

Amplify.

Planning for Success: Implementing
Complex Tasks Accessible to All Learners

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Agenda

Implementing Complex Tasks Accessible to All Learners

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Introduction:
What is a
Complex Task?

2

Planning Phase 1:
The Launch


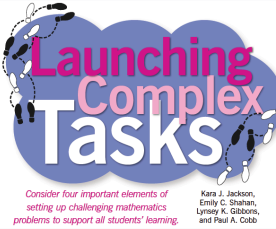
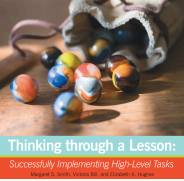

3

Planning Phase 2:
The Dig In

4

Planning Phase 3:
The Share Out

Resources:

Citation	Reference	What it looks like
Stein et al. (2000)	Stein, M. K., Smith, M. S., Henningsen, M. A., & Silver, E. A. (2000). <i>Implementing Standards-based mathematics instruction</i> . NCTM: Reston, Virginia.	
Jackson et al. (2012)	Jackson, K. J., Shahan, E. C., Gibbons, L. K., & Cobb, P. A. (2012). Launching Complex Tasks. <i>Mathematics Teaching in the Middle School</i> , 18(1), 24–29.	
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Stein and Smith (2011)	Stein, M. K., & Smith, M. (2011). <i>5 Practices for Orchestrating Productive Mathematics Discussions</i> . NCTM: Reston, Virginia.	

What is a Complex Task?

A Complex Task:

- is cognitively demanding (Stein et al., 2000).
- does not provide students with a method for solving the task.
- has multiple solution strategies.
- asks students to make mathematical connections within or after solving the task.

The Results Are In!

Implementation in Three Phases

- **Launch**

The problem is introduced.

- **Dig In**

Students work on the problem, usually in groups.

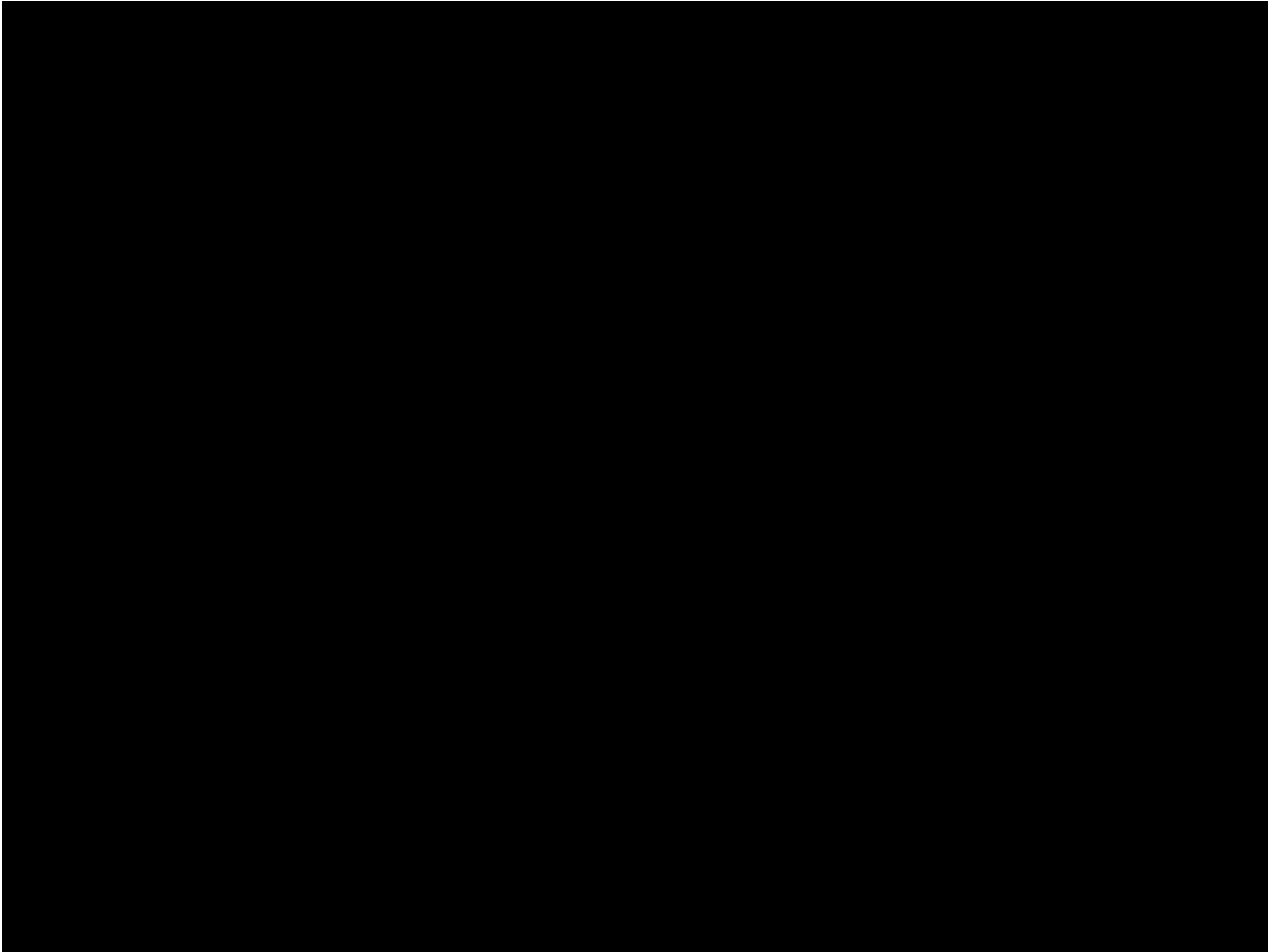
- **Share Out**

The teacher facilitates a discussion during which students share and compare across strategies to develop an understanding of the mathematical concept that are the goal of the lesson. Not “show and tell”.

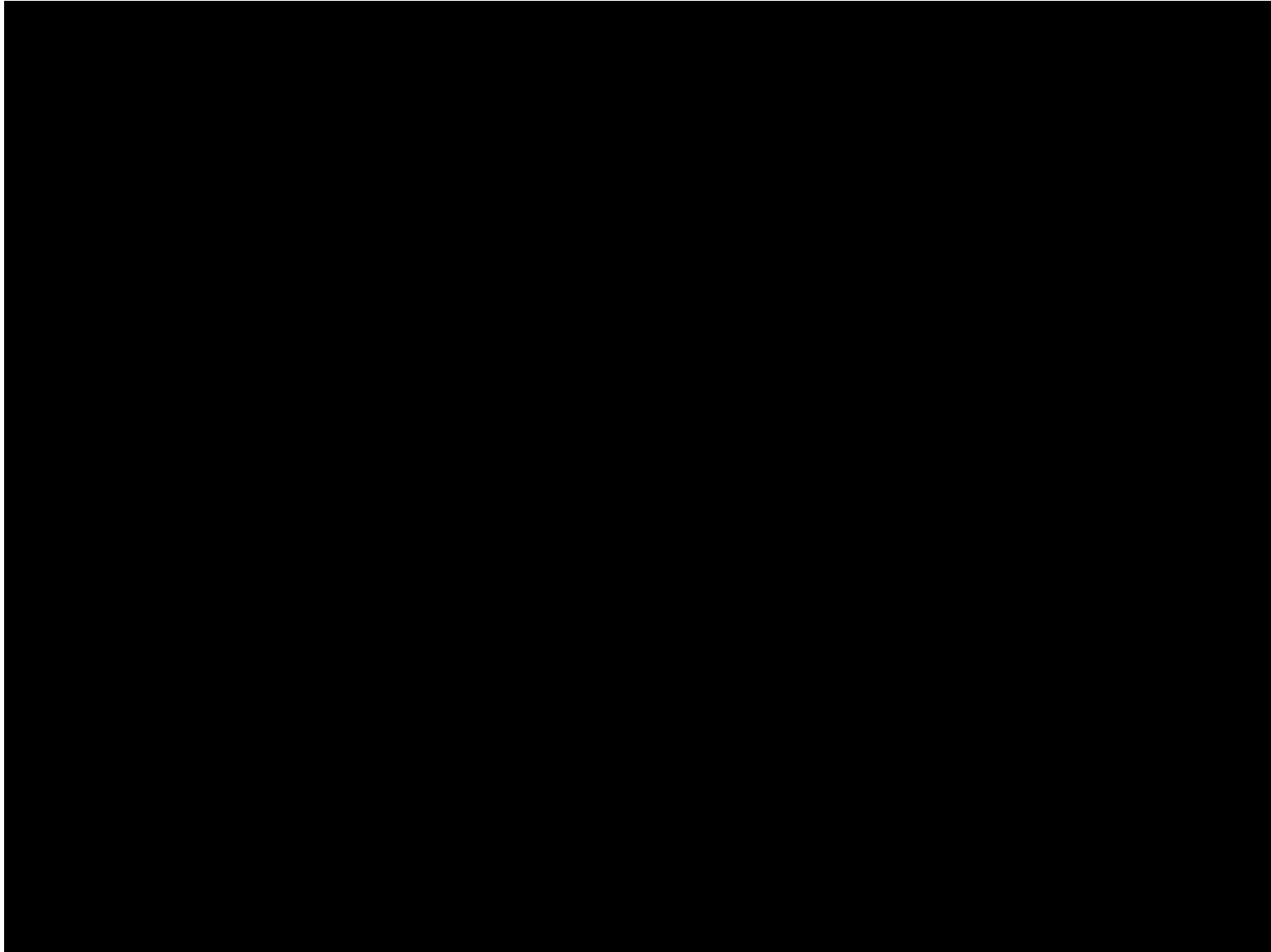
The Back Story: Previous Lessons

- Lesson 1: Survey Says
- Lesson 2: Equivalent Ratios
- Lesson 3: Base Ratios
- Lesson 4: Using Ratios to Make Predictions
- Lesson 5: Unit Ratios
- Lesson 6: Comparing Ratios with Tables
- Lesson 7: Graphing Ratios

Video A



Video B



Survey Says



Video A



Video B

1. Which video do you prefer, Video A or Video B?
2. Do you consider yourself funny or serious?
3. Do you consider yourself patient or impatient?

The Back Story: Previous Lessons

- Lesson 1: Survey Says
- Lesson 2: Equivalent Ratios
- Lesson 3: Base Ratio
- Lesson 4: Using Ratios to Make Predictions
- Lesson 5: Unit Ratios
- **Lesson 6: Comparing Ratios with Tables**
- Lesson 7: Graphing Ratios

The Back Story: Previous Lessons

Lesson 6: Comparing Ratios with Tables



Compare Our Recipe to each of the recipes of the other gates and decide which is more lemony.

The Back Story: Previous Lessons

Lesson 6: Comparing Ratios with Tables



Our Recipe	
Cups of Sugar Water	Number of Lemons
12	8
24	16

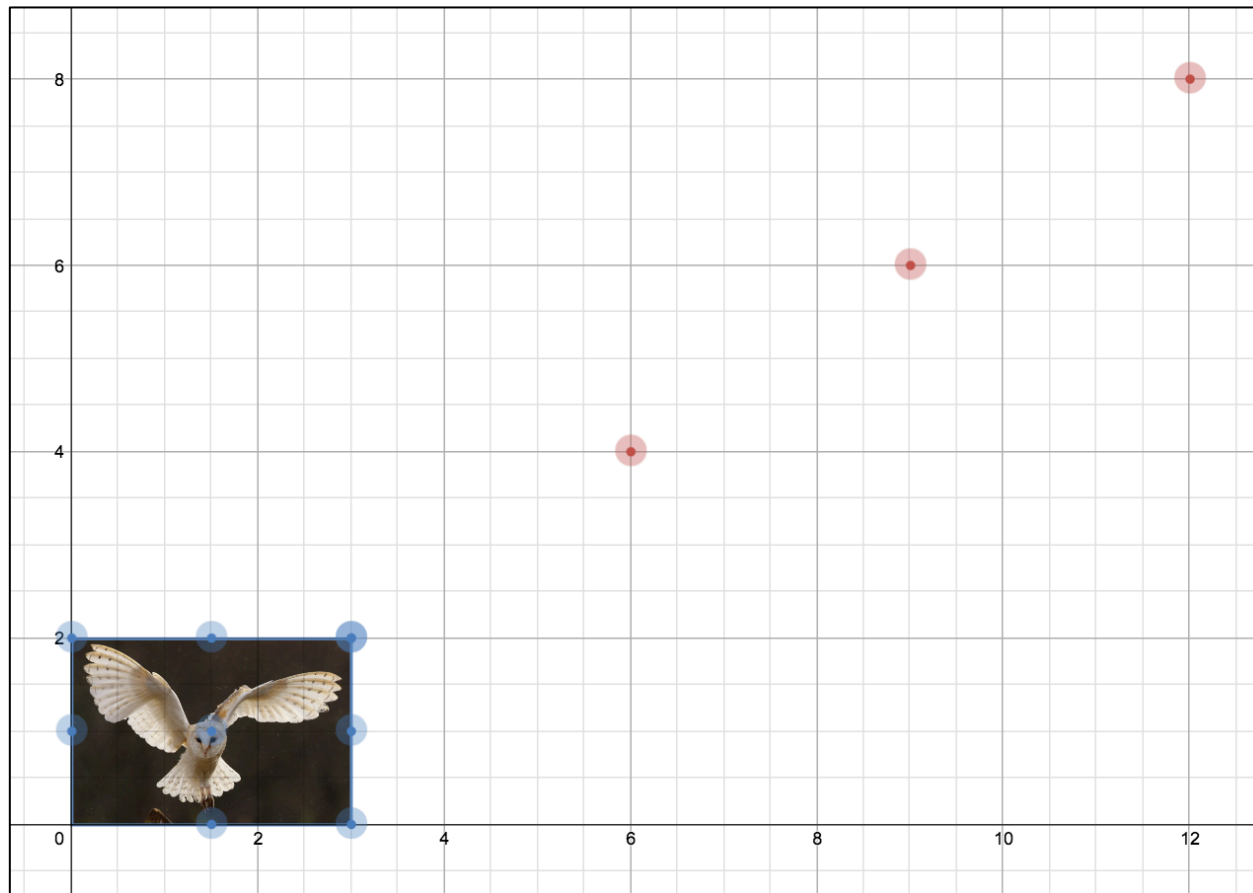
West Gate	
Cups of Sugar Water	Number of Lemons
24	10

The Back Story: Previous Lessons

- Lesson 1: Survey Says
- Lesson 2: Equivalent Ratios
- Lesson 3: Base Ratio
- Lesson 4: Using Ratios to Make Predictions
- Lesson 5: Unit Ratios
- Lesson 6: Comparing Ratios with Tables
- Lesson 7: Graphing Ratios

The Back Story: Previous Lessons

Lesson 7: Graphing Ratios



This Lesson

- Lesson 1: Survey Says
- Lesson 2: Equivalent Ratios
- Lesson 3: Base Ratio
- Lesson 4: Using Ratios to Make Predictions
- Lesson 5: Unit Ratios
- Lesson 6: Comparing Ratios with Tables
- Lesson 7: Graphing Ratios
- **Lesson 8: Ordering Survey Results**

The Results Are In!

Funny People	
Number Who Prefer Video A	Number Who Prefer Video B
5	3

Serious People	
Number Who Prefer Video A	Number Who Prefer Video B
7	5

Impatient People	
Number Who Prefer Video A	Number Who Prefer Video B
6	2

Patient People	
Number Who Prefer Video A	Number Who Prefer Video B
8	8

Using ratios, order the groups according to their preference for Video A.

Then, use points and rays to graph the ratios for the groups on the coordinate plane provided.

The Results Are In!

Funny People	
Number Who Prefer Video A	Number Who Prefer Video B
5	3

Serious People	
Number Who Prefer Video A	Number Who Prefer Video B
7	5

Impatient People	
Number Who Prefer Video A	Number Who Prefer Video B
6	2

Patient People	
Number Who Prefer Video A	Number Who Prefer Video B
8	8

- Order the groups from “prefers Video A the most” to “prefers video A the least”.
- What strategy did you use to answer Question a?
- How does the graph support your answer for Question a?

(Hint: Try to think about how the strategy you used to compare the ratios in the tables would look on the graph.)

Phase 1: The Launch

What does research tell us is important?

Jackson et al. (2012) identify four components of successful launches:

1. Discuss the Key Contextual Features
2. Discuss the Key Mathematical Ideas
3. Develop Common Language to Describe the Key Features
4. Maintain the Cognitive Demand

Planning the Launch

1. Discuss the Key Contextual Features

What questions would you ask given that students last encountered this context over a week ago?

2. Discuss the Key Mathematical Ideas

What questions would you ask to increase the likelihood that students understand any mathematical ideas embedded in the task statement?

3. Develop Common Language to Describe the Key Features

What words are potentially troublesome? What vocabulary might you want to amplify if students introduce it during the launch discussion?

4. Maintain the Cognitive Demand

What do you want to avoid doing that would lower the cognitive demand by giving away a solution strategy?

Planning the Launch

What have we learned about supporting teachers in the Dig In as we “playtest” and pilot?

There is a delicate balance between covering the first three recommendations by Jackson et al. (2012) and overdoing the Launch.

Planning the Launch:

What to look for in teachers' support materials

Orienting questions:

Can anyone describe the videos and the survey questions from Survey Says?

How did you plot points representing the width-to-height ratios of pictures?

Essentials:

Students must understand that they need to consider the number of students who preferred Video B in each group as well as the number who preferred Video A in order to address the question.

Phase 2: The Dig In

What does research tell us is important?

This phase involves 2 of the 5 practices identified by Smith and Stein (2011):

- **Anticipating** student responses to the task
- **Monitoring** students' work

Phase 2: The Dig In

What have we learned about supporting teachers in the Dig In as we “playtest” and pilot?

Students benefit from in-the-moment reminders of strategies developed in response to prior tasks. Contexts are valuable cues.

One significant decision a teacher needs to make during the Dig-In is when to transition from the Dig-In to the Share-Out.

Planning the Dig In

1. Anticipate strategies do you predict students will use. How will you respond?

2. Anticipate questions you will ask to:

Help groups get started

Probe students' thinking

Focus students on the intended mathematics

Help students make mathematical connections

Extend students' thinking if they finish early

(Smith et al., 2008)

3. Plan how far you want students to get before you would transition to the Share-Out.

Planning the Dig In:

What to look for in teachers' support materials

- Misconceptions or Partial Understandings
- Productive Strategies
- Differentiated Instruction
- Other Types of Support

Planning the Dig In:

Misconceptions or Partial Understandings

Ignoring the Number who Preferred Video B

Next steps

Ask: What if there was a group where 10 people preferred Video A and 12 people preferred Video B? Would that group prefer Video A the most?

Ask: How did we compare how lemony different lemonade recipes would taste yesterday?

Planning the Dig In:

What to look for in teachers' support materials

- Misconceptions or Partial Understandings
- **Productive Strategies**
- Differentiated Instruction
- Other Types of Support

Planning the Dig In:

Productive Strategies

1. Determining a Common Value

Funny People	
Number Who Prefer Video A	Number Who Prefer Video B
5	3
25	15

Serious People	
Number Who Prefer Video A	Number Who Prefer Video B
7	5
21	15

Impatient People	
Number Who Prefer Video A	Number Who Prefer Video B
6	2
3	1
45	15

Patient People	
Number Who Prefer Video A	Number Who Prefer Video B
8	8
1	1
15	15

Planning the Dig In:

Productive Strategies

1. Determining a Common Value

Explore Meaning/Relationships

Ask: Where on the graph are the ratios you used to compare each group?

Ask: Is there another value that could be used to compare the ratios?

Planning the Dig In:

Productive Strategies

2. Determining Unit Ratios

Funny People	
Number Who Prefer Video A	Number Who Prefer Video B
5	3
$\frac{5}{3}$	1

Serious People	
Number Who Prefer Video A	Number Who Prefer Video B
7	5
$\frac{7}{5}$	1

Impatient People	
Number Who Prefer Video A	Number Who Prefer Video B
6	2
3	1

Patient People	
Number Who Prefer Video A	Number Who Prefer Video B
8	8
1	1

Planning the Dig In:

Productive Strategies

2. Determining Unit Ratios

Explore Meaning/Relationships

Ask: Can you show these unit ratios on the graph?

Ask: How could you use the other unit ratio to make the comparison?

Planning the Dig In

What to look for in teachers' support materials

- Misconceptions or Partial Understandings
- Productive Strategies
- **Differentiated Instruction**
- Other Types of Support

Planning the Dig In:

Differentiated Instruction

Jumpstarts

Ask: How did we compare how lemony different lemonade recipes would taste yesterday?

Planning the Dig In:

Differentiated Instruction

Extension

On your coordinate plane from the Dig-In, plot the point that represents a unit ratio of the number of people who prefer Video A to the number of people who prefer Video B for each group.

How could you use the unit ratios to help you decide which group has a greater ratio of people who prefer Video A to people who prefer Video B?

Planning the Dig In:

What to look for in teachers' support materials

- Misconceptions or Partial Understandings
- Productive Strategies
- Differentiated Instruction
- Other Types of Support

Planning the Dig In:

Other Types of Support

Eliciting Questions

Ask: How did you decide which group preferred Video A the most?

Transition Points

Not all students need to have answered Questions 2 or 3 before you transition to the launch; but, ideally, all have attempted to order the groups using tables.

Phase 3: The Share Out

What does research tell us is important?

This phase involves three of the five practices identified by Smith and Stein (2011).

- **Selecting** strategies that highlight intended mathematics
- **Sequencing** presentations
- **Connecting** to intended mathematics

Planning the Share Out

Which strategies would you select? How would you sequence the presentations?

Planning the Share Out

Which strategies would you select? How would you sequence the presentations?

Group A: Found common value for the number of people who prefer Video A. Graphed the original ratio for each group.

Group B: Found the unit ratio where representing one person in the group preferring Video B. Graphed the original values and the unit ratios, connected with a ray.

Group C: Found common value for the number of people who prefer Video B. Graphed the original ratio for each group.

Group D: Ignored the number of people who preferred Video B in each group. Graphed the original ratio for each group.

Planning the Share Out:

What to look for in teachers' support materials

- Help with selecting/ordering
- Help with connecting strategies to the intended mathematics

Planning the Share Out:

Connecting Table Strategies to Graphs

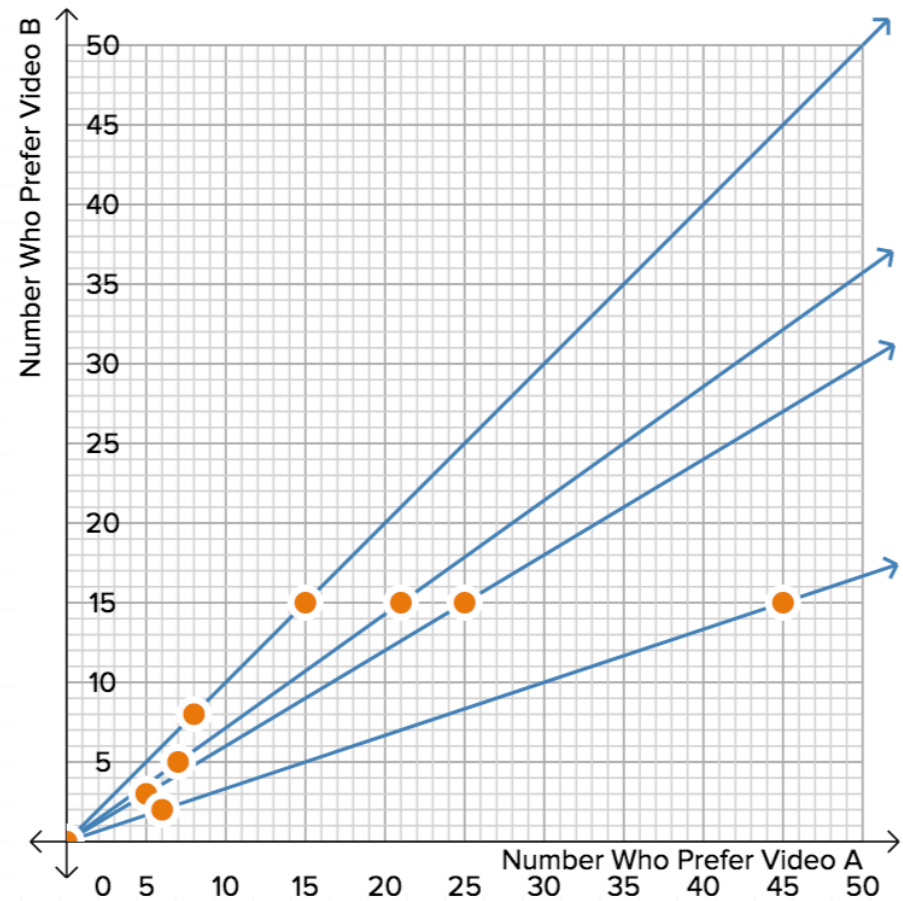
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Patient People	
Prefer Video A	Prefer Video B
8	8
1	1
15	15



Planning the Share Out:

Connecting Table Strategies to Graphs

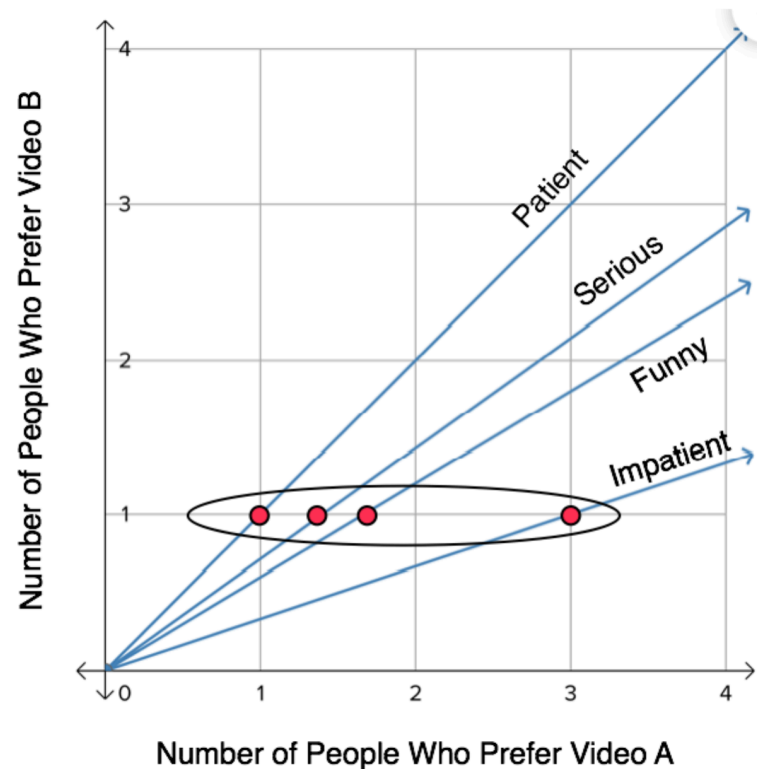
2. Determining Unit Ratios

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$\frac{5}{3}$	1

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$\frac{7}{5}$	1

Impatient People	
Prefer Video A	Prefer Video B
6	2
3	1

Patient People	
Prefer Video A	Prefer Video B
8	8
1	1



Planning the Share Out:

What have we learned about supporting teachers in the Dig In as we “playtest” and pilot?

- It’s helpful to have prepared formalizations so that teachers know the direction to take the discussion and so that students have some reference material.
- Teachers want the ability to assess which students are understanding the mathematical content after discussing the task.

Planning the Share Out:

What to look for in the curriculum

- Formalizations
- Examples
- Try Its

Planning the Share Out:

Formalizations

You can use a graph to compare ratios.

1. Plot the points representing the ratios.
2. Graph the rays representing equivalent ratios for each of the original ratios.
3. Locate common values by identifying points that line up either vertically or horizontally.
4. Use these points with common values to make the comparison.

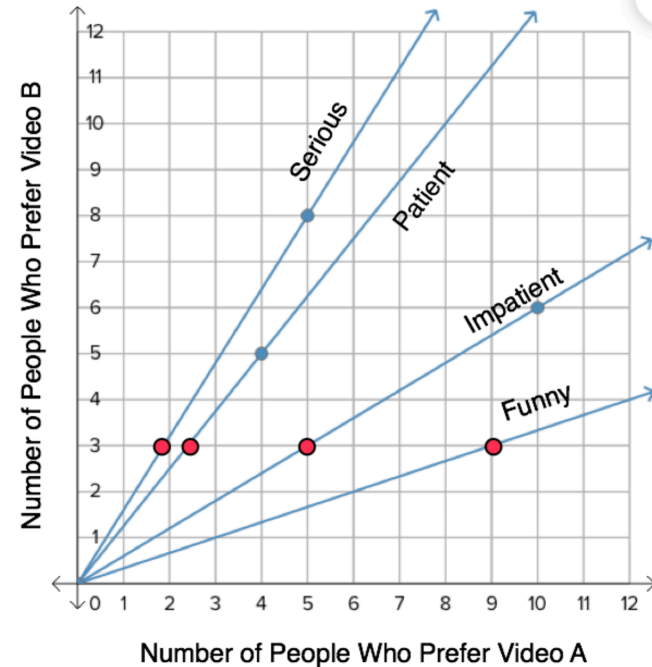
Planning the Share Out: Interactive Example

You can use the large red points to determine which group has a greater ratio of people who prefer Video A to people who prefer video B.

The large red points share a common value of 3 people who

prefer Video A / prefer Video B

Video Preferences of Students in Mr. Brown's Class



Of the groups represented by those points, the group of _____

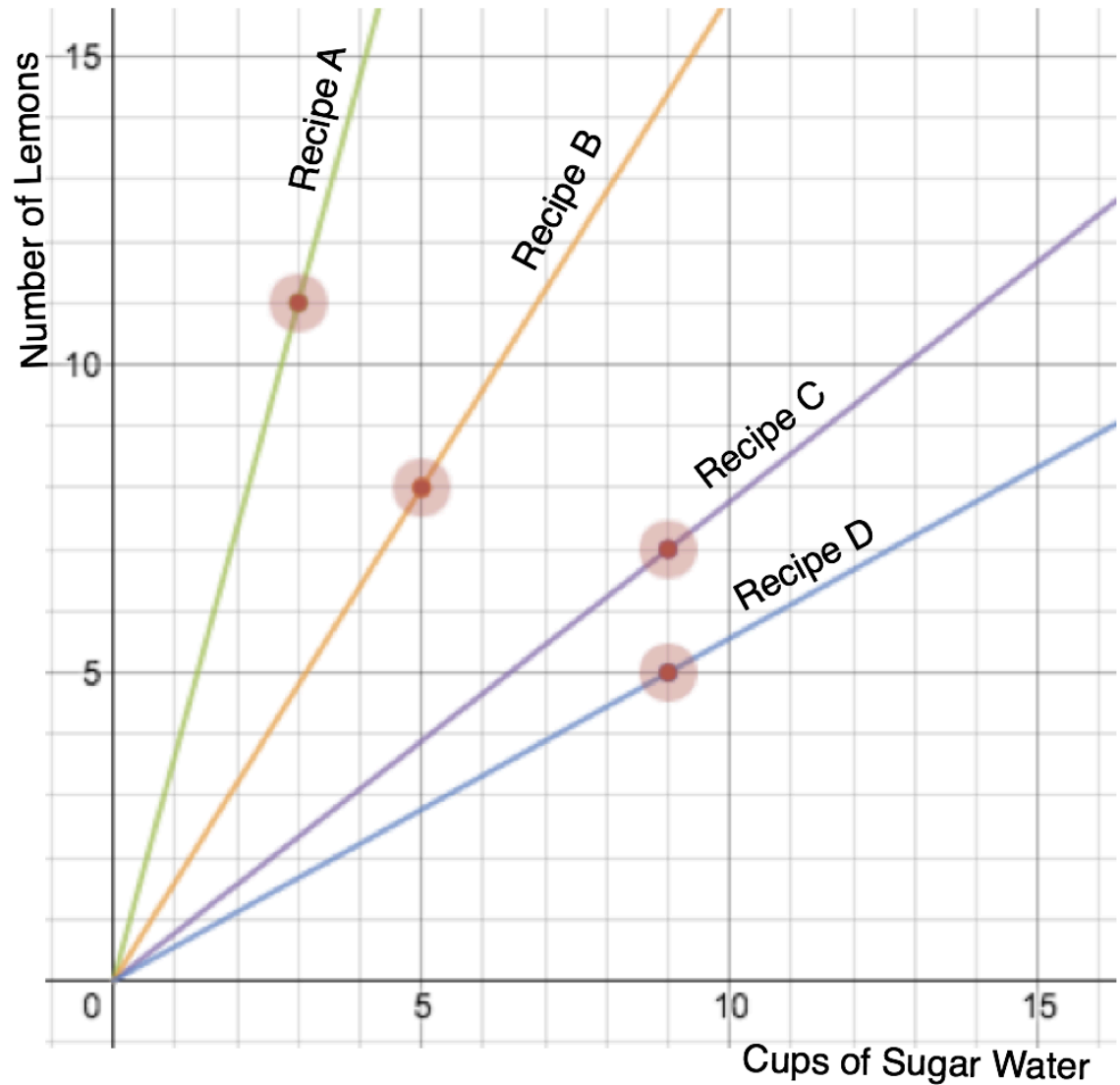
(serious/patient/impatient/funny)

people has the greatest number of people who prefer Video A. So, that is the group with the highest ratio of people

Planning the Share Out:

Try It


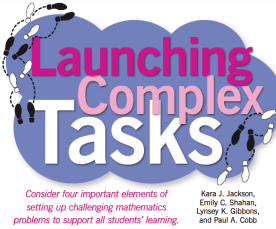
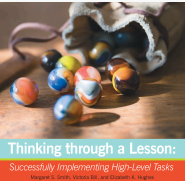

Drag the points so that they represent recipes with a common ratio value. Which recipe is the most lemony?



Intentional planning

1. It is very difficult in the moment to come up with appropriate questions to ask and ways to respond to students. By thoughtfully anticipating what students may do and how you will respond, you free up your mind to be truly focused on what the students are doing.
2. If you are using tasks provided by an external source, teacher support materials can inform your planning process.

Resources:

Citation	Reference	What it looks like
Stein et al. (2000)	Stein, M. K., Smith, M. S., Henningsen, M. A., & Silver, E. A. (2000). <i>Implementing Standards-based mathematics instruction</i> . NCTM: Reston, Virginia.	
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Thank you!

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