

# Preparation Notes

Please review and customize this deck to prepare it for use. Some notes:

- These professional learning (PL) materials (slide deck and accompanying handout) are being offered in editable forms so that you may make adjustments to better support the specific work happening in your school or district.
- For the 2024–25 school year, student work samples are not provided for most sessions. The facilitator will need to collect or create student work samples when implementing these materials during 2024–25.
- These PL materials are designed to easily accommodate remote delivery:
  - A [Jamboard template](#) is provided to facilitate discussion of student work; the facilitator will need to make a copy of this and be ready to share the link with participants as noted in the deck.
  - Text that can be readily pasted (marked with “—”) into a video call chat feature is included when participants need to reference the handout.
  - There are placeholders for handout links to be shared with participants in the notes field of selected slides; the facilitator will need to add a link to the handout where indicated by “[insert link].”

# M214 Overview

**XQ Badge Project PL Series Baseline  
Session**

Insert date

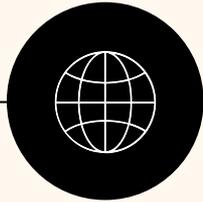


# Community Building

In 140 character or less, describe a how you've made shifts to remove deficit language or thinking in your practice.

*Use Google docs or Microsoft Word to check the character count.*

# Outcomes and Agenda



## Participants will be able to:

- Explain the content and practice expectations for the M214 badge
- Analyze tasks through the lenses of (1) content and practice expectations and (2) learning principles
- Analyze student work for evidence of learning

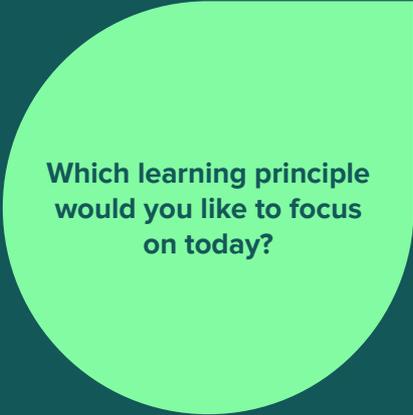


## Agenda:

- Exploring the Content
- Task 1: Expectations and Learning Principles
- Task 1: Student Work
- Task 2: Expectations and Learning Principles
- Task 2: Student Work
- Closing

# Learning Principles

1. Engage with cognitively demanding tasks in heterogeneous settings.
2. Engage in social activities.
3. Build conceptual understanding through reasoning.
4. Have agency in their learning.
5. View mathematics as a human endeavor across centuries.
6. See mathematics as relevant.
7. Employ technology as a tool for problem-solving and understanding.



**Which learning principle  
would you like to focus  
on today?**

01

# Exploring the Content

What comes to mind?  
What knowledge and skills  
should students learn to  
earn this badge?



**Come off mute  
or put your  
thoughts in the  
chat!**

# What's the Story of these Standards?

## **Selected Common Core Standards for Mathematics – Interpreting Categorical and Quantitative Data**

### **Summarize, represent, and interpret data on two categorical and quantitative variables**

5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
- Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.
  - Informally assess the fit of a function by plotting and analyzing residuals.
  - Fit a linear function for a scatter plot that suggests a linear association.

**How would you synthesize these?  
What are the key takeaways  
for students in 2–3 sentences?**

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  - Informally assess the fit of a function by plotting and analyzing residuals.
  - Fit a linear function for a scatter plot that suggests a linear association.

**Share your thinking!**

# M214 Content and Practice Expectations (CPE)

214.a	Demonstrate understanding of the role of variability in predictive modeling.
214.b	Use Pearson's $r$ to evaluate predictive models.
214.c	Use residuals to assess model fit and decide if changes to the predictive model or its variables are necessary.
214.d	Compare predictive models using statistical techniques in order to improve these models and decide which model makes the best predictions.
214.e	Consider the bias-variance trade-off that occurs when making a predictive model.

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**Put in the chat:  
Which ideas  
connect to  
what your  
group came up  
with?**

# M214 Content and Practice Expectations and Indicators

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**What new  
insights do you  
have?**

# Let's Investigate

Choose at least one task to explore:

- Used Subaru Foresters I
- Coffee and Crime

Which content and practice expectations are evident in each one?

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Which content and practice expectations are evident in each one?

**Come off mute  
or put your  
thoughts in the  
chat! What did  
you find?**

# What's the Same?

# What's Different?

1. How do these content and practice expectations align to ways you've taught this topic before?
2. How are they different?

**Come off mute  
or put your  
thoughts in the  
chat!**

# Inequity Is our Reality

**About**

60%

of community college students and 40 percent of four-year students are placed into non-credit bearing developmental mathematics (Ganga et al., 2018)

**Only**

33%

of community college students complete the developmental math sequence. Only 20 percent complete a college-level math course over three years (Bailey, Jeong, & Cho, 2010).

# We Must Lead the Movement

How can this approach give space for what math can be?

## Is math...?

- About getting one right answer, the teacher's way
- Irrelevant
- About doing procedures
- Independent work
- Something my teacher made up
- Formulaic

## Or could math be...?

- About using multiple strategies flexibly
- Connected to the real-world in ways that make sense
- About understanding and applying
- Collaborative work
- Lived across continents and centuries
- Novel, challenging problems

02

# Task 1: Expectations and Learning Principles

# Let's Do Some Math!

Build a bivariate model using machine learning relating variables in a baseball data set. While running Train/Test/Split in Colab, you will explore how model complexity affects the predictability of the algorithm. Run the program using Batting Average as the input target variable and Wins as the output predictor variable to answer the following questions:

- Run the cell with a complexity of 1. What function does this create?
- What is the difference between train data and test data?
- What do the points represent? What are the inputs and outputs of this model?
- Which model do you feel would be most predictable?
- Does lower testing error or lower training error indicate a more predictable model?
- How would you use this model to make a prediction?
- What does the ERR value mean?
- How would you describe the complexity of this model?
- Does increase in complexity improve the model? What complexity value do you feel is the best choice?

**Do the task as a student would. Jot down any reflections that you have as you do the math!**

# Content and Practice Expectations

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**Choose 1-2 Content and Practice Expectations that student work could give evidence of.**

# Content and Practice Expectations

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**214d.** Compare predictive models using statistical techniques in order to improve these models and decide which model makes the best predictions.

# Learning Principles

**In M214 Statistical Error and Predictive Modeling Validation, students will employ the following learning principles:**

- Engage with cognitively demanding tasks in heterogeneous settings (LP 1).
- Engage in social activities (LP 2).
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**Which of these principles does this task lend itself to? Which ones can the task be easily adapted to accommodate?**

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**Share what  
you came up  
with!**

03

# Task 1: Student Work

# Our Focus: Evidence of Learning



## Disrupting “High,” “Medium,” and “Low” in Mathematics Education

**Question:** Why is labeling students “high,” “medium,” and “low” problematic?

Do you, your school, or your district attempt to ensure that all students have access to mathematics learning opportunities that are rigorous, challenging, and affirming of their identities as learners and human beings? At the same time, do you, your school, or your district use terms such as “high,” “advanced,” “gifted,” “below basic,” “far below basic,” “remedial,” and “low” to characterize students’ mathematical abilities? These practices are fundamentally incompatible. If our society is to ever make high-quality mathematics teaching and learning for each and every student a reality, the practice of ability labeling must end.

Ability labels are widely used in education and especially in mathematics education. They are connected to cultural beliefs that frame mathematical ability as innate and fixed, positioning some people as “good at math” and others as “bad” at the subject (Boaler, 2016). Furthermore, mathematical abilities are frequently associated with a narrow range of qualities, particularly speed and accuracy in computation (Boaler & Staples, 2008) as well as whiteness, Asianness, and maleness (Martin, 2009). The following declarations highlight problems with these ways of thinking and acting and assert the need for change at many levels of policy and practice.

### **Ability labels are false.**

The development of mathematical understanding over the course of human history and for students in classrooms today relies on diverse and multidimensional ways of thinking, learning, and knowing (Boaler & Staples, 2008; Joseph, 2011). Ability labels obscure and distort this fact, compressing mathematical ability into a single linear scale. For example, a student may be fast and accurate with arithmetic computations but struggle to explain their reasoning. Teachers may label such a student “high” or “advanced” because the predominant culture privileges quick computation as an indicator of mathematical ability. But this label omits many important facets of the student’s current strengths and learning needs. Moreover, mathematical thinking, learning, and knowing vary across time and context. For example, students may display fluency

# Round 1: What do you notice?

What do you notice?

- Jot down at least one thing you notice about this piece of student work.

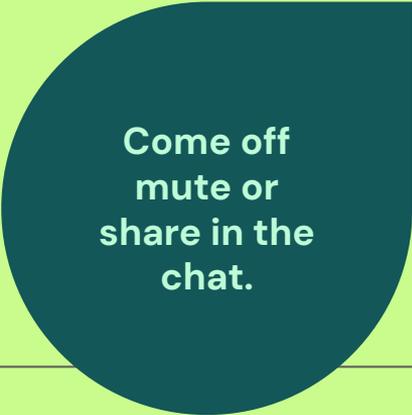


**Come off  
mute or  
share in the  
chat.**

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# Humanizing Assessment

Grading echoes the economic framework of testing, presuming that we can encapsulate learning in a number or a letter. Street data reminds us that our primary task as educators is to provide regular feedback to students so they can grow, not to evaluate them in order to anoint them academically capable or not. (Safir and Dugan, 2021, p. 135)

Source: Safir, Shane, and Jamila Dugan. *Street Data: A Next-Generation Model for Equity, Pedagogy, and School Transformation*. Corwin, 2021.

# Criteria for Success

<b>Conference and Provide Revision Support</b>	<b>Accept with Revision</b>	<b>Accept</b>
<p>The student's artifact shows an emerging understanding of the expectations of the indicator(s). After conferencing and additional instruction/learning, the student may provide a revised or different artifact as evidence of the indicator(s).</p>	<p>The student's artifact is approaching a full understanding of the expectations of the indicator(s). The artifact may contain execution errors that should be corrected in revision. The student may revise the selected artifact or submit a different artifact.</p>	<p>The student's artifact demonstrates evidence that they have met the expectations of the indicator(s).</p>

**What resonates with you? What questions surface for you?**

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# Round 2: What evidence of learning is there?

**214d. Compare predictive models using statistical techniques in order to improve these models and decide which model makes the best predictions.**

## Let's examine some work together:

### **Conference and Provide Revision Support**

The student's artifact shows evidence of an emerging understanding of the expectations of the indicator(s). After conferencing and additional instruction/learning, the student may provide a revised or different artifact as evidence of the indicator(s).

### **Accept with Revision**

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### **Accept**

The student's artifact demonstrates evidence that they have met the expectations of the indicator(s).

# Examining Student Work

The image shows a digital workspace for reviewing student work. At the top, there are three buttons: "Conference and Provide Revision Support", "Accept with Revision", and "Accept". On the left is a vertical toolbar with icons for editing, erasing, pointing, Jamboard, image insertion, erasing, and zooming. The "Jamboard" icon, which shows a document with a pencil, is circled in green, and a large green arrow points from a callout box to it. The callout box is a dark green rounded rectangle containing the text "Put your thoughts on the Jamboard!". In the bottom right corner, there is a circular label that says "Work Sample 1".

# Example #1



**Let's compare  
notes.**

# Example #2



**Let's compare  
notes.**

# Example #3



**Let's compare  
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04

# Task 2: Expectations and Learning Principles

# Let's Do Some Math!

Here is data of iPhone sales during the opening weekends:

iPhone	Year	Units Sold (millions)
Original	2007	0.5
3G	2008	1
3Gs	2009	1
4	2010	1.7
4S	2011	4
5	2012	5
5C, 5S	2013	9
6, 6 Plus	2014	10
6S, 6S Plus	2015	13

Work with a partner to complete the following questions. Be prepared to share your findings with another group:

- Use technology to create a scatterplot of the data with year as the explanatory variable and units sold as the response.
- Describe the form of the relationship.
- Use the technology to find the least squares regression line, and include its graph on your scatterplot.
- Use the least squares regression line to calculate the residual for 2007. Interpret the residual.
- Now graph the residuals using technology.

Do the task as a student would. Jot down any reflections that you have as you do the math!

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**214.c: Use residuals to assess model fit and decide if changes to the predictive model or its variables are necessary.**

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05

# Task 2: Student work examination

# Round 1: What do you notice?

What do you notice?

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**Our goal: understand student thinking so we can help to move it forward!**

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# Round 2: What evidence of learning is there?

**214.c: Use residuals to assess model fit and decide if changes to the predictive model or its variables are necessary.**

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# Example #1

**Let's Compare  
Notes**

# Example #2

**Let's Compare  
Notes**

# Example #3



**Let's Compare  
Notes**

06

# Closing

# Closing Discussion

Consider:

- What is next for you with M214 or other badges?
- What questions linger for you?
- What further support would you like to see?