



## A Variety of Ways to Assess Fact Fluency Assessing the Three Phases of Understanding



### De-emphasis of rote work

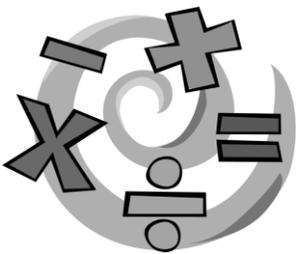
Fluency with the math facts is an important component of any student's mathematical learning. Research has shown that an overemphasis on memorization and the frequent administration of timed tests is counterproductive. Both of these can produce undesirable results (Isaacs and Carroll, 1999; Van de Walle, 2001; National Research Council, 2001). We encourage the use of strategies to find facts, so students become confident they can find answers to fact problems that they do not immediately recall.



### Appropriate assessment

The goal of the math facts assessment program is to determine the degree to which students can find answers to fact problems quickly and accurately and whether they can retain this skill over time. Teachers assess students' knowledge of the facts through a variety of ways. Some suggestions are listed below. They are broken down by assessments that can be done within the three phases of understanding.

### Phase I: Constructing operational meaning



Through the use of manipulatives, pictorial representations, as well as problem solving context, students will begin to develop a conceptual understanding of each of the operations and how they are related. In this stage, students decompose and compose number as well as solve real-life problems involving combining, separating, part/whole relationships, equal groups, and comparing sets to develop a sense of number and how it is related to the mathematical operation.

Addition/Subtraction	Multiplication/Division
<ol style="list-style-type: none"><li>1. Build addition and subtraction number sentences with manipulatives.</li><li>2. Represent an addition and subtraction number sentence with a part-part whole mat.</li><li>3. Word problems that require an understanding of the operation.</li><li>4. Pictures to represent addition and subtraction number sentences.</li></ol>	<ol style="list-style-type: none"><li>1. Build multiplication arrays or other multiplication and division models, such as circles and stars.</li><li>2. Place manipulatives in groups to represent division number sentences to represent a fair share.</li><li>5. Word problems that require an understanding of the operation.</li><li>3. Pictures to represent multiplication and division number sentences.</li></ol>

## Phase II: Reasoning strategies

When focusing on the acquisition of basic math facts Phases I and II are by far the most critical. Phase II involves the student in seeking efficient mental strategies for the solving of basic number combinations. While developing an awareness of many specific strategies, students will become adept with some strategies and their application to solve facts that are not yet retained. During this stage, students will use mathematical properties as well as decomposing and composing numbers to reason through mental computation. This phase develops through the use of the brief systematic daily instruction over time.



1. Teacher observation of strategies and student performance on the "5 a day: Daily Instruction to Develop Fact Fluency
2. Have students complete an open sort where they identify which strategies they would use to solve problems in the sort.
3. Have students complete a closed sort where they sort facts according to specific strategies that are defined in the sort. It is important to accept any reasonable answer, since students can use many strategies to solve the same fact.
4. Have students' circle ten facts on a list of facts, which ones they would use a specific strategy to solve, such as make a ten, doubles, near doubles, counting up, or zero facts.
5. Teacher observations as students are solving problems. If students are head bobbing or counting on fingers, it shows that the student needs more work with Phase I.
6. Observe students as they work on basic fact games that are geared towards the application of specific strategies.
7. Individual Oral Assessments can be used to determine how fluent students are with specific strategies. The teacher presents the student with a number of facts and the students will respond with the answer. At the end of the session, the teacher can show the child how to use strategies that the child has mastered to solve the unknown facts.

## Phase III: Working toward quick recall

Quick recall of math facts is usually defined as the ability to solve a basic number computation in a few seconds or less (without resorting to inefficient methods like counting). This is somewhat different than "instant recall" in that it does not preclude a student's ability to use a known fact to quickly derive an unknown one. Phase III is simply about increasing a student's quick recall. Spending more time in Phase III will not lead to quick recall of unknown facts. Successfully addressing Phases I and II will significantly decrease the need for prolonged work in Phase III.



1. **Short strategy assessments** that help children apply specific strategies that they have learned. This information could be charted to demonstrate which strategies children have mastered and which ones they still need work with. These assessments have a few problems that are similar in that they use the same strategy. By using these assessments it will help build mastery and automaticity with specific strategies.
2. **Self assessments**, where students record his or her progress on Facts that they know charts and determine which facts they still need to study. Students can also sort their flash cards into two piles (facts that they know and facts they still need to work on)
3. **CCPS Basic Fact Expectation Assessments** of all facts for each operation are used sparingly in Grades 2-5 (no more than one per month) to assess students' progress with fact fluency.
4. **Computer Games and Software** can be used to assess student understanding and fluency with facts. FASTMath is an excellent software program that is designed to track, which facts students has mastered, and uses them to solve unknown problems. Factdash.com as well as multiplication.com are some other sites, which can be used to assess fact fluency. (See Internet Basic Facts Fluency Practice)
5. **Basic Fact Games** are another way to assess fact fluency, since through the use of games and other center activities, students are able to build accuracy, efficiency, and flexibility with strategies to ensure quick recall of basic facts.