Science

South Dakota CCC Webinar Elementary School
December 6, 2018

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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)?"

4-PS3 Energy		
4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.		
Science and Engineering Practices **Core Content Connectors**	**Disciplinary Core Ideas** **Core Content Connectors**	**Crosscutting Concepts** **Core Content Connectors**
Asking Questions and Defining Problems With guidance and support from peers and adults, make qualitative measures of energy (e.g., relative motion, relative speed) of an object before and after a collision.	**PS3.C: Relationship Between Energy and Forces** • Identify the change in energy or the change in the objects' motions when objects collide (e.g., speeds as objects interact, direction).	**Energy and Matter** With guidance and support from peers and adults, predict reasonable outcomes about the changes in energy that occur after objects collide.

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- Students want to explore what happens when objects collide. One object has kinetic energy (is moving) and one has potential energy (is not moving). They will experiment with ramps of different angles.

What do I teach? (Deconstruct the performance expectation)

4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.

- Verbs
  - Ask
  - Predict
- Nouns
  - Questions
  - Outcomes

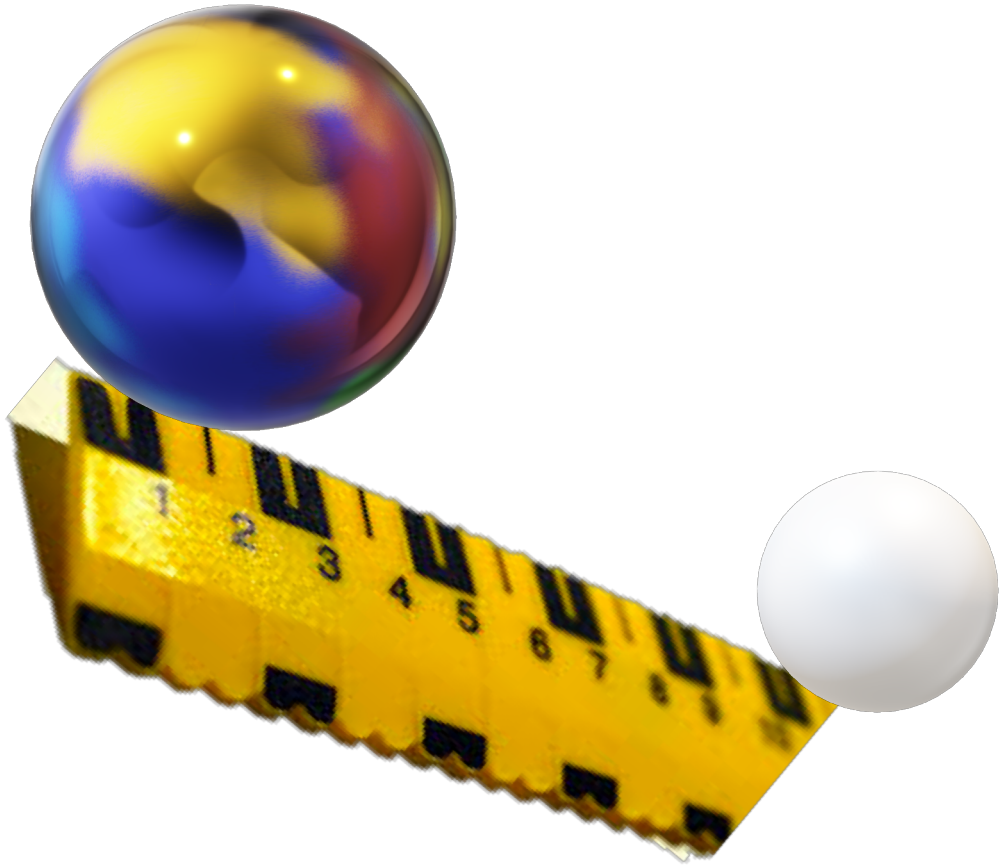
Ask questions
Predict outcomes

- Students will ask questions about different variables of the experiment
- 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

What could that look like?

- 4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.

Potential energy
(no + go + energy)



Kinetic energy (go+ energy)

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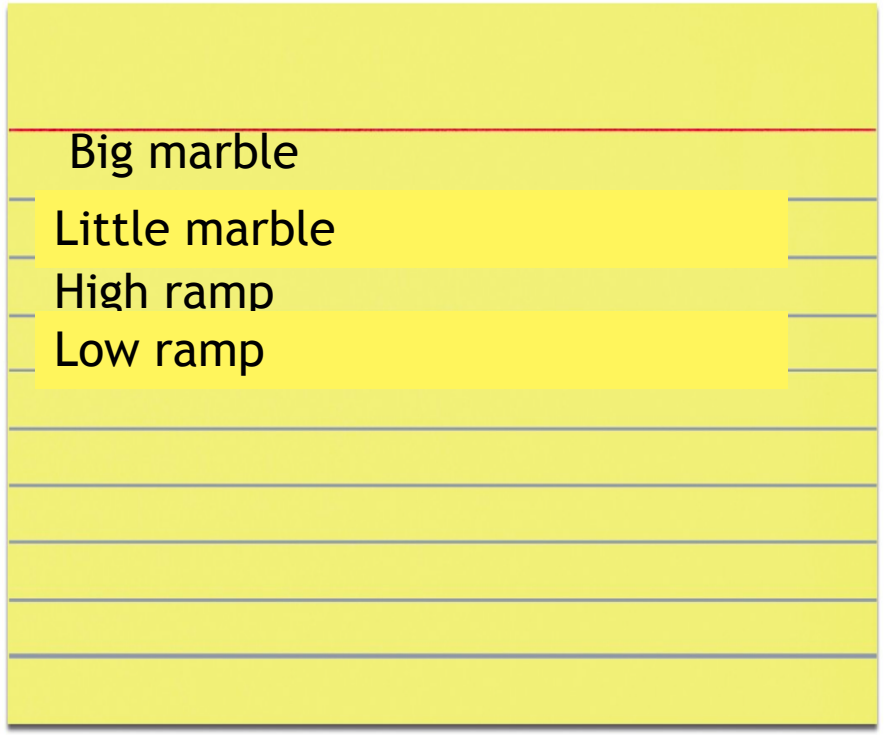

If I use a _____ how does that affect the second marble?

If I use a _____ I think the second marble will _____.

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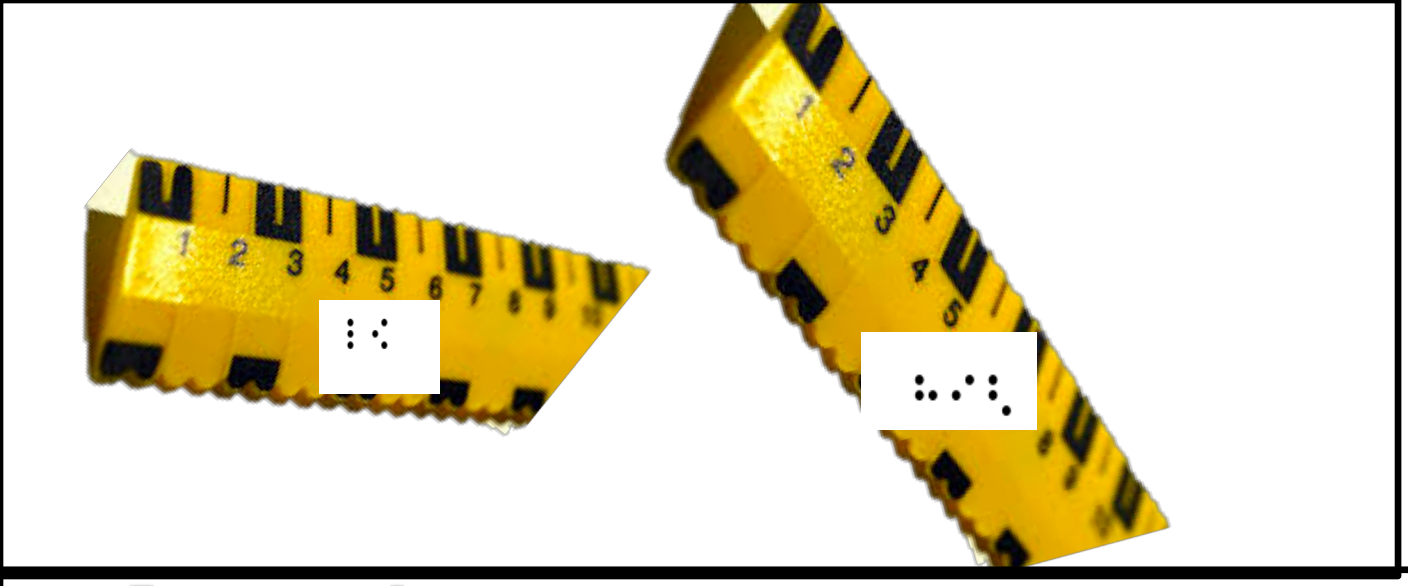

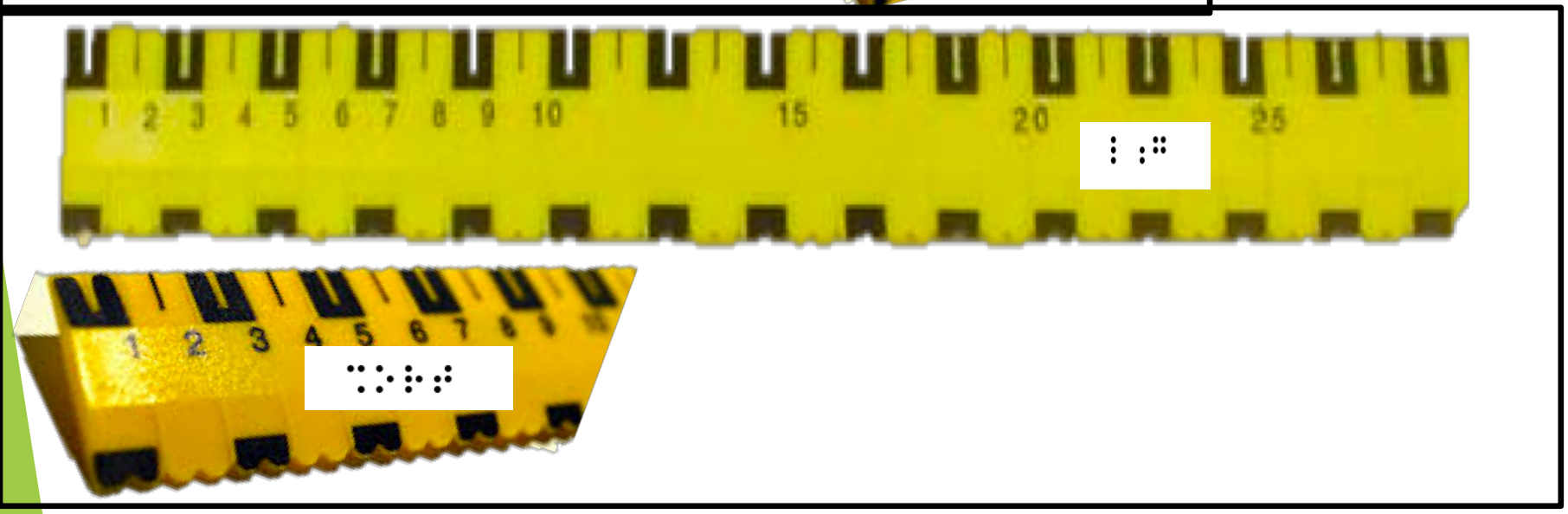

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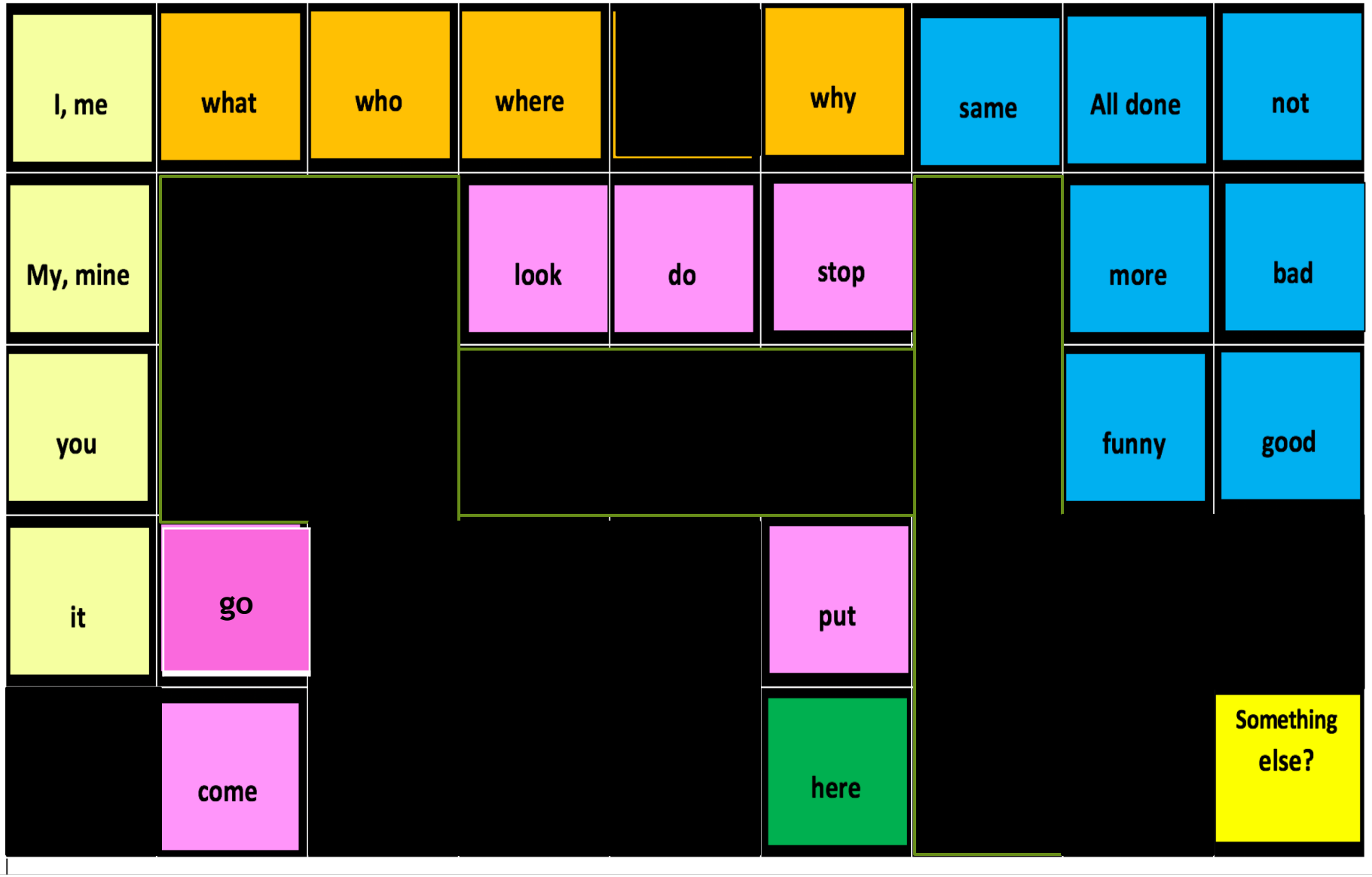

High	Low
Predict	Fast
Energy	Slow

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I	Predict

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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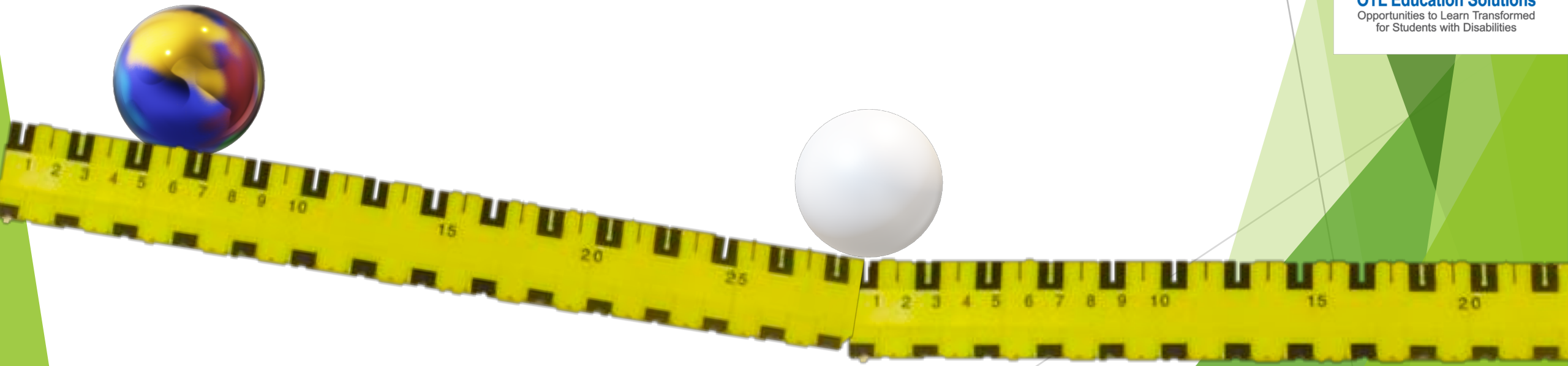
What could that look like?

- 4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.

Kinetic energy (go + energy)



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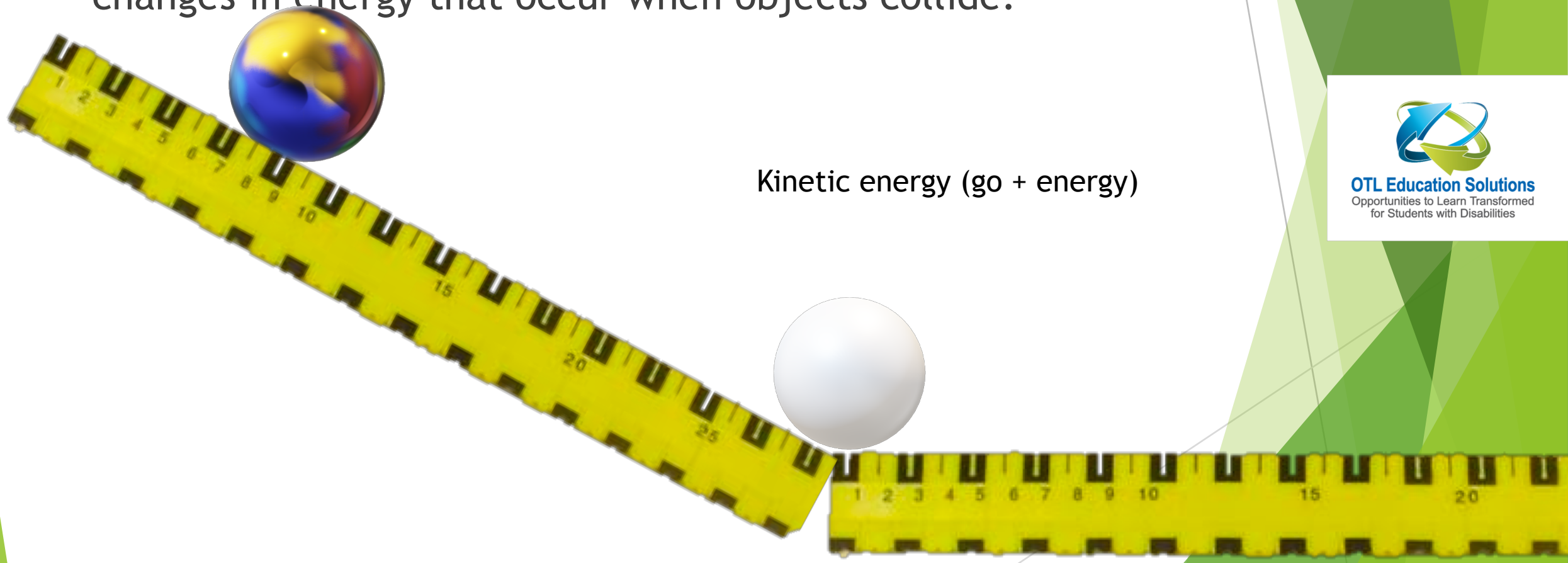
What could that look like?

- 4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.



Kinetic energy (go + energy)

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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)

		
	⠼⠉ ⠼⠁	3 ⠼⠉
	⠼⠁⠲⠑	1.5 ⠼⠁⠲⠑
	⠼⠉ ⠼⠁	3 ⠼⠉
	⠼⠁⠚	10 ⠼⠁⠚
	⠼⠁⠚	10 ⠼⠁⠚

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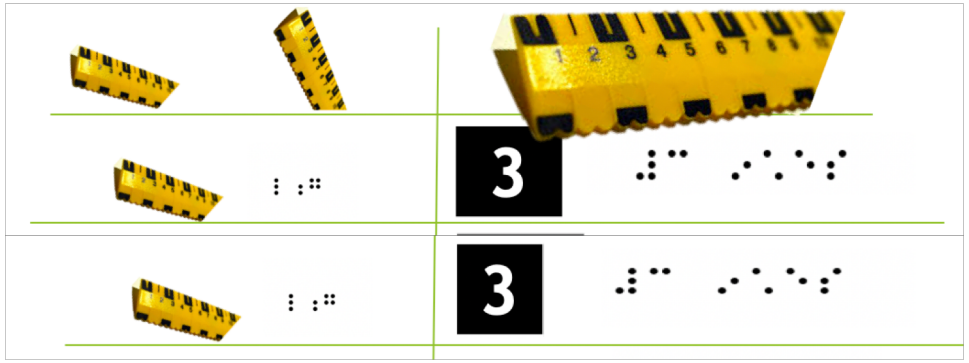
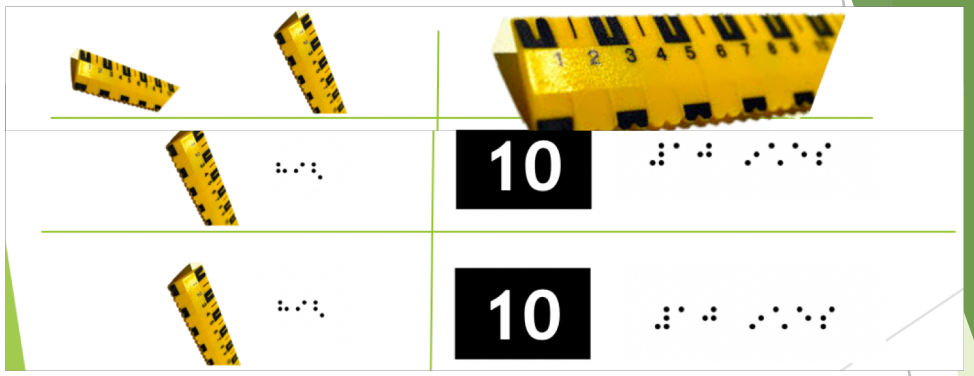
4. Analyze and interpret data

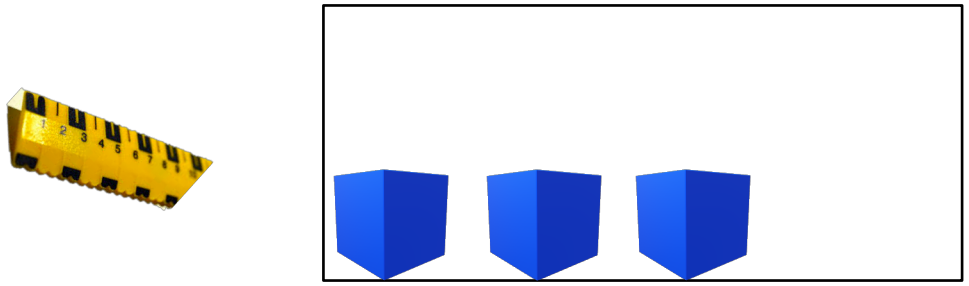
- Use in science to determine meaning
- Use in engineering to test solutions

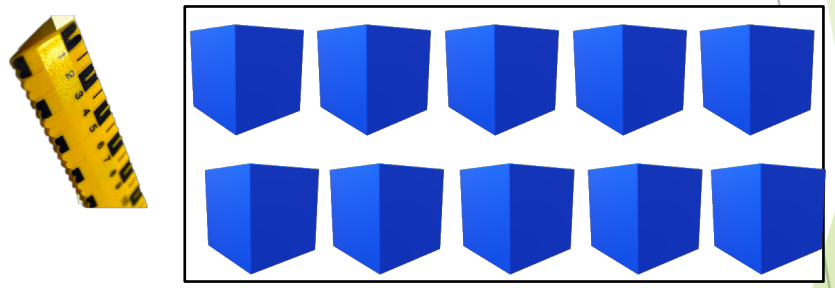
- Analyze data
  - Organize
  - Graph
- Interpret data
  - Evaluate
  - Use statistics

- 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)









Not Far

Far

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)

High go Energy 10 Inches

Low go Energy 3 Inches

High go Energy Far

Kinetic energy (go + energy)

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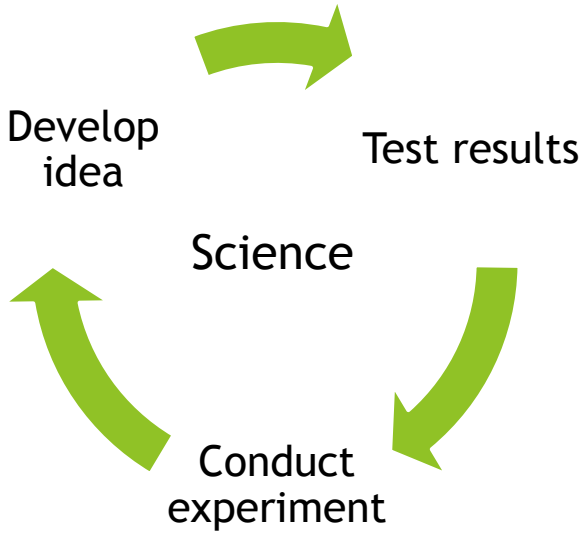
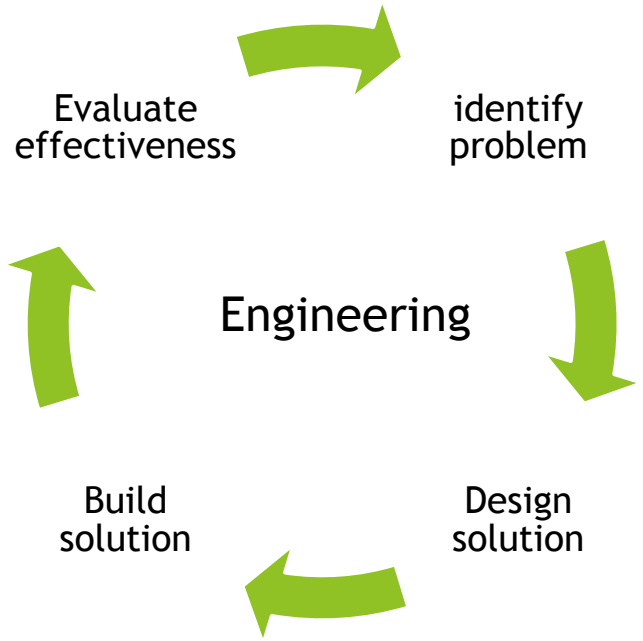
6. Construct explanations (for science) and design solutions (for engineering)





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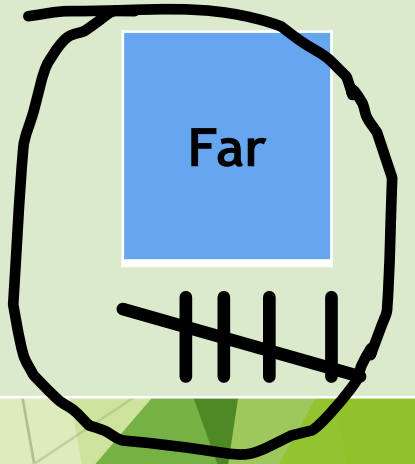
7. Engage in argument from evidence

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)

	Team 1	Team 2	Team 3	Conclusion
 go	Far	Same	Far	Same II



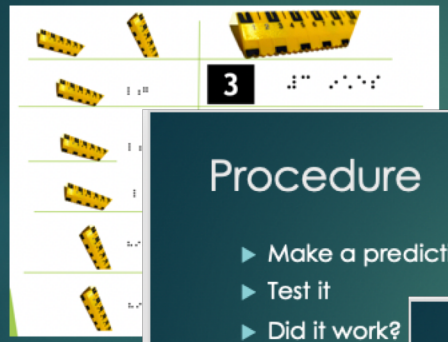
Conclusion

High go Ener

Our Class Data

	Team 1	Team 2	Team 3
go			

Our Data



Procedure

- Make a prediction
- Test it
- Did it work?

Problem

- How can
- How can

Potential and Kinetic Energy

AMY, HARRIS, AND DAWN

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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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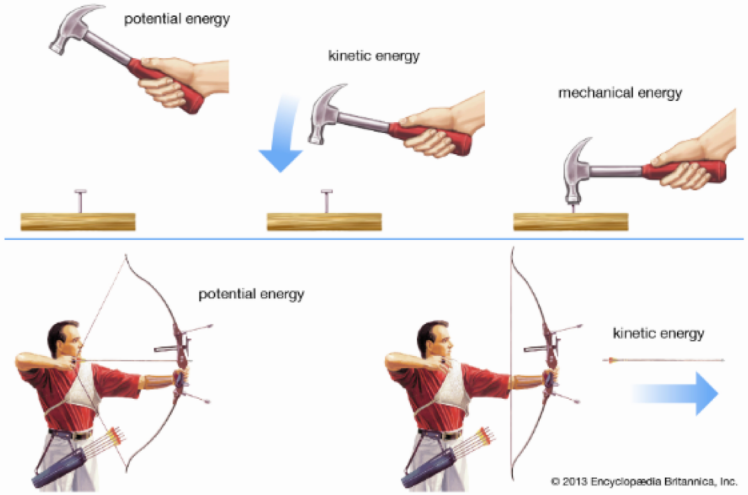
Stored And Moving Energy



Potential energy is stored energy. Kinetic energy is the energy of moving things. Graphic from: Encyclopaedia Britannica.

Moving energy is never still. It is always doing something. Moving energy is also called kinetic energy. All moving objects have kinetic energy.

https://newsela.com/read/elem-sci-energy/id/29722/

Comments on RKE-based avalanche models

By Issler, D., Jenkins, J. T., McElwaine, J.N.

Abstract: Scientists want to save people from avalanches. They need to predict how an avalanche will move.

Problem/Research Question: How can we predict where avalanches will go?

Method: Using models of kinetic energy, the authors made models of avalanches.

Conclusion: Scientists cannot yet predict how avalanches move, but they are getting closer.

Issler, D., Jenkins, J. T., & McElwaine, J. N. (2018). Comments on avalanche flow models based on the concept of random kinetic energy. *Journal of Glaciology*, *64*(243), 148-164.

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http://inclusiveclassrooms.org/inquiries/first-grade-podcasts/class-presentation-podcasts

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."

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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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1-LS1 From Molecules to Organisms: Structures and Processes		
1-LS1-1. Design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.		
Science and Engineering Practices **Core Content Connectors**	**Disciplinary Core Ideas** **Core Content Connectors**	**Crosscutting Concepts** **Core Content Connectors**
Constructing Explanations and Designing Solutions With guidance and support from peers and adults, identify and design a solution for human problems that can be solved by mimicking plant or animal solutions (e.g., a helmet to protect a bicyclist that mimics a turtle's shell).	**LS1.A: Structure and Function** • Identify how animals use their external parts to help them survive, grow, and meet their needs. • Identify how plants use their external parts to help them survive, grow, and meet their needs.	**Structure and Function** With guidance and support from peers and adults, recognize that eyes and ears are related to their function of protecting animals by detecting danger.

How could humans better protect themselves from very hot or very cold temperatures?

- Students will research an animal or plant that is successful in that habitat and create a similar design humans could use.

What	Who	Why
cold	People	frostbite
hot		heat stroke

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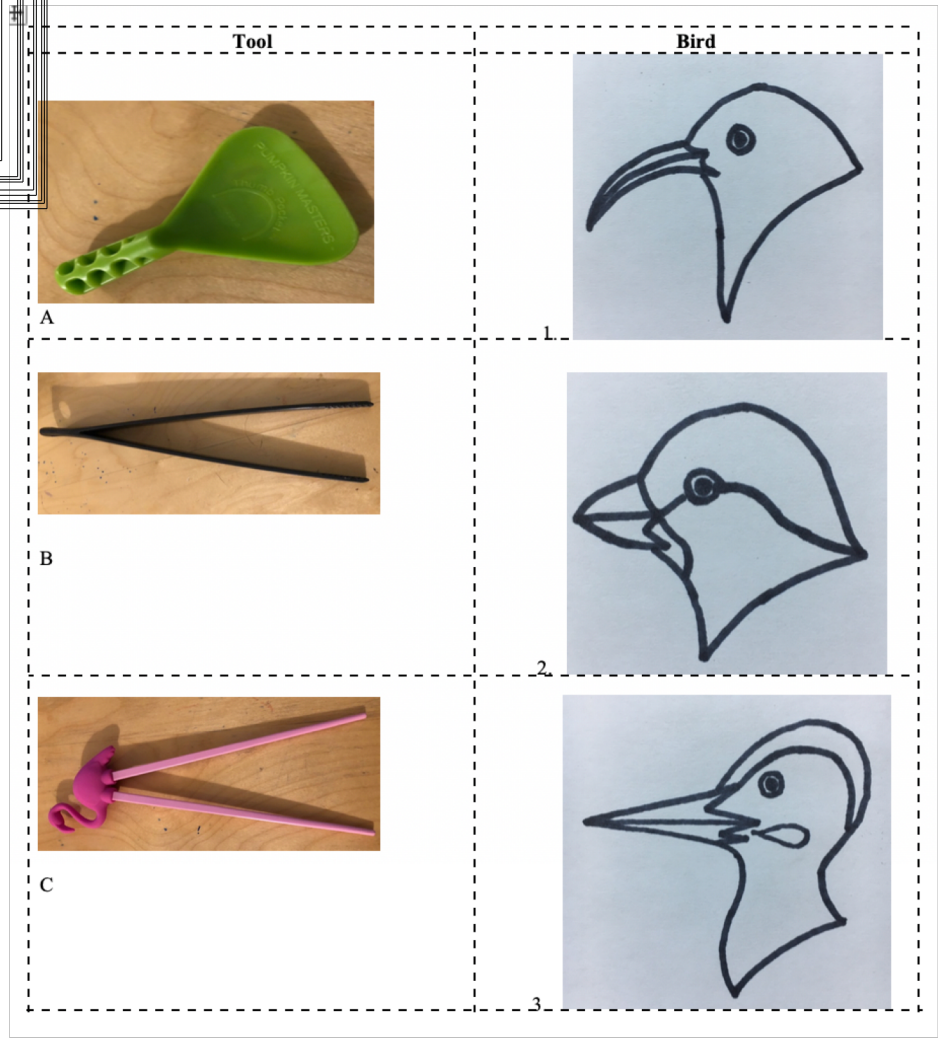
_____People_____ who are _____cold_____ get _____frostbite_____.

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

What could that look like?



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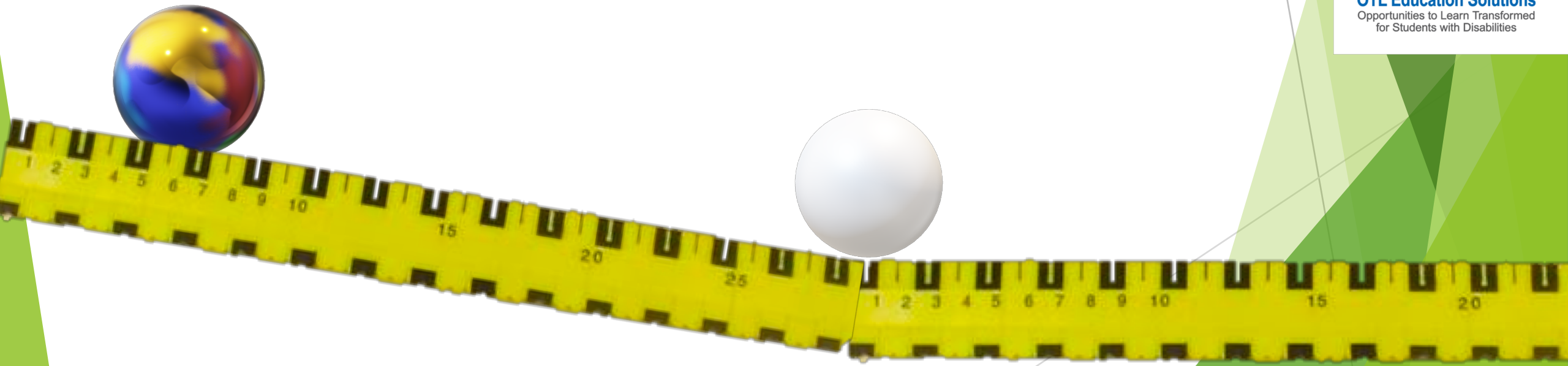
3. Plan and carry out investigations

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

1. Develop a question. 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?

- Size of marble (control)
- Degree of incline (independent variable)
- Distance second marble rolls (dependent variable)



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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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Month	Inches of precipitation
December	4
January	4
February	3
March	4

Rain gauge

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

What could that look like?

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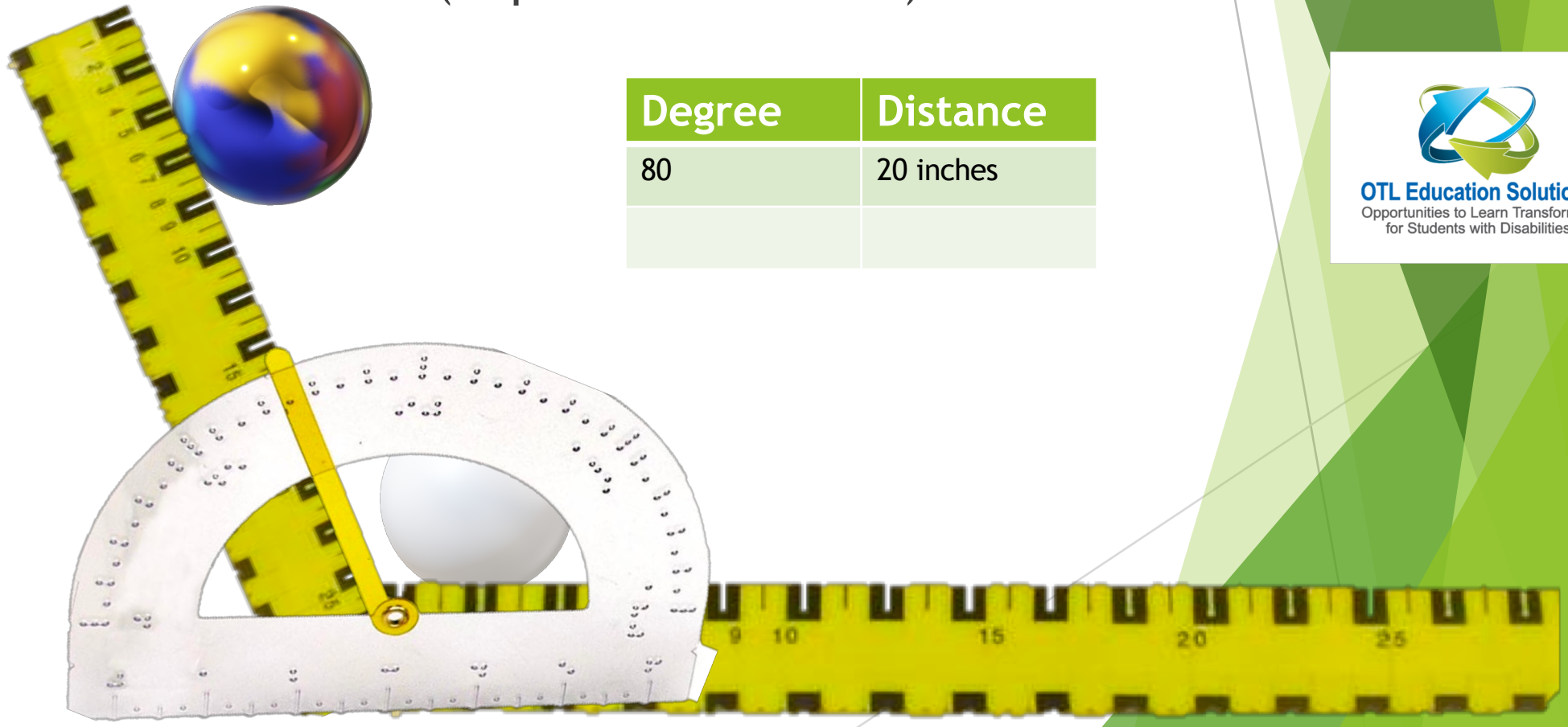

Degree	Distance
80	20 inches

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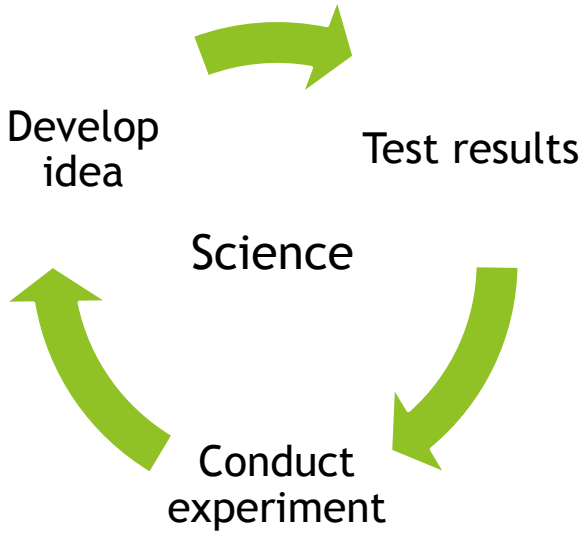
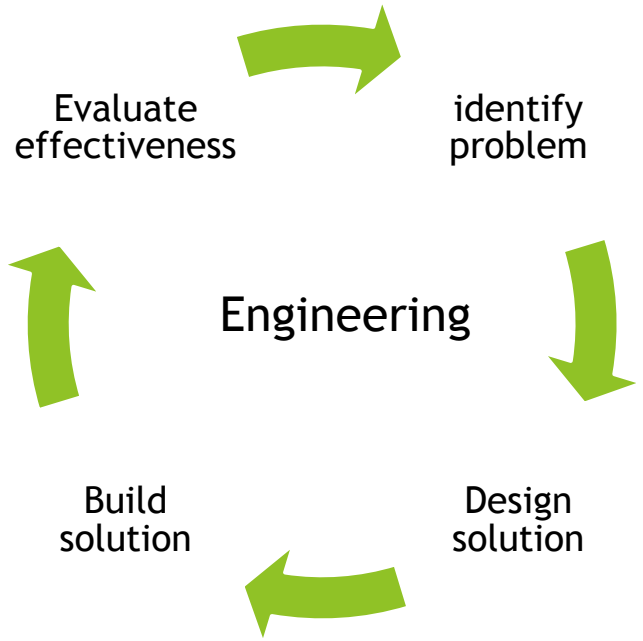
6. Construct explanations (for science) and design solutions (for engineering)





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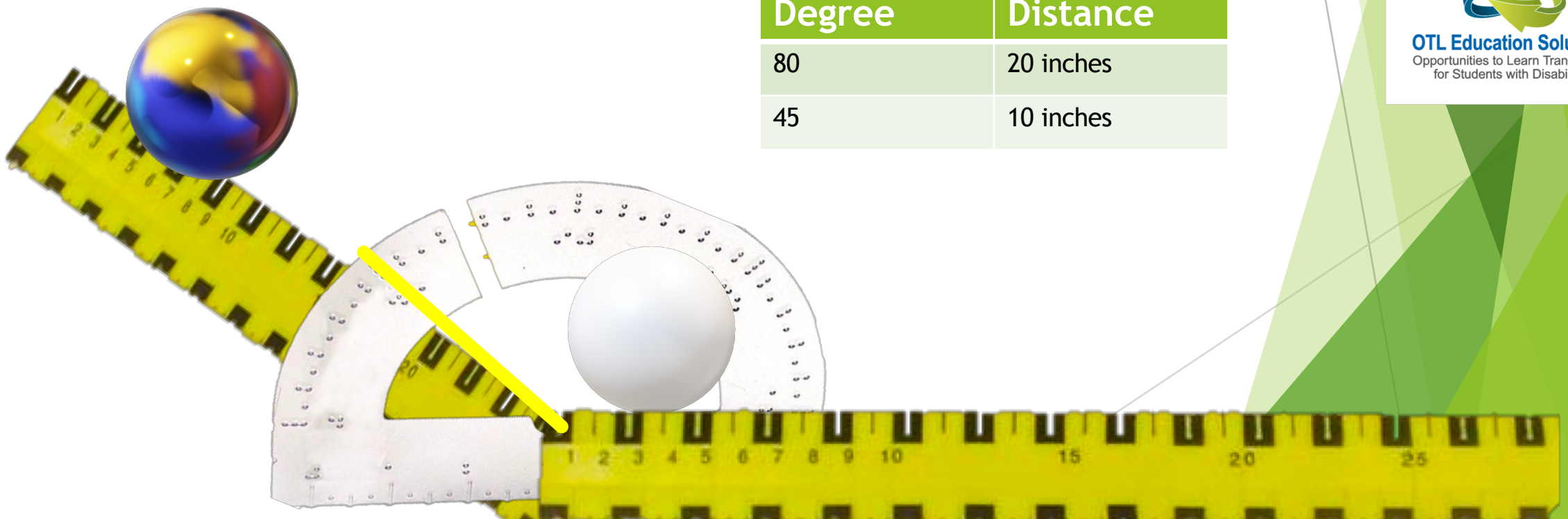
What could that look like?

- Size of marble (control)
- Degree of incline (independent variable)
- Distance second marble rolls (dependent variable)

Degree	Distance
80	20 inches
45	10 inches



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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)
3. Listen to other arguments (take notes- write, use symbols, highlight text, Velcro words/pictures)
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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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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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Thank you!

Thank you!

Thank you!

Thank you!

Thank you!

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www.otltransformed.com

DebbieTaub

Thank you!