Supporting the Development of Professional Noticing with Representations of Practice

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IMAGINE

IMAGINE

an instance of

PRACTICE

Statistics
Classroom

IMAGINE

an instance of

PRACTICE

Statistics
Classroom

IMAGINE

an instance of

PRACTICE

Line of
Best Fit

Statistics
Classroom

Contextual
Problem

IMAGINE

an instance of

PRACTICE

Line of
Best Fit

Statistics
Classroom

Contextual
Problem

IMAGINE

an instance of

PRACTICE

Set of
Historical Data

Line of
Best Fit

Statistics
Classroom

Student-Generated
Strategies

Contextual
Problem

IMAGINE

Set of
Historical Data

an instance of

PRACTICE

Line of
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Statistics
Classroom

Student-Generated
Strategies

Contextual
Problem

IMAGINE

Set of
Historical Data

an instance of

PRACTICE

Good
Discussion

Line of
Best Fit

Statistics Classroom

Student-Generated Strategies

Contextual Problem

IMAGINE

Set of Historical Data

an instance of

PRACTICE

Good Discussion

Line of Best Fit

The lesson title says graph so we're "going to make a graph."

Statistics Classroom

Student-Generated Strategies

Contextual Problem

Set of Historical Data

IMAGINE

an Instructional

PRACTICE

Good Discussion

Line of Best Fit

HUH???

The lesson title says graph so we're "going to make a graph."

IMAGINE

an instance of

PRACTICE

UTILIZE

an instance of

PRACTICE

Observed
Pre-Service Teacher

UTILIZE

an instance of

PRACTICE

Observed
Pre-Service Teacher

UTILIZE

an instance of

PRACTICE

Current
Methods Class

Observed
Pre-Service Teacher

Future Methods
Class

UTILIZE

an instance of

PRACTICE

Current
Methods Class

Observed
Pre-Service Teacher

Future Methods
Class

UTILIZE

an instance of

PRACTICE

Current
Methods Class

Intelligent and Beautiful Conference Session Attendees

Observed
Pre-Service Teacher

Other Preparation
Programs

Future Methods
Class

UTILIZE

an instance of

PRACTICE

Current
Methods Class

Intelligent and Beautiful Conference Session Attendees

UTILIZE

an instance of

PRACTICE

REPRESENT

an instance of

PRACTICE

Words

REPRESENT

an instance of

PRACTICE

Words

DESCRIBING

an issue with

PRACTICE

Words

REPRESENT

an instance of

PRACTICE

Words

REPRESENT

an instance of

PRACTICE

Student Work

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Work

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REPRESENT

an instance of

PRACTICE

Student Work

Words

Video

REPRESENT

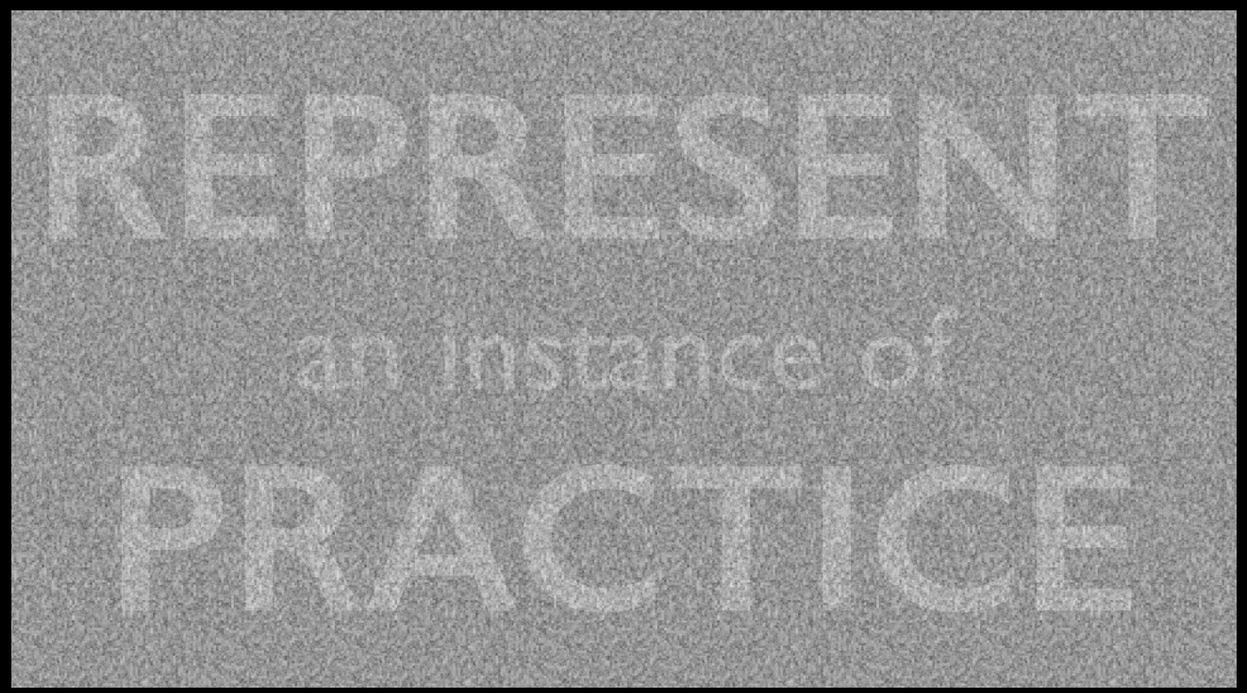
an instance of

PRACTICE

Student Work

Words

Video



Student Work

Words

Video

REPRESENT

an instance of

PRACTICE

Student Work

Words

Video

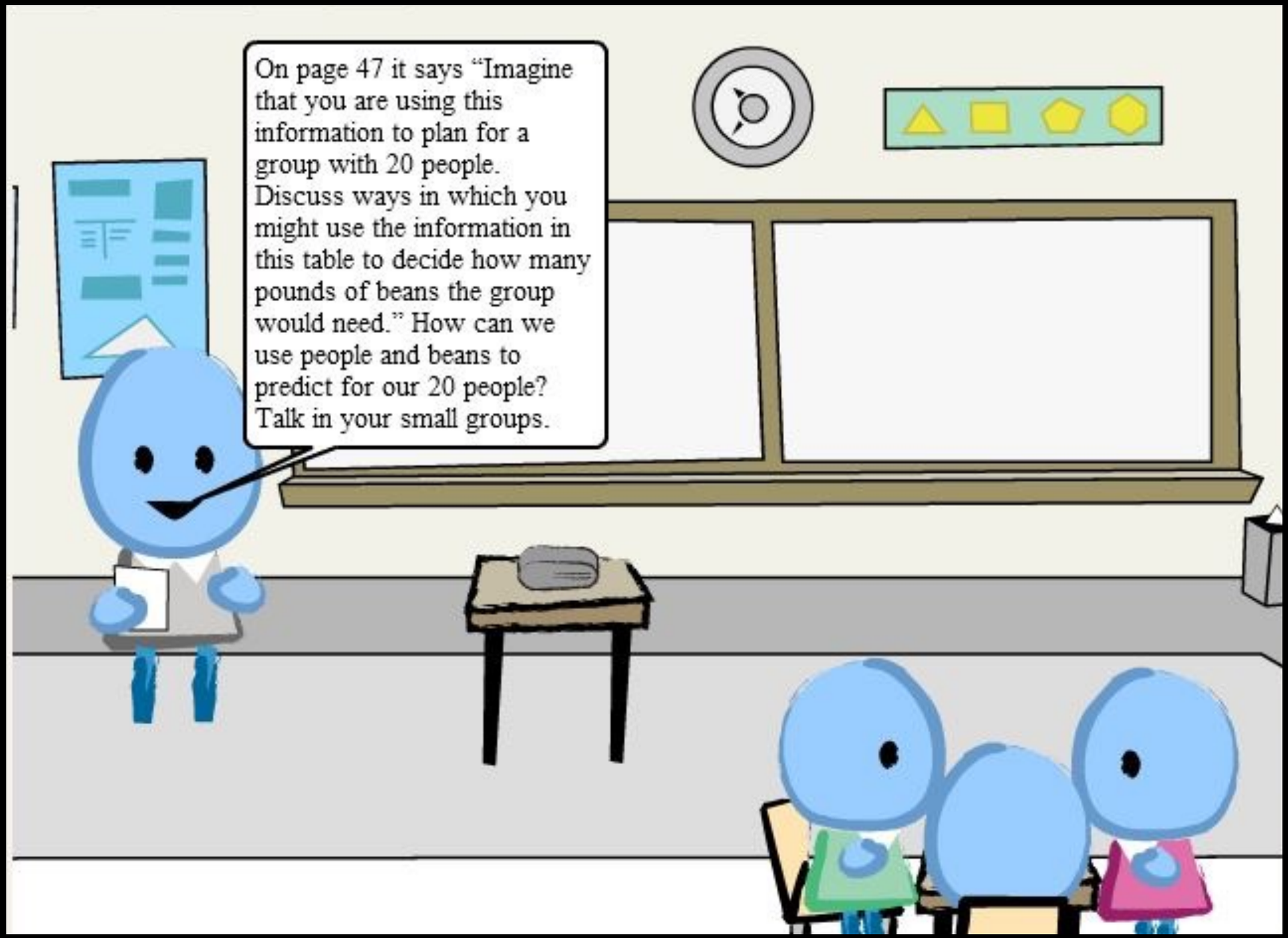
REPRESENT

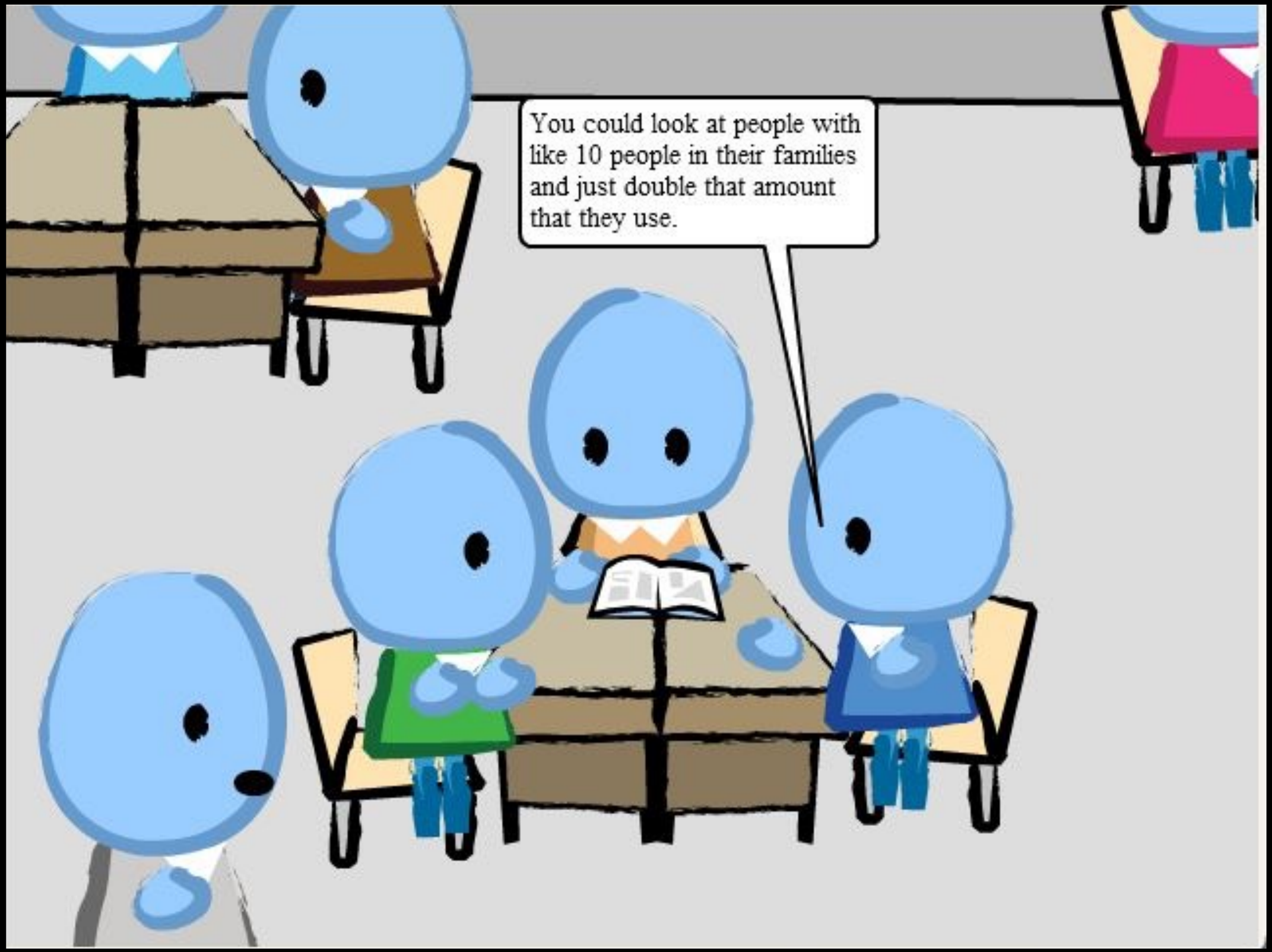
Animations

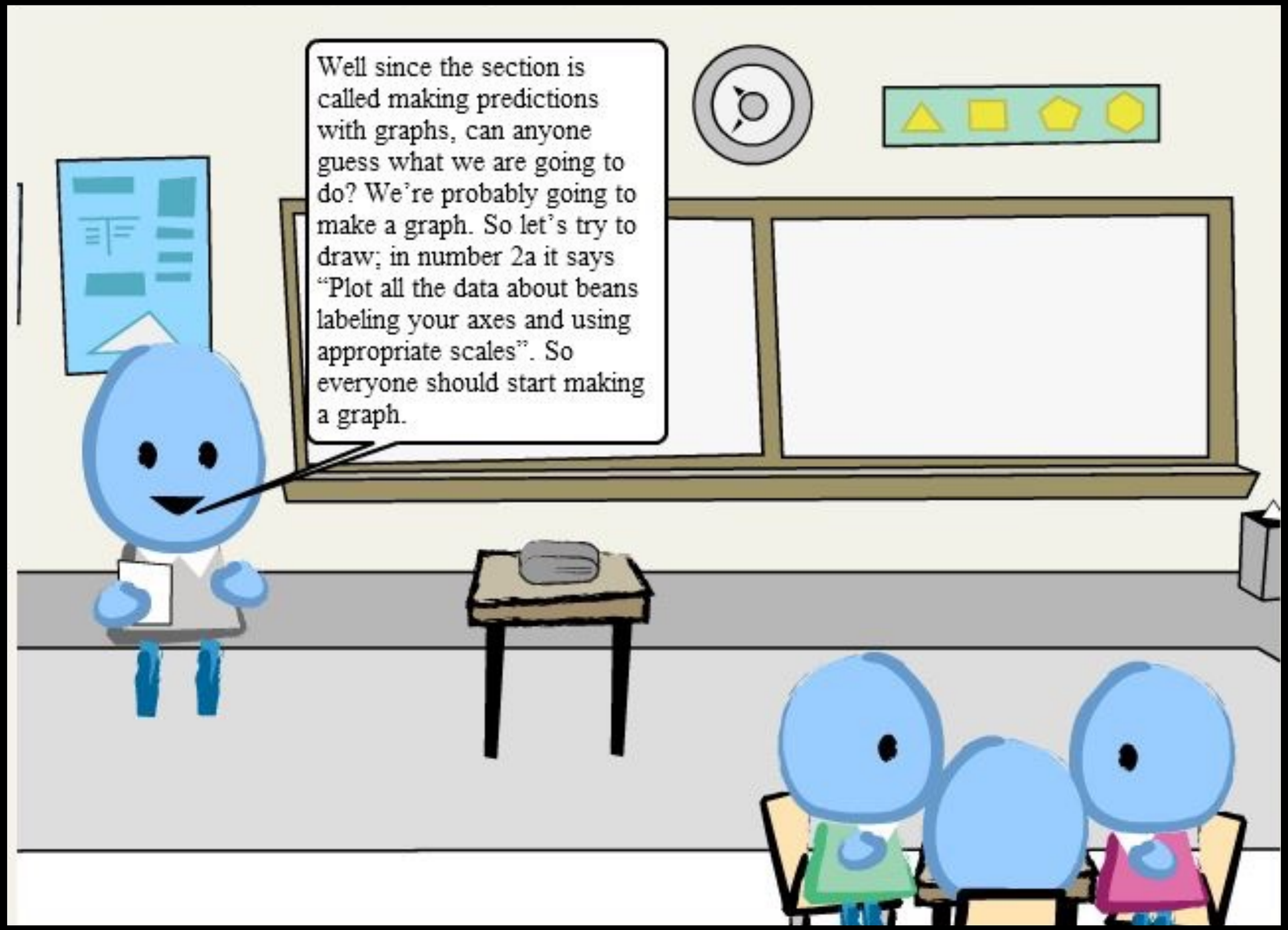
Student Work

an instance of

PRACTICE


On page 47 it says "Imagine that you are using this information to plan for a group with 20 people. Discuss ways in which you might use the information in this table to decide how many pounds of beans the group would need." How can we use people and beans to predict for our 20 people? Talk in your small groups.


You could look at people with like 10 people in their families and just double that amount that they use.


Well since the section is called making predictions with graphs, can anyone guess what we are going to do? We're probably going to make a graph. So let's try to draw; in number 2a it says "Plot all the data about beans labeling your axes and using appropriate scales". So everyone should start making a graph.

At this point, the class is convinced that this ‘scaling up’ strategy is the best one to take. However, the curriculum writers designed this question to be an introduction to the line of best fit, which is to be the focus of the day’s lesson. If you were the teacher, what would you do in this situation? Things to address include a way to convince the students that the ‘scaling up’ strategy is not the best one; how to transition from this ‘scaling’ method to the ‘best fit line’ method; how to help the students look at the data from an aggregate view (looking at data set as a whole) as opposed to a case view (looking at one data point at a time).

Please write your response here.

REPRESENT

an instance of

PRACTICE

NOTICING

an instance of

PRACTICE

NOTICING

NOTICING

Attending Interpreting Responding

Journal for Research in Mathematics Education
2010, Vol. 41, No. 2, 169–202

Professional Noticing of Children's Mathematical Thinking

Victoria R. Jacobs, Lisa L. C. Lamb, and Randolph A. Philipp
San Diego State University

The construct *professional noticing of children's mathematical thinking* is introduced as a way to begin to unpack the in-the-moment decision making that is foundational to the complex view of teaching endorsed in national reform documents. We define this expertise as a set of interrelated skills including (a) attending to children's strategies, (b) interpreting children's understandings, and (c) deciding how to respond on the basis of children's understandings. This construct was assessed in a cross-sectional study of 131 prospective and practicing teachers, differing in the amount of experience they had with children's mathematical thinking. The findings help to characterize what this expertise entails; provide snapshots of those with varied levels of expertise; and document that, given time, this expertise can be learned.

Key words: Children's strategies; Early childhood, K–4; In-service teacher education; Pedagogical knowledge; Planning, decision-making; Preservice teacher education; Professional development; Teaching practice

NOTICING

Attending Interpreting Responding

NOTICING

Attending Interpreting Responding

"attending to children's strategies"

NOTICING

Attending Interpreting Responding

"interpreting children's understandings"

NOTICING

Attending Interpreting **Responding**

"deciding how to respond on the basis of children's understandings"

Use of Video Analysis to Support Prospective K–8 Teachers' Noticing of Equitable Practices

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Mathematics teacher educators (MTEs) designed and studied a video analysis activity intended to support prospective teachers (PSTs) in learning to notice equitable instructional practices. PSTs from 4 sites ($N = 73$) engaged in the activity 4 to 5 times during the semester, using a set of 4 "lenses" to analyze teaching and learning as shown in videos. In an earlier analysis of this activity, we found that PSTs increased their depth and expanded their foci in noticing equitable instructional practices (Roth McDuffie et al., 2013). In this analysis, we shift the focus to our work as MTEs: We examine our decisions and moves in facilitating the video analysis activity with a focus on equity, and we discuss implications for other MTEs.

Key words: Children's mathematical thinking; Community; Culture; Diverse students; Funds of knowledge; Language; Mathematics methods course; Noticing; Prospective teachers

Teachers Empowered to Advance CHange in Mathematics (TEACH MATH) is a multiuniversity research project designed to promote equitable instructional practices by supporting teachers in learning to (a) capitalize on students' diverse cultural, linguistic, and community knowledge in ways that support students' mathematics learning (Aguirre et al., 2013; Turner et al., 2012), and (b) access and build on children's multiple ways of understanding mathematics and solving mathematical problems (e.g., Carpenter, Franke, Jacobs, & Fennema, 1998; Kazemi & Franke, 2004). We refer to these resources as children's *multiple mathematical knowledge bases* (Turner et al., 2012). A goal of the project is to design, study, and refine instructional modules for K–8 mathematics methods courses that explicitly develop prospective teachers' (PSTs') competencies for drawing on these knowledge bases in their mathematics teaching.

As part of the larger TEACH MATH project, we[1] designed and studied a video analysis activity intended to support PSTs in learning to notice children's multiple mathematical knowledge bases. PSTs use a set of four "lenses" (teaching, learning, task, and power and participation)[2] to analyze teaching and learning as represented in selected published videos. In an earlier study related to this activity, we found that the prompts and structure of the activity supported PSTs in increasing their depth of noticing and their foci in noticing. PSTs moved from attending primarily to teacher moves (and merely describing what they saw) to becoming aware of significant classroom interactions (e.g., between students, between teacher and students) and interpreting effects of these interactions on learning (Roth McDuffie et al., 2013). In this study, we shift the focus to our work as mathematics teacher educators (MTEs): We examine our decisions and moves in facilitating the video analysis activity with a focus on equitable instructional practices.

Supporting PSTs' Noticing and Learning

With this focus in mind, we briefly review literature related to how prospective (or practicing) teachers learn to notice and how mathematics teacher educators

1 Throughout the article, "we" refers to the first six authors, who are mathematics teacher educators and researchers who designed and enacted the video analysis activity. Data reported are from classes of four of the six authors. The last author is a graduate research assistant working on the project.

2 The Teaching, Learning, and Task Lenses were adapted from the work of Moschkovich (2003, 2011). The Power and Participation Lens was adapted from the work of Spencer (2006).

What is/are the central mathematics ideas in this task? (i.e., identify specific concepts, processes, skills, problem-solving strategies).

1. TASK: What makes this a good and/or problematic task? How could it be improved?

2. LEARNING: What specific math understandings and/or confusion are indicated in students' work, talk, and/or behavior?

RESOURCES & KNOWLEDGE BASES STUDENTS USE

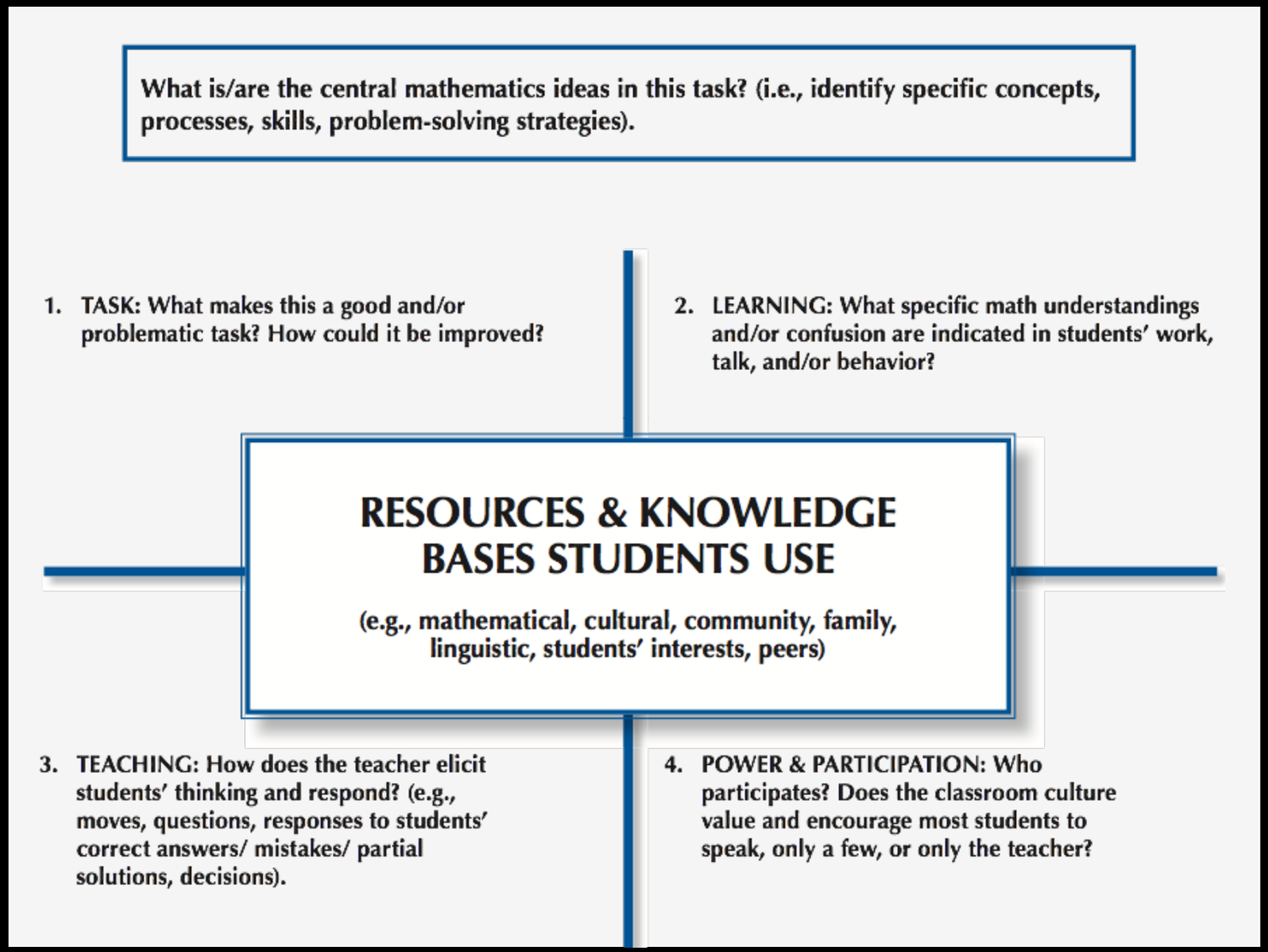
(e.g., mathematical, cultural, community, family, linguistic, students' interests, peers)

3. TEACHING: How does the teacher elicit students' thinking and respond? (e.g., moves, questions, responses to students' correct answers/ mistakes/ partial solutions, decisions).

4. POWER & PARTICIPATION: Who participates? Does the classroom culture value and encourage most students to speak, only a few, or only the teacher?

NOTICING

Attending Interpreting Responding



NOTICING

Attending Interpreting Responding

NOTICING

Attending **Interpreting** **Responding**

student-centered

NOTICING

Attending **Interpreting** **Responding**

student-centered

cognitive demand

NOTICING

Attending **Interpreting** **Responding**

student-centered

cognitive demand

funds of knowledge

NOTICING

Attending **Interpreting** **Responding**

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

Methods

Methods

Setting

Secondary Methods

Methods

Setting

Participants

18 Pre-Service Teachers

3 different academic semesters

Methods

Setting

Participants

Data Generation

LessonSketch

Methods

Setting

Participants

Data Generation

Data Analysis

QDAS

Cycles of Coding

NOTICING

Attending Interpreting Responding

NOTICING

Responding

NOTICING

Responding

"deciding how to respond on the basis of children's understandings"

NOTICING

Responding

"deciding how to respond on the basis of children's understandings"

There's a way that we can represent this data other than in a table. Can anyone tell me what we can do? We can plot these as points on a graph! Let's do this. Do we see any trends about the families with more people and the families with fewer people? Do some families with the same number of people have different values? Point to a spot on the graph that may represent a 20 person family.

Participant 1

NOTICING

Responding

"deciding how to respond on the basis of children's understandings"

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Participant 1

NOTICING

Responding

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

NOTICING

Responding

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

If we took your approach by finding the mean of the families of 5 members and multiplying that by 4, we get a different value than our answer with ten family members! Maybe we should try observing this data in a different way to get another idea, does anyone have an idea on how we can view this data a different way (graph the data points)?

Participant 15

NOTICING

Responding

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

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Participant 15

NOTICING

Responding

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

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Participant 15

NOTICING

So what we have done so far is find specific points and use the data for those to scale up to 20. What do you notice when you use all these different data points? Try a few! Are any of the answers the same or similar at all? How similar? We have 15 different data points to chose from! Maybe we should consider looking at the group of data as a whole. Do you see how this may be more accurate with our sample? What could we even do with the whole sample? What tools do we have? Brainstorm some ideas!

Participant 17

Responding

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

NOTICING

So what we have done so far is find specific points and use the data for those to scale up to 20. What do you notice when you use all these different data points? Try a few! Are any of the answers the same or similar at all? How similar? We have 15 different data points to chose from! Maybe we should consider looking at the group of data as a whole. Do you see how this may be more accurate with our sample? What could we even do with the whole sample? What tools do we have? Brainstorm some ideas!

Participant 17

Responding

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

NOTICING

Responding

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

contradicting

"The section is called graphing so we should make a graph" does NOT teach students to think critically or problem solve. In the real world if they have a problem like this there isn't going to be a "creating graphs" header to tell them what to do.

Participant 8

NOTICING

I would have the students look at two families of the same size which used a different number of beans and ask them what could have caused the families to use different amounts. This should get them thinking about the variability in family make-up. If we don't know how many children vs adults, men vs women, etc. make up each familiy, how can we still get a good estimate?

"The section is called graphing so we should make a graph" does NOT teach students to think critically or problem solve. In the real world if they have a problem like this there isn't going to be a "creating graphs" header to tell them what to do.

Participant 8

Responding

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

contradicting

NOTICING

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I would then suggest we graph all of the data points. Do they see any trends or patterns in the way the data points appear?

"The section is called graphing so we should make a graph" does NOT teach students to think critically or problem solve. In the real world if they have a problem like this there isn't going to be a "creating graphs" header to tell them what to do.

Participant 8

Responding

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

contradicting

NOTICING

Responding

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

contradicting

NOTICING

Responding

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

contradicting

NOTICING

Responding

student-centered

cognitive demand

funds of knowledge

context of problem

context of student

contradicting

MTE provides individual feedback on Noticing

Establish Noticing Norms

REFERENCES

Jacobs, V. R., Lamb, L. L. C., & Philipp, R. A. (2010). Professional noticing of children's mathematical thinking. Journal for Research in Mathematics Education, 41(2), 169–202. doi:10.2307/20720130

Roth McDuffie, A., Foote, M. Q., Drake, C., Turner, E., Aquirre, J., Bartell, T. G., & Bolson, C. (2014). Use of video analysis to support prospective K – 8 teachers ' noticing of equitable practices. Mathematics Teacher Educator, 2(2), 108–140.