

M111 Modeling with Data: One-Variable Measurement Data

[Illustrative Mathematics–Algebra 1 Unit 1: One-variable Statistics](#)

[Illustrative Mathematics- Algebra 2 Unit 7: Statistical Inferences](#)

Notes for improving overall alignment:

- Opportunities for students to engage in pair or group work are an integral part of this curricular design, and special considerations will need to be taken into account if working outside of a traditional classroom setting to give students opportunities to **engage in social activities (LP2)**.
- Leverage the structure of the curriculum to give space for students to **have agency in their learning (LP4)**. This can be accomplished by learning about students’ interests and lived experiences, then tailoring curricular prompts to reflect those experiences and interests. Use the curriculum’s mathematical learning arcs to structure opportunities and check for progress toward attainment of *Content and Practice Expectations*.
- Leverage the structure of the curriculum to give students space to **view mathematics as a human endeavor across centuries (LP5)**. This can be accomplished by offering opportunities for students to reflect on how the knowledge and skills they’re developing are being used to impact decision making at the local level (classroom, campus, or neighborhood). This can be done in conjunction with attention to [Indicator 111.g](#).
- While most of the modeling cycle is well represented, there are few opportunities for students to formulate their own questions or to identify the variables of interest in a given situation or data set. The use of [Math Language Routine 5: Co-Craft Questions](#) may be useful in building these opportunities into some of the existing modeling tasks within the unit, particularly some of the more complex tasks toward the end of the unit. This is necessary to fully meet [Content and Practice Expectation 111.a](#).
- Educators will need to bring in space to attend to [Indicator 111.g](#) by using selected lessons from IM Algebra 2 Unit 7-Statistical Inference. Spaces where we see an opportunity for this are indicated by a square ■ in the unit overview chart.

Learning Principles

Engage with cognitively demanding tasks in heterogeneous settings (LP 1). Students should be given opportunities to grapple with multistep, non-routine tasks that promote mathematical rigor. These experiences should be differentiated so that all students engage in appropriate challenges—for example, through tasks with multiple entry points and solution pathways. These experiences should continue to integrate knowledge and skills developed in grades 6-8 at the level of sophistication of high school mathematics.

Engage in social activities (LP 2). Students should have opportunities to work independently and to communicate with one another about mathematics by engaging in collective and collaborative learning activities. Explaining and having opportunities to revise one’s thinking has excellent value in solidifying one’s knowledge.

Build conceptual understanding through reasoning (LP 3). Students should be given the opportunity to reason, justify, and problem solve with critical thinking, reading, writing, speaking, and listening. Through reasoning and work with multiple representations, students learn why procedures work and build a conceptual understanding of key mathematical ideas.

Have agency in their learning (LP 4). Students should be able to choose tasks and learning experiences that align with their interests and aspirations. All students have rich and varied experiences and home lives. Learning mathematics should bring students’ identities and interests to the fore and build on the strengths that they bring to the learning space.

View mathematics as a human endeavor across centuries (LP 5). Students should understand that mathematical ideas emanated over time from civilizations around the world and have opportunities to explore these contributions to mathematics. Students should develop an appreciation of mathematics as a human endeavor: one in which they feel a sense of belonging, where they see themselves as mathematicians, and one that offers opportunities to broaden their ideas about what mathematics is, how it is used, and who it is for.

See mathematics as relevant (LP 6). Students should engage with mathematics in ways that authentically involve real-world situations. Problem-solving contexts should allow students to perceive mathematics as a tool for addressing the questions that arise in everyday life, as well as the ways it can model our world and address global economic, social, and environmental

challenges. Students should also engage with mathematics in ways that connect to academic disciplines and future careers by doing the mathematics used by artists, designers, engineers, and other professionals.

Employ technology as a tool for problem-solving and understanding (LP 7). Research indicates that technology is a powerful tool for learning deeper mathematics by improving calculation efficiency and enabling more sophisticated analysis. Students should learn to use technology, with emphasis put on widely used tools and software, such as calculators and spreadsheets, to make sense of models. Technology use should not be limited to supporting “doing mathematics,” but should also be used as a tool for displaying and communicating results to appropriate audiences.

Content and Practice Expectations

Content and Practice Expectations	Indicators Choose an artifact where you...
111.a: Engage in the modeling cycle.	i. engage with the full modeling cycle (problem, formulate, compute, interpret, validate, revise as necessary, report).
111.b: Develop statistical questions in the course of modeling with one-variable measurement data.	i. develop a statistical question to investigate.
	ii. explain or justify why your question is statistical.
111.c: Interpret differences in shape, center, and spread in the context of data sets, accounting for the possible effects of extreme data points (outliers).	i. determine and construct an appropriate graphical representation of collected data, such as box plot, line plot, histogram, or other data display.
	ii. describe the shape, center, and spread of a data set.
	iii. interpret the real-world meaning of the shape, center, and spread of a data set.

	iv. identify and explain the effect of an outlier on the shape, center, and spread of a data set.
111.d: Use measures of center and variability to describe one-variable measurement data.	i. find the mean or median of a set of data and explain its meaning.
	ii. find the interquartile range or standard deviation of a set of data and explain its meaning within the context of the data.
111.e: Generate a random sample in the course of modeling with one-variable measurement data.	i. describe a process for generating a random sample to investigate a statistical question.
	ii. explain why a proposed process generates a random sample that is appropriate for the statistical question being investigated.
111.f: Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	i. construct a box plot, line plot, histogram, or other data display for each of two related data sets.
	ii. find measures of center (mean or median) and variability (standard deviation or interquartile range) for two data sets.
	iii. compare two data sets in terms of their center and variability.
	iv. explain the choice of measures of center and variability used to compare the two populations.
111.g: Estimate population percentages by using a normal curve to approximate a data distribution.	i. explain why a normal distribution is an appropriate approximation for a data set.
	ii. find an estimated population percentage by using a normal curve to approximate a data distribution.
	iii. explain the meaning of an estimated population percentage.

Unit Overview

	<u>L1</u>	<u>L2</u>	<u>L3</u>	<u>L4</u>	<u>L5</u>	<u>L6</u>	<u>L7</u>	<u>L8</u>	<u>L9</u>	<u>L10</u>	<u>L11</u>	<u>L12</u>	<u>L13</u>	<u>L14</u>	<u>L15</u>	<u>L16</u>	<u>L17</u>	<u>L18</u>	<u>L19</u>	<u>MT</u>
111.a.i																X				X
111.b.i	X															X				X
111.b.ii	X															X				X
111.c.i		X	X						X	X						X				X
111.c.ii		X	X	X						X	X									X
111.c.iii			X	X							X									X
111.c.iv									X	X		X		X						X
111.d.i		X	X		X					X	X	X		X						
111.d.ii		X	X		X						X	X		X						
111.e.i																				
111.e.ii																				
111.f.i																				X
111.f.ii											X		X							
111.f.iii											X		X		X					X
111.f.iv											X		X		X					X
111.g.i																	■	■	■	■

111.g.ii																			■	■	■	
111.g.iii																				■	■	■

Note: Columns in gray indicate a recommendation to delete the lesson

Guidance for Lesson Priority

Unit.Lesson	Priority D - Delete M - Modify K - Keep	Content and Practice Expectations (CPE)	Learning Principles (LP)	Additional Lesson Information
1.1	K Needed for later activity.	111.b.i 111.b.ii	LP2, LP4	Context: Last names, birthdays, mileage from home, food, movies Math focus: Writing and collecting Statistical and non-statistical questions and numerical and categorical data
1.2	K Practice with data displays for Lesson 3. Consider asking students to think about why anyone would want to know the number of days it takes for a tomato plant to start producing fruit as a launch to the activities in this lesson to attend to LP6.	111.c.i 111.c.ii 111.d.i 111.d.ii	LP1, LP3, LP6	Context: Tomato plants Math focus: Data represented by dot plots, histograms, and box plots
1.3	K Data display for Lesson 1.	111.c.i 111.c.ii 111.c.iii 111.d.i	LP1, LP3	Context: Last names, birthdays, mileage from home, food, movies Math focus: Creating two different data

Unit.Lesson	Priority D - Delete M - Modify K - Keep	Content and Practice Expectations (CPE)	Learning Principles (LP)	Additional Lesson Information
		111.d.ii		displays from information collected in Lesson 1
1.4	K	111.c.ii 111.c.iii	LP1, LP2, LP3, LP6	Context: Games, temperatures, restaurants, vocabulary, trees, weight of crystals, core samples Math focus: Describing the shape of distributions using formal language and inventing contexts for distributions with different shapes
1.5	K	111.d.i 111.d.ii	LP1, LP6	Context: Heart rates Math focus: Calculating MAD and IQR
1.6	D Delete unless students do not have any experience with spreadsheets.		LP7	Context: Variety of numbers and formulas Math focus: Creating formulas in a spreadsheet
1.7	D Delete unless students do not have any experience with spreadsheets.		LP7	Context: Speed limit, right triangles, recipes Math focus: Creating formulas in a spreadsheet

Unit.Lesson	Priority D - Delete M - Modify K - Keep	Content and Practice Expectations (CPE)	Learning Principles (LP)	Additional Lesson Information
1.8	D Delete unless students do not have any experience with spreadsheets.		LP7	Context: Birthdays, gym memberships Math focus: Entering values and patterns into a spreadsheet
1.9	M Change to include statistical data that actually connects to real life contexts, authentic challenges, and/or interests for students.	111.c.i 111.c.iv	LP3, LP5, LP6, LP7	Context: Statistical data Math focus: Display and investigate data using technology
1.10	K	111.c.i 111.c.ii 111.c.iv 111.d.i	LP3, LP7	Context: Battle Royale, darts, dartboard Math focus: Measures of center and the shape of distribution
1.11	K	111.c.ii 111.c.iii 111.d.i 111.d.ii 111.f.ii 111.f.iii 111.f.iv	LP1, LP2, LP3	Context: Miles driven in a month, sea scallop shells Math focus: Variability using data

Unit.Lesson	Priority D - Delete M - Modify K - Keep	Content and Practice Expectations (CPE)	Learning Principles (LP)	Additional Lesson Information
1.12	K	111.c.iv 111.d.i 111.d.ii	LP2, LP7	Context: Purely mathematical Math focus: Standard deviation as a measure of variability
1.13	K	111.f.ii 111.f.iii 111.f.iv	LP1, LP2, LP3, LP6	Context: African and Asian elephants, trees, forest, German language, raisins in cereal, granny smith apples, navel oranges, points scored in a basketball game Math focus: Standard deviation in context
1.14	K	111.c.iv 111.d.i 111.d.ii	LP2, LP5, LP6, LP7	Context: Healthcare spending, number of crimes reported in CA colleges, number cube, siblings, and biodiesel mass Math focus: The impact outliers have on measures of center and variability
1.15	K	111.f.iii 111.f.iv	LP3, LP6	Context: Bowling, marathon times, political podcast, cooking podcast, stress testing concrete, wide receiver times, tight end times

Unit.Lesson	Priority D - Delete M - Modify K - Keep	Content and Practice Expectations (CPE)	Learning Principles (LP)	Additional Lesson Information
				Math focus: Comparing data sets using variability (standard deviation) and measures of center
1.16	K	111.a.i 111.b.i 111.b.ii 111.c.i 111.e.i 111.e.ii	LP1, LP2, LP5, LP6, LP7	Context: Dropping a ruler, heights and handedness Math focus: Data collection, data analysis, answering a statistical questions
A2.7.5	M Can amplify relevance by inviting students to explore <u>why hand size might matter</u> for piano players in Activity 5.2. In doing so, look to bring relative frequency histogram questions from Activity 5.3 into the discussion of 5.2.	111.g.i	LP3, LP5, LP6, LP7	Context: Hand span and playing piano, distribution of butter sticks manufacturing Math focus: Introduction of normal distribution, relative frequency histogram, and normal curve
A2.7.6	M Add this lesson from A2 Unit 7. Consider asking students to reflect on	111.g.i 111.g.ii 111.g.iii	LP3, LP7	Context: Length of short stories, website load times Math focus: Making connections

Unit.Lesson	Priority D - Delete M - Modify K - Keep	Content and Practice Expectations (CPE)	Learning Principles (LP)	Additional Lesson Information
	the following question to engage students in LP6: <i>why do you think understanding these distributions is important?</i>			between histograms, normal distributions, the mean, and the standard deviation to estimate population proportions
A2.7.7	M Add this lesson from A2 Unit 7. Consider asking students to reflect on the following question to engage students in LP6: <i>why do you think understanding these distributions is important?</i>	111.g.i 111.g.ii 111.g.iii	LP3, LP7	Context: Lifespan of lightbulbs, wait times at a restaurant Math focus: Finding area under a normal curve and interpreting the area as a proportion of values in context
Modeling Task 1- <u>Display Your Data</u>	M Broaden the scope of this prompt to give students the option to apply their understanding of normal distribution.	111.a.i 111.b.i 111.b.ii 111.c.i 111.c.ii 111.c.iii 111.c.iv 111.f.i 111.f.iii	LP4, LP6, LP7	Context: Student choice Math focus: Statistical question, data collection, comparing data sets, using measure of center and variability, data display, outliers, shape of distribution

Unit.Lesson	Priority D - Delete M - Modify K - Keep	Content and Practice Expectations (CPE)	Learning Principles (LP)	Additional Lesson Information
		111.f.iv		