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An Introduction to Formative Assessment Classroom Techniques (FACTs)

WHAT DOES A FORMATIVE ASSESSMENT-CENTRED CLASSROOM LOOK LIKE?

In a primary classroom, students are having a "maths talk" to decide which figures are triangles. After using a *Card Sort* strategy to group picture cards as "triangles" and "not triangles", the teacher encourages the students to develop a list of characteristics that could be used to decide whether a figure is a triangle. As students share their ideas and come to an agreement, the teacher records the characteristic and draws an example and nonexample to further illustrate the idea. She then gives students an opportunity to regroup their cards, using the defining characteristics developed as a class. As the students discuss the results of their sorting process, she listens for and encourages students to use the listed characteristics to justify their choices. Throughout the discussion, the class works together to revise the triangle characteristics already listed and to add additional characteristics that were not included in the initial discussion.

In an intermediate classroom, the teacher uses a *Justified List Probe* to uncover students' explanations of how to determine equivalent and non-equivalent sums and differences of various two-digit numbers (for example, is 23 + 42 equal to 42 + 23? Is 23 + 42 equal to 22 + 43? Is 42 – 23 equal to 23 – 42? Is 42 – 23 equal to 43 – 22? Using the *Sticky Bars* strategy to anonymously display students' ideas, the teacher and the class can see that many students believe that both sums and differences are equivalent regardless of the order of the numbers. Knowing that this is a common misunderstanding cited in the research literature and seeing that the data from her own class mirrors that misunderstanding, the teacher designs a lesson that involves the students in using manipulatives to model the addition and subtraction of various two-digit numbers. After students experience modelling the operations, they revisit their original ideas and have an opportunity to revise them. The next day, students are given the task of defining the commutative property of addition. They work in small groups with *Whiteboards* to demonstrate the commutative property for addition and explain why there is no commutative property for subtraction. At the end of the lesson, students use *I Used to Think … But Now I Know …* to reflect on their original thinking about whether the sums and differences were or were not equivalent.

In a middle years classroom, the students use a *P-E-O Probe* to predict the number line location of the results of a number of multiple multiplication and division problems. Using the *Human Scatter Graph* technique, the teacher quickly sees that students differ in their responses and their confidence in their answers regarding whether multiplication always makes bigger and division always makes smaller. Knowing that this would be a difficult idea to change, the teacher provides students with various visual representations of multiplication and division with whole numbers, decimals, fractions and integers using an interactive technology-based program. For multiple problems, students observe the modelling of the operation and discuss the pattern of results with various number types. After the demonstration and class discussion, the students use *Thinking Logs* to reflect on their new ideas regarding the effects of multiplication and division.

In a secondary school geometry class, small groups of students are using a collection of *Examples and Nonexamples* to discuss and reconcile their different ideas about whether the information provided about a figure is sufficient to determine whether that figure is a parallelogram. With the goal of consensus, students within each group justify their choice, trying to persuade others who disagree. As the groups work to produce justifications that will be shared with the whole class, the teacher circulates among the group, probing further and encouraging argumentation. Students write a *Two-Minute Paper* at the end of class to share their thinking with the teacher and describe the information needed to determine whether a figure is a parallelogram. The teacher uses this information to prepare for the next day's lesson on conditions of parallelograms.

What do all of these classroom snapshots have in common? Each of these examples embeds formative assessment techniques into instruction for a specific teaching and learning purpose. Often it is hard to tell whether a particular technique or strategy serves an instructional, assessment or learning purpose because they are so intertwined. Students are learning while at the same time the teacher is gathering valuable information about their thinking that will inform instruction and provide opportunities for students to surface, examine and reflect on their learning.

Each of these snapshots gives a brief glimpse into the different techniques teachers can use in their lessons to promote student thinking, uncover students' ideas and use information about how their students are progressing conceptually to improve their instruction. The teaching strategies in these snapshots are just a few of the 75 formative assessment classroom techniques (FACTs) described in Chapter 4 that, along with the background on formative assessment described in Chapters 1 to 3, will help you understand and effectively use these techniques. While you may be tempted to skip ahead and go directly to Chapter 4 to find FACTs you can use in your classroom, you are encouraged to read all of the chapters in this book. The image and implementation of formative assessment in your classroom will be sharper and more deliberately focused if you have a firm knowledge base about the purposes and uses of formative assessment, including clearly articulated learning goals, before you select a FACT.

WHY USE FACTS?

Every day, mathematics teachers are asking questions, listening carefully to students as they explain their thinking, observing students as they work in groups, examining students' writing and representations, and orchestrating classroom discourse that promotes the public sharing of ideas. These purposeful, planned and often-spontaneous teacher-to-student, student-to-teacher and student-to-student oral and written interactions involve a variety of assessment techniques. These techniques are used to engage students in thinking deeply about their ideas in mathematics, uncover the thinking students bring to their learning that can be used as starting points to build upon during instruction, and help teachers determine how well individual students and the class are progressing towards developing mathematical understanding.

The 75 mathematics FACTs described in this book are inextricably linked to assessment, instruction and learning. The interconnected nature of formative assessment clearly differentiates the types of

> "Assessment for learning is any assessment for which the first priority in its design and practice is to serve the purpose of promoting pupils' learning. It thus differs from assessment designed primarily to serve the purposes of accountability, or of ranking, or of certifying competence" (Hodgen & Wiliam, 2006).

#1. A & D STATEMENTS

Description

Students use *A & D Statements* to analyse a set of "fact or fiction" statements. In the first part of *A & D Statements*, students may choose to agree or disagree with a statement or to state that they need more information. In addition, they are asked to describe their thinking about why they agree, disagree or are unsure. In the second part of the FACT, students describe what they can do to investigate the statement by testing their ideas, examining what is already known, or using other means of mathematical inquiry. Figure 4.1 shows an example of *A & D Statements* for the topic *Fractions*.

Figure 4.1 Fraction *A & D Statements*

Statement	**How Can You Find Out?**
1. 9/16 is larger than 5/8. ___ agree ___ disagree ___ it depends on ___ not sure My thoughts:	
2. Denominators must be larger than numerators. ___ agree ___ disagree ___ it depends on ___ not sure My thoughts:	
3. Decimals can be written as fractions. ___ agree ___ disagree ___ it depends on ___ not sure My thoughts:	
4. Dividing a number by a fraction makes a larger number. ___ agree ___ disagree ___ it depends on ___ not sure My thoughts:	

How This FACT Promotes Student Learning

A & D Statements provide an opportunity for students to practise metacognition (thinking about their own understanding). In addition, this FACT "primes the pump" for mathematical inquiry by having students describe how they could prove each statement using concrete or virtual manipulatives or mathematical procedures, or identify information sources that would help them determine the validity of the statement. When used in small groups, *A & D Statements* encourages mathematical discussion and argumentation. Through the process of defending their ideas or challenging the ideas of others, students may solidify their own thinking, consider the alternative views of others, or modify their own thinking as new information replaces or becomes assimilated into their existing knowledge and beliefs.

How This FACT Informs Instruction

A & D Statements can be used at the beginning of a learning cycle to elicit students' ideas about a mathematical topic. The information helps teachers identify areas where students may need targeted instructional experiences that will challenge their preconceptions and increase confidence in their own ideas. The results can be used to differentiate instruction for selected groups of students who have similar ideas about the topic. Students' descriptions of how they can find out whether the statements are correct provide data the teacher can use regarding their ability to prove their ideas or identify appropriate sources of information that confirm their ideas.

Design and Administration

Select *A & D Statements* that focus on specific concepts or procedures that students will encounter in the mathematics curriculum. Develop statements that can launch into mathematical inquiry using manipulatives, learned or invented algorithms and procedures, or use of various information sources. Examine the research on learning to find common errors or misconceptions related to the topic. Use some of these common errors and misconceptions to develop the statements. Try to develop at least one statement each for the *agree*, *disagree* and *it depends on* choices.

Students should first be given the opportunity to respond to the FACT individually. If they choose *disagree* or *it depends on*, ask them to provide an example that refutes the statement or makes the statement true in some cases but not in others. Then, have students discuss their ideas in small groups, coming to consensus on why they agree or disagree with the statement while noting any disagreements among group members. After they have had time to consider others' ideas and design a way to conduct further tests, solve problems or research the information, allow time for small groups to investigate the statements as exploratory activities. These activities provide a common experience for whole-class discussion aimed at resolving discrepancies between students' initial ideas and discoveries made during their explorations. The teacher should listen carefully as the class shares its findings, building off the students' ideas to provide guidance and clarification that will help students accommodate new mathematical understandings.

General Implementation Attributes

Ease of Use: Medium
Cognitive Demand: Medium/High
Time Demand: Medium

Modifications

This FACT can be modified for younger students by focusing on one statement at a time, rather than a set of statements.

Caveats

This FACT should not be used solely as a true-or-false assessment. It is important to provide follow-up experiences for students to investigate the statements, particularly those in which there is a conflict between students' existing ideas and the correct mathematical idea.

Use With Other Disciplines

This FACT can also be used in **science*, social studies, English, health, foreign language, and visual and performing arts.

My Notes

#2. AGREEMENT CIRCLES

Description

Agreement Circles provide a kinesthetic way to activate thinking and engage students in discussing and defending their mathematical ideas. Students stand in a large circle as the teacher reads a statement. The students