

# 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].”

# M212 Overview

**XQ Badge Project PL Series Baseline  
Session**

Month XX, XXXX

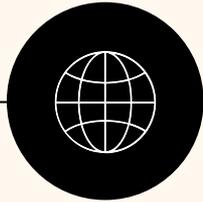


# Community Building

In 140 character or less, describe a moment or interaction that pushed your teaching 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 M212 badge
- Analyze tasks through the lenses of (1) content and practice expectations and (2) learning principles
- Analyze student work for evidence of learning

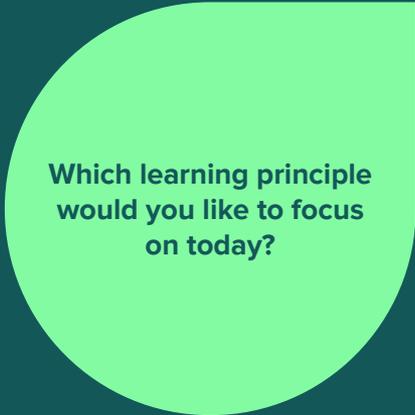


## Agenda:

- 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 – Using Probability to Make Decisions

### Calculate expected values and use them to solve problems

1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.
1. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

### Use probability to evaluate outcomes of decisions

5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.
  - a. Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fastfood restaurant.
  - b. Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.

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

# What's the Story of these Standards?

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  - a. Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fastfood restaurant.
  - b. Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.

**Share your thinking!**

# M212 Content and Practice Expectations (CPE)

|       |   |
|-------|---|
| 212.a | Engage in the modeling cycle.   |
| 212.b | Construct questions that can be answered by predictive modeling.  |
| 212.c | Select appropriate types of predictive models that help answer statistical questions and justify these choices.   |
| 212.d | Demonstrate understanding that $\text{Data} = \text{Model} + \text{Error}$ , where the Model may contain one predictor, multiple predictors, or no predictors at all. |
| 212.e | Understand and implement machine learning methods, and distinguish between supervised and unsupervised learning methods.  |
| 212.f | Improve predictive model fit by transforming variables, selecting variables, or using an alternate type of predictive modeling method.                                |
| 212.g | Use predictive models to make predictions and interpret these predictions in context.   |
| 212.h | Distinguish between correlation and causation.  |
| 212.a | Engage in the modeling cycle.   |

# M212 Content and Practice Expectations (CPE)

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| 212.h | Distinguish between correlation and causation.  |
| 212.a | Engage in the modeling cycle.   |

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

# M212 Content and Practice Expectations and Indicators

| Content and Practice Expectations                                       | Indicators<br>Choose an artifact where you...   |
|---|---|
| 212.a: Engage in the modeling cycle (performance assessment).           | i. engage with the full modeling cycle (problem, formulate, compute, interpret, validate, revise as necessary, report).   |
| 212.b: Construct questions that can be answered by predictive modeling. | i. differentiate between statistical and non-statistical questions by recognizing that a statistical question can be answered by collecting data and anticipates variability in those data. |
|   | ii. formulate statistical questions with the intent of answering the question using a predictive model.   |
|   | iii. postulate statistical questions that produce a given data visualization/model to answer those questions.   |
|   | iv. identify and define independent, dependent, and codependent relationships between potential variables in a given context or data set.   |



What new  
insights do you  
have?

# Let's Investigate

Choose at least one task to explore:

- Filtering Method Flowchart
- Your Favorite Sandwich

Which content and practice expectations are evident in each one?

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Choose at least one task to explore:

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- Your Favorite Sandwich

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

Seven of the ten fastest growing job categories in the United States are data centered, and an incredible 90% of the data ever created by humanity has emerged in the last two years. When our young people enter the workforce they will need to be confident and skilled at working with big data sets but we are woefully under preparing our students for this important mathematical work (Boaler & Levitt, 2019).

Source: [YouCubed](#)

# 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!

In groups, ask students to create a visual representation that communicates the relationship between the following terms: correlated, spurious correlation, causation, random relationship, direct relationship, confounding variable, and mediating variable. Some examples [here](#).

As you walk around groups, encourage students to share their thinking with each other as they decipher between these terms and decide on a visual that they feel represents the situation. The process and conversation is more important than the final product.

After groups have created a visual, invite them to share their visual with the class. Highlight the many different ways that groups have represented the relationship. As a class, discuss the different representations and the meanings of the terms, considering how they relate to each other.

**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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**212.h Distinguish  
between correlation  
and causation.**

# Learning Principles

**In M212 Predictive Modeling, students will employ the following learning principles:**

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

# Learning Principles

**In M212 Predictive Modeling, 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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- Have agency in their learning (LP 4).
- View mathematics as a human endeavor across cultures (LP 5).
- See mathematics as relevant (LP 6).
- Employ technology as a tool for problem-solving and understanding (LP 7).

**Which of these principles does this task lend itself to? Which ones can the task be easily adapted to accommodate?**

# Learning Principles

**In M212 Predictive Modeling, students will employ the following learning principles:**

- Engage with cognitively demanding tasks in heterogeneous settings (LP 1).
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**Share what  
you came up  
with!**

03

# Task 1: Student Work

## ASSET-BASED LANGUAGE

- Focuses on the strengths that a student brings to the learning community
- Views diversity in thought, culture, and traits as positive assets
- Is opportunity focused
- Signals the need to change the system to meet the needs and gifts of the student

## DEFICIT-BASED LANGUAGE

- Focuses on what a student is lacking
- Conveys what is missing that must be found/fixed
- Is needs/problem focused
- Leads educators to make assumptions about what a student may know and can do
- Implies the student must change to fit the system

*[T]erms are never neutral [...]; language, orientation, and definitions have the power to impact human relationships, identity, and academic success.*

*(Lu and Webster 84)*

# 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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# 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?**

# 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.

# Round 2: What evidence of learning is there?

**212.h Distinguish between correlation and causation.**

## 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**

The student's artifact shows evidence of 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.

### **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 interface for reviewing student work. At the top, there are three tabs: "Conference and Provide Revision Support", "Accept with Revision", and "Accept". On the left side, there is a vertical toolbar with several icons: a pencil, an eraser, a mouse cursor, a document icon (highlighted with a red circle and a red arrow), a photo icon, a circle icon, a text box icon, and a scissors icon. In the center of the workspace, there is a large red callout bubble with the text "Put your thoughts on the Jamboard!". In the bottom right corner, there is a red circular badge with the text "Work Sample 1".

# Example #1



**Let's compare  
notes.**

# Example #2



**Let's compare  
notes.**

# Example #3



**Let's compare  
notes.**

# Three Key Components of the Math Badging System

- Content and Practice Expectations
- Learning Principles
- Criteria for Success

Which one excites you the most?

What one will have the greatest impact on students?

What questions surface for you?



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

04

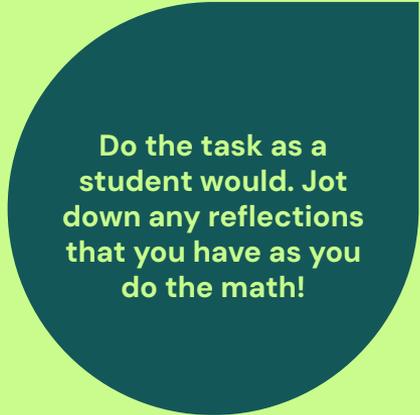
# Task 2: Expectations and Learning Principles

# Let's Do Some Math!

Students are given a prompt like this:

*A decision tree is similar to a series of questions that are asked sequentially. Observations start by answering the first question (at the root of the tree), and then proceed along the different branches based on the answers they give to the questions that follow. At the end, based on all of the questions asked, observations are then classified as one of  $k$  classifications.*

*Your goal today is to work with your group to design a decision tree that may help solve a classification problem. Your decision tree should have at least seven clearly defined **nodes**/leaves that either classify a person/object or prompt the need for a new leaf. Draw a diagram of your group's decision tree.*



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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| 212.f | Improve predictive model fit by transforming variables, selecting variables, or using an alternate type of predictive modeling method.                                |
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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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**212.b Construct questions that can be answered by predictive modeling**

# Learning Principles

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**Which of these principles does this task lend itself to? Which ones can the task be easily adapted to accommodate?**

05

# Task 2: Student Work

# 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!**

# M212 Content and Practice Expectations (CPE)

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# Round 2: What evidence of learning is there?

**212.b Construct questions  
that can be answered by  
predictive modeling.**

## Let's examine some work together:

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# Example #1

**Let's Compare  
Notes**

# Example #2



**Let's Compare  
Notes**

# Example #3



**Let's Compare  
Notes**

06

# Closing

# Let's Hear Some Reflections

What kinds of support will students need to demonstrate evidence of learning?

Has your thinking changed at all on how to implement this task? If so, how?



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