Science Assessment System Through Course Task

Comparing Cities

Grade Levels:
6, 7

Phenomena:
Climate Differences at Equivalent Latitude

Science & Engineering Practices:
Asking Questions and Defining Problems
Analyzing and Interpreting Data

Crosscutting Concepts:
Patterns

Designed and revised by Kentucky Department of Education staff
in collaboration with teachers from Kentucky schools and districts.

Preparing to implement Through Course Tasks in the Classroom

What is a TCT?

- TCTs are 3-dimensional tasks specifically designed to get evidence of student competency in two dimensions, Science and Engineering Processes (SEPs) and Crosscutting Concepts (CCC), untethered from Performance Expectations (PEs)/standards. Tasks are sense-making experiences.
- Tasks are to be used formatively. The goal is for both students and teachers to understand areas of strength and improvement for the SEP(s) and CCC assessed within the task.

How do I facilitate a Through Course Task (TCT)?

- TCT facilitation is a collaborative process in which teacher teams calibrate understanding of the expectations of the task and refine strategies to be used during task facilitation.

Before the task:

1. Complete the TCT as a learner – compare understanding of task through the lens of success criteria (identified in the task) in order to understand expectations.
   Success criteria include:
   - What is this task designed to get evidence of?
   - What is the task asking the students to do?
   - What might a student response look like?
2. Identify the phenomenon within the task. Consult resources to assure teacher teams have a deep understanding of associated science concepts.
3. Collaborate to generate, review and refine feedback questions during facilitation.
4. Identify potential "trouble spots" and plan for possible misconceptions.

During the task:

5. Collect defensible evidence of each student's competencies in 3-dimensional sense-making for the task.
6. Ask appropriate feedback questions to support student access and engagement with the task in order to elicit accurate evidence of student capacities.

After the task:

7. Reflect on the task as a collaborative team.
8. Review student work samples to identify areas of strength and areas of need.
9. Determine/plan next steps to move 3-D sense making forward through the strengthening of the use of SEPs and CCCs.

Using the materials included in this packet:

- **Task Annotation:**
  - The task annotation is a teacher guide for using the task in the classroom. Additionally, the annotation gives insight into the thinking of developers and the task overall.

    - Each task has science and engineering practices, disciplinary core ideas, and crosscutting concepts designated with both color and text style:
        - **Science and Engineering Practices**
        - *Disciplinary Core Ideas*
        - Crosscutting Concepts
- **Student Task:** The materials to be used by students to complete the TCT.

Comparing Cities Task Annotation

After **analyzing and interpreting data** *about monthly temperature variation for two cities at similar latitudes*, **develop reasoned questions** *whose answer would help explore the phenomenon* using the patterns in the data **to support development of the questions.**

Overall intent

This task was developed with the intention of **evaluating students' ability to ask questions** about a phenomenon and explain their reasoning for why they think answers to their questions would be useful to explore the phenomenon. **The intended grade level for the task is 6-7th.**

Phenomenon within the task

This task presents two cities located at the same latitude that have monthly temperatures that can be quite different. Because locations on the Earth at the equivalent latitude receive equivalent sunlight intensity, one could reasonably assume that the temperatures at the locations would be similar. The fact that monthly temperatures at these 2 locations vary as they do is a phenomenon.

Data and Background Support to Facilitate Phenomenon Development for Students

The data provided within the task allows for multiple ways to identify and describe the differences in temperature between the two locations. Students are also provided with a map and the latitude/longitude coordinates in order to realize that the two cities are at the same latitude, but one city is by an ocean and the other is in the middle of a continent. Students may need scaffolding to realize that locations at the same latitude on Earth could be expected to have similar temperatures due to equivalent sunlight intensity. While this concept could be provided in the task stimulus, it is recommended that the teacher develop this understanding through class discussion, as appropriate for the students involved, in order to set a positive learning climate for the task. This should help set the stage for effective formative assessment through task use – eliciting the best evidence of student performance with the task, especially with respect to the SEPs and CCC used within the task.

Other information teacher teams might find useful when preparing to use this task in the TCT process

Engage students in class discussions about the types of things used to compare and contrast data, e.g., venn diagrams, T-charts, tables, etc. Students can use graphs and tables from other resources to work in groups and create well thought out questions. Use

exemplars to help students understand what a good question and explanation look like. These ideas are not to be used as the TCT but as a way to help prepare students to access the TCT so that it provides the best information to student and teacher.

Intent of the Task for Assessment

The intent of this task is to elicit evidence about a student's ability to ask reasoned questions about a phenomenon based, in part, on patterns identified in a collection of data. Although students are asked to create a display that synthesizes their interpretation of the data**,** this display is **NOT** the focus of evaluation of student success with the task. The purpose of creating the synthesized display is to increase the likelihood of *authentic engagement* with the data. Students need to authentically consider how the temperatures of the cities are different – what it would *feel like* to be in one climate vs. the other. This leads students to genuine wonderings about *why* the phenomenon occurs as it does, which will hopefully result in *accurate evidence* of the student's ability to create reasoned questions and provide a clear explanation of their reasoning. If students authentically wonder based on careful synthesis of data, connecting to whatever current knowledge they have about the phenomenon or ways to solve problems, then the wonderings, connections and/or solutions offered by students based on their synthesis of data will be the best evidence of their ability to ask reasoned questions.

Success Criteria

Evidence of Learning Desired based on Progression from Appendices

- Students ask questions that arise from careful observation of a phenomena, models or unexpected results to clarify and/or seek additional information. (App F –questions)
- Students use graphical displays to identify temporal relationships. (App F – data)
- Students analyze and interpret data to provide evidence for a phenomenon. (App F -- data)
- Students can identify patterns in the data when interpreting a graph. (App G -- patterns)
- Students identify patterns in numerical relationships to provide information about a natural system (i.e., temperature variation for a geographical location). (App G -- patterns)

Success Criteria

- Students develop questions that have sound reasoning for how the answer to the question will be useful in making sense of the phenomenon.

  ** Students may develop reasoning based on the student's current knowledge with factors that might affect the phenomenon or experience with problem solving, i.e., comparative analysis.

- Students develop valid questions that are sufficiently justified based on the effective use of patterns within a collection of data to provide evidence for a phenomenon.

  ** Valid: compares the temperatures of the 2 cities during the same season, must be able to investigate and identify temperature patterns between the 2 cities that support the development of the question.

Possible Student Responses (these are not "look fors")

- "What is the rainfall for each city? The data indicate that it is not hot in San Francisco in the summer as compared with Lexington. Perhaps it rains a lot in San Francisco in the summer and that cools things down."
- "What are the temperatures like for a city on the east coast (Atlantic Ocean) that is at the same latitude as Lexington and San Francisco? Perhaps the ocean is having an effect on the temperature because there is not nearly as much variation in temperature throughout the year in San Francisco (near an ocean) as there is in Lexington (not near an ocean). The information about an east coast city might help me know what to explore next."

List components of the task / resources used with the task.

1. US map with latitude and longitude indicated
2. average temperature charts and graphs for both cities
3. graphic organizer for student use

Extensions and/or other uses after the task is implemented

This task was designed for the specific purpose of evaluating students' abilities to ask reasoned questions. However, use of the task does not have to end with that outcome and can provide opportunities for rich learning experiences without significant effort from the teacher. For example, subsequent to implementation of the task using the TCT process, a teacher might use the results of the task in other ways, including, but not limited to:

1. Students evaluate the various displays created to communicate the differences between San Francisco and Lexington according to student generated success criteria.
2. Students categorize all of the questions generated, looking for patterns in the types of questions asked.
3. Students critique the reasoning for the questions.

4. Students and/or teachers use the questions to develop explorations into why the climate is different between these 2 cities.

Thus, in addition to the benefits stated elsewhere of engaging with the TCT process as part of our Science Assessment System, follow-on learning experiences may be easily developed after engagement with the task for TCT purposes.

Through Course Task – Comparing Cities

Part A: Synthesize for Mom

Your family, who has lived in Lexington for many years, has an opportunity to move from Lexington to San Francisco. Your mother is wondering how the climate in San Francisco compares with what she is used to in Lexington. She has asked you to look at some data for both cities and **create a display that illustrates a comparison of the two city's climates in each season.**

You have the following resources:

1. A map of the US that indicates the location of Lexington and San Francisco, with latitude and longitude indicated.
2. Temperature data for each city, including:
    a. monthly average high temperatures
    b. monthly average low temperatures

Your mother would like a comparison for each season – that is, how are winter, spring, summer and fall different in San Francisco as compared with Lexington. You can do this any way you'd like. For example, you could generalize the weather characteristics for each season (winter, spring, summer, or fall), or you could make a specific comparison for one month of each season (such as a comparison of January, April, July and October).

You can make your display in any way you like, but you should remember that the purpose is to compare the climate for two cities for each season based on the data you have. You will notice that the data are presented in two ways: both graphs and tables. You may use either form to draw your conclusions – the information is the same.

Part B: Generating Questions

Now that you have made a comparison of the monthly temperatures for both cities, consider the geographical differences between each location and think about how these differences might affect the monthly temperatures for each location.

1. **Generate 2 valid questions that could explain the differences in temperatures between the two cities.**
2. **Explain why or how an answer will help you understand the temperature differences between the two cities.**
3. **Explain how patterns in the data support the development of your questions.**

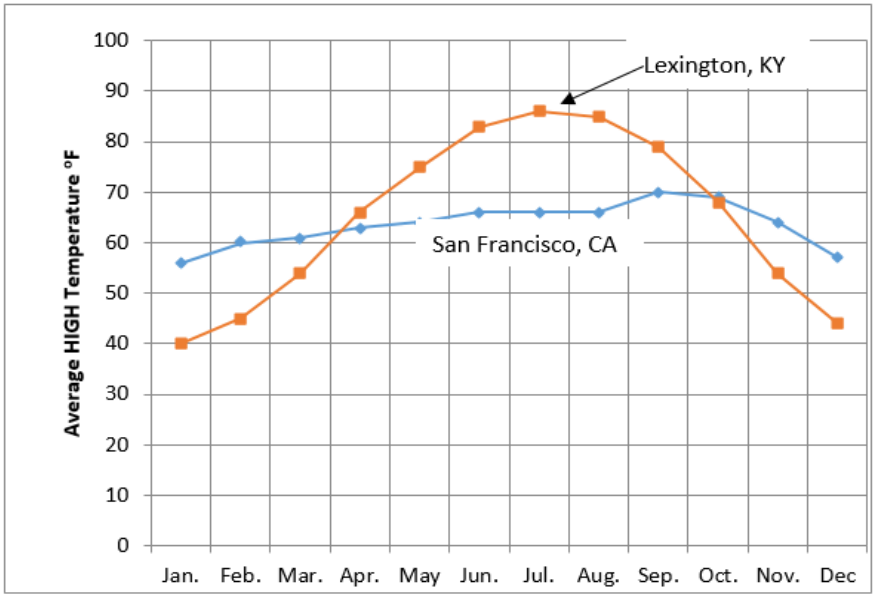
San Francisco - geographical info

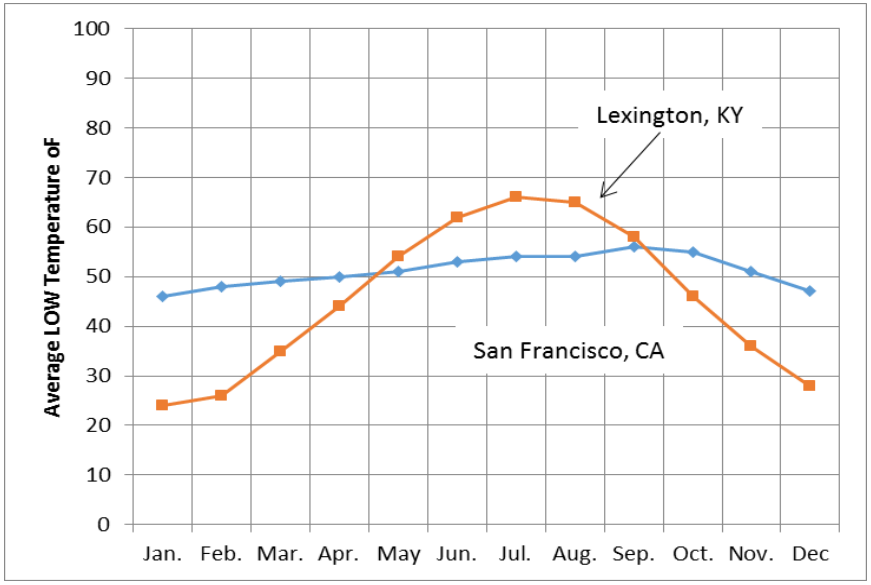
latitude	approximately 38 degrees N
longitude	122 degrees W

Lexington - geographical info

latitude	approximately 38 degrees N
longitude	84 degrees W

	Average Temperature		Average Temperature		Average Temperature	
	SF, Ca	Lex, KY	SF, Ca	Lex, KY	SF, Ca	Lex, KY
Jan.	51	32	56	40	46	24
Feb.	54	36	60	45	48	26
Mar.	55	45	61	54	49	35
Apr.	56	55	63	66	50	44
May	58	64	64	75	51	54
Jun.	60	73	66	83	53	62
Jul.	60	77	66	86	54	66
Aug.	61	75	66	85	54	65
Sep.	63	68	70	79	56	58
Oct.	62	57	69	68	55	46
Nov.	58	46	64	54	51	36
Dec	52	36	57	44	47	28


Average HIGH Temperature °F
100
90
80
70
60
50
40
30
20
10
0
Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec
Lexington, KY
San Francisco, CA


Average LOW Temperature oF
100
90
80
70
60
50
40
30
20
10
0
Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec
Lexington, KY
San Francisco, CA

Comparing Locations on a Map

Lexington: Latitude: 38 02N Longitude: 084 36W **San Francisco:** Latitude: 37 46N Longitude: 122 26W

Mark the approximate location of Lexington and San Francisco on the map. Compare the Latitude and Longitude Coordinates. What does this tell you about the location of Lexington compared to San Francisco? _____

_____

NAME:_____ Class Period: _____

Questions	Explanation	Patterns in the Data
1.		
2.		

Extra tables and graphs, if desired.

Highest recorded temp			Lowest recorded temp	
SF, Ca	Lex, KY		SF, Ca	Lex, KY
79	76		30	-21
81	75		31	-21
84	82		35	-15
94	88		40	-2
96	92		44	18
101	101		47	26
103	103		47	39
96	103		48	47
101	103		48	42
102	91		43	34
86	83		39	20
76	75		27	-3