



## MODULE 3: INFORMATION

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### Tools and Resources for Information



3.1.1T: Data Collection Planning Tool

3.2.1T: Practice Making Valid Inferences

3.3.1T: Data Analysis Protocol

Also revisit tools from *Inquiry*:

2.4.1T: Building Data Displays Protocol

2.4.2R: Data Display Rubric

2.4.3R: Types of Data Displays

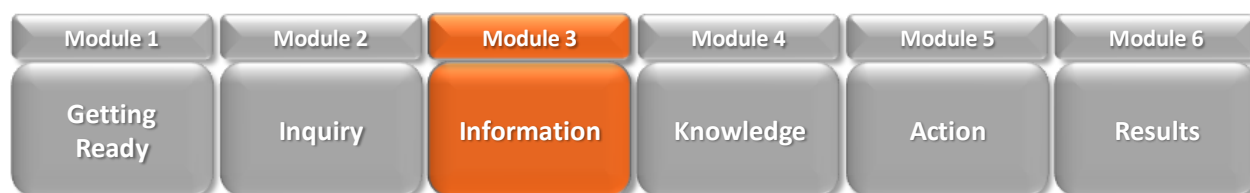
2.4.4R: More Data Display Resources





## WHERE ARE WE NOW?

The District Data Team Toolkit is based on the Data-Driven Inquiry and Action Cycle. The Cycle provides the structure that takes data use within the district from asking the right questions to getting results. It is an iterative process in which the district acts on data to support continuous improvement. The Toolkit uses the steps of the Cycle to structure a progression through the model—you are now in **Module 3: Information**.



Raw data alone does not support the inquiry process. Central to turning raw data into information is the process of data analysis. The *Information* module can help a District Data Team build its capacity to analyze data by considering the appropriate use of assessment results and the formation of valid inferences.

Through the data overview process introduced in the *Inquiry* module, the District Data Team identified the data needed to move the inquiry process forward. Next the Team must collect and organize the data in order to be poised to analyze the data and make meaning from them.

## MODULE OBJECTIVES

The **Information** module will help a District Data Team:

- ▶ Collect and organize data relevant to the inquiry process
- ▶ Distinguish between observations and inferences
- ▶ Make inferences from multiple sources of data



## PREPARING DATA FOR ANALYSIS

At this stage of the process, the District Data Team should develop a list of data needed to address the clarifying questions related to its focus of inquiry. Now the Team must actually collect the data and organize these in a meaningful way that promotes rigorous analysis. The *Focusing Questions Investigation Template (2.5.2T)* and the *Data Inventory Template (1.5.1T)* can be useful in taking this next step.



### Activity 3.1 Data Collection

This tool will help guide the collection of specific data needed to answer a focusing question and related clarifying questions.

(3.1.1T: Data Collection Planning Tool)

Once data are collected, the Team will want to display the data in a meaningful way that prompts curiosity and allows viewers to make comparisons and inferences about causality. Displays should show as much information as possible in as small an area as possible, without any distractions or extraneous information. The *Inquiry* module introduced a variety of data displays that may be useful for the Team to revisit at this stage in the process. In addition, the Team may want to consider the following questions:

- Do the displays highlight contrasts and differences?
- Do they show multiple factors?
- Is evidence from different sources integrated?
- Is the data of high quality and integrity?
- Is it relevant to the questions being investigated?
- Are displays laid out so important comparisons are in the same page or eye span? (It's best not to have to turn pages to compare data)<sup>1</sup>

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## **REVISIT 2.4 Building a Data Display**

These tools were first introduced in *Module 2: Inquiry*, but may be useful at this stage of the process.

The *Building Data Displays Protocol* enables District Data Team members to apply the principles of data display construction to tell a story related to a focusing question. The *Data Display Rubric* provides a framework for the Team to assess the quality of the data displays it creates. The *Types of Data Displays* and *More Data Display Resources* provide some ideas for different ways that data can be represented.

(2.4.1T: Building Data Displays Protocol)

(2.4.2R: Data Display Rubric)

(2.4.3R: Types of Data Displays)

(2.4.4R: More Data Display Resources)

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## ANALYZING DATA

A thoughtful and rigorous analysis of data is key to a successful inquiry process. It can be easy to unknowingly approach data with the answer already in our minds, consciously or unconsciously seeking evidence that supports what we already believe to be true. Approaching data with a truly open mind takes practice and discipline.

Approaching data with a truly open mind takes practice and discipline.

The first step in data analysis, as described in the data overview process in the *Inquiry* module, is the objective description of what the data say. What patterns and trends are evident in the data? It is very important to focus on this first step before making inferences or drawing conclusions from the data, because clarifying questions often need to be posed and additional data collected before valid inferences can be made. Colleagues on a District Data Team can play an important role in helping each other use language that is as specific and objective as possible when discussing information and data. For example, helping each other distinguish between observations and inferences:

**Observation:** Factual interpretations and statements about quantities, e.g., “Over half the principals report...”; the presence of specific information and/or numerical relationships between ideas, e.g., “Over 90% of the district’s schools have teams...”; or patterns, e.g., “most principals report that their teams are focused on...” An observation captures an unarguable fact and may be indicated by phrases such as *I observe that...*, *some patterns/trends that I notice...*, or *I am surprised to see...*

*Example: About one third of our students performed below proficient in mathematics.*

**Inference:** A conclusion, explanation, or conjecture that is drawn from a data set, such as using a smaller set of data to make broader generalizations or predictions. An inference reflects the meaning that the observer is making from the data, and may be indicated with phrases like *I predict...*, *I think...*, *because...*, or *therefore...*, or by imprecise qualifiers like *smarter*, *adequate*, or *poorly*.

*Example: About one third of our students are not on track to meet the mathematics criteria for graduation.*

Both observations and inferences play crucial roles in the data analysis process. What is important is to distinguish between the two. The Team should be sure to rigorously examine the data for patterns, trends, and outliers that can be factually explained, prior to making any inferences or conclusions about what those patterns may mean.

## ANALYZING ASSESSMENT DATA

Much of the data analysis work that the District Data Team will undertake will involve assessment data. Prior to engaging in analysis, it is important for the Team to have a common understanding of assessment terms, concepts, and how these data should and should not be used to form inferences about student performance. If the Team has not done so already, it may want to review the resources on assessment literacy in the *Getting Ready* module in order to expand the Team's capacity in this area.

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### Activity 3.2 Making Valid Inferences From the Data

During this activity, the Team will view multiple data displays and check the inferences made by another data team for validity.

This activity also appears in the ESE Data Warehouse course DW 102. The Data Displays used are all “Pre-defined Reports” from the ESE Data Warehouse. You may want to revisit *Activity 1.5 Assessment Literacy*.

(3.2.1T: Practice Making Valid Inferences)

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## INCORPORATING OTHER TYPES OF DATA

To this point, making inferences has been based on only one measure, the MCAS. Yet no single data source can provide a complete picture of the business of teaching and learning within the district. The District Data Team can increase the validity and credibility of its inferences if it can use a variety of related data sources to provide more information about the question being investigated. Because unconscious biases and assumptions can unknowingly skew analysis of data, a group can increase the validity and credibility of the inferences it generates by ensuring at least two data elements yield the same or similar information.

The Team might consider the impact of simultaneously examining data from two or more of the domains discussed in the *Getting Ready* module: student outcomes; perceptions of stakeholders; demographics of students; faculty and staff; and school and district processes.<sup>2</sup> Similarly a team might consider looking at data from different intervals throughout the year.

Questions the Team might ask when triangulating across data sets include:

- What patterns or inconsistencies are evident across the different data sets?
- Do different data sets reveal the same patterns and trends? If not, what can be learned from the differences? (For example, does the same student score at comparable levels of proficiency on different assessment measures?)
- How has the data changed over time? (Longitudinally)
- How does the data compare with data from other populations in the district?



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### Activity 3.3 Data Analysis Protocol

These protocols can guide the District Data Team in the process of analyzing data from non-traditional and/or multiple sources.

(3.3.1T: Data Analysis Protocol)

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## FACILITATING THE PROCESS

When designing the format for a discussion of data, the district may want to assign a facilitator who can help the group with the following:

- Ensure all Team members have an equal voice in sharing observations of the evidence that has been gathered
- Put as much data on the table as possible, from high-level to fine-grained observations
- Keep the conversation at the level of specific and objective evidence, redirecting people if the language drifts to become more general and/or judgmental
- Beware of allowing broad generalizations based on only one source of evidence
- Challenge each other's assumptions and generalizations by asking "why?" and "what's the evidence?"
- Be prepared to be surprised
- Think ahead about what the group might want to report out to others in the district and how, and look for ways to generate reports and visuals as part of the discussion process. For example, might the group want to leave certain flip charts up for display and public comment? Would it help to type notes directly into a laptop so they don't need to be rewritten later?

It is crucial for the Team to create the conditions for thoughtful consideration of the evidence. If the Team reads the data wrong, it can misdiagnose the appropriate course of action. As with medicine, car repairs, or other problem-solving processes, a misdiagnosis could not only result in wasted time and resources, it could also actually cause damage. The more time the Team spends engaging with data, critically looking at the data, and asking each other hard questions about the inferences drawn from these data, the more capacity it will build and the more confidence it can have in the subsequent conclusions and actions taken.



The *Information* module provides concepts and tools that enable the District Data Team to further the inquiry process introduced in the preceding module, *Inquiry*. It offers guidance for collecting data specifically related to the focusing and clarifying questions generated in the *Inquiry* module, and revisits tools from that module to guide meaningful displays of that data.

The module helps clarify the difference between making factual observations from data and making inferences about what the data mean. It also provides a protocol for the District Data Team to use to engage with the data related to its inquiry process and the focusing and clarifying questions that are guiding it.

The District Data Team should emerge from this stage in the process with inferences or conclusions drawn from the data analysis process, and perhaps also with some new questions for consideration.

All of this work sets the stage for the next module, *Knowledge*, which will help the Team place the information that it gathers in the context of research and practice literature, as well as local knowledge and expertise. This will help the Team narrow and refine its focus even further as it moves toward identifying strategies and actions steps to address the problems that it has identified.

### References

<sup>1</sup> Adapted from Tufte, E. (2009, November 10). *Presenting Data and Information*. Boston, MA.

<sup>2</sup> Adapted from Bernhardt, V.L. (2004). *Data Analysis for Continuous School Improvement*. Larchmont: Eye on Education.

For more information on this and other district support resources, or to share feedback on this tool, visit <http://www.doe.mass.edu/sda/ucd/> or email [districtassist@doe.mass.edu](mailto:districtassist@doe.mass.edu).



# DATA COLLECTION PLANNING TOOL

3.1.1T

<b>Purpose</b>	To guide the collection of specific data needed to answer a focusing question and its related clarifying questions.
<b>Description</b>	Use this template to identify who will collect specific data needed for analysis.
<b>Time</b>	30–90 minutes

<b>Related Documents</b> 3–Information Module
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**Instructions:** In the table below, begin by listing the specific data elements needed in order to address each of the clarifying questions in your inquiry process. If the Team has completed *2.5.2T: Focusing Question Investigation Template*, it can simply use the list of data documented there.

For each data element, indicate the required information. A *Data Inventory (1.5.1T)* can help identify the location/owner of the data. For this stage in the process, the most important details to note are who will collect the information, by when, and in what format.

**Question/Issue being addressed:** \_\_\_\_\_

Data Element Needed	Location/Owner	Who Will Collect It for the Team?	By When?	In What Format? Paper, Electronic, etc.

<b>Data Element Needed</b>	<b>Location/Owner</b>	<b>Who Will Collect It for the Team?</b>	<b>By When?</b>	<b>In What Format?</b> Paper, Electronic, etc.



## PRACTICE MAKING VALID INFERENCES

3.2.1T

<b>Purpose</b>	To practice making valid inferences.	<b>Related Documents</b>
<b>Description</b>	This activity can be used within your Data Team or with other audiences to improve data analysis skills. During this activity, you will have the chance to view multiple data displays and “check” the inferences made by another data team for validity.	3–Information Module
<b>Time</b>	About 30 minutes.	

# Practice Making Valid Inferences

1. Read a scenario.
2. Review the accompanying data display to observe what the data say.
3. Consider the statements provided.
4. As a Data Team, decide which statements are *observations* (factual interpretations) and which are *inferences* (conclusions, explanations, or conjectures).
5. Also, note whether each statement is *true*, *not necessarily true*, or *false*.
6. Possible answers are provided at the end.

# Scenario #1

## SCENARIO

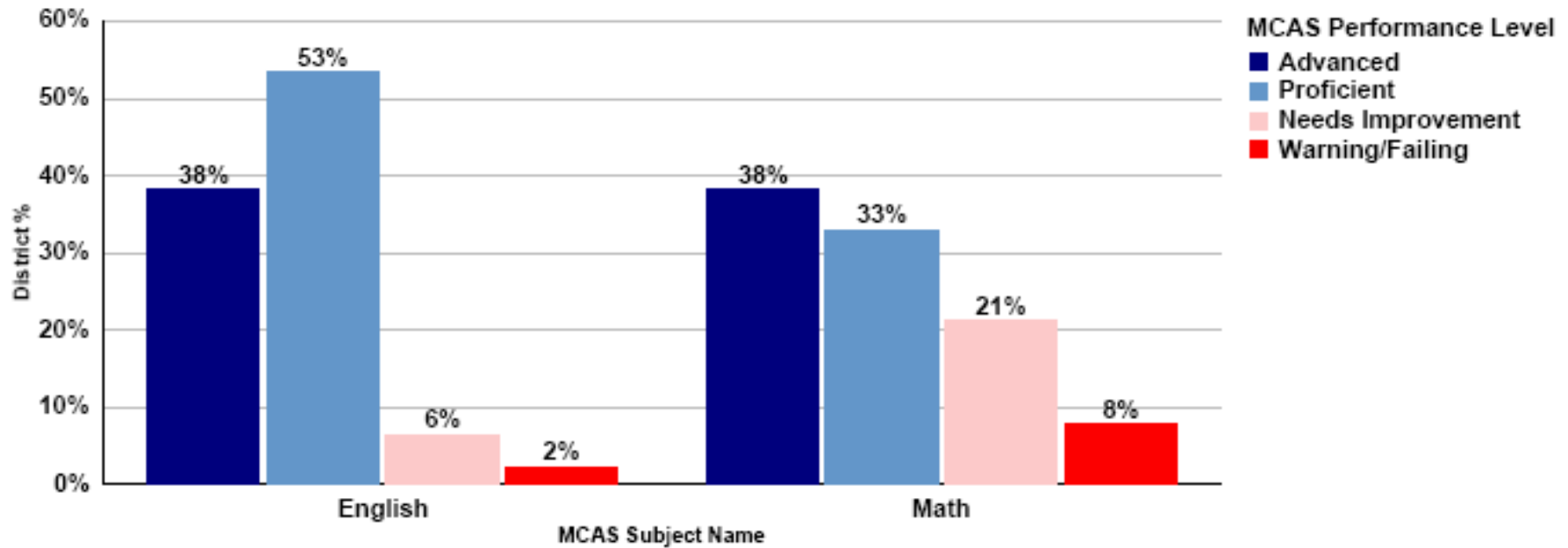
The Data Team in District A wanted to examine the performance of 8<sup>th</sup> grade students on the 2007 MCAS ELA and Mathematics tests. The Team posed this focusing question.

## FOCUSING QUESTION

How did our 8<sup>th</sup> graders, district-wide, perform on the 2007 MCAS tests?

Year: 2007  
 District: District A  
 Grade: 8  
 Subject1: English  
 Subject2: Math

## ESE Data Warehouse Pre-defined Report R-303: District Performance Distribution



MCAS Subject Name	MCAS Performance Level	District #	District %	State %
English	Advanced	103	38%	30%
	Proficient	144	53%	56%
	Needs Improvement	17	6%	10%
	Warning/Failing	6	2%	3%
Math	Advanced	103	38%	30%
	Proficient	89	33%	28%
	Needs Improvement	57	21%	25%
	Warning/Failing	21	8%	17%

NOTE: MCAS results are suppressed (-) for cohort counts fewer than 10. Suppressed cohorts are not rendered in charts.



# District Performance Distribution Report (R-303)

<b>Statement</b>	<b>Observation or Inference?</b>	<b>True</b>	<b>Not Necessarily True</b>	<b>False</b>
1A. Our students are smarter in English than they are in mathematics.				
1B. Compared to the state, our students performed poorly in mathematics.				
1C. About one third of our students performed below proficient in mathematics.				

# Scenario #2

## SCENARIO

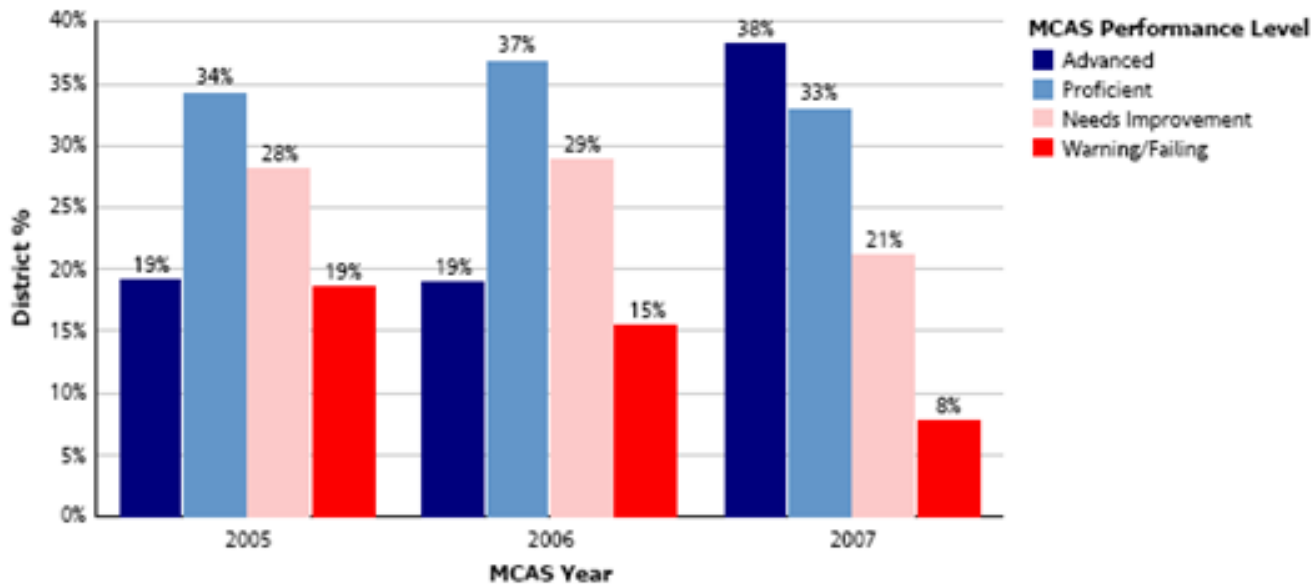
After comparing the performance of the students in District A to the performance of students statewide, the Data Team posed a clarifying question.

## CLARIFYING QUESTION

How did the mathematics performance of the 8<sup>th</sup> graders in our district change over the past three years?

Year(s): 2005, 2006, 2007  
 District: District A  
 Grade: 8  
 Subject: Math

## ESE Data Warehouse Pre-defined Report R-305: District Performance Distribution by Year



MCAS Year	MCAS Performance Level	District %	District #	State %
2005	Advanced	19%	60	16%
	Proficient	34%	107	33%
	Needs Improvement	28%	88	31%
	Warning/Failing	19%	58	20%
2006	Advanced	19%	54	18%
	Proficient	37%	105	32%
	Needs Improvement	29%	82	30%
	Warning/Failing	15%	44	21%
2007	Advanced	38%	103	30%
	Proficient	33%	89	28%
	Needs Improvement	21%	57	25%
	Warning/Failing	8%	21	17%

NOTE: MCAS results are suppressed (-) for cohort counts fewer than 10. Suppressed cohorts are not rendered in charts.

# District Distribution by Year Report (R-305)

Statement	Observation or Inference?	True	Not Necessarily True	False
2A. Students who were in 8 <sup>th</sup> grade in 2007 made gains from year-to-year since 2005.				
2B. 8 <sup>th</sup> grade performance has improved from year-to-year.				
2C. Our year-to-year trend performance follows the state's trend performance.				

# Scenario #3

## SCENARIO

The District Data Team reviewed the longitudinal performance of the district's students and concluded that the percent of students scoring at the lowest level decreased each year and the percent scoring at the Advanced level increased dramatically in 2007. This was encouraging, but the Team felt that performance could still be improved. The Team formulated the following clarifying question.

## CLARIFYING QUESTION

With which specific strands and standards did the students have the most difficulty?

Year: 2007  
 District: District A  
 Group: None

Grade: 8  
 Subject: Math

ESE Data Warehouse Pre-defined Report  
**R-306: District Standards Summary Report**

**Subgroup: None**

MCAS Subject Name	State % Correct	District % Correct
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Math	68%	75%
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MCAS Question Type	State % Correct	District % Correct
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Multiple-Choice	71%	76%
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Open-Response	65%	72%
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Short-Answer	67%	74%
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MCAS Strand Name	MCAS Standard Name	State % Correct	District % Correct
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Data Analysis, Statistics, and Probability		<b>66%</b>	<b>72%</b>
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Inferences and Predictions	66%	70%
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Probability	42%	50%
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Statistical Methods	69%	75%
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Geometry		<b>70%</b>	<b>76%</b>
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Locations and Spatial Relationships	67%	74%
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Properties of Shapes	81%	85%
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Visualization and Models	69%	76%
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Measurement		<b>63%</b>	<b>69%</b>
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Measurable Attributes and Measurement Systems	52%	58%
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Techniques and Tools	65%	71%
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Number Sense and Operations		<b>68%</b>	<b>73%</b>
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Computation	64%	73%
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Numbers	72%	77%
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Operations	57%	62%
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Patterns, Relations, and Algebra		<b>72%</b>	<b>79%</b>
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Change	68%	75%
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Models	77%	87%
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Patterns, Relations, and Functions	81%	87%
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Symbols	76%	80%
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# District Standards Summary Report (R-306)

Statement	Observation or Inference?	True	Not Necessarily True	False
3A. Our students performed better than students statewide in each of the strands.				
3B. Out of all the strands, our students performed worst in <b>Measurement</b> .				
3C. Compared to student performance statewide in the strand <b>Patterns, Relations, and Algebra</b> , our students performed the best on the symbols standard.				

# Scenario #4

## SCENARIO

The review of the District Standards Summary Report helped the Team determine specific areas where the students were weak on the 2007 test. The Team delegated several members to review this report for the three prior years to see if these strands were problems for the students on those tests.

The Data Team also wanted to learn more about the performance of subgroups on specific test items. The Team posed the following clarifying question.

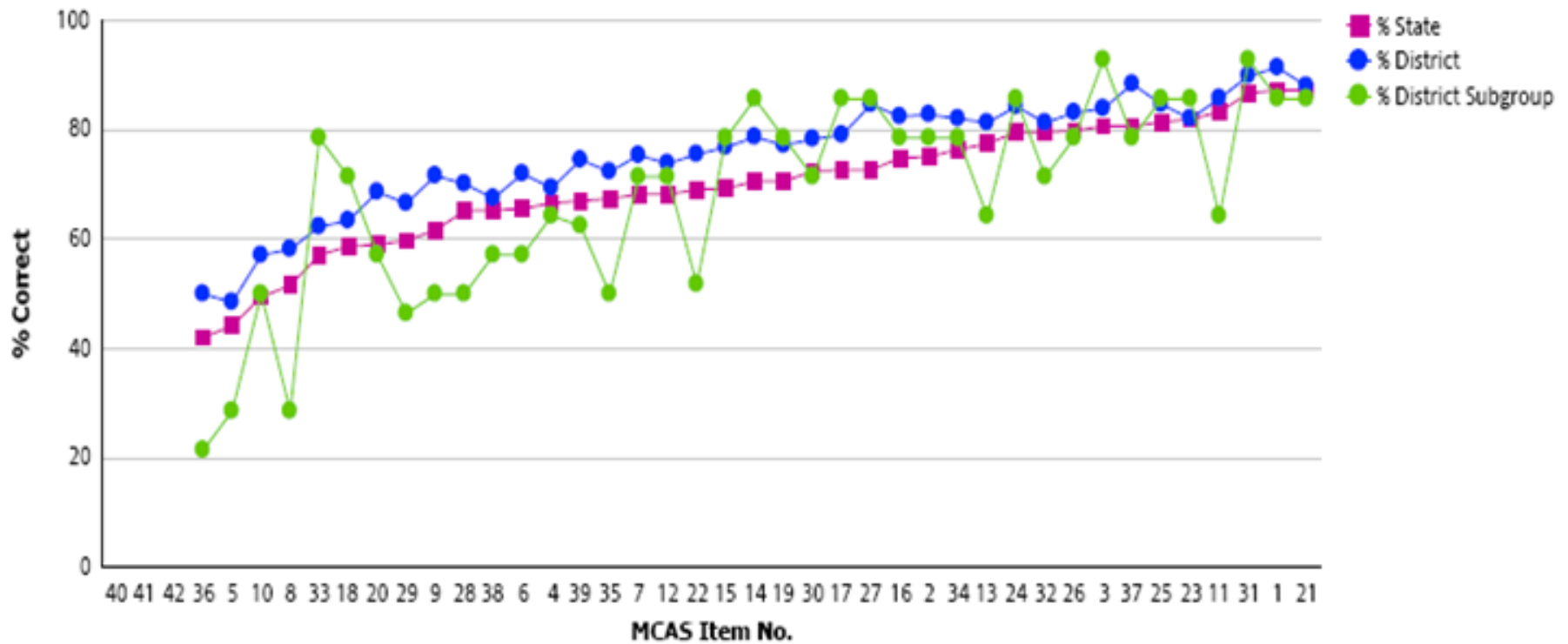
## CLARIFYING QUESTION

How did the ELL students in our LEP program perform across all test items as compared to all students in the district and in the state?



## ESE Data Warehouse Pre-defined Report R-302 District Item Analysis Graph

Year: 2007  
 District: District A  
 MCAS Grade: 8  
 Subject: Math  
 Subgroup: LEP



# District Item Analysis Graph (R-302)

Statement	Observation or Inference?	True	Not Necessarily True	False
4A. The performance pattern of all students in our district follows the state more closely than the pattern for LEP students.				
4B. Item 36 is the most difficult item.				
4C. Our LEP program is not preparing our students adequately.				

# Possible Answers

## Instructions:

Reflecting on the statements that have been made using the data reports:

- Which are Observations and which are Inferences?
- Which are True, False, or Not Necessarily True (more data needed)?
- What clarifying questions would help make better inferences?

## **Scenario #1**

- 1A. Inference (NNT) – The English (reading comprehension and writing) assessments are developed to assess completely different knowledge and skills, so a mathematics score cannot be directly compared to an English score.
- 1B. Inference – (F) The statement is false because our students performed BETTER than the state at each performance level. It is an inference because poorly is a conclusion that is not factually precise.
- 1C. Observation – (T) 29% of our students performed below proficient.

## **Scenario #2**

- 2A. Inference – (NNT) While the data do show increases in MCAS performance from 2006 to 2007, there could be slight differences in the student cohort due to changes in population since 2005. Additionally, the data do not reflect individual student growth over time, only MCAS scores for a class from one year to another. You would need more data to be sure.
- 2B. Observation – (T) The percent of students below proficient decreased over time. Caveat—again, these are different groups of students.
- 2C. Observation – (F) For the first two years, our students showed a small decrease in the percent of students below proficient, while the state stayed at about the same level (percent at warning actually increased slightly). In the most recent year, there was a decrease in percent below proficient at the state level, but a much larger decrease among the tested students in District A.

# Possible Answers (continued)

## **Instructions:**

Reflecting on the statements that have been made using the data reports:

- Which are Observations and which are Inferences?
- Which are True, False, or Not Necessarily True (more data needed)?
- What clarifying questions would help make better inferences?

## **Scenario #3**

- 3A. Observation – (T) A larger percentage of District A students was successful in each strand than students statewide.
- 3B. Observation – (T) Relative to all other strands, our students did indeed score the poorest in Measurement.
- 3C. Observation – (F) They performed best in Models relative to the state (10 percentage points difference).

## **Scenario #4**

- 4A. Observation – (T) LEP student pattern is up and down and district pattern and state pattern are very similar overall. Stress that this is probably due to the relatively small size of the population. Smaller populations show greater variation.
- 4B. Inference – (NNT) A factual interpretation (observation) is that the LEP group and the State scores are lowest for Item 36, but not for the District. It is an inference that this is the most difficult item for these groups, as there could be other reasons why so many students scored low on it.
- 4C. Inference – (NNT) You can't infer this from the data. For example, the most difficult items for the LEP group may be those that have the most language, such as story problems. The next step is looking at the actual items and drawing conclusions about what might have made the items difficult for the LEP subgroup. Also, the LEP students did better than the other two populations on several items.



## DATA ANALYSIS PROTOCOL

### 3.3.1T

<b>Purpose</b>	To collaboratively analyze data.
<b>Description</b>	The protocol is a collaborative process for analyzing data that can be applied to many types of data.
<b>Time</b>	About 60 minutes.

**Related Documents**  
3–Information Module

This is a collaborative protocol designed to be used by groups of 3–5 people. It is necessary to identify the questions that are being addressed and prepare (or gather) the necessary data prior to beginning the protocol (such as those generated by 2.1.1T: *Question Formulation Protocol*). Be sure all are clear on the protocol before beginning.

1. **Write** the question(s) being analyzed at the top of a piece of chart paper. Check to make sure each person understands the question. **(1–5 minutes)**
2. **Distribute** copies of the data in either graphical or numerical displays to each member of the Team. Ask each person to silently observe the data by taking notes and jotting observations. **(5 minutes)**

Note: By this point, the Team may have three levels of data: high-level data that spurred the inquiry in the first place; data used in the data overview (2.3.1) to generate clarifying questions; and even more specific data collected subsequently to address these clarifying questions. In some cases, the first two data sets may be fairly similar. Engaging with all data sets simultaneously can better poise the group to see patterns, trends, and outliers that had not previously been evident.

3. **Observe: (15 minutes)** Ask Team members to take turns (round-robin fashion) and report one of their observations. Observations should be facts or evidence that can be readily seen in the data and stated without interpretation.

Instruct participants to use a sentence starter like one of the following to keep the observations factual:

*I see...*

*I observe...*

*I notice...*

**Remember. Only discuss the facts at this stage of the process!**

If you catch yourself using any of the following, **STOP!**

~~However...~~

~~Because...~~

~~Therefore...~~

After participants have shared their initial observations, probe for deeper analysis by asking a combination of the following questions:

*How do data sets (or populations) compare to each other?*

*Such as comparing one grade to another, or school vs. district vs. state*

*What are the commonalities among a given data set (or population)?*

*Such as among students who are scoring below standard, or those who are achieving?*

*What patterns or similarities are evident across different data sets?*

*Such as comparing local formative assessment data with state assessments like MCAS, or comparing student achievement with teacher attendance.*

*What inconsistencies or discrepancies (if any) are evident?*

*What is not represented in the data?*

*What questions do the data raise?*

Capture the observations in list form on the chart paper as quickly as possible and without comment. Capture questions on a separate sheet. Continue until all Team members have reported all of their observations. (Note: During this step, it is acceptable for Team members to make observations based on those made by others in the group. Allow the process to proceed as long as logical and factual observations can be made.)

Note: It is often helpful to make a very distinct transition from the observation stage to the interpretation stage, clarifying when the group can begin to allow statements that may not be factually based.

- 4. Interpret: (20 minutes)** Ask each Team member to review the entire list of observations. Working together, code (or group) the observations into categories of findings. To facilitate this process ask questions such as:

*What assumptions might be underneath what we are noticing in the data?*

*What clues help explain why a certain population is meeting or missing targets?*

*What areas in the data stand out as needing further explanation?*

*What patterns or themes do we see in our observations?*

*Which of these observations are most relevant and important to our inquiry?*

And finally:

*Based on our observations, what do we know now?*

- 5. Extend: (10 minutes)** On a new piece of chart paper, write “New Questions and Conclusions.” Work as a group to identify new questions that this analysis has raised and any possible conclusions that have been identified. The questions may serve as the basis for another round of analysis, so it may be helpful to conclude by prioritizing them. Any conclusions will become the basis for subsequent action.

This protocol is based on work presented by Nancy Love, author of “Using Data/Getting Results (2002),” who, in turn adapted it from Bruce Wellman’s and Laura Lipton’s “Data-Driven Dialogue (MiraVia LLC, 2004).” Additional questions adapted from Guide for Standard Bearer Schools: Focusing on Causes to Improve Student Achievement (2007). Community Training and Assistance Center (CTAC). Boston, MA.