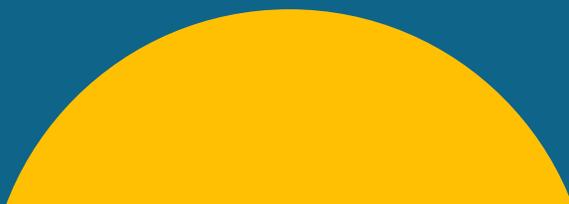


A Pathway to Equitable Math Instruction

SEAD Theme Guidebook: Agency

STRIDE

3



Agency SEAD Theme Guidebook

Agency for Mathematics Grade 6–8

National Council of Teachers of Mathematics (NCTM) Definition of **Agency**: *“the presentation of one’s identity to oneself and to others, combining identity (who we are) with what we can do (agency). Agency is evident in a student’s self-awareness and self-management, and his/her sense of confidence and knowledge about academic work.”*

The Collaborative for Academic, Social and Emotional Learning (CASEL) defines the characteristics of Agency:

- **Self-Awareness**: The ability to accurately recognize one’s own emotions, thoughts, and values and how they influence behavior. The ability to accurately assess one’s strengths and limitations, with a well-grounded sense of confidence, optimism, and a “growth mindset.”
- **Social Awareness**: The ability to take the perspective of and empathize with others, including those from diverse backgrounds and cultures. The ability to understand social and ethical norms for behavior and to recognize family, school, and community resources and supports.
- **Responsible Decision-Making**: The ability to make constructive choices about personal behavior and social interactions based on ethical standards, safety concerns, and social norms. The realistic evaluation of consequences of various actions, and a consideration of the well-being of oneself and others.
- **Self-Management**: The ability to successfully regulate one’s emotions, thoughts, and behaviors in different situations—effectively managing stress, controlling impulses, and motivating oneself. The ability to set and work toward personal and academic goals.
- **Relationship Skills**: The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. The ability to communicate clearly, listen well, cooperate with others, resist inappropriate social pressure, negotiate conflict constructively, and seek and offer help when needed.

CASEL (November 2018) describes the characteristic of agency *in mathematics* as also including:

- **Cultural Competence**: A historically grounded, strengths-focused facility with the relational skills that are valued in the students’ culture of origin.
- **Cultural Fluency**: the capacity to effectively learn about and negotiate cultural differences.

Standards for Mathematical Practice¹

SMP 1: Make sense of problems and persevere in solving them.

(STRONG CONNECTION WITH AGENCY)

Mathematically proficient students start by **explaining to themselves** the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and **plan a solution pathway**, rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to **gain insight into its solution**. They **monitor and evaluate their progress and change course if necessary**. . . . Mathematically proficient students **check their answers to problems** using a different method, and they continually **ask themselves**, “Does this make sense?” They can **understand the approaches of others** to solving complex problems and identify correspondences between different approaches. (Excerpted “Overview of Standards”².)

¹ “Overview of the Standards Chapters of the Mathematics Framework for California Schools,” California Department of Education, 2015, <https://www.cde.ca.gov/ci/ma/cf/documents/mathfwoverview.pdf>.

² “Overview of the Standards Chapters”

Sample Actions / Instructional Strategies Related to Agency and SMP 1

Examples referenced from [ELSF Mathematics Guidance](#):

- ▼ Engage students to create their own problems, justify their arguments, and explain math concepts to others.
- ▼ Use strategic grouping strategies and routines that cultivate discussions, including through Zoom, Google Meet, or a discussion board.
- ▼ Discussion activities such as Numbered Heads Together and Reciprocal Teaching give students a choice in what they will do, and some autonomy in the way they say it.

Examples referenced from [“Supporting ELLs in Mathematics”](#):

- ▼ Use Math Talk to improve the quality of discourse in mathematics conversations (*Classroom Discussions: Using Math Talk to Help Students Learn*³).

Example referenced from [Teachers Development Group](#):

- ▼ Invite a group of students to discuss the mathematical conditions in which an idea will or won't always work. Let students select if they want to be pro or con in the discussion.

³ Suzanne H. Chapin, Catherine O'Connor, and Nancy Canavan Anderson, *Classroom Discussions: Using Math Talk to Help Students Learn* (Sausalito, CA: 2009).

Student Actions ⁴	Teacher Actions ⁵
<ul style="list-style-type: none"> ● Listen to the reasoning of others, compare arguments, and decide whether the arguments make sense. ● Ask clarifying and probing questions. ● Engage in discussions about the math concepts and processes. 	<ul style="list-style-type: none"> ▼ Create a culture that welcomes “rough draft” thinking so that students can solidify their ideas while they are still working them out. ▼ Provide opportunities for academic conversations, with sentence starters or frames. Use student talk to clarify ideas and make connections to other students’ responses. ● Include as much student choice as is reasonable within the activity, so that students have a sense of ownership of the discussion. ● Highlight the ways that one student’s thinking influences others.

⁴ “2017 Kansas Mathematics Standards Flip Book,” Kansas State Department of Education, March 12, 2019, <https://community.ksde.org/LinkClick.aspx?fileticket=iJwuHEM6Qqo%3d&tabid=5646&mid=15542>.

⁵ “2017 Kansas Mathematics Standards Flip Book.”

Summary of Practice / Best Practices / Reflection for Agency and SMP 1

- ▼ Interpret and make meaning of the problem, looking for starting points. Analyze what information is already given to have students explain to themselves/each other the meaning of the problem in their own words. Let them own the problem.
- Invite small groups to plan a solution pathway of their own, instead of jumping to a solution.
- ▼ Identify language demands and provide the language supports that ELs will need to understand the content, such as audio recordings, highlighted key concepts in the text, and modifying the text-based questions if necessary.
- ▼ Engage students in open-ended math discussions. Use mathematics and language development routines to cultivate discussions in pairs and small groups to maximize each EL student's opportunity to use language for academic purposes.
- Save whole-group discussions for the purpose of comparing, contrasting, and connecting the variety of ways of thinking about the mathematics under discussion.
- ▼ Relate current situations to concepts or skills previously learned in order to connect mathematical ideas to one another. A sense of connection builds agency and confidence in the material.
- ▼ Use multilingual/multicultural resources to provide additional scaffolds for ELs. They help students see themselves and their heritage in the learning, which promotes student agency. An overall resource about multilingual resources can be found at the ELSF website: ["Using Multilingual Resources to Support English Learners' Remote Learning."](#)
- ▼ Don't forget all the meaning-making resources and realia that you use in the regular classroom; similar tools are available online and in students' immediate environment. Tools such as virtual manipulatives, Desmos, and GeoGebra provide ELs with additional, dynamic sense-making opportunities.

- ▼ This icon is used to identify strategies and actions particularly beneficial to support ELs in mathematics because they integrate language and content.

Standards for Mathematical Practice⁶

SMP 3: Construct viable arguments and critique the reasoning of others.

(STRONG CONNECTION WITH AGENCY)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They **justify their conclusions, communicate them to others, and respond to the arguments of others**. . . . Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. . . . Students at all grades can listen or read the arguments of others, **decide whether they make sense**, and ask useful questions to clarify or improve the arguments. (Excerpted “Overview of Standards”⁷.)

⁶ “Overview of the Standards Chapters”

⁷ “Overview of the Standards Chapters”

Sample Actions / Instructional Strategies Related to Agency and SMP 3

Examples referenced from [Student Achievement Partners document](#):

- Position students as competent and elevate their status by valuing different contributions students make when they share representations and make connections between these representations, (e.g., tables, graphs, equations, and verbal descriptions of proportional relationships).
- ▼ Use discussion protocols to provide a safe environment for students to share their developing thinking and to allow for interactions where peers value multiple contributions.

Examples referenced from [ELSF Mathematics Guidance](#):

- ▼ [Choose and Defend](#) is a helpful protocol to build up the routinized conversation segments for ELs.
- ▼ [Group Activity: Problem Solving Quadrant](#) is a barrier game for building the vocabulary and content necessary to construct viable arguments.

Examples referenced from other sources:

- ▼ Consider using the [World of Tales](#) to incorporate culturally relevant materials, providing important linkages between the home language and school language.
- When you see that students can do the problem itself with little difficulty, bring in multicultural resources such as the mathematical tale, *One Grain of Rice*, written by Demi, to open up linkages to other ways of thinking. Students may connect with the story in ways they would never link to an equation!

Student Actions	Teacher Actions
<ul style="list-style-type: none"> ● Allow simple brainstorming or Post-it note put-ups to get students to make conjectures in a low-risk setting. ● Examine counter examples for what features they add to the knowledge of the problem. ● Encourage students to have the confidence to justify and defend their conclusions, both mathematically and linguistically. ● Recognize and explain flaws in arguments, which may need to be demonstrated using objects, pictures, diagrams, or actions. 	<ul style="list-style-type: none"> ● Encourage students to use proven mathematical understandings—definitions, properties, conventions, theorems etc.—to support their reasoning. ● Question students so they can tell the difference between assumptions and logical conjectures. ● Ask questions that require students to justify their solution and their solution pathway. ▼ For EL students, create short slide presentations to explain and extend the content in a lesson about constructing arguments. Provide sentence stems for students to choose from in their responses, such as <ul style="list-style-type: none"> ○ Analysis: “How would you explain...? What is the importance of...?” ○ Clarification: “Explain how... What is meant by...?” ○ Cause and Effect: “What connection is there between...?” ○ Comparison: “What is the difference between...? How are they alike?”

Summary of Practice / Best Practices / Reflection for Agency and SMP 3

- Analyze problems and use stated mathematical assumptions, definitions, and established results in constructing arguments.
- Justify conclusions with mathematical ideas, using support from anchor charts and other visual aids.
- When possible, offer students choices in what problems to solve (or create themselves), what methods to use, and how to represent their solutions. They will take much greater ownership of the work and their answers.
- Compare two arguments and determine correct or flawed logic. Be sure to keep the focus on the flaw in the logic, not the person.
- ▼ Use multilingual resources that can “refresh” EL students with concepts they have already learned but may have forgotten. These include posters about content in Spanish or other primary languages, online flashcards, YouTube videos and other sources.
- Online discussion boards can keep the conversation alive over time. Pose questions such as:
 - What made you think that?
 - Can you give me another example so I understand, or an example from the problem itself?

- ▼ This icon is used to identify strategies and actions particularly beneficial to support ELs in mathematics because they integrate language and content.

Standards for Mathematical Practice⁸

SMP 4: Model with mathematics.

(STRONG CONNECTION WITH AGENCY)

Mathematically proficient students can **apply the mathematics they know to solve problems arising in everyday life**, society, and workplace. In middle grades, a student might apply proportional reasoning to **plan a school event** or **analyze a problem in the community**. Mathematically proficient students who **can apply what they know** are **comfortable making assumptions and approximations** to simplify a complicated situation, realizing that these may need revision later. They routinely interpret their mathematical results in the context of the situation, **and reflect on** whether the results make sense, possibly improving the model if it has not served its purpose. (Excerpted “Overview of Standards”⁹.)

⁸ “Overview of the Standards Chapters”

⁹ “Overview of the Standards Chapters”

Sample Actions / Instructional Strategies Related to Agency and SMP 4

Example referenced from [Student Achievement Partners document](#):

- Enhance students' mathematical agency by including regular collaborative opportunities for them to work with others as a team on modeling tasks that provide multiple pathways for success, and that require reasoning and problem solving.

Examples referenced from [ELSF Mathematics Guidance](#):

- ▼ Provide students with access to independent learning. Use online tools that include hyperlinked academic language connected to glossaries, examples, videos, or interactive organizers so that students may choose how to represent themselves in a discussion.
- ▼ Use a Nonverbal and Verbal Communication Routine so ELs can heighten their understanding of others by both seeing and hearing.

Example referenced from [Fostering Math Practices](#):

- Use the routine of Decide and Defend, in which students make sense of another's line of mathematical reasoning, decide if they agree with that reasoning, then draft an argument defending their decision.

Student Actions	Teacher Actions
<ul style="list-style-type: none"> ● Apply mathematics to everyday life. ● Write equations and commentary to describe real-world situations. ● Illustrate mathematical relationships using diagrams, data displays, and/or formulas. ● Identify important quantities and analyze relationships to draw conclusions. ● Check on their own understanding through monitoring, evaluating, and reflecting on their work at different stages. 	<ul style="list-style-type: none"> ▼ Consistently use and model correct content terminology. Provide sentence frames or starters for ELs to model the appropriate phrasing. Support them by having anchor charts, visuals, word walls, etc., with the desired terms. (ELSF Mathematics Guidance) ▼ Demonstrate and provide students experiences with the use of various mathematical models. This also includes linguistic models for ways to express themselves (e.g., theorems). ● Question students to justify their choice of model and the thinking behind the model. Ask students about the appropriateness of the model chosen. ● Recognize that teacher modeling of the terminology as well as the solution pathway is vital to students so that they can become independent in their production.

Summary of Practice / Best Practices / Reflection for Agency and SMP 4

- ▼ Apply the math they know to solve problems in everyday life. Provide real-world contexts regularly for the mathematics they are doing in school.
- Simplify a complex problem by laying out the solution steps, together with the students, as a modeling technique,
- ▼ Represent mathematics to describe a situation in multiple ways, offering students choice in their selection of mathematics tools.
- ▼ Use strong questioning throughout instruction to prompt student meta-cognitive thinking and develop awareness of how they use their language and skills.
- Give students time to monitor, self-assess, and reflect on whether the results make sense, possibly improving/revising the model.
- Include computer-graded checks for understanding or discussion board posts where students can explain their processes and get “just in time” feedback/support from the teacher.
- Make teacher comments to student work available (prior to grading) digitally through word processing, audio recording, drawing, speech-to-text, or screencasting tools.

▼ This icon is used to identify strategies and actions particularly beneficial to support ELs in mathematics because they integrate language and content.

Example of connections to priority content mathematics standards:

Students can develop **Agency** as they engage in a lesson related to “*Understand ratio concepts and use ratio reasoning to solve problems*” (6.RP.A). This can be accomplished by supporting students in SMP 1 utilizing the following actions and strategies:

- ▼ Engage students to create their own problems, justify their arguments, and explain math concepts to others.
- ▼ Create a culture that welcomes “rough draft” thinking so that students can solidify their ideas while they are still working them out.
- ▼ Relate current situations to concepts or skills previously learned and connect mathematical ideas to one another.

Glossary for Agency (from SMPs 1, 3, 4)

Analyze situations and problems: *to study (something) closely and carefully; to learn the nature and relationship of the parts of (something) by a close and careful examination.*

Apply to real-world problems: *to be able to take a process from the abstract (solving word problems) to using it in actual situations requiring the mathematics.*

Ask useful questions to **clarify** or improve arguments/statements: *to make (something) clear or clearer, such as to make (something) easier to understand.*

Compare arguments, recognize and **explain flaws:** *to look at (a statement or series of statements for or against something) closely to see what is similar or different about them, or to decide which one is better, and be able to explain small faults or weaknesses.*

Construct arguments and represent them **coherently:** *to make or create (something, such as an argument) by organizing ideas, words, data, etc., and to describe the argument so that it makes sense to those who are listening.*

Draw and justify conclusions: *to come to a final decision or judgment; an opinion or decision that is formed after a period of thought or research, and to be able to explain one's reasoning for that conclusion.*

Explain to themselves: *to be able to put their reasoning into their own words in order to make sense of the argument or solution. This is part of mindfulness and reflection.*

Listen to, read, and understand the **perspectives** and approaches of others: *to be open to hearing an argument or statement that may be different from one's own and see if it makes sense, perhaps even to shift one's own perspective.*

Monitor and evaluate own progress: *to build in a self-feedback loop along the way, to check in on one's own work during and afterwards. This is a part of reflection, which includes having the student check their answers, ask themselves questions about their work, and possibly change course on their solution pathway.*

Plan a solution pathway: *to think carefully instead of jumping to a conclusion, with the student laying out the steps that s/he will take in order to solve the problem*

Respond to arguments of others: *to say or write something as an answer to a question or an argument from someone else.*

Use assumptions with careful thought: *to offer an idea or argument that is believed to be true or probably true, but that is not known to be true.*

Use/provide **clear, explicit definitions:** *to explain the meaning of a word, phrase, etc., in a way that others can grasp that meaning.*

All definitions taken from the [Merriam Webster English Learners Dictionary \(2020\)](#).