

Instructional Implementation Sequence:
Attaining the CCSS Mathematical Practices
Engagement Strategies

Strategy	Description	Practice	Degree	Matrix Code
Think pair-share	<p>Pair-Share, or Think-Pair-Share, is a strategy easy to implement in any classroom at any grade level or subject. This strategy does not require any other change in pedagogy or materials. For pair – share, teachers merely ask a question or assign a problem and allow students to think and work with a partner for one to three minutes before requesting an answer to the question or problem. In think – pair – share students are given a brief period of time to think independently before working with a partner. While effective in results, this strategy is a significant first step in engaging all students in classroom instructional activities.</p>	<ul style="list-style-type: none"> • Make sense of problems. • Critique the reasoning of others. 	<ul style="list-style-type: none"> • Explain their thought processes in solving a problem one way. • Understand and discuss other ideas and approaches. 	<p>1a I</p> <p>3b I</p>
Showing thinking in classrooms	<p>Teachers need to work toward higher degrees of student involvement in classroom activities. Once pair – share is incorporated into classroom routines, teachers need to incorporate additional strategies that promote “every pupil response” (EPR). EPR strategies include such responses as “thumbs up/thumbs down,” or use of individual white boards for noting answers. Students are also pressed to be more aware of their thinking and express their thinking in more detail. Students are routinely asked to share their thinking in mathematics classrooms. However, what is routinely accepted as thinking is actually process description. Students merely provide the steps they used to solve the problem, not their reasoning and thinking about how they knew which processes</p>	<ul style="list-style-type: none"> • Construct viable arguments. • Attend to precision. 	<ul style="list-style-type: none"> • Explain their thinking for the solution they found. • Communicate their reasoning and solution to others. 	<p>3a I</p> <p>6 I</p>

	to use. In order to reveal student thinking, more challenging, open-ended problems are needed.			
Questioning and wait time	As thinking is increased in mathematics classroom, better questioning and wait time are required. Teachers need to provide thought provoking questions to students, then allow the students time to think and work toward an answer.	<ul style="list-style-type: none"> • Make sense of problems. • Persevere in solving them. • Construct viable arguments. • Critique the reasoning of others. 	<ul style="list-style-type: none"> • Explain their thought processes in solving a problem in several ways. • Stay with a challenging problem for more than one attempt. • Explain their thinking with accurate vocabulary both their own thinking and thinking of others. • Explain other student’s solutions and identify strengths and weaknesses of the solution. 	<p>1a IN</p> <p>1b I</p> <p>3a IN</p> <p>3b IN</p>
Grouping and engaging problems	The strategy of “grouping and engaging problems” is a significant shift in pedagogy and materials. Students are given challenging problems to work, and allowed to work on the problem in a group of two, three, or four. Challenging mathematics problems take time, effort, reasoning, and thinking to solve.	<ul style="list-style-type: none"> • Make sense of problems. • Persevere in solving them. • Reason abstractly and quantitatively. 	<ul style="list-style-type: none"> • Discuss, explain, and demonstrate solving a problem with multiple representations and in multiple ways. • Try several approaches in finding a solution, and seek only hints if stuck. • Reason with models or pictorial representations to solve problems. 	<p>1a A</p> <p>1b IN</p> <p>2 I</p>

		<ul style="list-style-type: none"> • Reason abstractly and quantitatively. • Construct viable arguments. • Critique the reasoning of others. • Model with mathematics. • Use appropriate tools strategically. • Use appropriate tools strategically. • Look for and express regularity in repeated reasoning. 	<ul style="list-style-type: none"> • Translate situations into symbols for solving problems. • Justify and explain, with accurate language and vocabulary, why their solution is correct. • Compare and contrast various solution strategies and explain the reasoning of others. • Use models to represent and solve a problem, and translate the solution to mathematical symbols. • Use the appropriate tool to find a solution. • Select from a variety of tools the ones that can be used to solve a problem, and explain their reasoning for the selection. • Look for patterns, and use if, then reasoning strategies for obvious patterns. 	<p>2 IN</p> <p>3a A</p> <p>3b A</p> <p>4 I</p> <p>5 I</p> <p>5 IN</p> <p>8 I</p>

<p>Using questions and prompts with groups</p>	<p>Once students are provided with opportunities to solve challenging problems in groups, teachers need to increase their ability to ask supporting questions that encourage students to continue working, provide hints or cues without giving students the answers, and ask probing questions to better assess student thinking and current understanding.</p>	<ul style="list-style-type: none"> • Model with mathematics. • Look for and make use of structure. 	<ul style="list-style-type: none"> • Use models and symbols to represent and solve a problem, and accurately explain the solution representation. • Look for structure within mathematics to help them solve problems efficiently. 	<p>4 IN</p> <p>7 I</p>
<p>Allowing students to struggle</p>	<p>Students learn to persevere in solving challenging mathematics problems by being allowed to struggle with challenging problems. Students need to understand that mathematical problems do not usually have a quick, easy solution. Effective effort is a life-skill and should be learned interdependently and independently. Appropriate degree of difficulty is foremost on teachers' minds. If the problem is too easy, students do not need to struggle. If the problem is far too difficult, students are not capable of solving the problem. Teachers need to balance working in groups and working independently, and be able to quickly adjust grouping strategies as the need arises.</p>	<ul style="list-style-type: none"> • Persevere in solving them. • Model with mathematics. • Use appropriate tools strategically. • Attend to precision. • Look for and make 	<ul style="list-style-type: none"> • Struggle with various attempts over time, and learn from previous solution attempts. • Use a variety of models, symbolic representations, and technology tools to demonstrate a solution to a problem. • Combine various tools, including technology, explore and solve a problem as well as justify their tool selection and problem solution. • Incorporate appropriate vocabulary and symbols in communicating their reasoning and solution to others. • Compose and decompose number situations and 	<p>1b A</p> <p>4 A</p> <p>5 A</p> <p>6 IN</p> <p>7 IN</p>

		<p>use of structure.</p> <ul style="list-style-type: none"> • Look for and express regularity in repeated reasoning. 	<p>relationships through observed patterns in order to simplify solutions.</p> <ul style="list-style-type: none"> • Find and explain subtle patterns. 	8 IN
Encouraging reasoning	<p>Students need to be encouraged to carefully think about mathematics, and to understand their level of knowledge. They also need to be able to accurately communicate their thinking. Reasoning, in this context, is used to convey having students stretch their understanding and knowledge to solve challenging problems. Reasoning requires students to pull together patterns, connections, and understandings about the rules of mathematics, and then apply their insight into finding a solution to a difficult, challenging problem.</p>	<ul style="list-style-type: none"> • Reason abstractly and quantitatively. • Attend to precision. • Look for and make use of structure. • Look for and express regularity in repeated reasoning. 	<ul style="list-style-type: none"> • Convert situations into symbols to appropriately solve problems as well as convert symbols into meaningful situations. • Use appropriate symbols, vocabulary, and labeling to effectively communicate and exchange ideas. • See complex and complicated mathematical expressions as component parts. • Discover deep, underlying relationships, i.e. uncover a model or equation that unifies the various aspects of a problem such as discovering an underlying function. 	<p>2 A</p> <p>6 A</p> <p>7 A</p> <p>8 A</p>