

Math391 Fifth Meeting

Assignments to Be Completed Prior the End of the Semester

- a. **Classroom observation:** Pick one classroom observation, and print and fill out the observation scoring guide (See below. All 15 pages).
- b. **Required reading for next meeting:**
Read Chapter 7 in the book (*Connecting Mathematical Ideas* by Jo Boaler and Cathy Humphreys). Also, watch the corresponding videos from the CD. Write a brief summary (no more than two pages) of these texts and video. Again, your summary should be focused on what you think are the most salient and interesting points, and express your overall opinion of the texts. Connect your comments with the class participations you see in the classrooms, and with your idea in the previous assignment about student involvement.

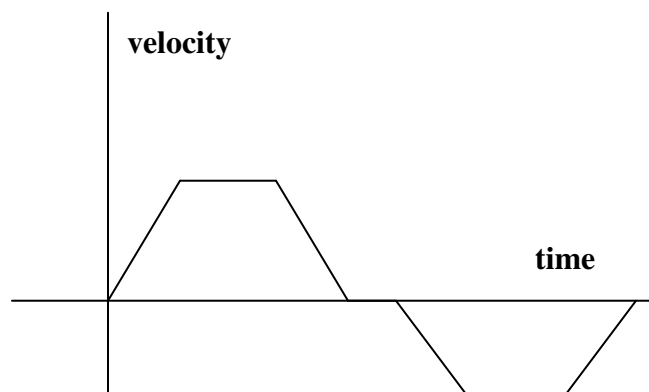
c. Interesting problem:

Math Short Stories

For numbers 1-4, sketch a graph that would be a reasonable model for the situation described. Label axes with appropriate quantities and their units. For number 5 write a story for the graph.

1. The birthday gift he received was such a large amount of money that he used it to start a savings account to which he regularly added a fixed amount.
2. A car starts out slowly and then goes faster and faster until a tire blows out.
3. They started their business with a large no-interest loan from a rich uncle. Each time they sold one of their products they were able to pay down the loan.
4. When she took up jogging, she was very slow and she felt like it took forever. Each time she ran she was able to go a little faster. She was glad because then she had to set aside less time for her run, and had more time for her latte afterward.

5.



MATH 391

OBSERVATION SCORING GUIDE

School _____

Teacher _____

Briefly describe classroom:

Briefly describe the topic(s) of lesson:

For the following questions give your ratings (write your rating in the *Rating* box using the rubric above it), and justify your rating.

1. How well did the teacher manage the classroom, keeping all students engaged and on task?	
High (6,7,8)	All or almost students were engaged and on task throughout the lesson
Medium (3,4,5)	Many students were engaged and on task throughout the lesson or for some of the lesson
Low (0,1,2)	Few students were engaged and on task throughout the lesson or for some of the lesson
Rating:	Justification:

2. How well did the students appear to learn the material in the lesson?	
High (6,7,8)	All or nearly all students appeared to learn the skills or concepts the lesson was designed to teach
Medium (3,4,5)	Many students appeared to learn the skills or concepts the lesson was designed to teach
Low (0,1,2)	Few students appeared to learn the skills or concepts the lesson was designed to teach
Rating:	Justification:

3. To what extent did the lesson/teacher focus on/guide toward conceptual understanding?	
High (6,7,8)	<p>Guides students to generalize from a specific instance to a larger concept or relationship.</p> <ul style="list-style-type: none"> Example: Teacher starts the lesson by asking students to compare $\frac{4}{4}$ to $\frac{4}{8}$, and the discussion results in the idea that “the bigger the bottom number, the smaller the pieces.” The teacher follows up by asking, “Is this always true?” Students then try to generalize this idea by seeing if it holds true with other fractions, namely by drawing representations of $\frac{1}{9}$ and $\frac{1}{4}$, and $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{8}$
Medium (3,4,5)	<p>Teacher mentions the concept or relationship that a particular problem or procedure illustrates, but does not require students to elaborate fully.</p> <ul style="list-style-type: none"> Example: Students are working on 3-digit by 1-digit division problems. The teacher explains how estimation may be used to find the first digit of the quotient: “312 divided by 5 can be rounded to 300 divided by 5 and 5 goes into 300 6 times. So the first digit of the answer should be around 6. Estimating can usually give you a good idea of what the first number should be.” Estimation is used as a means of obtaining the correct answer and the larger math concept (e.g., place values) is never mentioned.
Low (0,1,2)	<p>Little or no attention to broad concepts. Emphasis strictly on rote application of algorithms or memorization.</p> <ul style="list-style-type: none"> Example: The teacher is explaining to students how to divide 435 by 5. Students have just figured out that 5 goes into 43 eight times. To emphasize where to place the 8, the teacher asks, “But we just said that we can’t get 5 out of 4. So where should the 8 go?” Emphasis is on aligning the numbers correctly rather than on the process of dividing. Another example of the teacher’s emphasis on rote application includes having the students turn their ruler-lined paper horizontally so that the columns can help students “keep their place” while dividing.
Rating:	Justification:

4. To what extent did the lesson/teacher focus on/guide reasoning and problem solving?	
High (6,7,8)	<p>Teacher emphasizes the process through which students arrived at solutions. Makes certain that procedures are explained and understood.</p> <ul style="list-style-type: none"> • Example: The teacher asks, “How many digits must the answer have if you divide one digit into a 3-digit number?” <p>S: “2 or 3 digits.”</p> <p>T: “Why can’t it have 1 digit? Or can it have 1 digit?”</p>
Medium (3,4,5)	<p>Solutions are explained but methods are not explored and reasoning strategies are not made explicit for all.</p> <ul style="list-style-type: none"> • Example: Lesson is about fractions, but the lesson stays within one activity, finding $\frac{1}{2}$ (or $\frac{1}{4}$, etc). Questions are specific to reaching an answer (e.g., “Did you see how she got her answer?”). The explanations are solution-oriented, “If you can’t find the answer to what is half of your cubes, use your eyes to find the middle, or count them all and estimate.” The teacher may also be very directive: “Put them into this many or that many groups.”
Low (0,1,2)	<p>Little or no emphasis on reasoning strategies. Single explanations without any generalization to broad strategy or approach</p> <ul style="list-style-type: none"> • Example: Students are asked to estimate the answer to 37×3. The teacher asks students, “What is the basic math fact to estimate this problem?” Students answer 4 times 3, and the teacher moves on.
Rating:	Justification:

5. To what extent did the teacher connect the lesson to other topics in mathematics?	
High (6,7,8)	<p>Teacher shows (or encourages students to show) how current topic is related to topics studied previously or topics to be studied in the future. Compares and contrasts current topic with previously studied mathematics making explicit the associations, similarities or differences.</p> <ul style="list-style-type: none"> Example: When learning about operations that are inverses (e.g., subtraction and addition), there is a discussion of why they are inverses and how both are tied into the larger context of the base-10 system and place values (e.g., when solving the problem 34-29, “borrowing” is in essence an exchanging of one block of 10 units to 10 smaller units of 1’s. And this process is the inverse of “carrying,” where the smaller units of 1’s are exchanged for larger unit blocks of 10).
Medium (3,4,5)	<p>Connects current topic to previous one, but only in superficial way. Does not explore relationship between concepts, operations, or procedures.</p> <ul style="list-style-type: none"> Example: Teacher may state that certain operations are inverse operations and can therefore be used to double-check results, but there is no discussion of why they are inverse operations in the context of place values. “What is the reverse of division?” How do I back-check using multiplication?”
Low (0,1,2)	<p>Little or no attempt to link current topic to anything studied previously.</p>
Rating:	Justification:

6. To what extent did the teacher connect the lesson to other subject areas or disciplines?	
High (6,7,8)	<p>Teacher makes connections (or encourages students to make connections) between mathematics and other subjects that students are familiar with, particularly other things they have learned in class. Shows how mathematical ideas are used in other disciplines</p> <ul style="list-style-type: none"> • Example: In a probability lesson, the teacher discusses the likelihood and importance of false positives in medical testing. For example, there can be a discussion of what it means to be a false positive, what factors may lead to a false positive, how the incidence of a disease in the population as well as the accuracy of the medical test can affect the likelihood of seeing a positive result, etc. • Example: To make connections to geography and science, students gather information about the temperature at certain times of the day. They then find the minimum, maximum, and range of temperatures, and discuss factors which make one area of town cooler or warmer than another (e.g., elevation change, body of water, urban heat island effect)
Medium (3,4,5)	<p>Teacher connects math to other subjects superficially but does not explore the application of mathematical ideas in any depth.</p> <ul style="list-style-type: none"> • Example: The teacher may mention that probability is useful for other contexts. For example, a teacher may say something like, “Probability is very useful for things like medical testing in science or quality control of products in business” but there is no further discussion. • Example: The lesson is embedded within a science context (as in collecting data about weather or recycling), but that is the only connection
Low (0,1,2)	<p>Little or no connection between mathematics being learned and any other subjects.</p>
Rating:	Justification:

7. To what extent did the teacher engage in scaffolding to help students make large conceptual or procedural jumps (e.g., asking questions incrementally based on students response)?	
High (6,7,8)	<p>Teacher recognizes that student has only partial understanding of a concept or procedure and provides just enough help to move the student forward so she/he can try to finish the solution.</p> <ul style="list-style-type: none"> • Example: A student is having trouble deciding how many rectangles are needed to represent a particular fraction. Specifically, she notices that sometimes 2 rectangles are used (as in the case of $\frac{3}{2}$) and other times only 1 rectangle is used (as in the case of $\frac{1}{2}$). Teacher asks, “How do you know that you need 2 or 3 rectangles instead of 1? What about S’s conjecture about size of pieces and its size?” • Example: A student is demonstrating how to represent $\frac{4}{4}$ and $\frac{4}{8}$ on a number line. She is representing each part by drawing $\frac{1}{8}$ and $\frac{1}{4}$ on a number line. The teacher asks, “How’d S know that she could put the $\frac{1}{8}$ halfway between the $\frac{1}{4}$’s?”
Medium (3,4,5)	<p>The teacher asks questions that will help the student to arrive at the correct answer, but the questioning is more direct and does not necessarily allow the student to reflect on his/her thinking</p> <ul style="list-style-type: none"> • Example: The teacher poses the following problem: ”To get their mother a birthday present, Ken, Kathleen, and Art contribute their savings. Ken has 80 pennies, 2 nickels, and 1 dime. Kathleen has 3 half-dollars. Art contributes the rest. If the total is \$8.12, and Art contributed 17 coins, what coins could Art have?” To a student who is trying to use 12 pennies to make Art’s total, the teacher asks, “If you use 12 pennies, that means you have 5 coins left to make \$5.50. Is it possible to make \$5.50 with 5 coins?”
Low (0,1,2)	<p>Teacher tells the students explicitly how to solve problems or does not pose problems that require the students to create new solutions only to repeat learned procedures</p> <ul style="list-style-type: none"> • Example: Students are dividing 3 digit numbers by 1 digit number with remainder (i.e., 435 divided by 5). Teacher asks questions that emphasize the procedural order of the algorithm, “First cover all the digits except the first one. Can you take any 5 out of 4?” “Then uncover the next number. Can you get some 5’s out of 43, etc.”
Rating:	Justification:

8. To what extent did the teacher encourage students to come up with more than one way of solving the problem?	
High (6,7,8)	<p>Teacher provides opportunities for students to explain solution strategies and encourages students to demonstrate different strategies. Values different strategies equally.</p> <ul style="list-style-type: none"> • Example: To compare $\frac{4}{4}$ to $\frac{4}{8}$, there were two different approaches. First, one student drew two rectangles of the same size and divided one rectangle into 8 pieces and the other into 4 pieces, then noticed that 4 pieces take up more space. Another student drew two rectangles of different sizes, but then explained that $\frac{4}{4}$ means “you take the whole thing, but $\frac{4}{8}$ is only half of it so $\frac{4}{4}$ is bigger.” • Example: Students are working on $\frac{250}{17}$. One student solved it by the traditional algorithm, another student solved it by making 17 columns and filling the columns with an “x” until the student came to 14 rows and had 12 left over, still another student subtracted 17 from 250 until he got down to 12, then counted how many 17’s, and found that he had 14 with a remainder 12.
Medium (3,4,5)	<p>The teacher may superficially encourage different ways of solving a problem but does not explore them in depth or value them equally.</p> <ul style="list-style-type: none"> • Example: Teacher says, “Did anyone do it another way?” but there is little beyond the teacher asking those types of questions (e.g., there is no attempt to reconcile different approaches by students). • Example: The teacher poses the problem, “There are 5 students in the class. On Valentine’s Day, every student gives a valentine to each of the other students. How many valentines are exchanged?” Teacher values efficiency rather than the correctness of the solution. In response to a suggestion that valentines should be exchanged then counted, the teacher responds, “Passing out the valentines and then counting the amount everyone received will probably take too much time. Can you think of a quicker way to solve this problem?”
Low (0,1,2)	<p>Little or no effort to explore alternative ways of solving problem</p> <ul style="list-style-type: none"> • Example: Teacher asks several students for their answer and verifies that it’s correct, but there is no discussion of how the students arrived at the answer and does not solicit any other solution strategies.
Rating:	Justification:

9. To what extent did the teacher facilitate discussion about ideas or concepts among students?	
High (6,7,8)	<p>Teacher encourages students to discuss mathematical concepts, to listen and respond to each other's ideas, and to learn from each other. Builds a community of mathematical learning.</p> <ul style="list-style-type: none"> • Example: Students are working on how to compare $\frac{4}{4}$ and $\frac{4}{8}$, and one student illustrates the problem by drawing two rectangles of different sizes. When the student thinks he did something wrong, the teacher asks, "S thinks he did something wrong, but I don't understand what's the problem. Why must the rectangles be the same size?"
Medium (3,4,5)	<p>There is an attempt to engage students in discussion of student remarks, but the teacher remains the focus and does most of the reasoning.</p> <ul style="list-style-type: none"> • Example: Students may still have a whole class discussion about all possible enumerations of COW and the patterns that they see, but instead of allowing students to conclude when all possibilities have been exhausted, the teacher guides students to the answer. A teacher may say, "Okay, we have some possibilities on the board. Let's see if we have all possible permutations. So for my first spot, how many ways do I have of choosing the first letter? [Students answer 3] If I choose C for my first letter, how many letters do I have to choose for the second spot? [Students answer 2] And for the last spot? [Students answer 1]. So what does tell us about how many permutations we should be looking for? [Students answer 6] Do we have all 6?"
Low (0,1,2)	<p>Little or no student-to-student discussion of mathematical concepts or procedures.</p> <ul style="list-style-type: none"> • Teacher states that there should be 6 permutations, and some possibilities are missing.
Rating:	Justification:

10. To what extent did the teacher stress the relevance of mathematics to the students' own lives?	
High (6,7,8)	<p>Teacher emphasizes connections between mathematical ideas and students own lives. Encourages students to identify application of mathematics in their lives.</p> <ul style="list-style-type: none"> • Example: In explaining the importance of division, the teacher says, "Suppose you're backpacking in the woods for 5 weeks and you have \$550. There's no bank around so you can't withdraw money, and you can't use your credit card in the wild. How much can you spend per week without running out of money?"
Medium (3,4,5)	<p>The lessons are framed in a real-life context, but are artificial or are not meaningful to students directly.</p> <ul style="list-style-type: none"> • Example, if a student asks, "Why do we need to know combinations," a teacher might say, "It's important in combinatorial DNA analysis." • Example: For a lesson on percents, the lesson is about the projected returns by mutual funds and stocks based on different interest rates.
Low (0,1,2)	<p>Little or no connection between mathematics and students' own lives.</p> <ul style="list-style-type: none"> • Example: Which gives you the larger number, A) 25% of 40, or B) 30% of 45?
Rating:	Justification:

11. Did lessons involve a variety of pictures, graphs, diagrams, or other representations to illustrate an idea or concept?	
High (6,7,8)	<p>Lesson emphasizes multiple ways to represent mathematical concepts or ideas. These include figures, diagrams, graphs, and other physical representations. (Different from multiple solution strategies, this is multiple representations of an idea.)</p> <ul style="list-style-type: none"> • Example: To compare $\frac{4}{4}$ and $\frac{4}{8}$, different representations were used, including circles, rectangles of the same and different sizes, and a number line. The teacher then asks about the equivalence of the responses, “So you took 4ths and cut them in half on your rectangle? So is that the same thing as what S did on the number line? So how are they the same?”
Medium (3,4,5)	<p>Teacher lets students illustrate ideas in alternative ways, but does not encourage it and does not push for more alternatives when it occurs.</p> <ul style="list-style-type: none"> • Example: Student shows that four twos are eight by holding up hands showing fingers held together in pairs. Teacher acknowledges that approach is correct, but does not use it as an opportunity to elicit other ways of demonstrating this relationship.
Low (0,1,2)	<p>Few or no cases of ideas being illustrated in more than one way.</p> <ul style="list-style-type: none"> • Example: In a lesson on long division, the teacher uses only numbers to explain how to divide. There is no attempt to use other means such as pictures (e.g., depicting pictorially how to group the objects together) or manipulatives.
Rating:	Justification:

12. To what extent did the students work cooperatively in groups?	
High (6,7,8)	<p>Teacher has students work collaboratively on non-trivial mathematical tasks in groups. Teacher ensures that all students are engaged on the underlying mathematics of the activity.</p> <ul style="list-style-type: none"> • Example, suppose there is an activity in which students are to make triangles of different lengths using fasteners and polymer strips. After building their triangles, students discuss whether they can make another triangle with the same side lengths. • Students are playing the web-based game, “Lemonade,” where they try to maximize their profits while taking into account factors such as lemonade price, weather conditions, cost of materials (e.g., lemons, sugar, etc). Students are actively keeping track of their trial-and-error approaches, trying to see which pricing structure under which conditions gives the best profits.
Medium (3,4,5)	<p>Students supposed to work collaboratively in groups, but the work is not extensive, students focus on the procedural aspects of the activity, or students work independently and do not collaborate.</p> <ul style="list-style-type: none"> • Example, they are more focused on getting the fasteners in the correct place on the polymer strips than on the kinds of triangles that can be built • Students are working cooperatively with each other, but are off-task (e.g., trying outrageous pricing schemes, such as selling lemonade for \$100 per glass).
Low (0,1,2)	Students in groups but no intention to work collaboratively; or no group activity occurs.
Rating:	Justification:

13. To what extent did the students participate in hands-on activities using manipulatives that was related to mathematical ideas or concepts?	
High (6,7,8)	<p>Teacher has students use concrete objects to model mathematical ideas. These explorations become the basis for building more abstract mathematical representations.</p> <ul style="list-style-type: none"> • Example: Using geoboards, students are asked to make figures that have an area of 4, sometimes with a constraint that the figure touches a specified number of points. Students are then asked to identify their figures using correct terminology, make observations about lines of symmetry, congruence, similarity, etc. and discuss how the constraints affect the number of ways that a figure of area 4 can be made.
Medium (3,4,5)	<p>Limited use of concrete objects to build understanding.</p> <ul style="list-style-type: none"> • Example: Students are engaged, but they are focused on doing the activity, not the underlying concept. For example, students may be engrossed in finding all possible permutations of Tetris-like figures (which have areas of 4), but there is no discussion of symmetry, congruence, similarity, constraints, etc.
Low (0,1,2)	<p>Little or no hands-on mathematical development.</p> <ul style="list-style-type: none"> • Example: Students are arranging tiles on a board for a multiplication lesson, but the tiles are used to get the right answers only, not to build knowledge or a larger process. Also, the tiles cannot be worked with in different ways.
Rating:	Justification:

14. To what extent did the students work on complex problems that involve multiple steps, multiple solutions or assess more than one mathematical skill or concept?

High (6,7,8)	<p>Teacher assigns complex problems that admit multiple solutions and foster more complicated mathematical reasoning.</p> <ul style="list-style-type: none"> Example: Students work on long division in the context of word problems. Consider three different division problems that require students to divide 413 by 30. Whether the answer is 13 remainder 23, 13, or 14 depends on the context. E.g., if the problem asks students to find how many buses are needed to transport 413 kids if each bus can seat 30 students, the answer is 14. However, if the problem were framed as “You are working for a jellybean factory and you must group the jellybeans into packages of 30 each. You are allowed to keep all full packages of jellybeans. How many packages do you get to keep” the answer is 13. Still, if the problem were to be reframed as, “How many full jellybean packages do you have and how many pieces are left over” the answer is 13 remainder 23.
Medium (3,4,5)	<p>Students are given problems of moderate complexity that are not as rich in terms of solutions and reasoning.</p> <ul style="list-style-type: none"> Example: The long division problems are in the context of word problems, but do not require students to interpret the meaning of their answer. For example, “If there are 30 students in a classroom, and there are 420 stickers, how many stickers does each student receive?”
Low (0,1,2)	<p>Students work only routine problems requiring one or two procedures they have already learned.</p> <ul style="list-style-type: none"> Example: Students work on decontextualized long division problems that intend to give students practice on the algorithm (e.g., many problems of the form 413 divided by 5).
Rating:	Justification:

15. To what extent did the lesson have a sequence of activities that build conceptual understanding?	
High (6,7,8)	<p>Teacher presents material in a sequential, connected, logical manner to foster understanding. Lesson might begin with a problem, followed by a hands-on activity to solve it, then a discussion of general methods, and end with an abstract formula. The sequence may be apparent in an individual lesson or in a series of lessons within a unit.</p> <ul style="list-style-type: none"> • Example: When learning about relative sizes of fractions (e.g., $\frac{4}{4}$ compared to $\frac{4}{8}$), the lesson proceeded from comparing fractions with unlike denominators to comparing two fractions with unlike denominators in which the denominator of one of the fraction was not a multiple of the other (e.g., comparing $\frac{1}{9}$ to $\frac{1}{4}$), and then proceeded to considering two fractions in which the numerator was greater than the denominator.
Medium (3,4,5)	<p>The lesson is logically ordered, but the elements do not build conceptual understanding.</p> <ul style="list-style-type: none"> • Example: To explain division to students who were struggling with 3-digit division, the teacher started with a 2-digit problem, then extended the problem to 3-digits. Specifically, the teacher guided students through the process of dividing 38 by 6 (“How many times can 6 go into 38? Can 6 go into 2? So what’s your remainder?”) then moved to the same reasoning for 182 divided by 2. Although it makes sense to start with a simple problem, the emphasis of the progression was procedural (i.e., what are the order of the steps when dividing) • Example: The teacher presented the material in a logical conceptual order: if you don’t know how to solve two digit multiplication problems like 7×328, you can use estimation to get in the ballpark and then use expanded notation to put it in a form where you can use mental multiplication. But the discuss was strictly procedural (i.e., first do this, then do this). And the teacher did not make the point that the traditional and expanded approaches give the same result.
Low (0,1,2)	<p>One set of activities follows the next with no logical connections or no concern with building understanding.</p> <ul style="list-style-type: none"> • Example: Students may be working on “challenge” problems, some of which deals with area, others with ratios and proportions, and still others with fractions.
Rating:	Justification: