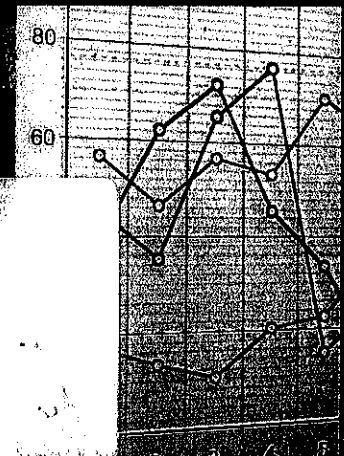


Practical Strategies for Linking Assessment, Instruction, and Learning



Property of:
Christ the Teacher Catholic Schools
Central Library
45A Palliser Way
YORKTON, SK Tel 306.783.8787

1
2

thing 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	

#3. ALWAYS, SOMETIMES, OR NEVER TRUE

Description

Always, Sometimes, or Never True involves a set of statements that students examine and decide if they are always true, sometimes true, or never true. This strategy is useful in revealing whether students overgeneralize or undergeneralize a mathematical concept. In addition, they are asked to provide a justification for their answer. Figure 4.2 shows an example of *Always, Sometimes, or Never True* for a lesson on multiples.

How This FACT Promotes Student Learning

Always, Sometimes, or Never True provides an opportunity for students to practice metacognition (thinking about their own understanding). In addition, this FACT helps students understand that whenever a mathematical assertion is made, it should be checked out to determine whether it always applies, applies in some cases, or never applies. The FACT also encourages mathematical thinking by having students come up with examples and counterexamples to support their answers. When used in small groups, this FACT encourages mathematical discussion and argumentation.

How This FACT Informs Instruction

Always, Sometimes, or Never True can be used at the beginning of a learning cycle to elicit students' prior ideas about a mathematical topic, or it can be used to check for understanding after students have had opportunities to learn about the topic. This FACT is helpful in revealing whether students over-apply or misapply a concept and may point out the limitations

Ease of Use: High
Time Demand: Medium

Cognitive Demand: High

Modifications

This FACT can be modified for younger students by focusing on one statement at a time rather than on a set of statements. To encourage justification, ask students to describe how they would convince someone that it is always true, sometimes true, or never true.

Caveats

Make sure students try out multiple examples for each statement before deciding whether it is always, sometimes, or never true.

Use With Other Disciplines

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

My Notes

As students work in pairs or small groups to sort the cards, they put forth their own ideas for others to consider, strengthen their skills at explaining and justifying their ideas, evaluate the thinking of others, and modify their own thinking as new information persuades them to reconsider their original ideas. Since card sorts can often have a variety of outcomes, this helps students recognize that there can sometimes be more than one right answer in mathematics. Card sorts can also be used to help students revisit material they learned previously in order to scaffold their learning for the next lesson.

How This FACT Informs Instruction

Card Sorts provide a way for the teacher to elicit students' preconceptions, assess students' ability to transfer knowledge when provided with new examples or contexts, and look for areas of uncertainty or disagreement among students that may signify the need for further instructional opportunities. *Card Sorts* are best used in small groups to encourage students to share their thinking with their peers. While students discuss their ideas, the teacher circulates around the classroom listening to students agree, disagree, or express their uncertainty. By probing further as students lay out their cards, the teacher gains specific insights into students' levels of understanding. Using this FACT, if the teacher knows how many cards should go into each category, he or she can in effect observe students' ideas from a distance and quickly evaluate the progress of the different groups. The teacher notes ways of thinking or examples that seem to be problematic to make them the focus for subsequent lessons.

The cards can also be used to orchestrate whole-class discussion. The discourse that ensues provides feedback to learners to help resolve conceptual difficulties, while the teacher maintains a nonjudgmental role as listener and clarifier, guiding students toward the accepted mathematical ideas.

second group received marks (answers marked right or wrong, accompanied by a grade) only; and the third group received both marks and comments. On subsequent tasks, the students who received comments only performed better than the other two groups. The research indicates that feedback that emphasizes only ways to improve versus feedback that passes judgment on students' abilities (marks and grades), even though comments were provided with the marks and grade in the third group, is more effective at getting students to consider and use the feedback for improvement.

How This FACT Promotes Student Learning

The purpose of this FACT is to provide feedback to students on ways they can improve their work. Making comments only is nonjudgmental; on the other hand, students who often receive a marked-up paper with a poor grade (with or without comments) may feel that they aren't "good at math" and fail to use any comments made to improve their work. Likewise, students who get a good grade but can still improve will often ignore the comments when the grade is good, because they feel their work is "good enough." Providing only the feedback they need to improve, without marks and grades affecting their self-esteem, whether it is high or low, provides students with what they need to further develop their understanding and make progress in their learning.

How This FACT Informs Instruction

The primary purpose of this FACT is to provide an alternative to feedback when a grade is not essential. Seeing the difference it makes in learning for their students when comments only are used helps teachers break the cycle of correcting and grading every piece of work.

the room until the teacher instructs them to stop and pick up or hold on to one paper. Students take the paper they end up with and share the answer and explanation that is described on the paper they are holding. They read only from the paper that is in their hand and do not present their own ideas.

How This FACT Promotes Student Learning

Commit and Toss incorporates an essential component of conceptual change teaching and learning—committing to an answer that best matches one's own thinking and providing an explanation for why that answer was chosen. Before students crumple and toss their papers, they must think about the question posed, commit to a response, and explain the thinking that informed the answer they selected. Once answers are anonymously shared, this FACT helps students recognize that it is common for students in a class to have different ideas. Confidence is built when a student realizes that he or she is not the only one to have a different answer. It helps students see that "wrong" answers can be just as valuable for informing learning opportunities and constructing new ideas as "right" answers. It provides a nonthreatening opportunity to make everyone's ideas public regardless of whether they are right or wrong. It allows students to tap into others' thinking, comparing their own ideas with those of others in the class. Since the technique is anonymous, individual students are more likely to reveal their own ideas rather than providing a "safe" answer they think the teacher wants to hear, which may not be what they actually believe.

How This FACT Informs Instruction

Commit and Toss allows the teacher to get a quick read on ideas and explanations held by the class. It is a very engaging way to get a class

the one they caught, ask them to get down the answer from the selected response part. The students can then bring their sticky notes up to the wall or whiteboard and create a class bar graph of the results. This visual display is followed by a discussion of the different explanations on their tossed and caught papers.

Caveats

This is a fun, engaging technique; for that reason, be careful not to overuse it, or it will lose its effectiveness. Remind students to honor anonymity even if they recognize someone's handwriting or get their own paper back. It is also important to establish the norm that disparaging or other types of belittling comments should never be made about the student paper they end up with.

Use With Other Disciplines

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

My Notes

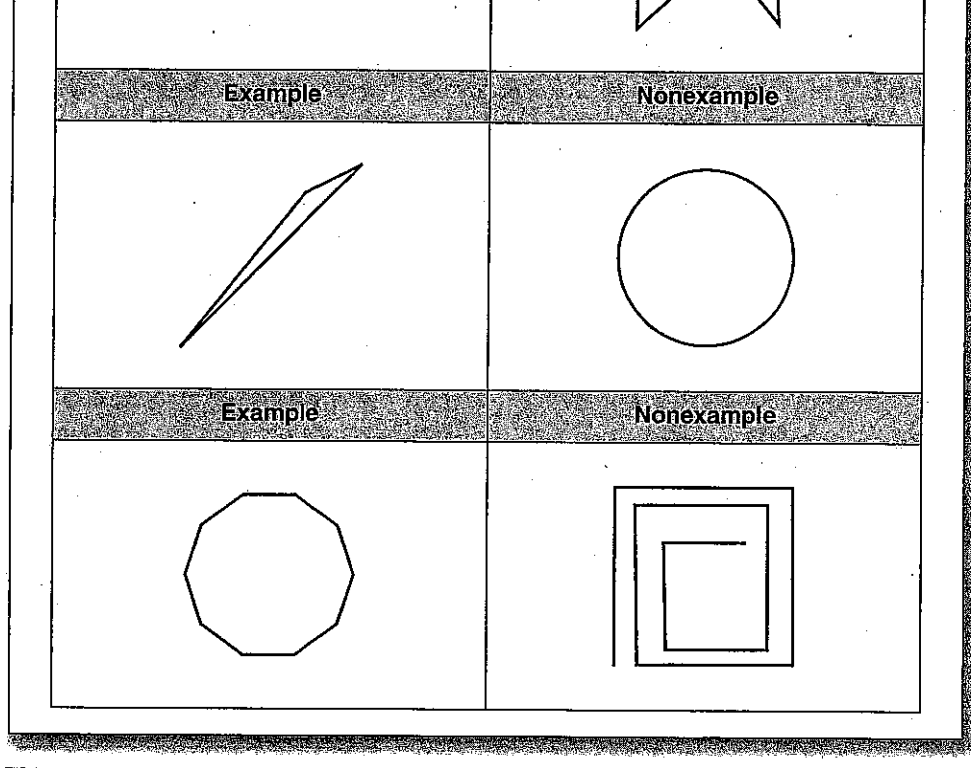
#8. CONCEPT ATTAINMENT CARDS

Description

jects in
e asked
ditional
f a par-
, defini-
ning to
tudy of

r is cru-
ACT can
te a rule
or

ncept or
re asked
examine
r opera-
ematical
generate
r each of
ples and
figure 4.5
: polygon.
lave stu-



Source: Adapted from Rose Tobey & Minton (2010).

General Implementation Attributes

Ease of Use: Medium
Time Demand: Medium

Cognitive Demand: Medium

art using this
more complex

mathematics is



use of graphic
often interpret
ic representa-
; McDermott,

Every Graph Tells a Story helps teachers identify the common errors students make when interpreting a graph. Visuality is a key source of difficulty for students using graphs, particularly in physics situations that involve time and distance. The FACT helps teachers see whether students respond to the visual attributes of the graph by interpreting it literally (for example, interpreting an upward slope as going uphill) or conceptually understand how one type of data in a graph depends upon or is related to another. The information also reveals how well students consider the context of a given graph.

Design and Administration

Choose from a variety of graphic data and types of graphs, preferably representing real-world situations that students are familiar with. Present students with the graph and labeled axes, and develop statements that (1) partially mirror the actual data, (2) mirror literal interpretations of the visual components, and (3) accurately describe the data. Distance-time or position-time graphs are particularly useful for this type of FACT. Have students describe why they selected a particular statement to tell the story of the graph. Provide an opportunity for students to give feedback on others' interpretations. Figure 4.8 is an example of a position-time graph from *Uncovering Student Ideas in Physical Science: 45 Force and Motion Assessment Probes* (Keeley & Harrington, 2010).

General Implementation Attributes

Ease of Use: Medium
Time Demand: Medium

Cognitive Demand: High

Modifications

Description

Successful mathematics students are able to generate examples and non-examples to support their mathematical understanding. Identifying and examining examples and nonexamples reveal students' understanding of a concept as well as how they interpret definitions of mathematical terms.

How This FACT Promotes Student Learning

Coming up with examples and nonexamples requires different cognitive skills from those used to carry out a procedure or memorize a definition. Students need to carefully consider the numbers or objects in terms of their attributes. Often the question asked in the classroom is "Is this an example of . . . ?" In this FACT, students are asked to generate their own examples and describe why they are or are not examples of a particular concept or mathematical term. By asking students to come up with their own examples rather than providing them with examples selected by the teacher, this FACT supports students in learning to generate examples, a critical skill they will use throughout mathematics.

How This FACT Informs Instruction

An understanding of mathematical concepts and terminology is crucial to students' ability to understand and solve problems. This FACT can help teachers assess the extent to which students are able to apply a rule or definition presented to them when learning about a new concept or mathematical term.

Design and Administration

nd graph
ds. This is

ie bottom."

th 

a full stop."

out."

o-cart,

example, if
e between
the vocab-

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

My Notes

#16. FIST TO FIVE

Description

Fist to Five asks students to indicate the extent of their understanding of a concept, mathematical procedure, or directions for an activity by holding up a closed fist (no understanding), one finger (very little understanding), and a range up to five fingers (I understand it completely and can easily explain it to someone else). For example, after giving instructions for a mathematical game, teachers might ask for a *fist to five* to do a quick check on whether students understand the directions before proceeding with the game.

How This FACT Promotes Student Learning

Fist to Five provides an opportunity for all students in a class to indicate when they do not understand a concept, procedure, or set of directions and need additional support for their learning. It is especially effective with individual students who are reluctant to let the teacher know that they are experiencing difficulty during a lesson. It encourages metacognition by raising

#17. FOUR CORNERS

Description

Four Corners is used with selected-response questions to identify and group students who have similar responses to the question asked. Students move to a corner of the room designated to match their response or similar way of thinking.

How This FACT Promotes Student Learning

Four Corners provides an opportunity for students to make their ideas public. By meeting "in the corner" with students who have similar ideas, students can further discuss and clarify their own thinking with others before returning to their seats and engaging in mathematical discussions with the class or small groups of students in which students have a range of conflicting ideas. Members of each corner group can also defend their ideas to the entire class. In the process of explaining their thinking and getting feedback from the teacher and class, students sometimes notice gaps or inconsistencies in their own reasoning and change their ideas to reflect newly accepted information.

How This FACT Informs Instruction

Teachers can visually see which response individual students selected as well as the most prevalent response. By circulating among the corners while students are sharing their thinking,

Description

The *Frayer Model* was first developed by Dorothy Frayer and her colleagues at the University of Wisconsin. The *Frayer Model* graphically organizes prior knowledge about a concept or mathematical term into an operational definition, characteristics, examples, and nonexamples (Buell, 2001). An example of a *Frayer Model* template is shown in Figure 4.11.

How This FACT Promotes Student Learning

The *Frayer Model* helps activate students' prior knowledge about a mathematical concept or word. It provides students with the opportunity to clarify a concept or mathematical term and communicate their understanding by providing an operational definition, describe characteristics (or properties), and list examples and nonexamples from their own prior knowledge of the concept or familiarity with the term. This FACT can also be used to help solidify conceptual understanding after students have had an opportunity to learn about the concept or use the term.

How This FACT Informs Instruction

Frayer Models have typically been used to introduce new terminology. However, for formative assessment purposes, they can be used to determine students' prior knowledge about a concept or mathematical term before planning a lesson. Barriers that can hinder learning may be uncovered with this FACT. Students' completed *Frayer Models* provide a starting point with an operational definition and understandings gained through prior instructional experiences that can be further refined through class discussion and formal clarification of the concept.

in our

per to find

ta. It is

dividing

at friend

lium to High

be by repre-
ual learners,
ving the text
ig. Multiple-
ials can be
question so
etter choices

#20. GIVE ME FIVE

Description

Give Me Five is a technique used to promote and publicly share personal reflections that collectively provide feedback from the group. Students are given a prompt and take a minute or two for a "quiet think." Five students then volunteer to publicly share their reflection.

How This FACT Promotes Student Learning

Give Me Five provides students with an opportunity to individually and publicly reflect on their learning during or after a lesson. This FACT encourages students to be thoughtful reflectors and demonstrates teachers' respect and value for students' sharing personal insights into their learning.

How This FACT Informs Instruction

Selecting five students to publicly share their reflection provides a sample collage for the teacher to gain feedback on how students perceived the impact of a lesson on their learning. *Give Me Five* is a simple, quick technique for inviting and valuing public reflection and welcoming feedback from students that will be used to design responsive instruction.

Design and Administration

Provide a reflection prompt that is inviting and open to a variety of

Observations of teachers' questioning techniques reveal that the same few students are frequently called upon to answer questions. Often, these are the students who raise their hands. Students who do not raise their hands "opt out" of not only responding, but also opt out of thinking if they know they are likely not to be called upon. Because any student can be selected at any time to sit in a "hot seat" and respond to a question, this FACT activates thinking among all learners who must be prepared to give a response.

How This FACT Informs Instruction

This FACT helps teachers provide an opportunity for all students to be ready to respond to questions. During the question-response phase, the teacher can assess individual students' conceptual understanding of a mathematical idea or procedure and where they may be having difficulty. Additionally, the teacher can assess the extent to which the class understands the concept or may need further instruction by listening to the feedback given by the class to the student in the hot seat.

Design and Administration

Place anywhere from one to five chairs in an area of the classroom such as the front of the room to serve as the hot seats. Tell students that you are going to ask a question or series of questions and that different students will be asked to sit in the hot seat or seats to respond to the questions. Distribute the question or questions for the whole class to consider first and prepare their own individual responses. Then ask a student or students to sit in the hot seats to share their responses. The class listens to the responses and provides feedback to the students on whether they agree or disagree with the answers presented and why, or on the strategy used to solve the problem. For problem-solving questions, the students in the hot seat may be encour-

#28. LEARNING GOALS INVENTORY (LGI)

Description

An *LGI* is a set of questions that relate to an identified learning goal in a unit of instruction. Students are asked to "inventory" the extent to which they feel they have prior knowledge about the learning goal. They also describe prior learning experiences related to the learning goal.

How This FACT Promotes Student Learning

The *LGI* activates student thinking about a topic of instruction that targets explicitly identified learning goals. It requires them to think about what they already know in relation to the learning goal statement as well as when and how they may have learned about it. It also helps make the target learning goals explicit to students. A key principle of learning is that students must know what the learning target is. Explicitly sharing learning goals with students raises their awareness of the focus of a lesson.

How This FACT Informs Instruction

The *LGI* provides information to teachers on students' perceptions of their existing knowledge in relation to identified learning goals, including state or national standards. It helps teachers identify areas of student

#33. MUDDIEST POINT

Description

Muddiest Point is a commonly used, quick monitoring technique in which students are asked to take a few minutes to jot down what the most difficult or confusing part of a lesson was for them (Angelo & Cross, 1993).

How This FACT Promotes Student Learning

The *Muddiest Point* provides a metacognitive opportunity for students to think about their own learning and what it is that is difficult or easy for them to understand. It is especially helpful when students encounter new information, complicated procedures, or engage in discussions that result in cognitive conflict. This FACT provides a comfortable outlet for students who are reluctant to speak out and let others know when they are having difficulty understanding a concept or procedure.

How This FACT Informs Instruction

The *Muddiest Point* is a feedback and monitoring strategy used to efficiently collect information on what students find most difficult or confusing about a lesson or part of a lesson. It can be used any time during instruction, including on the spur of the moment when teachers detect that students may be experiencing difficulty understanding a concept or using a procedure. The information provides feedback to the teacher that can be used to modify teaching strategies in order to address student difficulties. Teachers can quickly administer, collect, and sort responses to make immediate decisions about instruction for the whole

#34. NO-HANDS QUESTIONING

Description

Students typically raise their hands when they wish to respond to a teacher's question. With *No-Hands Questioning* students do not put their hands up to respond to a teacher's question. The teacher poses a question, practices *Wait Time*, and calls on students randomly. This FACT acknowledges that everyone needs to be ready to share his or her ideas. It reinforces the notion that everyone's response is important, not just those of students who show they know the answer by raising their hand (Black et al., 2003).

How This Strategy Promotes Student Learning

No-Hands Questioning is used to stimulate thinking and provide an opportunity for all students to be asked to share their ideas, not just students who raise their hands. Often, when a question is asked, hands will shoot up immediately. As a result, the students who take longer to think about a problem stop thinking once they see that others already have the answer. This FACT can increase students' engagement and motivation to think about their ideas and frame a high-quality response, since everyone in the class has an equal chance of being called upon to respond.

How This Strategy Informs Instruction