Video Links: 8th Grade Math Lesson on Conjecturing about Functions
Lesson Objective: Analyze patterns and represent functions
Compass Component and Rating: Questioning and Using Discussion Techniques (3b), *Effective Proficient;* Engaging Students in Learning (3c), *Effective Proficient*

Common Core State Standard(s)
CCSS.Math.Content.8.F.B.4: Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

Compass Component 3b: Questioning and Using Discussion Techniques (Rating: *Effective Proficient*)		
Indicators	**Evidence**	**Common Core Connection**
Teacher uses open-ended questions, inviting students to think and/or have multiple possible answers.	• During the lesson, the teacher asks multiple students, *"What did you notice?"* (2:32) This open-ended question has numerous possible answers and begins to support students in the formation of their conjectures.	CCSS.Math.Content.8.F.B.4 Teacher gives students three series of dots, from which they must determine a pattern. Students must develop a function to represent each of the three series. These functions include a rate of change and y-intercept.
The teacher builds on and uses student responses to questions effectively.	• While students are working in small groups, the teacher builds on a student's response to help the student arrive at the important point he needs to turn the patterns into equations. The student says, *"It's the same rate for each one…"* The teacher then asks, *"So each one has the same rate of change and what's the rate of change?"* Student: *"Four."* Teacher: *"Four. And so what does that mean for every*	

	single one of these functions, the formula is always going to start what?" Student: *"Uh, Y equals 4x."* (5:31) • At a different point in the lesson, a student gives a response but doesn't get to the depth of explanation that the teacher is looking for. After the teacher asks for more explanation, the student provides higher quality response. The student says, *"They all start at different times."* The teacher then says, *"They all start at different times. Tell me more about that."* Student: *"Like one will start at the beginning and then one will start at one minute and then one doesn't have anything at all."* (2:25)	
Many students actively engage in the discussion.	• Students engage in the discussion with their small groups (3:41), as well as with the teacher when getting individual help (4:25). This allows the students to work independently, but also provides an opportunity for the teacher to hear from all the students and assess their progress.	

Compass Component 3c: Engaging Students in Learning (Rating: *Effective Proficient*)

Indicators	Evidence	Common Core Connection
Lesson tasks have multiple correct responses or approaches and/or demand higher-order thinking.	• During this lesson, the learning task requires students to engage higher order thinking skills to create a conjecture, of which there are several possible responses. Teacher tells students, *"I want you to try to make a conjecture. So the end goal is to kind of analyze this whole set of functions and think about is there a conjecture you can make. Can you think of a*	CCSS.Math.Practice.MP1 Students are provided with a challenging set of patterns during this lesson, from which they must identify patterns, create formulas, and ultimately compose a conjecture. Students use the content knowledge they have to make sense of the problem and work diligently on progress toward a conjecture.

	math statement you can make that kind of goes beyond this set that will always hold true?" (3:21)	CCSS.Math.Practice.MP7 In order to create a conjecture based on functions, students must analyze the patterns provided and determine a common structure within.
Students have some choice in how they complete learning tasks.	• Students can choose which relationships they utilize between the patterns and the process they use to make progress toward a conjecture. Allowing students to have these choices is important for them to be able to understand and explain the conjecture they create.	
Materials and resources support the learning goals and require intellectual engagement, as appropriate.	• Teacher provides students with visual representations of patterns (1:30), colors (4:00), graph paper (6:08), all helping them to develop functions and conjectures.	
Students have an opportunity for reflection and closure on the lesson to consolidate their understanding. (*Highly Effective* indicator)	• Students complete an exit slip at the end of the lesson to review content. (7:20) Teacher asks students to reflect on their own learning and math practices. *"If you had to pick two or three math practices that you think you engaged in the most today, that were the most helpful to you while you did this work."* (7:28) This process helps students to learn to self-assess and think critically about their own learning.	

WHAT COULD THIS TEACHER DO TO IMPROVE?

What did the teacher do in this lesson?	*Highly Effective* Indicators	What could the teacher do to move to *Highly Effective*? (example actions)
Throughout the lesson, the teacher poses higher-order and open ended questions to the students.	Students initiate higher-order questions. (Questioning – 3b)	Circulate to each group to discuss their work. After visiting the groups, pair groups that used different methods to solve the problem and have the groups explain their

		process. After groups have listened to the explanations, have them develop questions about the process. During whole-class discussion, use these questions to advance the discussion about the conjectures and allow students to answer each other's questions. Alternately, ask students to record the questions they asked each other while working toward a conjecture. Ask them to record their responses, which can be used for future reflection or as evidence of their progress through the process.
The teacher provides the colors and graph paper to the students, which guides students to certain solution methods.	Students have extensive choice in how they complete tasks. (Engaging – 3c)	Provide students visual representations of the patterns only and allow them to solve the problem without additional guidance toward a particular solution method. Encourage students to explain how they understood the problem and the methods they chose to help identify the functions and develop a conjecture.