District 287 Student Interview Protocol Instructions and Student Recording Sheets
Equality

Attached are the masters for problems you will use in your interview with three students from your classroom. The attachments are as follows:

- Protocol goals and directions (pp. 3-4)
- Teacher recording sheets, pp. 5-10 (3 copies are included in case you want to record for each student. It might be possible to do all 3 students on one copy of the recording sheet.).
- Student copy masters of the problems, pp. 11-16 (3 copies are included so students can see the problems and record any written work that they might need to do.)

Do not discuss the problems with students prior to presenting the tasks. Give all of the problems to the student in one sitting if at all feasible.

Take as many notes as you can on your recording sheet as to how the student explained their thinking. Ask questions of the student to clarify their thinking. **This interview is a teaching interview.** Please try to select appropriate true/false and open number sentences as well as ask questions to help your students achieve the goal of each problem rather than simply telling them the correct procedure. The main findings from the interviews are the questions you use and the sequenced examples you select as you guide your students through the interview.

Select three students who you are interested in learning more about. You are welcome to try to interview a pair of students at the same time. The students seem to feel more comfortable discussing their strategies when they work in pairs. If you try this approach you may want to allow only one pencil per pair to encourage them to work together.

Bring your recording sheets and the student work to the PLC meeting in your building.

nterview Protocol – Equality

1. Goal: To see if the student is familiar with number sentences that are true and ones that are false.

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1. Is the sentence below true or false? _____

$$11 = 6 + 5$$

Ask the student to explain response. Move onto the next question if the student says *true* and gives a reasonable response. If a student says *false*, try some other equations. RECORD STUDENT RESPONSES AND EXPLANATIONS.

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2. Goal: The student should be able to view the equal sign to mean that the value on the left of the equal sign is the same as the value on the right side and that the sentence is true if both values match and the sentence is false if they do not. In this particular example you want your student to say that 4 goes in the box because that would make the value on both sides of the equal sign 12.

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2. What goes in the box **to make the sentence true?**

$$9 + 3 = \boxed{} + 8$$

If the student says 12, 20, or 12 & 20 then use a sequence of true/false sentences to move that student to view the equal sign as meaning "the same as." Try to use your sentences and the responses your student gives to you as you have this **conversation**. You may have already determined your sequence of true/false sentences before the interview. You are encouraged to be flexible with your sequence and change the sequence to match your student's responses. **There are many sequence choices that work**. Please remember that this is a **teaching interview** and it is acceptable for you to **help by selecting examples and asking questions.**

If the student initially says 4 because both sides would be 12 then try to develop a sequence of open number sentences that would encourage students to think more relationally (e.g. try larger numbers.) RECORD STUDENT RESPONSES AND EXPLANATIONS.

Goal: The student should be able to give examples of number sentences that are both true and false.

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3. Write down three number sentences that are true and three that are false.

Be sure to ask your student to explain why the sentences are true and why others are false. RECORD STUDENT RESPONSES AND EXPLANATIONS.

4. Goal: To see how students think about the equal sign if a letter appears in the open sentence instead of a box.

4. *b* stands for a number. What number could you put in for *b* that would **make the number sentence true?** OR What would *b* have to be to **make the number sentence true?**

$$17 + 23 = b + 15$$

You may have to explain to the student that the *b* stands for a number. You may skip this problem if you feel the interview is taking too long. Or you might try a simpler equation, e.g. 7 + 3 = *b* + 6. RECORD STUDENT RESPONSES AND EXPLANATIONS.

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5. Goal: Students should be able to give a relational definition for the equal sign.

5.   The following questions relate to the number sentence below.

$$3 + 4 = 7$$
$$\uparrow$$

   a) The arrow above points to a symbol. What is the name of this symbol?
   b) What does the symbol mean?
   c) Can the symbol mean anything else? If yes, please explain.

The reason for part a) of question 5 is to get the student to name the equal sign first. Knuth found that when students were asked to define what the symbol '**=**' means they often said it means "the equal sign." He found that if he asked children to name the symbol first and then asked them to define what it means then he would get children to define what the symbol means rather than just the name.

The purpose of part c) is to give students an opportunity to provide another definition. Some students respond to part b) with an operational definition but when asked to give another definition will provide a more relational definition. Please document the student's "best definition" given for the equal sign as asked in parts b) or c). The best definition is the more sophisticated of the two definitions provided. If a student only provides one definition it should be considered the "best".

If students give you an operational definition you may want to push them a bit by asking them what the equal sign means in sentences like 7 = 3 + 4 and 4 + 5 = 3 x 3 where operations appear on both sides. RECORD STUDENT RESPONSES AND EXPLANATIONS.

Example responses:

Relational (most sophisticated)	• "It means that what is to the left and right of the sign mean the same thing." • "The same as, the same thing." • The left side of the equals sign and the right side of the equals sign are the same value."
Operational	• "What the sum of the two number are" • "A sign connecting the answer to the problem." • "The total." • "How much the numbers added together equal."
Other	• "it means equals." • "it means equal to." • "3 plus 4 equals 7"

Teacher Recording Sheet
Teaching Interview Protocol – Equality

Directions: Present these items to your student one at a time. Read each question aloud before he or she begins to work on each problem. Ask the student to think out loud as they work. Write down the strategies he or she describes. You are able to use guiding questions to help the students to accomplish the desired goals. Write down what you said that helped your student(s) accomplish the goals.

1. Is the sentence below true or false? $$11 = 6 + 5$$ Record why student says it is true or false. If they say false, try some other equations and record the equations you use and student's responses to them.	
2. What goes in the box **to make the sentence true?** $$9 + 3 = \boxed{} + 8$$ **If the student says 12, 17, 12 & 17 or any other number other than 4, record the sequence of examples you used to get the student to say 4.** **If the student says 4, record why he/she knows the equation is true if 4 goes in the box.**	

3. Write down three number sentences that are true and three that are false. **Also,** RECORD why student say the sentence are true or false.	
4. *b* stands for a number. What number could you put in for *b* that would make the number sentence true? $$17 + 23 = b + 15$$ RECORD why student says *b* is that particular number.	
5. $$3 + 4 = 7$$ $\uparrow$ RECORD each of the following: a) The arrow above points to a symbol. What is the name of this symbol? b) What does the symbol mean? c) Can the symbol mean anything else? If yes, please explain. RECORD whether the "best" definition is relational or operational (computing) thinking.	

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true number sentences	false number sentences

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