have shown partial to full mastery (yellow or green) with an emphasis on major standards. The aims sequence also informs cumulative review topics during the IA cycle, as once a unit has been completed the core standards from that unit should be rotated into cumulative review. Cumulative review preparation consists of creating 20-30 minutes of work.<br><br>**Assessment:** Cumulative review standards are worked into the weekly assessment, particularly when the class has seen a standard come up in cumulative review on multiple days and the teacher needs to know if the review is having an impact on students' ability to successfully answer these kinds of questions without any support.<br><br>**Resources:** Classwork, Quizzes, enVision, Prentice Hall, Connected Math | **Ratio of Student to Teacher Heavy Lifting:** Cumulative review is done almost entirely by students (independently or in collaboratively), with the teacher assisting only when needed and as unobtrusively as possible.<br><br>**Feedback/Discussion of Work**: After completing cumulative review questions, students have a chance to receive feedback on their work so they know if they have completed the questions correctly or not. This generally takes the form of placing student work under the document camera so the class can discuss the work and determine if it is correct, and correct it if is not.<br><br>**100% Engagement:** All students must be actively engaged in solving the cumulative review problems and in the discussion around those problems that follows.<br><br>**At-Bats:** The teacher chooses the right practice opportunities for students to get meaningful at-bats of the day's concept (Partner Practice and IP) for at least 30% of the lesson's time. The at-bats vary in rigor and question type so that all students are appropriately challenged and are asked to apply, conceptually understand and fluently use math skills.<br><br>**J-Factor:** Cumulative review is an exceptionally joyful time, with scholars having the chance to return to previously mastered material and experience immediate success and/or to face challenging problems and develop their ability to persevere.<br><br>**Pacing and Urgency:** A timer is utilized when working on developing students' procedural fluency in order to promote speed and precision. A timer can also be used for more challenging problems as a means to communicate the duration for which students have been working on a challenging problem in an effort to promote the development of perseverance.<br><br>**Planned and Rigorous Questioning:** As part of planning for cumulative review, teachers have a bank of questions ready for the standard at hand that they have used during the teaching of the standard and can be used to reactivate students' knowledge and scaffold for them as necessary. They also know how deeply they are going to go into a given question during the discussion of the cumulative review, knowing that they have a limited amount of time to spend on it.<br><br>**Effective Visual Anchors:** Visual anchors are created before a lesson or with students during the introduction, guided practice and/or discussion to illustrate core concepts, strategies, vocabulary and Criteria for Success. There is a permanent place in the classroom for the long-term visual anchors.<br><br>**Checks for Understanding:** During every section of the lesson, teachers utilize whole class and individual CFUs to gauge student understanding of the content at multiple cognitive levels and adjust instruction using the data collected. |

# Achievement First: Middle School Math Program Overview | 2013

## Math Re-Teach

| Scheduling | Purpose, Aims, and Assessment | Baseline Expectations |
|---|---|---|
| **G5-G8 Math**<br>M-Th<br>Math Class is 90 minutes, broken up into two parts:<br><br>**Core Instruction (when re-teach aim) 60 min**<br><br>Cumulative Review or **Targeted Re-Teach 30 min**<br><br>F<br>**Core Instruction (when re-teach aim) 50 min**<br><br>Cumulative Review<br>0 min | **Purpose:** Lessons are devoted to standards and skills for which students have previously demonstrated unacceptable levels of mastery (<65%), evidenced by weekly assessment, unit assessment or IA data. The standards or skills to be re-taught may be from the current year of study or from a previous year. Standards or skills from a previous year that will be re-taught must prepare students for success with an up-and-coming unit. Students engage in work that hones in on common misunderstandings and allows students to be reflective of their misconceptions as a means to developing a more coherent understanding of the previously not-mastered material.<br><br>**Aims:** The aim of a math re-teach is to clear up students' misconceptions and drive mastery of previously taught and not-mastered content to ensure success with grade level material. The teacher must approach re-teaching in one of two ways: 1) Teach the content in a new, meaningful way that addresses the previous misunderstandings and moves from a concrete to pictorial to abstract representation; 2) Teach the content through engaging students in error analysis to allow students to reflect on their previous misconceptions and errors. The teacher decides which strategy will more effectively drive student mastery given the extent of misunderstanding.<br><br>**Planning & Preparation:** Teachers must select standards or skills for re-teaching based on student data. Data comes from weekly assessments, unit assessments, IAs (current and from previous year) and diagnostics. Typically, any standard or skill that less than 60 or 65% of scholars have mastered is re-taught. Re-teach can also focus a mathematical practice that students struggle with as evidenced in student data. Typically, daily exit ticket data is not cause to re-teach a skill or concept to the entire class; learning is a process that occurs over time and our expectations for mastery should reflect that. Re-teaching after collecting data for one lesson is appropriate when fluency or complete conceptual understanding is expected after a series of lessons have been taught. When considering up-and-coming units of study, teachers determine the pre-requite skills that will not be taught as part of the grade level unit and assess students to determine whether or not those skills should be re-taught. In preparation for re-teaching a standard or skill, teachers reflect on how the standard or skill was previously taught in addition to the common misconceptions evidenced in the student data; these two considerations will guide the approach the teacher takes when planning the re-teach.<br><br>**Assessment:** Re-taught skills and standards are assessed with a daily exit ticket as well as on weekly assessments. Data collected from these assessments allows the teacher to determine whether students are ready to move forward with new content. Assessments include questions that target the previously identified common misconceptions.<br><br>**Resources:** Classwork, Quizzes, enVision, Prentice Hall, Connected Math | **Tight, clear, aim and introduction:** The teacher focuses on a specific concept and introduces it in a clear introduction with deliberate scaffolded questioning to enable students to articulate why the lesson is being re-taught.<br>**Guided Practice:** Teacher provides just the right amount of direction through scaffolded questions.<br>**At-Bats:** Every student practices. Teachers have a meaningful way for each scholar to access the information and practice. The teacher chooses the right practice opportunity for students to get meaningful at-bats of the day's skills.<br>**Assessment:** The teacher assesses each day through written exit ticket or independent practice.<br>**Planned and Rigorous Questioning:** As part of planning, teachers have pre-determined questions to get students to reflect on and analyze previous misunderstandings as well as to stretch student thinking.<br>**Feedback/Discussion of Work**: At the start of the lesson and/or after completing independent practice, students are given a chance to receive feedback on their work from previous lesson(s) or the day's lesson so they know if they have completed the questions correctly or not. This generally takes the form of placing student work under the document camera so the class can discuss the work, analyze it, determine if it is correct and correct it if is not.<br>**Effective Visual Anchors:** Visual anchors are created before a lesson or with students during the introduction, guided practice and/or discussion to illustrate core concepts, strategies, vocabulary and Criteria for Success. There is a permanent place in the classroom for the long-term visual anchors.<br>**Checks for Understanding:** During the every section of the lesson, teachers utilize whole class and individual CFUs to gauge student understanding of the content at multiple cognitive levels and adjust instruction using the data collected. |

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## Math Interventions

| Scheduling | Purpose, Aims, and Assessment | Baseline Expectations |
|---|---|---|
| 5-8<br>Monday-Thursday<br>45 minutes<br><br>*some schools may be able to accommodate a 45 minute SGI block on Friday, though this is what most AF schools can accommodate on average.<br><br>*Items listed and referenced in this document are general, baseline expectations, although individual schools may choose to operate differently | **Purpose:** For students who are severely underperforming or have mandated small group instruction (SGI) in their IEP, math teachers must provide additional math instruction and practice.<br>Math interventions serve one of three possible purposes.<br>a) The first type of intervention is to hold students accountable for doing top quality work. This type of intervention is appropriate when the student is capable of doing the work but is not doing so at an acceptable level. There may be a minimal amount of coaching or prompting, but the student is generally already capable of doing what needs to be done and understands the core concepts of the math.<br>b) The second type of intervention is appropriate for students who do not understand the math concepts being taught. When this occurs there are two options. The first is to reteach/pre-teach the concept using a different approach then was/will be tried in the lesson. The second option is to back up along the concrete-pictorial-abstract continuum until scholars are at a level where they can be successful.<br>c) The third type of intervention is appropriate for students who are not developing fluency with math facts and operations. When this occurs, students are given multiple at-bats with immediate feedback to ensure accuracy with computation.<br>d) The third type of intervention is appropriate for students who are well behind grade level expectations in a variety of mathematical understandings. These students need remediation of skills and concepts learned in previous grades. This can be accomplished by the teacher examining the standards being taught in the upcoming unit, looking at lower grade versions of those same standards, and then re-teaching the lower grade version of the standards so that scholars will be prepared for the grade level standard when it appears in the unit.<br>**Aims:** The aim of math intervention groups is to provide students who typically have felt unsuccessful with mathematics with excellent instruction targeted to their needs. With additional time, targeted, individualized, small group instruction using concrete, pictorial and abstract representations, and more at-bats, students make greater progress in a given school year.<br>**Planning & Preparation:** Small groups include several components: aim, mental math, procedural fluency practice. Teachers select standards to teach based on student data. Data come from diagnostics, IAs (previous years and current), daily exit tickets, weekly assessments and unit assessments. Teachers determine the root cause of students' misunderstanding and create a teaching plan that develops students' mastery of prerequisite skills and grade level skills using concrete, pictorial and abstract representations. The procedural fluency portion of the block provides each student with practice aligned to their needs and drive towards fluency of grade level expectations. Mental math focuses on developing students' ability to quickly convert among decimals, fractions and percents, recite number facts, and perform other mental calculations that are integral to their success with grade level standards. All SGI groups are planned for by a math teacher and ideally led by one as well. Groups contain between 4 and 8 students.<br>**Assessment:** A diagnostic is administered at the start of the year to gauge levels of students so as to determine which students should receive interventions. The MAP assessment is recommended. Daily exit tickets designed to assess the day's aim are expected. Students take weekly or bi-weekly quizzes and/or unit assessments to assess their understanding of topics learned in small group in addition to what is being taught in whole class.<br>**Resources:** Aligned to the three different types of interventions described above:<br>a) Classwork<br>b) enVision, Learn Zillion, STMath, T.A.I., Prentice Hall, Classwork (from all grades including elementary school), Khan Academy<br>c) Khan Academy, Key math, Learn Zillion<br>d) envision, Learn Zillion, ST Math, Khan Academy, Classwork (from all grades including ES) | **Group Size:** Intervention groups are no larger than 6-8 students in order to maintain an appropriate scholar to teacher ratio when working with our most struggling scholars.<br>**100% Engagement:** All students must be actively listening and participating through the use of high engagement strategies (choral, non-verbal, call-and-response, etc)<br>**At-Bats:** The teacher chooses the right practice opportunities for students to get meaningful at-bats of the day's concept, mental math topics and procedural fluency foci. The at-bats should vary in rigor so that all students are appropriately challenged.<br>**Assessment:** The teacher assesses each day through written exit ticket or independent practice and weekly on the weekly assessment.<br>**Planned and Rigorous Questioning:** Teachers have pre-determined questions to stretch student thinking and differentiate (why, how do you know, scaffolded questioning).<br>**Cumulative Review:** Students get multiple opportunities to systematically and successfully review and practice a variety of skills they have previously mastered or been introduced to in order to build fluency.<br>**Alignment of Time to Activity:** In a 5-8, 45 minute small group lesson, the Introduction 10, the Guided Practice 10, the Independent Practice 10 the Discussion 2, the Exit Ticket 3 minutes, the mental math 2, and the procedural fluency practice 8.<br>**Effective Visual Anchors:** Visual anchors are created before a lesson or with students during the introduction, guided practice and/or discussion to illustrate core concepts, strategies, vocabulary and Criteria for Success. There is a permanent place in the classroom for the long-term visual anchors.<br>**Checks for Understanding:** During the every section of the lesson, teachers utilize whole class and individual CFUs to gauge student understanding of the content at multiple cognitive levels and adjust instruction using the data collected. |