Science

South Dakota CCC Webinar Middle School

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OTL Education Solutions

Opportunities to Learn Transformed for Students with Disabilities

Goals

- Be able to plan instruction and assessment for students with significant cognitive disabilities in science

Science and Engineering Practices

1. Ask questions (for science) and define problems (for engineering)
2. Develop and use models
3. Plan and carry out investigations
4. Analyze and interpret data
5. Use mathematics and computational thinking
6. Construct explanations (for science) and design solutions (for engineering)
7. Engage in argument from evidence
8. Obtain, evaluate, and communicate information

Least Dangerous Assumption

- "…in the absence of conclusive data, educational decisions ought to be based on assumptions which, if incorrect, will have the least dangerous effect on the likelihood that students will be able to functional independently as adults."
- Anne Donnellan 1984

1. Ask questions (for science) and define problems (for engineering)

- Students have to
  - Choose the topic they want to ask about
  - Choose what question they want to ask about the topic
  - Formulate that into a question

- "If I change _____, how does that affect _____?"

1. Ask questions (for science) and define problems (for engineering)

- Present topic-related concepts/details/characteristics in words or phrases in student's form of communication (List 1)
- Have student choose what they want to ask about
- Present factors/questions that affect the topic (List 2)
- Have the student select what question they want to ask

- "If I change (List 2), how does that affect (List 1)?"

- Students will ask questions
- Students will predict what will happen
- Students will make a model to test their predictions
- Students will take data on what happened
- Students will analyze the data

MS-ESS2 Earth's Systems		
MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.		
Science and Engineering Practices **Core Content Connectors**	**Disciplinary Core Ideas** **Core Content Connectors**	**Crosscutting Concepts** **Core Content Connectors**
Planning and Carrying Out Investigations Work with peers to plan an investigation and describe the data to be collected for a study of the relationships between air mass movement and changes in weather.	**ESS2.C: The Roles of Water in Earth's Surface Processes** • Identify how water influences weather and weather patterns through atmospheric, land, and oceanic circulation.	**Cause and Effect** Work with peers to illustrate the relationship between the uneven heating of Earth's components (i.e., water, land, air) and its influence on weather and climate.

Collect data to provide evidence for how the motions and complex interactions of air masses results in weather conditions.

- Verbs
  - Collect
- Nouns
  - Data

Collect data

Equatorial wind

Poleward wind

Humidity

up

down

What happens if the _____ goes _____?

Warm front

Cold front

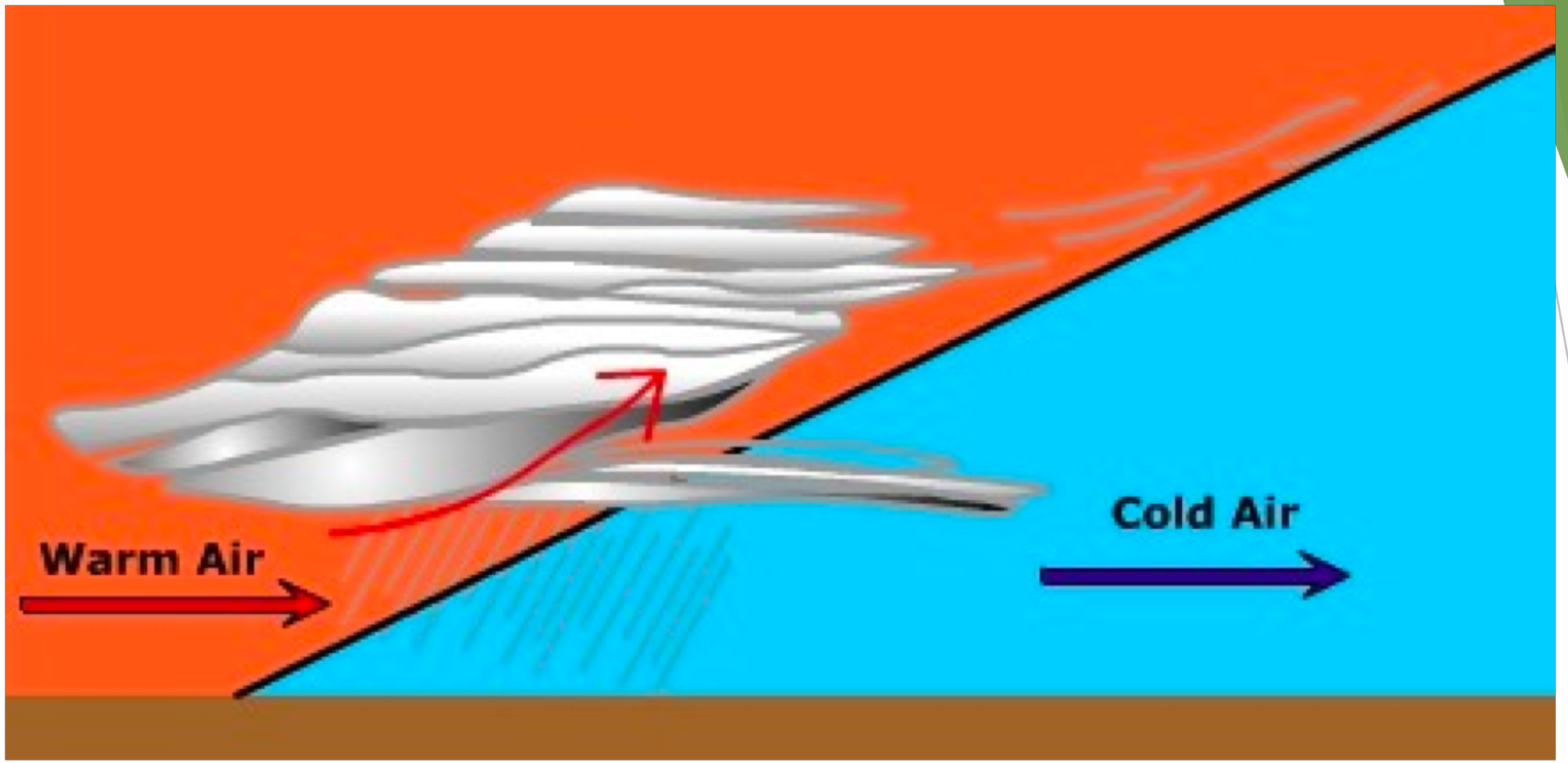
rain

snow

Warmer temperatures

Cold temperatures

If a _____ meets a cold front it will make _____ .



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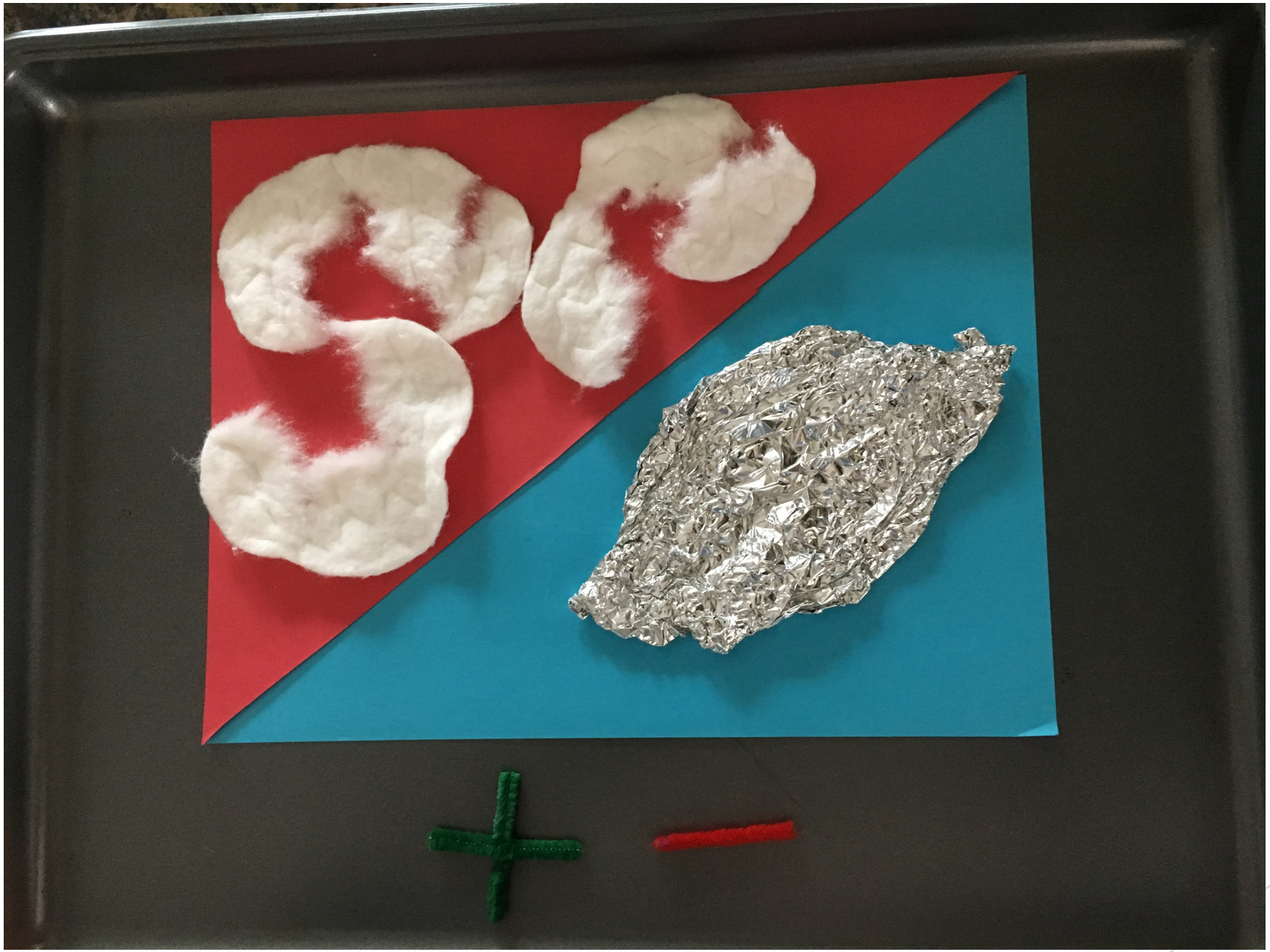
More likely Less likely



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2. Develop and use models

- Develop models
  - Physical representation (construct a drawing)
  - Analogy (represent a phenomena)

- Use models
  - Simulate a phenomena
  - Test a design

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3. Plan and carry out investigations

- In science, this is used to answer questions
- In engineering, this is used to test designs
- Both give **data**

1. Develop a question (use the same process as in SP1).
2. Select one independent variable from a list.
3. Carryout investigation multiple times, changing the independent variable to see the effect on the dependent variable (collect data)

Up

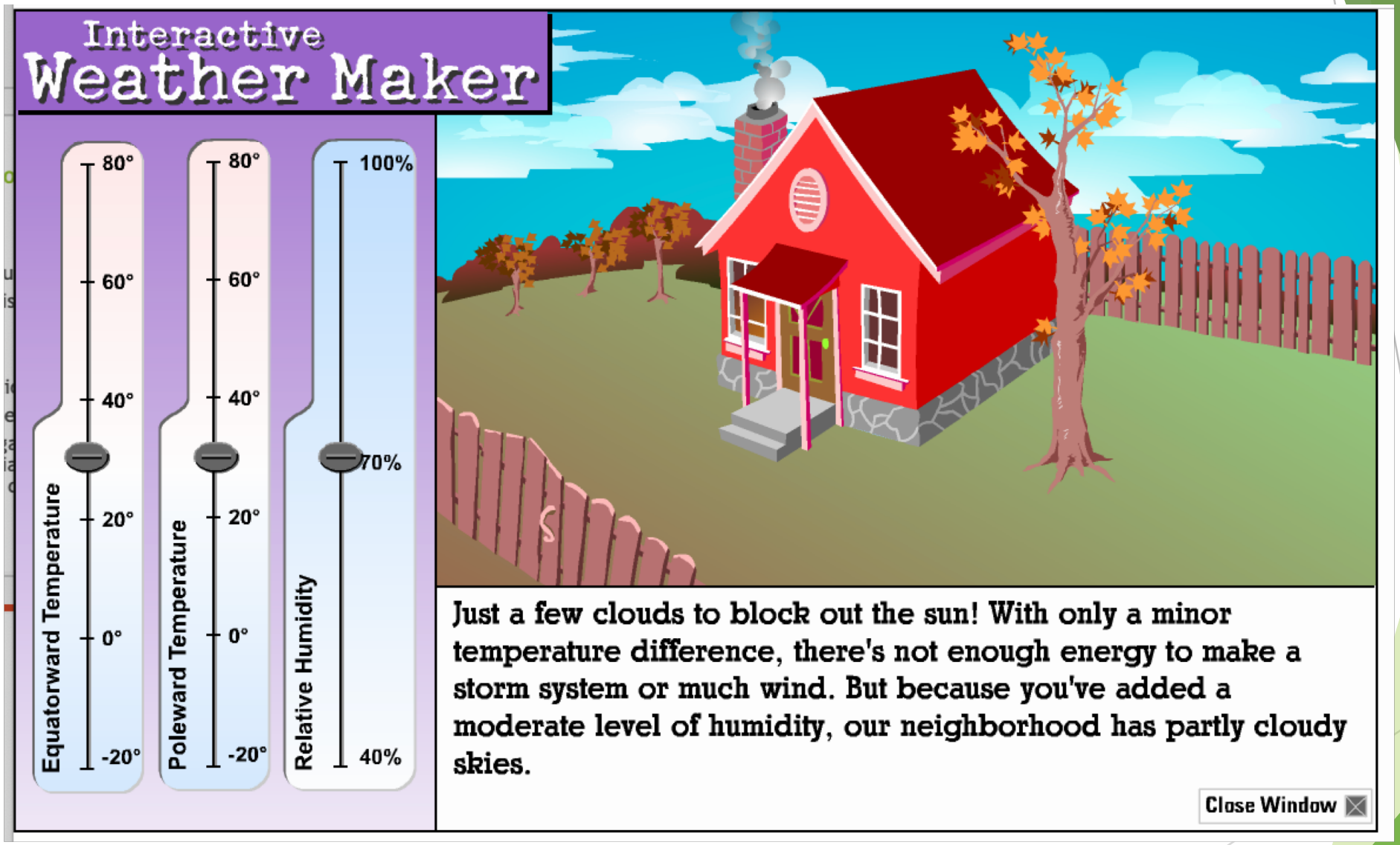
Down

Get cloudy

Get sunny

Rain

If the equatorial wind goes _____ the weather will _____



http://teacher.scholastic.com/activities/wwatch/sim/game.htm

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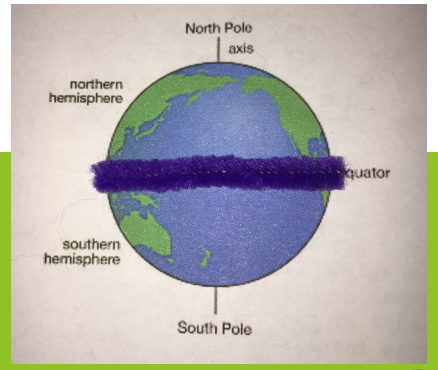
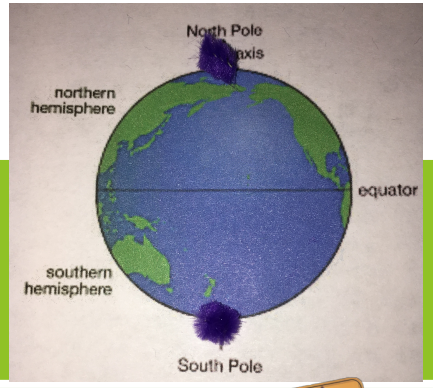
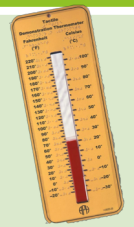
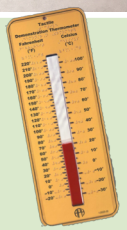
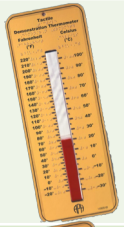
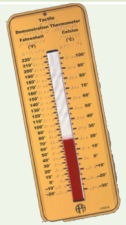
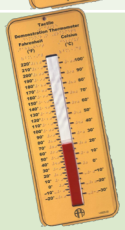
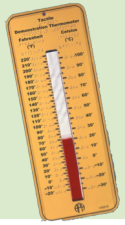




40 	20 	Observe 
10 	20 	
80 	20 	

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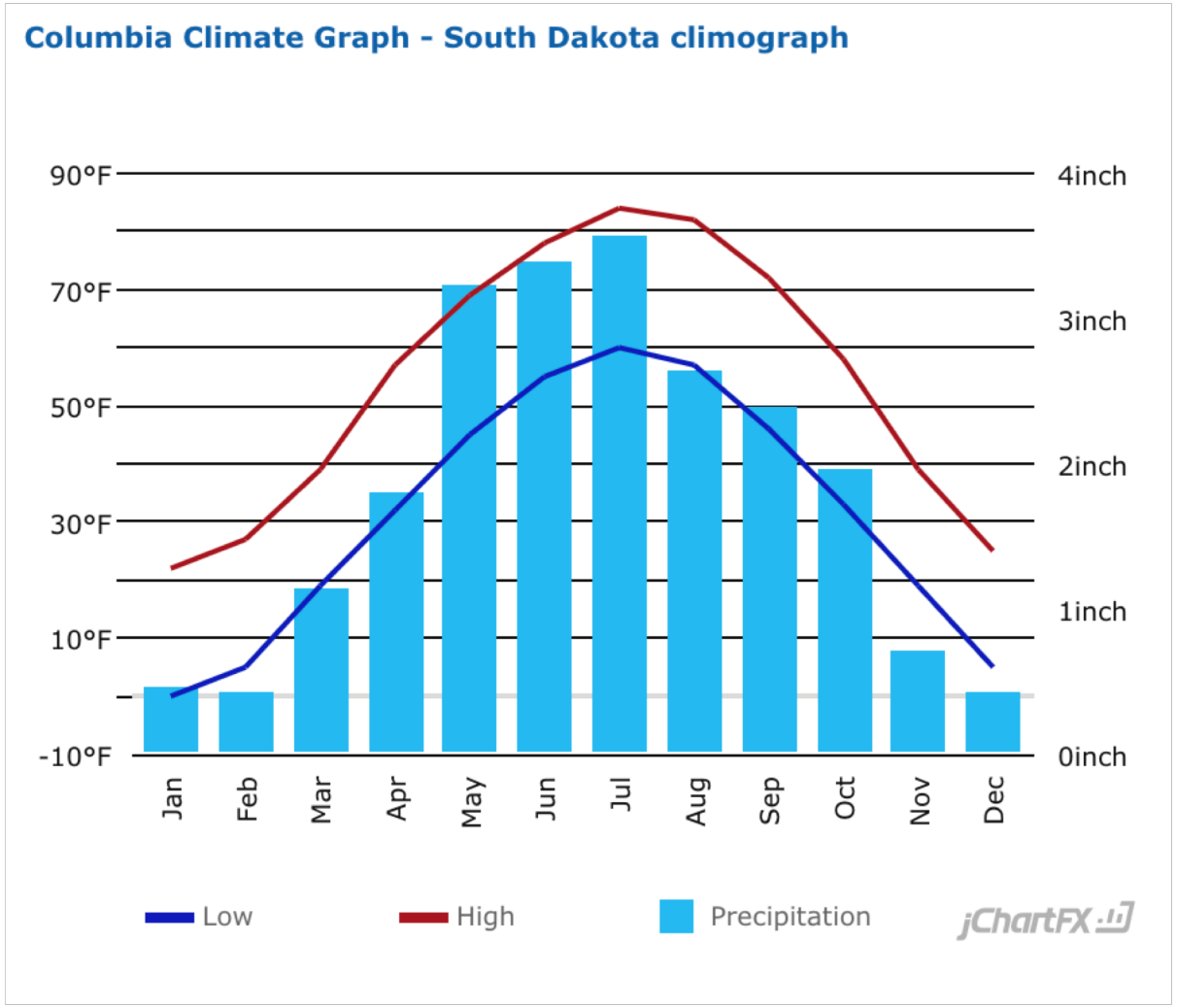
4. Analyze and interpret data

- Use in science to determine meaning
- Use in engineering to test solutions

- Analyze data
  - Organize
  - Graph
- Interpret data
  - Evaluate
  - Use statistics

- Grade level foci
  - Elementary – collect data in science notebook, use tables, use graphs
  - Middle – independent and dependent variables, different types of graphs
  - High – use math and statistics (mean, median, range; slope)



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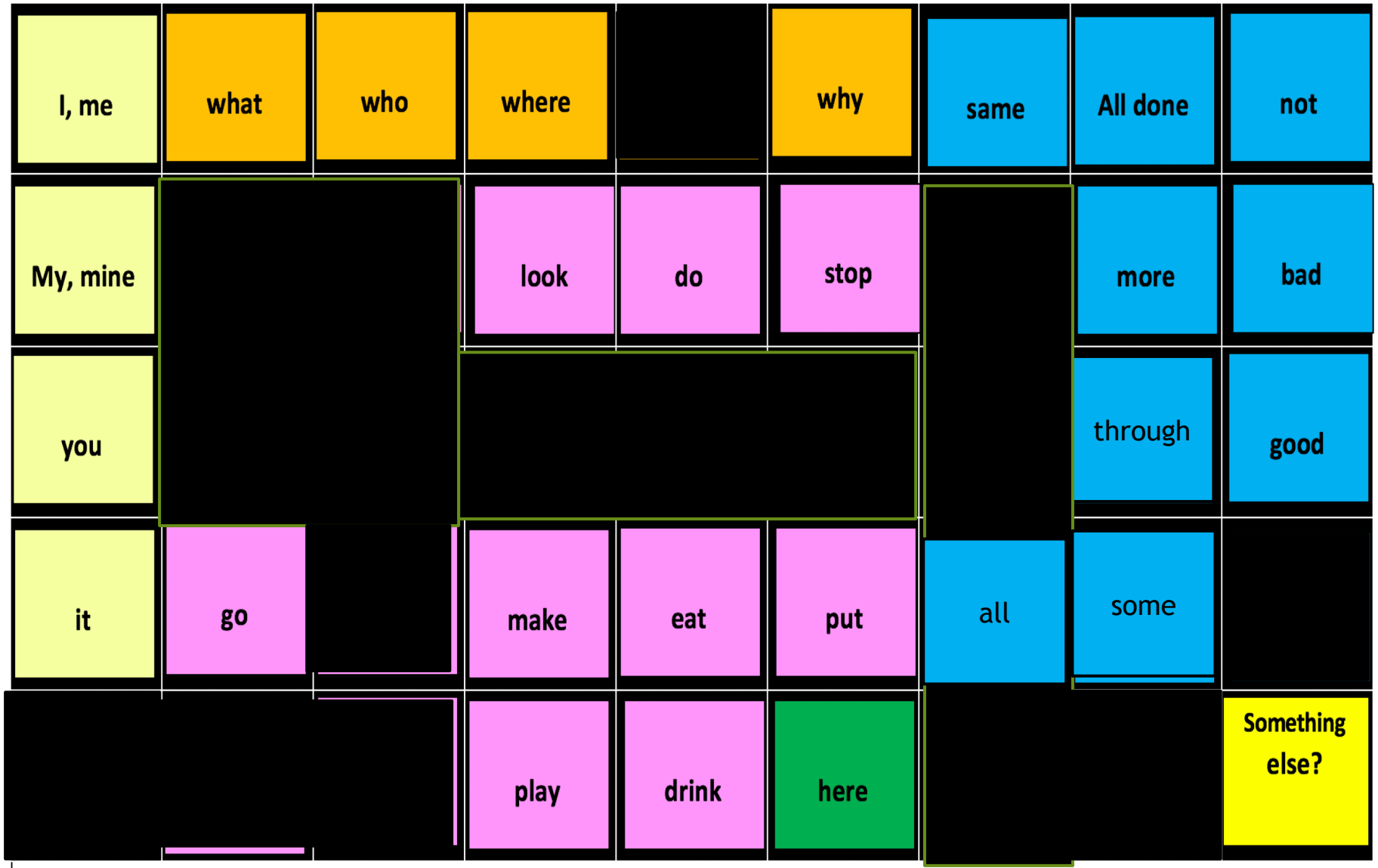
5. Use mathematics and computational thinking

- Progression
  1. Work with quantities and units: use rulers, thermometers, protractors)
  2. Use words to describe phenomena (“distance equals velocity multiplied by time”, “energy equals mass multiplied by the speed of light squared”)
  3. Represent words with symbols (d=vt, e=mc2)
  4. Gather data using spreadsheets
  5. Use models/simulations (refer to SP2)

MS-LS1 From Molecules to Organisms: Structures and Processes		
MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.		
Science and Engineering Practices **Core Content Connectors**	**Disciplinary Core Ideas** **Core Content Connectors**	**Crosscutting Concepts** **Core Content Connectors**
Developing and Using Models Work with peers to develop a model to identify the structures (e.g., nucleus, chloroplasts, cell wall, mitochondria, cell membrane, the function of a cell as a whole) and functions of components of cells.	**LS1.A: Structure and Function** • Identify the function of a cell as a whole. • Recognize that special structures within cells are responsible for particular functions. • Identify components of a cell. • Identify the functions of the components of a cell.	**Structure and Function** Work with peers to use the model to identify key differences between plant and animal cells based on structure and function (e.g., cell wall vs. cell membrane).



center	mighty
nucleus	cell
energy	wall

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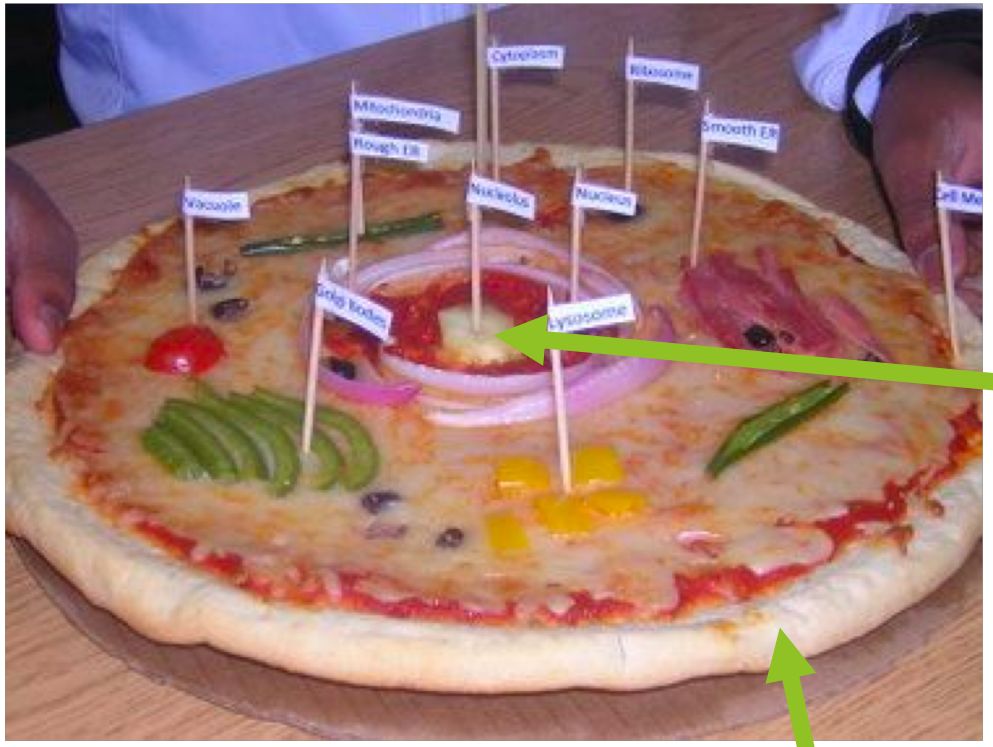

nucleus

make

more

cell

wall

all

go

through

Solutions
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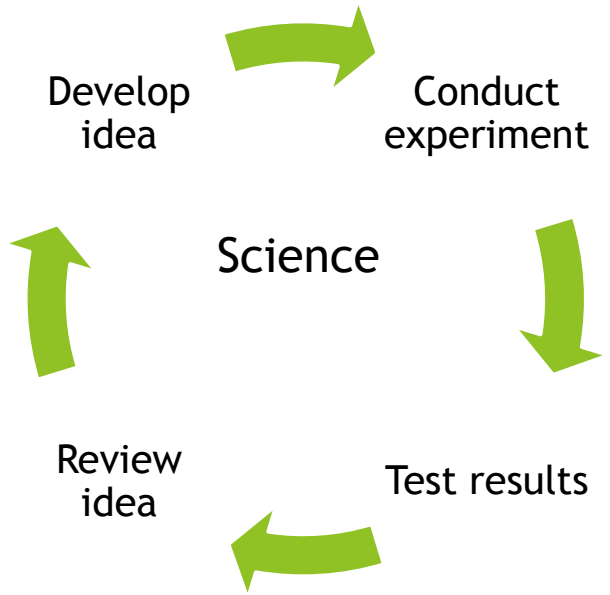
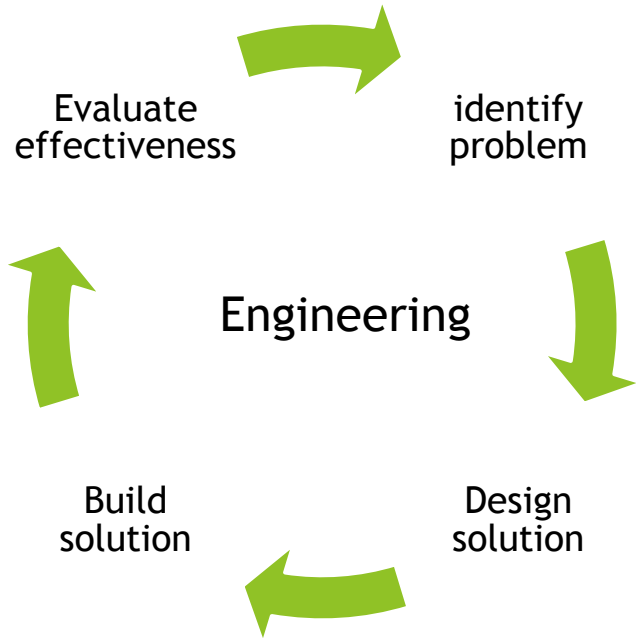
6. Construct explanations (for science) and design solutions (for engineering)





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7. Engage in argument from evidence

1. Construct an argument (refer to SP1-6)
2. Share the argument (orally, sequence pictures, powerpoint)
3. Listen to other arguments (take notes- write, use symbols, highlight text, Velcro words/pictures)
4. Evaluate all arguments to find the best explanation/solution (yes/no, agree/disagree, good better/best, vote/tally votes)

8. Obtain, evaluate, and communicate information

- In science, share explanations of phenomena
- In engineering, share solutions to problems

- Conduct research
- Read and interpret texts
- Communicate information
  - Write texts
  - Give presentations
  - Use websites
  - Participate in discussions
  - Write emails
  - Talk on phone
  - Write blog
  - Tweet

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1. Ask questions (for science) and define problems (for engineering)

- Students have to
  - Choose the problem they want to define
  - Define the problem
    - What is the problem?
    - Who has the problem?
    - Why is it important to solve?
  - Formulate that into a statement.

- "Who need(s) what because why."

1. Ask questions (for science) and define problems (for engineering)

- Present topic-related concepts in words or phrases in student's form of communication
- Have student choose what problem they want to define and related details about the problem
  - What is the problem? (List 1)
  - Who has the problem? (List 2)
  - Why is it important to solve? (List 3)

  Have the student select the answers to the above questions from a list (as student gains more content knowledge, "answers" that are unrelated to the problem could be presented so that the student uses their understanding to select only those relevant answers).

- "Who (List 2) need(s) what (List 1) because why (List 3)."

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2. Develop and use models

- Develop models
  - Physical representation: draw, label a drawing, assemble pieces of a drawing into a whole, use objects to create a “diorama”
  - Analogy: select from several options
- Use models
  - Use tools to “animate” a model
  - Evaluate what part of the model worked best, which model worked best, or how you could change it to make the model work better

3. Plan and carry out investigations

- In science, this is used to answer questions
- In engineering, this is used to test designs
- Both give **data**

1. Develop a question. This will define the dependent variable (what will be affected).
2. Select one independent variable (what you will change); the other variables are controls that will never change
3. Carryout investigation multiple times, changing the independent variable to see the effect on the dependent variable (collect data)

What could that look like?

- Distance a car rolls (dependent)
  - Weight of car (control)
  - Degree of incline* (independent)
- Plant growth (dependent variable)
  - Fertilizer* (independent variable)
  - Water (control)
  - Light (control)

4. Analyze and interpret data

- Analyze data
  - Use color coding, tactile, 3 dimensional
- Interpret data
  - Same/different
  - More/less/same
  - Higher/lower/same

- Grade level foci
  - Elementary – collect data in science notebook (written, drawing, Velcro "sentence", boardmaker)
  - Middle – independent and dependent variables in T-chart (magnetized, Velcro, objects; different types of graphs (line, bar, scatter)
  - High – use math and statistics (mean, median, range; slope); computer simulations, index cards, 3d numbers, calculator

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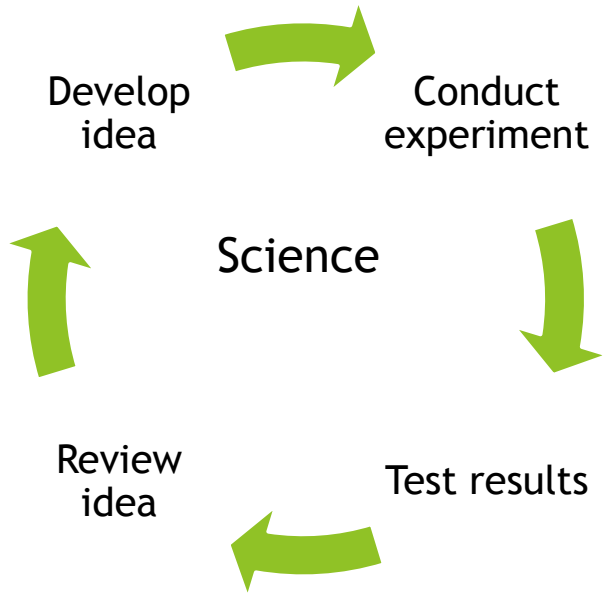
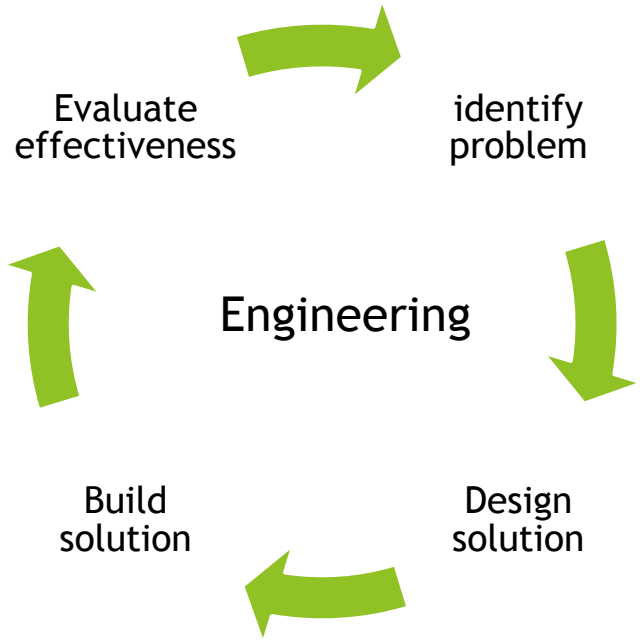
5. Use mathematics and computational thinking

- In science, represent variables with numbers
- In engineering, improve design

- Progression
  1. Work with quantities and units (use rulers, thermometers, protractors)
  2. Use words to describe phenomena (distance equals velocity multiplied by time, energy equals mass multiplied by the speed of light squared)
  3. Represent words with symbols (d=vt, e=mc2)
  4. Gather data using spreadsheets
  5. Use models/simulations

6. Construct explanations (for science) and design solutions (for engineering)





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7. Engage in argument from evidence

- In science, decide the best explanation for a phenomena
- In engineering, decide the best solution to a problem

1. Construct an argument
2. Share the argument
3. Listen to other arguments
4. Evaluate all arguments to find the best explanation/solution

7. Engage in argument from evidence

1. Construct an argument (refer to SP1-6)
2. Share the argument (orally, sequence pictures, powerpoint)
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8. Obtain, evaluate, and communicate information

- Conduct research (refer to SP1-7)
- Read and interpret texts
  - **All** students struggle with jargon, picking out priority points, reading multi-modal information (text, graphs, pictures)
  - This requires reading teachers to use scientific texts (including tables, data, graphs, pictures) and science teachers to explicitly instruct reading strategies
  - Science is not only hands-on activities but also TEXT
    - **A**dapted **P**rimary **L**iterature (APL): Research journal articles reduced to grade level explanation, could supplement these with pictures, symbols, real objects, motions
- Communicate information
  - Write texts (use science notebooks- refer to SP4)
  - Give presentations (refer back to SP7)
  - Use mini-posters

Resources

- https://doe.sd.gov/assessment/alternate.aspx
- www.bozemanscience.com
- https://ccl.northwestern.edu/netlogo/

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Evaluation

- https://www.surveymonkey.com/r/K9Q6J9C

Thank you!

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www.otltransformed.com

DebbieTaub

Thank you!