Operations and Algebraic Thinking: Equal or Not

Grade 1

Formative Assessment Lesson

Designed and revised by the Kentucky Department of Education
Field-tested by Kentucky Mathematics Leadership Network Teachers

Number Relationships (Equal or Not?)   Grade 1

> This Formative Assessment Lesson is designed to be part of an instructional unit. This task should be implemented approximately two-thirds of the way through the instructional unit. The results of this task should be used to inform the instruction that will take place for the remainder of your unit.

Mathematical goals

This lesson is intended to help you assess how well students are able to add and subtract within 20 using various strategies. It will help you to identify students who have the following difficulties:
- Recognizing equivalent equations and expressions
- Using strategies to determine related equations and expressions

Kentucky Academic Standards
This lesson involves mathematical content in the standards from within the grade, with emphasis on:

Grade 1 Operations and Algebraic Thinking
Clusters:
- Understand an apply properties of operations and the relationship between addition and subtraction.
- Add and subtract within 20.
- Work with addition and subtraction equations.

This lesson involves a range of Standards for Mathematical Practice, with emphasis on:
MP2. Reason abstractly and quantitatively.
MP7. Look for and make use of structure.
MP8. Look for and express regularity in repeated reasoning.

Introduction
This lesson is structured in the following way:
- Before the lesson, students work individually on an assessment task that is designed to reveal their current understandings and difficulties. You then review their work and create feedback questions for students to answer in order to improve their solutions.
- Students work in partners on collaborative discussion tasks to match multiple representations of quantities and expressions. As they do this, they interpret the expressions and sort them as equivalent or not. Throughout their work, students justify and explain their decisions to their peers.
- Students return to their original assessment task, and try to improve their own responses.

Materials required

Each individual student will need:
- Two copies of the assessment task *Equal or Not?*

For each pair of students you will need to have available a packet of each of the levels of cards and the t-chart that matches them:
- Card set A
- T-chart A
- Card set B
- T-chart B
- Card set C
- T-chart C

- Snap cubes set of 20 for each student pair. Each bag needs to have the same color cubes if possible.

Time needed
Approximately 15 minutes before the lesson for the individual assessment task, one 40-minute lesson (30 minutes for partner task and 10 minutes for whole class discussion), and 15 minutes for a follow-up lesson for students to revisit individual assessment task. Timings given are only approximate. Exact timings will depend on the needs of the class. All students need not complete all sets of cards.

Before the Lesson
Assessment task: *Equal or Not?* (15 minutes)
Have students do the initial task, *Equal or Not?,* individually in class a day or more before the formative assessment lesson. This will give you an opportunity to assess the work, and to find out the kinds of difficulties students have. You will be able to target your help more effectively in the follow-up lesson. Depending on your class you can have them do it all at once or in small teacher-led groups (they should still work individually).

Framing the pre-assessment: (10-15 minutes):
Give each student a copy of the assessment task *Equal or Not*.
> *Look at the card at the top of the page. Circle all the cards in the space below the card that are equal to it. Then look at the card at the bottom of the page and circle all the cards below it that are equal to it.*

It is important that the students answer the questions without your assistance or use of manipulatives, as far as possible.

Students should not worry too much if they do not understand or cannot answer everything, because in the next lesson they will engage in a similar task, which should help them. Explain to students that by the end of the next lesson, they should expect to answer questions such as these confidently. This is their goal.

Assessing Students' Responses:

- Collect students' responses to the task. Make some notes about what their work reveals about their current levels of understanding, and their different problem solving approaches. <u>We suggest that you do not score student's work.</u> The research shows that this will be counterproductive, as it will encourage students to compare their scores, and will distract their attention from what they can do to improve their mathematics.
- Instead, help students make further progress by summarizing their difficulties as a series of questions. Some questions in the *Common Misconceptions* chart may serve as examples. These questions have been drawn from commonly identified student misconceptions.
- Make notes about what their work reveal about their current levels of understanding and their different problem solving approaches.
- Strategically partner students based on pre-assessment data. Partner students with others who display similar errors/misconceptions on the pre-assessment task. While this may seem counterintuitive, this will allow each student to more confidently share their thinking. This may result in partnering students who were very successful together, those who did fairly well together, and those who did not do very well together.

We recommend you:

- Write one or two questions on each student's work, or
- Give each student a printed version of your list of questions and highlight the questions for each individual student or
- Display a small list of questions on the board that will be of help to the majority of students.
- For younger students, you may need to go over these questions orally, or just use them as you walk around the room and notice mistakes they are making.
- The solution to all these difficulties is not to teach one particular way of solving a problem, but to help students to find a variety of ways that work in different situations and make sense to them.

Below is a list of common issues and questions/prompts that may be written on individual initial tasks or during the collaborative activity to help students clarify and extend their thinking.

Common Issues:	Suggested questions and prompts:
Students may choose expressions that have the same numbers, whether the operation makes sense or not.	**What do the signs in the problem mean?** **What did you do to decide if this was equal or not?** **What did you do to the numbers?**
Students may choose only expressions with the same sign the original expression.	**Can you get the same answer by adding as you can by subtracting?** **Tell a way to make 6 by adding. Tell a way to make 6 by subtracting.**
Students randomly select expressions.	**Does this problem make sense?** **Can you draw a picture to show the problem?** **Does the problem you circled match the picture you drew?**

Suggested lesson outline

Whole Class Introduction (10 Minutes)

Today we are going to do some more work with equal expressions. I have 17 cubes and I am trying to look for different number combinations to make 17. Everyone think how you might decompose 17 into smaller parts/chunks. The teacher shows 8, 8, and 1. Write the expression 8 + 8 + 1 on the board.   Ask students, *"How have I broken my 17 cubes apart? How does this help me see the number 17? Could I break the cubes apart differently? Share with your partner a different way I might have tried."*

Take 13 cubes out of your bag. Think about how you might decompose 13 into smaller parts. Share some of your reasoning with others sitting close to you. Teachers look for specific strategies you have been teaching to share (counting on, making ten, creating easier or known sums, doubles, doubles plus one, etc.)

Collaborative Activity: Sorting Expressions as Equal/Not Equal

Strategically partner students based on pre-assessment data. Partner students with others who display similar errors/misconceptions on the pre-assessment task. While this may seem counterintuitive, this will allow each student to more confidently share their thinking. This may result in partnering students who were very successful together, those who did fairly well together, and those who did not do very well together.

Introduce the lesson carefully:

> *I want you to work in partners. Take turns choosing a card and decide if it is equal to the expression at the top of the T-chart and put it on the equal or not equal side. Each time you do this, explain your thinking clearly to your partner. If your partner disagrees with your match then challenge him or her to explain why. It is important that you both understand why each card is placed where it is. There is a lot of work to do today and you may not all finish. The important thing is to learn something new, so take your time. (Before passing out cards you may choose to model one example for students.)*

Give each pair *Card Set A and T-Chart A.*

During partner work, you are to make notes of student approaches to the task, and to support student problem solving.

Make a note of student approaches to the task
You can then use this information to focus a whole-class discussion towards the end of the lesson. In particular, notice any common mistakes and the strategies students use to solve the problems.

Support student problem solving
Try not to make suggestions that move students toward a particular approach to the task. Instead, ask questions to help students clarify their thinking. Encourage students to use each other as a resource for learning.

If one student has placed a particular card, challenge their partner to provide an explanation.

If the whole class is struggling on the same issue, then you may want to write a couple of questions on the board and organize a whole class discussion.

If you find students have difficulty articulating their decisions, then you may want to use the questions from the *Common Issues* table to support your questioning.

This task is designed for students to apply mental strategies they have been developing during the unit of instruction. Manipulatives should only be considered for students who have exhausted all other strategies.

Card Set B and T-chart B
As students finish with sorting card set A and can explain their work, hand out card set B and T-chart B. These are slightly more difficult.

As you monitor the work, listen to the discussion and help students to look for patterns and generalizations. The following patterns may be noticed: doubles +1, doubles -1, making 10, subtracting through 10.

Card Set C and T-chart C
As students finish sorting card set B and can explain their work, hand out card set C and T-chart C. Continue to monitor work and listen to discussion. ***Note that all students may not get to this level***. Allow students to work as long on a level as they need to without the expectation that all groups will complete all levels.

Taking two class periods to complete all activities
If you have to divide the lesson into two class periods, you may want to have a way for students to save the work they have done with sorting the card sets. You may have them tape the cards down to the T-chart. You may chose to have them do this even if you are not dividing up the class period to use as a visual during the class discussion.

Extension activities
Ask students who finish all of the sets quickly to make their own t-charts with a new expression and make cards that are equal and not equal.

Plenary whole-class discussion (10 minutes)
Call on students or groups to explain why various expressions are equal or not equal and the strategies used for some of the equivalent expressions.

You might have students discuss other expressions that would be equal for each set and how they know they are equal. Perhaps give each student a mini-whiteboard, pen, and eraser and have them write an expression that is equal.

Conclude the lesson by discussing and generalizing what has been learned. The generalization involves first extending what has been learned to new examples, and then examining some of the conclusions the students come up with.

Improving individual solutions to the assessment task (10 minutes)
Return to the students their original assessment, *Equal or Not?* You may want to give them a clean copy as well.

> *Look at your original responses and think about what you have learned during this lesson.*
> *Using what you have learned, try to improve your work.*

If you have not added questions to individual pieces of work then write your list of questions on the board. Students should select from this list only the questions appropriate to their own work. With first graders, you may only focus on the questions students really seemed to need and state these out loud and ask them again as you move around the room or work with a small teacher led group at a time.

Equal or Not?

Circle all the cards that are equal to the top card.   NAME_____

7+8

7+7+1	5+6+4
15-8	7+3+5
6+6+3	7+6+1

17-9

17-7-2	1+7
9+8	9+9+1
17-8	17-10

7

3+7

Equal	Not Equal

7+1+2

Card Set A

6+4

Card Set A

3+2+5

Card Set A

13-7

Card Set A

5+5

Card Set A

7+3

Card Set A

10-3

Card Set A

7+3+10

Card Set A

8+11

Equal	Not Equal

10+8+1	10+9	19+8	20-1
Card Set B	Card Set B	Card Set B	Card Set B

11+4+4	12+7	8-19	1-20
Card Set B	Card Set B	Card Set B	Card Set B

11

14-8

Equal	Not Equal

14+2 Card Set C	10+4 Card Set C
14-6-2 Card Set C	10-4 Card Set C
8+6 Card Set C	14-4-4 Card Set C
10-8-2 Card Set C	8-14 Card Set C