Linear or Quadratic? Engaging in Two Effective Mathematics Teaching Practices

Amy Hillen
Kennesaw State University

Jen Outzs
Pinellas County Schools

Blue Taylor
New Visions for Public Schools

NCTM 2016 Annual Meeting
April 14, 2016

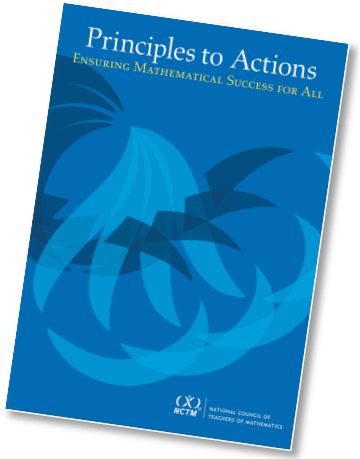
Handout is available from the online planner at nctm.org/planner

Introductions

- Please introduce yourself to your tablemates
  - Name
  - Where you teach
  - Grades/classes you teach
  - How long you have been teaching
  - One "fun fact" about yourself

Agenda

- Explore a rich mathematical task ("student hat")
- Connect to the *Effective Mathematics Teaching Practices* and consider aspects of implementing this task with students ("teacher hat")
- Challenge for today: Please share your thinking, even if you're not sure about it!



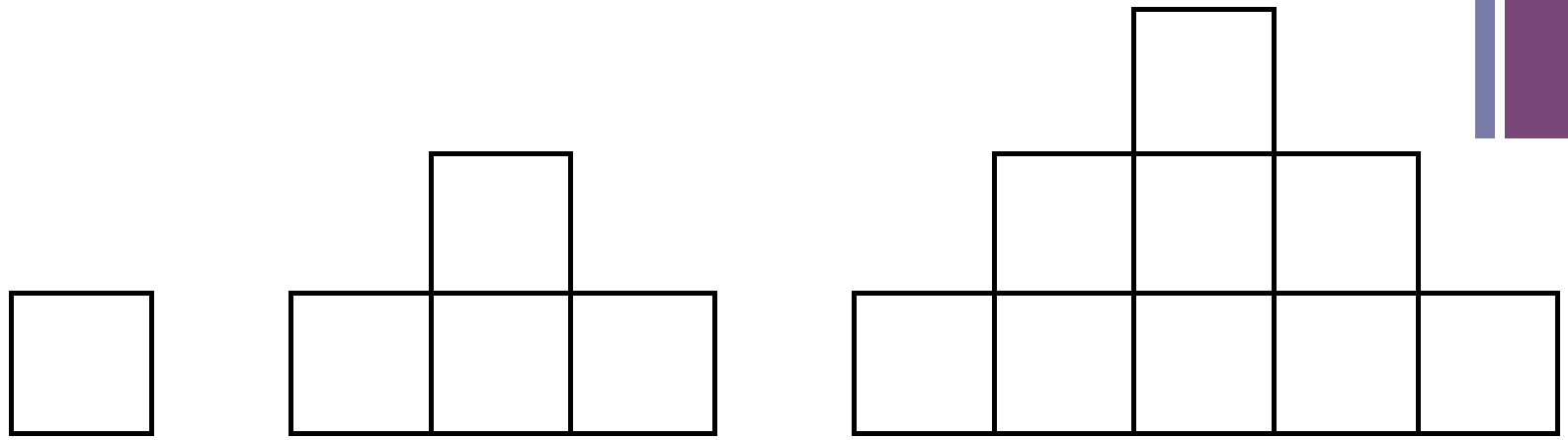
Effective Mathematics Teaching Practices

1. Establish mathematics goals to focus learning.
2. Implement tasks that promote reasoning and problem solving.
3. Use and connect mathematical representations.
4. Facilitate meaningful mathematical discourse.
5. Pose purposeful questions.
6. Build procedural fluency from conceptual understanding.
7. Support productive struggle in learning mathematics.
8. Elicit and use evidence of student thinking.

Effective Mathematics Teaching Practices

1. Establish mathematics goals to focus learning.
2. **Implement tasks that promote reasoning and problem solving.**
3. Use and connect mathematical representations.
4. Facilitate meaningful mathematical discourse.
5. Pose purposeful questions.
6. Build procedural fluency from conceptual understanding.
7. Support productive struggle in learning mathematics.
8. **Elicit and use evidence of student thinking.**

Considering Change



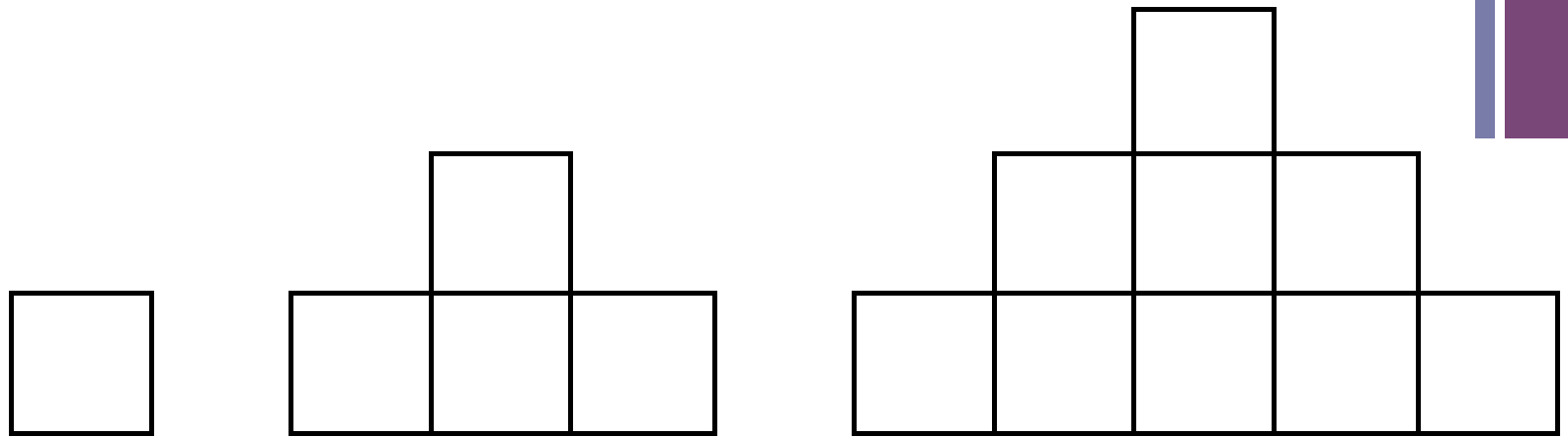
Step 1 Step 2 Step 3

"In this figure as the step changes, the _____ also changes."

Try to generate 10+ ideas!

Task adapted from Peterson, B. E. (2006). Linear and quadratic change: A problem from Japan. Mathematics Teacher, 100(3), 206-212.

Considering Change



Step 1 Step 2 Step 3

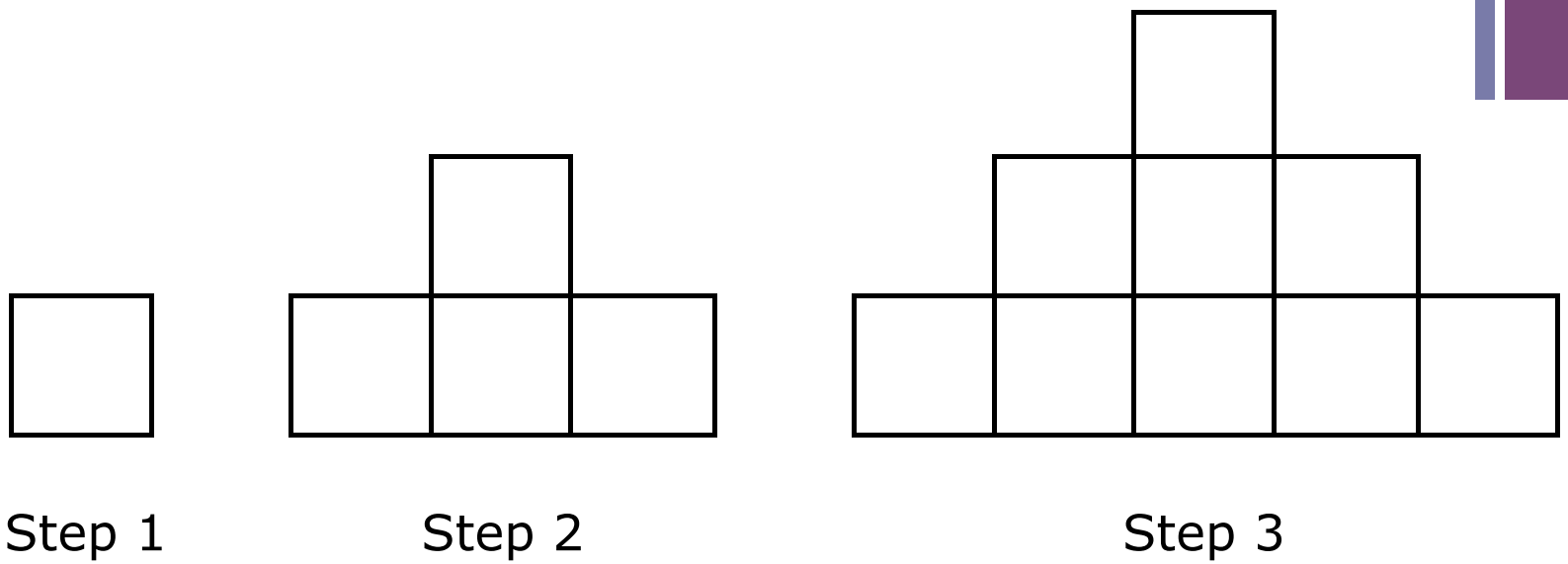
"In this figure as the step changes,

the _____ also changes."

Share your ideas with a partner or two.

See if hearing others' ideas inspire some new ideas!

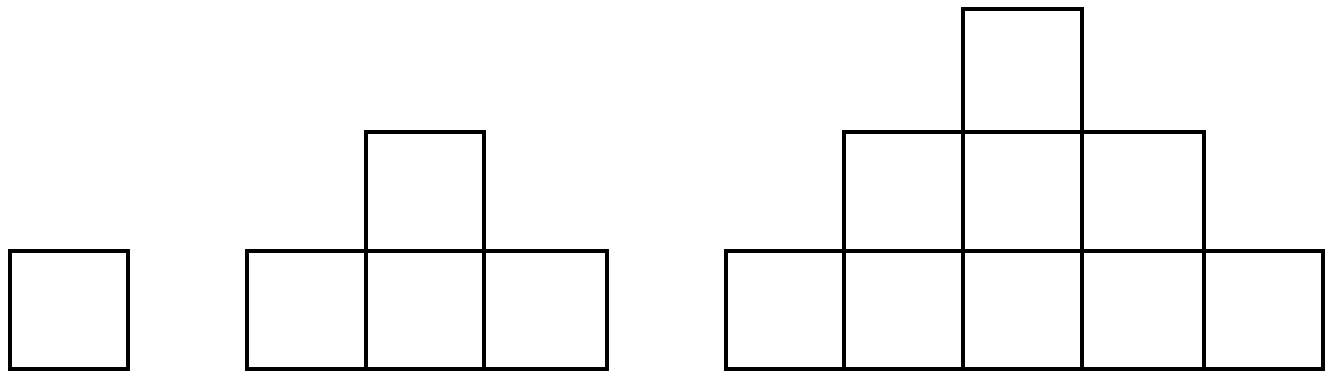
Exploring Change



In groups of 3-5, investigate one of the changes using multiple representations.

As you work, record enough so that others will be able to follow your thinking without additional explanation.

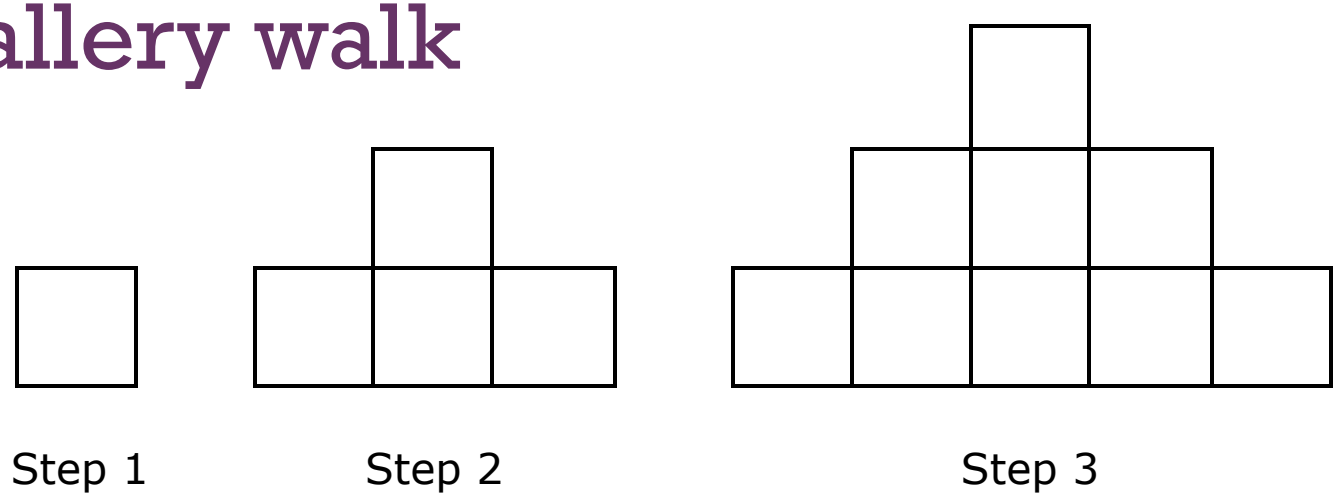
Gallery walk prep



Step 1 Step 2 Step 3

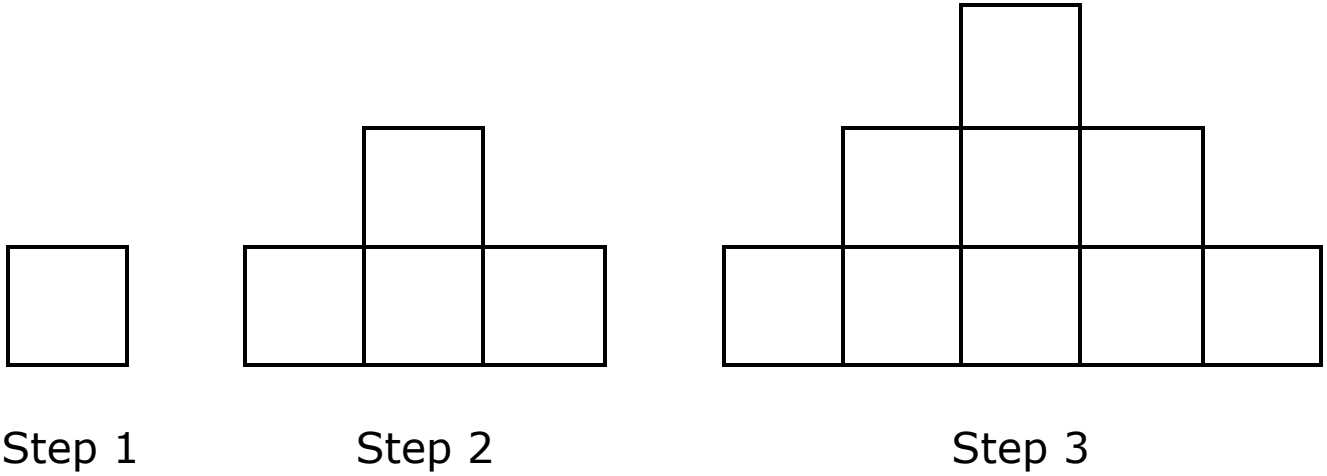
- Arrange the written records of your exploration on your table (i.e., make a "math collage")

Put on your "teacher hat:" Gallery walk



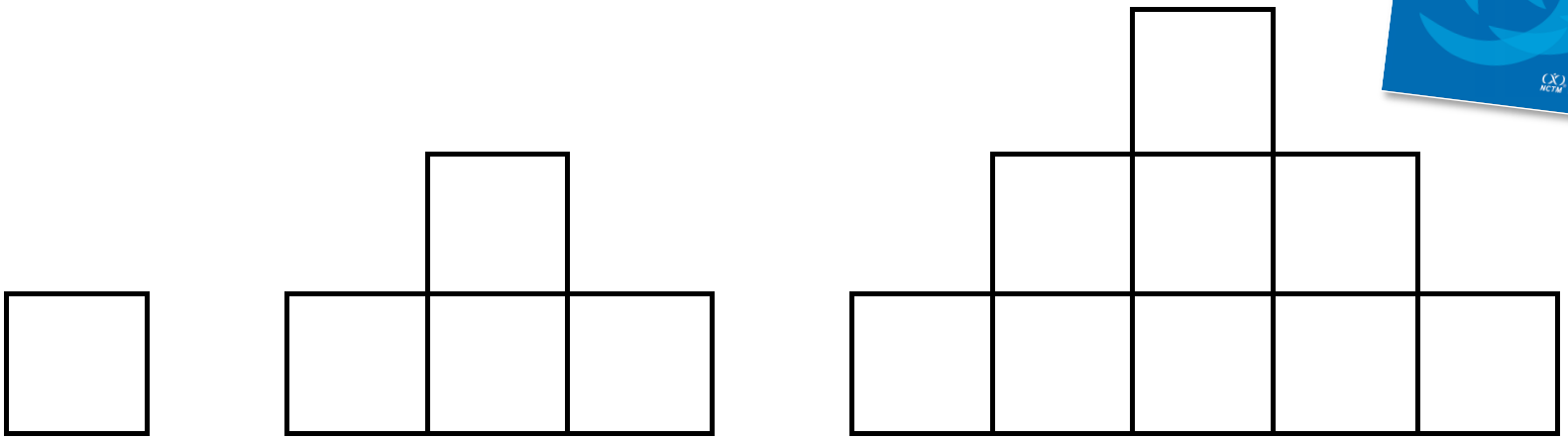
- Tour the other posters
- During your tour, consider:
  - What mathematical ideas can emerge from the exploration of this task?
  - What opportunities for reasoning and problem solving does the task provide?

Gallery walk debrief



- Chat with your table group – Round Robin style!:
  - What mathematical ideas can emerge from the exploration of this task?
  - What opportunities for reasoning and problem solving does the task provide?

+ Implement tasks that promote reasoning and problem solving

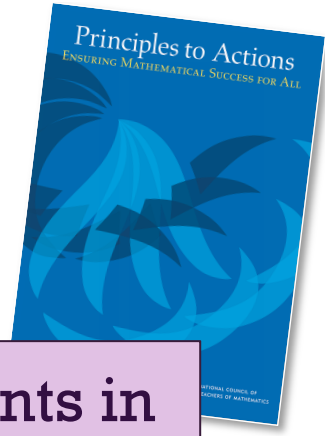


Step 1 Step 2 Step 3

Why launch the task with this question?

"In this figure as the step changes, the _____ also changes."

+ Implement tasks that promote reasoning and problem solving



Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.

"To ensure that students have the opportunity to engage in high-level thinking, teachers must regularly select and implement tasks that promote reasoning and problem solving. These tasks encourage reasoning and access to the mathematics through multiple entry points, including the use of different representations and tools, and they foster the solving of problems through varied solution strategies."

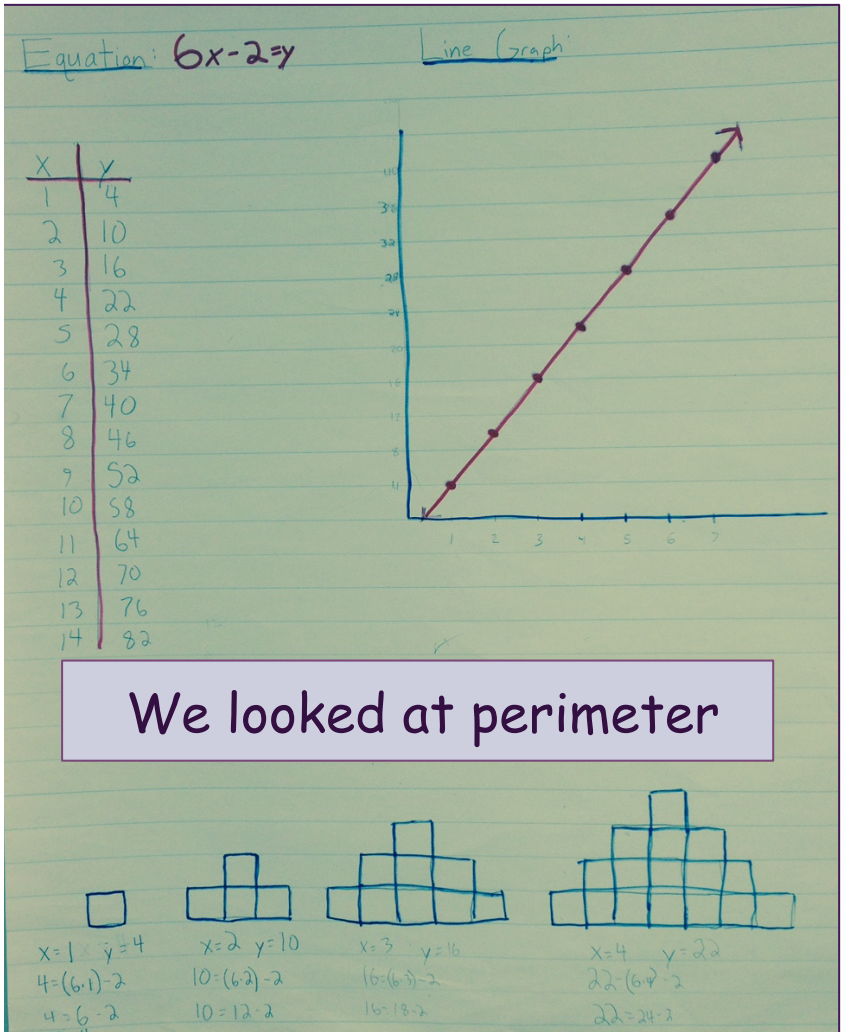
(NCTM, 2014, p. 17)

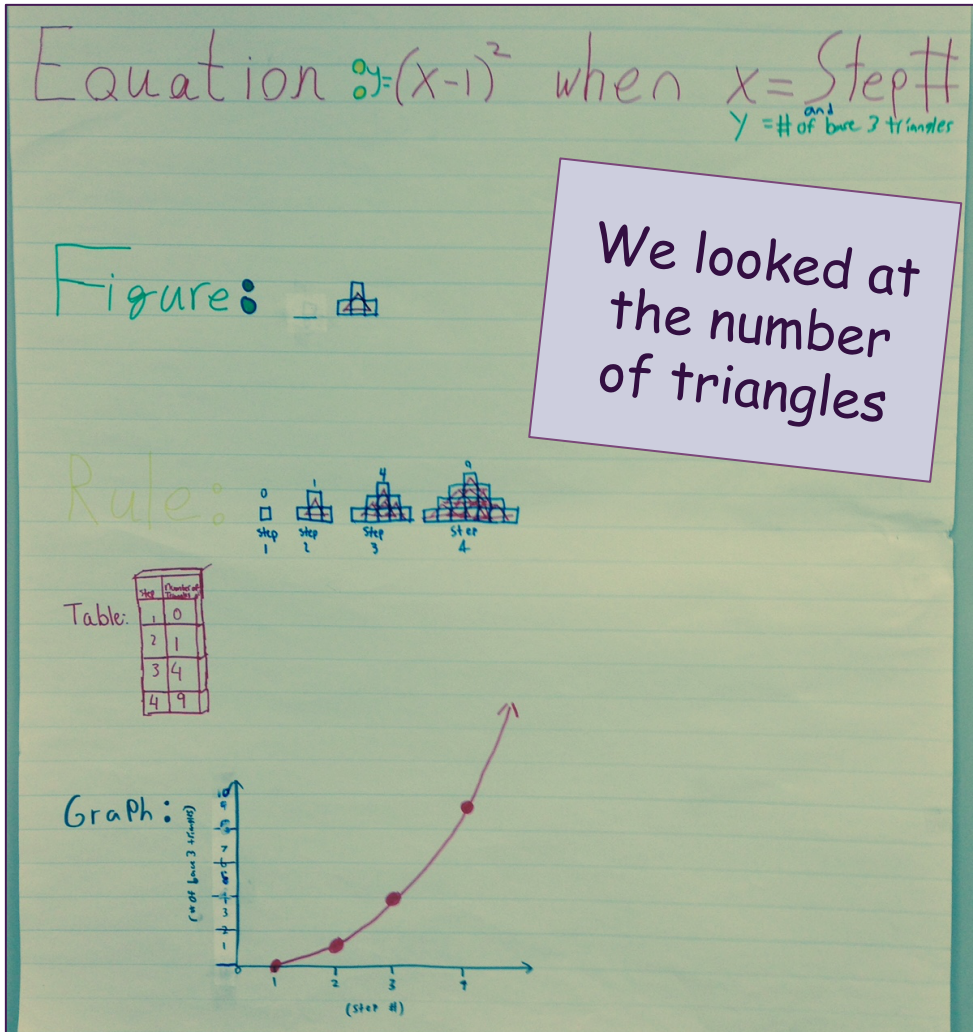
+ Elicit and use evidence of student thinking

"Effective mathematics teaching **elicits evidence of students' current mathematical understanding** and **uses it as the basis for making instructional decisions."**

(NCTM, 2014, p. 53)

- What question(s) would you ask to ***assess*** each group's thinking? Why?
- What question(s) would you ask to ***advance or extend*** each group's thinking? Why?





+ Characteristics of questions that support students' exploration

Assessing

- Based closely on the work the student has produced
- Clarify what the student has done and what the student understands about what they have done
- Provide information to the teacher about what the student understands

Advancing

- Use what students have produced as a basis for making progress toward the target goal
- Move students beyond their current thinking by pressing students to extend what they know to a new situation
- Press students to think about something they are not currently thinking about

Now what?

Assessing

- Based closely on the work the student has produced
- Clarify what the student has done and wh
- Provide information to the teacher about what the student understands

Stay & listen

Advancing

- Use what students have produced as a basis for progress toward the
- Move stu current thinking students to extend what know to a new situation
- Press students to think about something they are not currently thinking about

Walk away

Thank you for coming!
Thank you for your perseverance!

Amy Hillen

ahillen@kennesaw.edu

Jen Outzs

outzs@yahoo.com

Blue Taylor

mtaylor@newvisions.org

Where can I find tasks like this?

A few resources:

- *www.visualpatterns.org (180 visual growing patterns!)*
- *NCTM articles:*
  - *Ferrini-Mundy, Lappan, & Phillips (1997) (TCM)*
  - *Smith, Hillen, & Catania (2007) (MTMS)*
  - *Peterson (2006) (MT)*

Rate this presentation on the conference app!

Search "NCTM 2016" in your app store or follow the link at nctm.org/confapp to download

Join in the conversation!
#NCTMannual

Download available presentation handouts from the online planner at nctm.org/planner