Grade 6-8 Instructional Routines

Algebra Talk

What: One expression is displayed at a time. Students are given a few minutes to quietly think and give a signal when they have an answer and a strategy. The teacher selects students to share different strategies for each one, “Who thought about it a different way?” Their explanations are recorded for all to see. Students might be pressed to provide more details about why they decided to approach a problem a certain way. It may not be possible to share every possible strategy for the given limited time; the teacher may only gather two or three distinctive strategies per problem. Problems are purposefully chosen to elicit different approaches.

Where: Warm-ups

Why: Algebra Talks build algebraic thinking by encouraging students to think about the numbers and variables in an expression and rely on what they know about structure, patterns, and properties of operations to mentally solve a problem. Algebra Talks promote seeing structure in expressions and thinking about how changing one number affects others in an equation. While participating in these activities, students need to be precise in their word choice and use of language (MP6).

Anticipate, Monitor, Select, Sequence, Connect

What: These are the *5 Practices for Orchestrating Productive Mathematical Discussions* (Smith and Stein, 2011). In this curriculum, much of the work of anticipating, sequencing, and connecting is handled by the materials in the activity narrative, launch, and synthesis sections. Teachers need to prepare for and conduct whole-class discussions.

Where: Many classroom activities lend themselves to this structure.

Why: In a problem-based curriculum, many activities can be described as “do math and talk about it,” but the 5 Practices lend more structure to these activities so that they more reliably result in students making connections and learning new mathematics.

Group Presentations

Some activities instruct students to work in small groups to solve a problem with mathematical modeling, invent a new problem, design something, or organize and display data, and then create a visual display of their work. Teachers need to help groups organize their work so that others can follow it, and then facilitate different groups’ presentation of work to the class. Teachers can develop specific questioning skills to help more students make connections and walk away from these experiences with desired mathematical learning. For example, instead of

asking if anyone has any questions for the group, it is often more productive to ask a member of the class to restate their understanding of the group's findings in their own words.

MLR1: Stronger and Clearer Each Time
To provide a structured and interactive opportunity for students to revise and refine both their ideas and their verbal and written output. This routine provides a purpose for student conversation as well as fortifies output. The main idea is to have students think or write individually about a response, use a structured pairing strategy to have multiple opportunities to refine and clarify the response through conversation, and then finally revise their original written response. Throughout this process, students should be pressed for details, and encouraged to press each other for details.

MLR2: Collect and Display
To capture students' oral words and phrases into a stable, collective reference. The intent of this routine is to stabilize the fleeting language that students use during partner, small-group, or whole-class activities in order for student's own output to be used as a reference in developing their mathematical language. The teacher listens for, and scribes, the student output using written words, diagrams and pictures; this collected output can be organized, revoiced, or explicitly connected to other language in a display for all students to use. This routine provides feedback for students in a way that increases accessibility while simultaneously supporting meta-awareness of language.

MLR3: Clarify, Critique, Correct

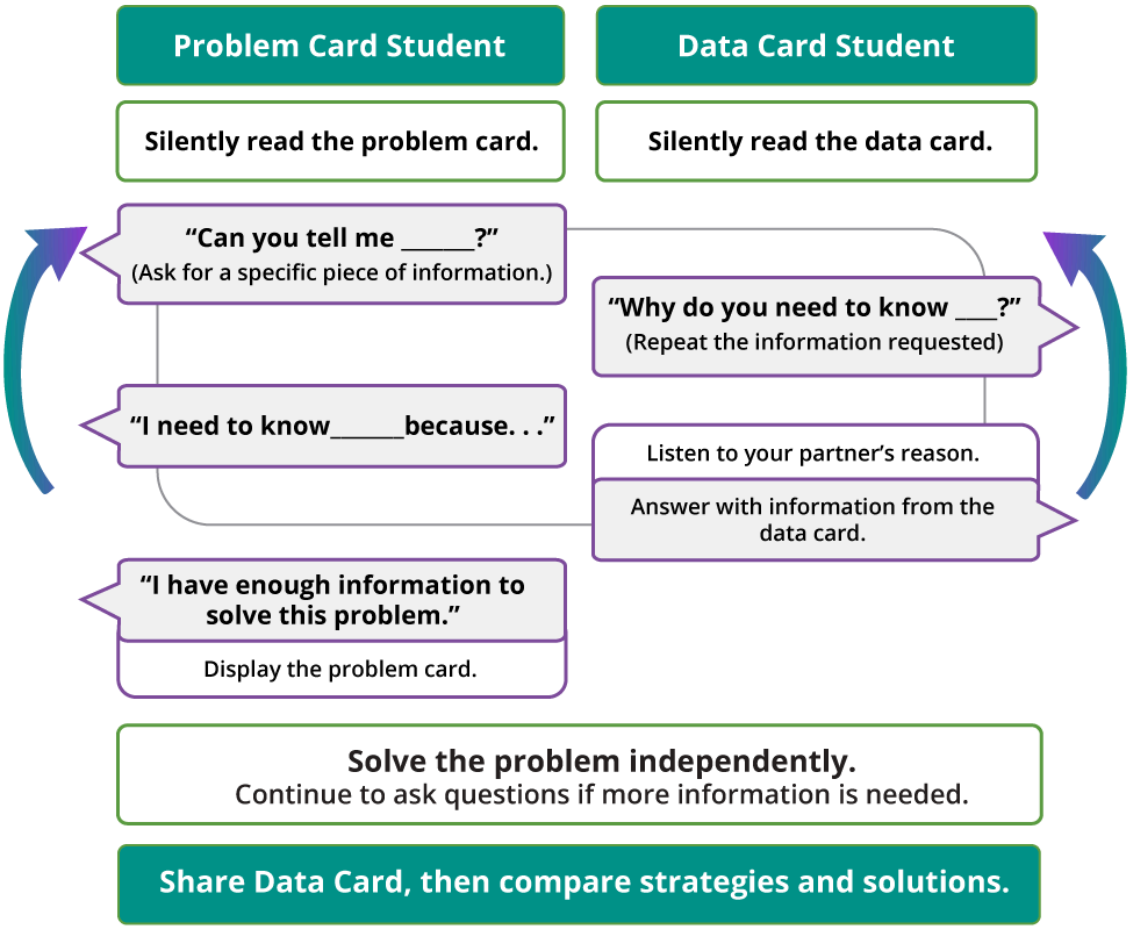
To give students a piece of mathematical writing that is not their own to analyze, reflect on, and develop. The intent is to prompt student reflection with an incorrect, incomplete, or ambiguous written argument or explanation, and for students to improve upon the written work by correcting errors and clarifying meaning. This routine fortifies output and engages students in meta-awareness. Teachers can demonstrate with meta-think-alouds and press for details when necessary.

MLR4: Information Gap Cards

What: Students conduct a dialog in a specific way. In an Info Gap, one partner gets a problem card with a math question that doesn't have enough given information, and the other partner gets a data card with information relevant to the problem card. Students ask each other questions like "What information do you need?" and are expected to explain what they will do with the information. The first few times students engage in these activities, the teacher should demonstrate, with a partner, how the discussion is expected to go. Once students are familiar with these structures, less set-up will be necessary.

Why: This activity structure is designed to strengthen the opportunities and supports for high-quality mathematical conversations. Mathematical language is learned by using

mathematical language for real and engaging purposes. These activities were designed such that students *need* to communicate in order to bridge information gaps. During effective discussions, students should be supported to do the following: pose and answer questions, clarify what is asked and happening in a problem, build common understandings, and share experiences relevant to the topic.



MLR5: Co-Craft Questions

To allow students to get inside of a context before feeling pressure to produce answers, and to create space for students to produce the language of mathematical questions themselves. Through this routine, students are able to use conversation skills as well as develop meta-awareness of the language used in mathematical questions and problems. Teachers should push for clarity and revoice oral responses as necessary.

MLR6: Three Reads

To ensure that students know what they are being asked to do, and to create an opportunity for students to reflect on the ways mathematical questions are presented. This routine supports reading comprehension of problems and meta-awareness of mathematical language. It also supports negotiating information in a text with a partner in mathematical conversation.

MLR7: Compare and Connect
To foster students' meta-awareness as they identify, compare, and contrast different mathematical approaches, representations, and language. Teachers should demonstrate thinking out loud (e.g., exploring why we one might do or say it this way, questioning an idea, wondering how an idea compares or connects to other ideas or language), and students should be prompted to reflect and respond. This routine supports meta-cognitive and meta-linguistic awareness, and also supports mathematical conversation.

MLR8: Discussion Supports
To support rich discussions about mathematical ideas, representations, contexts, and strategies. The examples provided can be combined and used together with any of the other routines. They include multi-modal strategies for helping students comprehend complex language and ideas, and can be used to make classroom communication accessible, to foster meta-awareness of language, and to demonstrate strategies students can use to enhance their own communication and construction of ideas.

Notice and Wonder

What: This routine can appear as a warm-up or in the launch or synthesis of a classroom activity. Students are shown some media or a mathematical representation. The prompt to students is "What do you notice? What do you wonder?" Students are given a few minutes to think of things they notice and things they wonder, and share them with a partner. Then, the teacher asks several students to share things they noticed and things they wondered; these are recorded by the teacher for all to see. Sometimes, the teacher steers the conversation to wondering about something mathematical that the class is about to focus on.

Where: Appears frequently in warm-ups but also appears in launches to classroom activities.

Why: The purpose is to make a mathematical task accessible to all students with these two approachable questions. By thinking about them and responding, students gain entry into the context and might get their curiosity piqued. Taking steps to become familiar with a context and the mathematics that might be involved is making sense of problems (MP1). Note: *Notice and Wonder* and *I Notice/I Wonder* are trademarks of NCTM and the Math Forum and used in these materials with permission.

Number Talk

What: One problem is displayed at a time. Students are given a few minutes to quietly think and give a signal when they have an answer and a strategy. The teacher selects students to share

different strategies for each problem, “Who thought about it a different way?” Their explanations are recorded for all to see. Students might be pressed to provide more details about why they decided to approach a problem a certain way. It may not be possible to share every possible strategy for the given limited time; the teacher may only gather two or three distinctive strategies per problem. Problems are purposefully chosen to elicit different approaches, often in a way that builds from one problem to the next.

Where: Warm-ups

Why: Number talks build computational fluency by encouraging students to think about the numbers in a computation problem and rely on what they know about structure, patterns, and properties of operations to mentally solve a problem. Dot images are similar to number talks, except the image used is an arrangement of dots that students might count in different ways. While participating in these activities, students need to be precise in their word choice and use of language (MP6).

Poll the Class

What: This routine is used to register an initial response or an estimate, most often in activity launches or to kick off a discussion. It can also be used when data needs to be collected from each student in class, for example, "What is the length of your ear in centimeters?" Every student in class reports a response to the prompt. Teachers need to develop a mechanism by which poll results are collected and displayed so that this frequent form of classroom interaction is seamless. Smaller classes might be able to conduct a roll call by voice. For larger classes, students might be given mini-whiteboards or a set of colored index cards to hold up. Free and paid commercial tools are also readily available.

Why: Collecting data from the class to use in an activity makes the outcome of the activity more interesting. In other cases, going on record with an estimate makes people want to know if they were right and increases investment in the outcome. If coming up with an estimate is too daunting, ask students for a guess that they are sure is too low or too high. Putting some boundaries on possible outcomes of a problem is an important skill for mathematical modeling (MP4).

Take Turns

What: Students work with a partner or small group. They take turns in the work of the activity, whether it be spotting matches, explaining, justifying, agreeing or disagreeing, or asking clarifying questions. If they disagree, they are expected to support their case and listen to their partner’s arguments. The first few times students engage in these activities, the teacher should demonstrate, with a partner, how the discussion is expected to go. Once students are familiar with these structures, less set-up will be necessary. While students are working, the teacher can ask students to restate their question more clearly or paraphrase what their partner said.

Why: Building in an expectation, through the routine, that students explain the rationale for their choices and listen to another's rationale deepens the understanding that can be achieved through these activities. Specifying that students take turns deciding, explaining, and listening limits the phenomenon where one student takes over and the other does not participate. Taking turns can also give students more opportunities to construct logical arguments and critique others' reasoning (MP3).

Think Pair Share

What: Students have quiet time to think about a problem and work on it individually, and then time to share their response or their progress with a partner. Once these partner conversations have taken place, some students are selected to share their thoughts with the class.

Why: This is a teaching routine useful in many contexts whose purpose is to give all students enough time to think about a prompt and form a response before they are expected to try to verbalize their thinking. First they have an opportunity to share their thinking in a low-stakes way with one partner, so that when they share with the class they can feel calm and confident, as well as say something meaningful that might advance everyone's understanding. Additionally, the teacher has an opportunity to eavesdrop on the partner conversations so that they can purposefully select students to share with the class.

True or False

What: One statement is displayed at a time. Students are given a few minutes to quietly think and give a signal when they have an answer. The teacher selects students to share different ways of reasoning for each statement. "Who thought about it a different way?" While students may evaluate each side of the equation to determine if it is true or false, encourage students to think about ways to reason that do not require complete computations. It may not be possible to share every possible reasoning approach for the given limited time; the teacher may only gather two or three distinctive strategies per problem. Statements are purposefully chosen to elicit different approaches, often in a way that builds from one statement to the next.

Where: Warm-ups

Why: Depending on the purpose of the task, the true or false structure encourages students to reason about numeric and algebraic expressions using base-ten structure, the meaning of fractions, meaning and properties of operations, and the meaning of comparison symbols. While the structure of a true or false is similar to that of a number talk, number talks are often focused on computational strategies, while true or false tasks are more likely to focus on more structural aspects of the expressions. Often students can determine whether an equation, an inequality, or a statement is true or false without doing any direct computation. While participating in these activities, students need to be precise in their word choice and use of language (MP6).

Which One Doesn’t Belong?

What: Students are presented with four figures, diagrams, graphs, or expressions with the prompt “Which one doesn’t belong?” Typically, each of the four options “doesn’t belong” for a different reason, and the similarities and differences are mathematically significant. Students are prompted to explain their rationale for deciding that one option doesn’t belong and given opportunities to make their rationale more precise.

Where: Warm-ups

Why: Which One Doesn’t Belong fosters a need to define terms carefully and use words precisely (MP6) in order to compare and contrast a group of geometric figures or other mathematical representations.