Science

South Dakota CCC Webinar High School

December 12, 2018

Debbie Taub and Mike Burdge

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)?"

HS-LS3 Heredity: Inheritance and Variation of Traits		
HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.		
Science and Engineering Practices **Core Content Connectors**	**Disciplinary Core Ideas** **Core Content Connectors**	**Crosscutting Concepts** **Core Content Connectors**
Asking Questions and Defining Problems Work with peers to ask questions to understand that the genetic instructions for forming species' characteristics are carried in the chromosomes; each chromosome consists of a single DNA molecule; and that genes are the regions in the DNA that contain the instructions that code for the formation of proteins.	**LS3.A: Inheritance of Traits** • Recognize that DNA molecules in all cells contain the instructions for traits passed from parents to offspring.	**Cause and Effect** Work with peers to describe the cause and effect relationships between DNA, the proteins it codes for, and the resulting traits observed in an organism.

Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instruction for characteristic traits passed from parents to offspring.

- Verbs
  - Ask
- Nouns
  - Questions

Ask questions

- Students will ask questions about different possibilities about genetic instructions
- 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

Mom

Dad

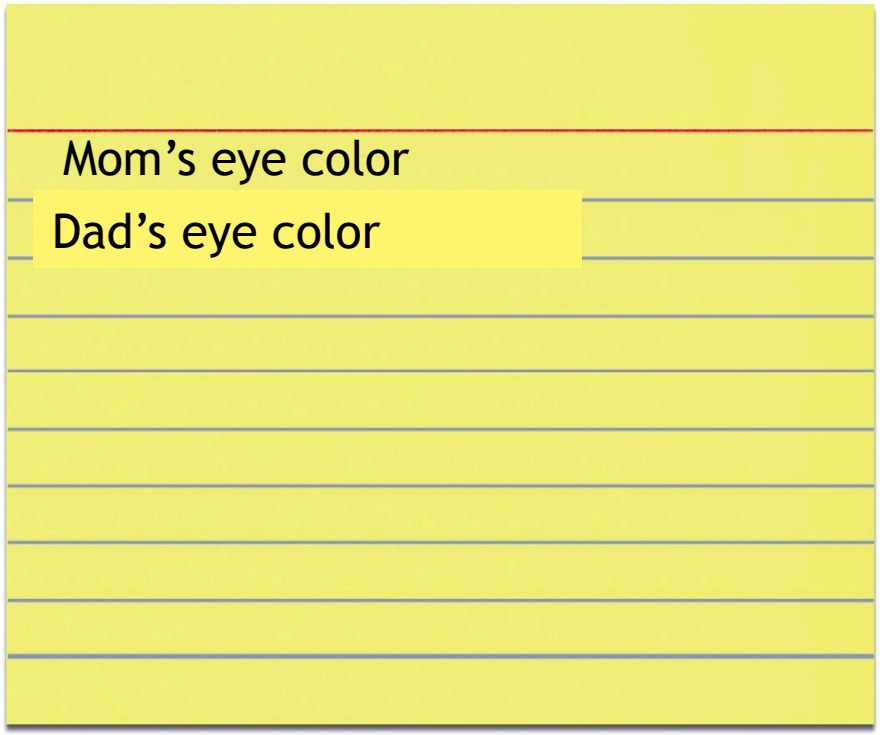
No one has brown eyed gene

Both parents

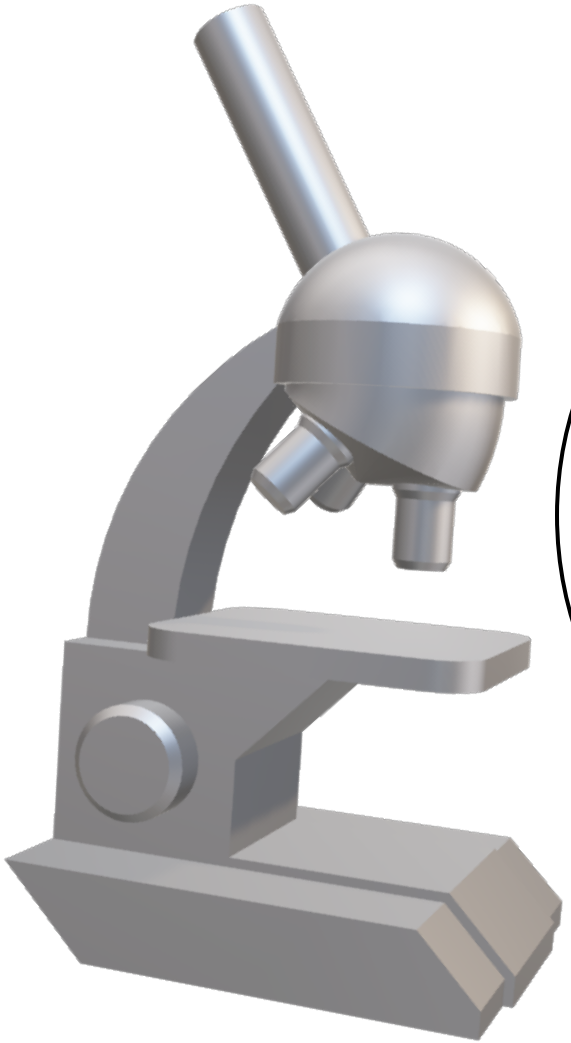
Brown eyes

Blue eyes

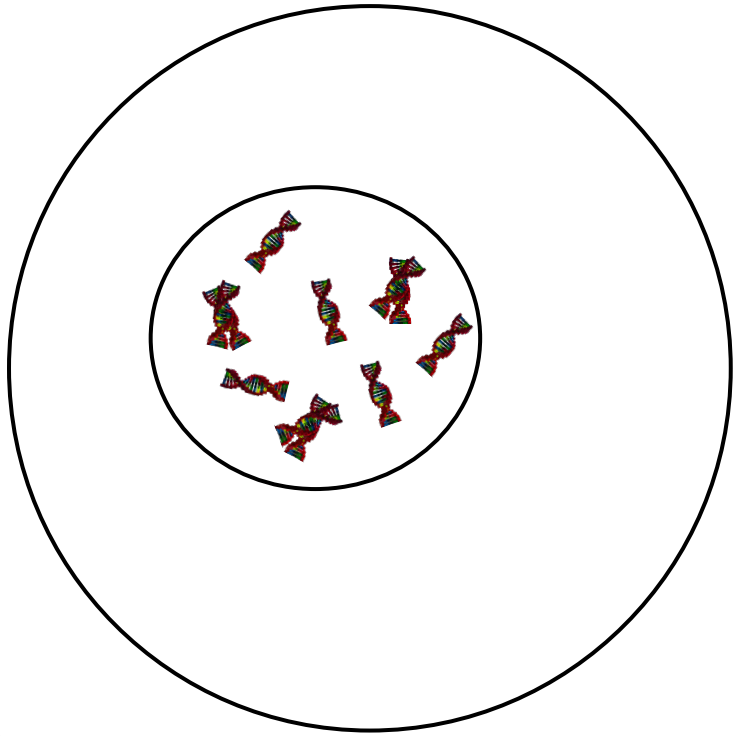
If _____ has a blue eyed gene and brown eyes, then child will probably have _____ .



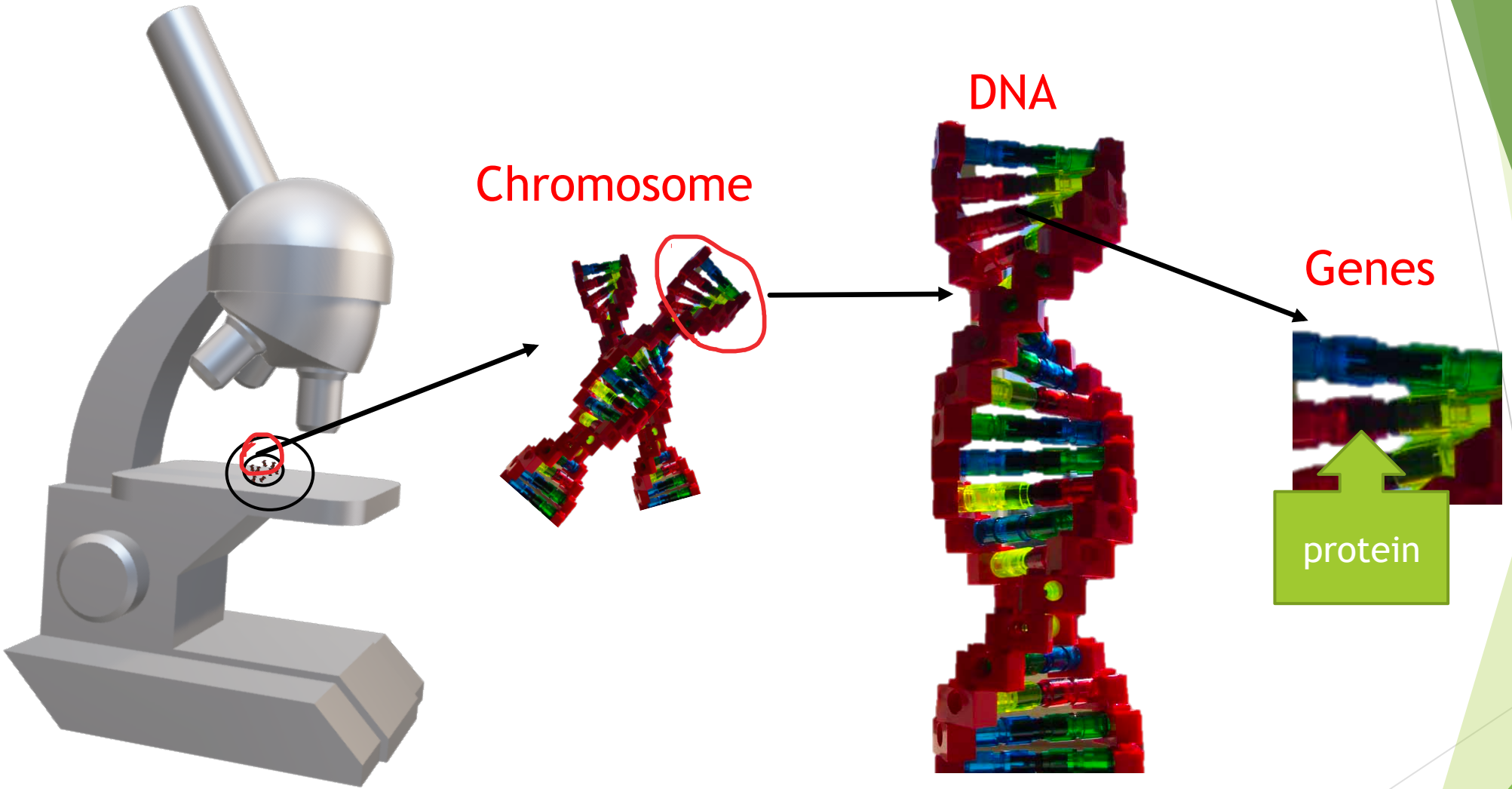
If I change _____ how does that affect the probability of the child having blue eyes?



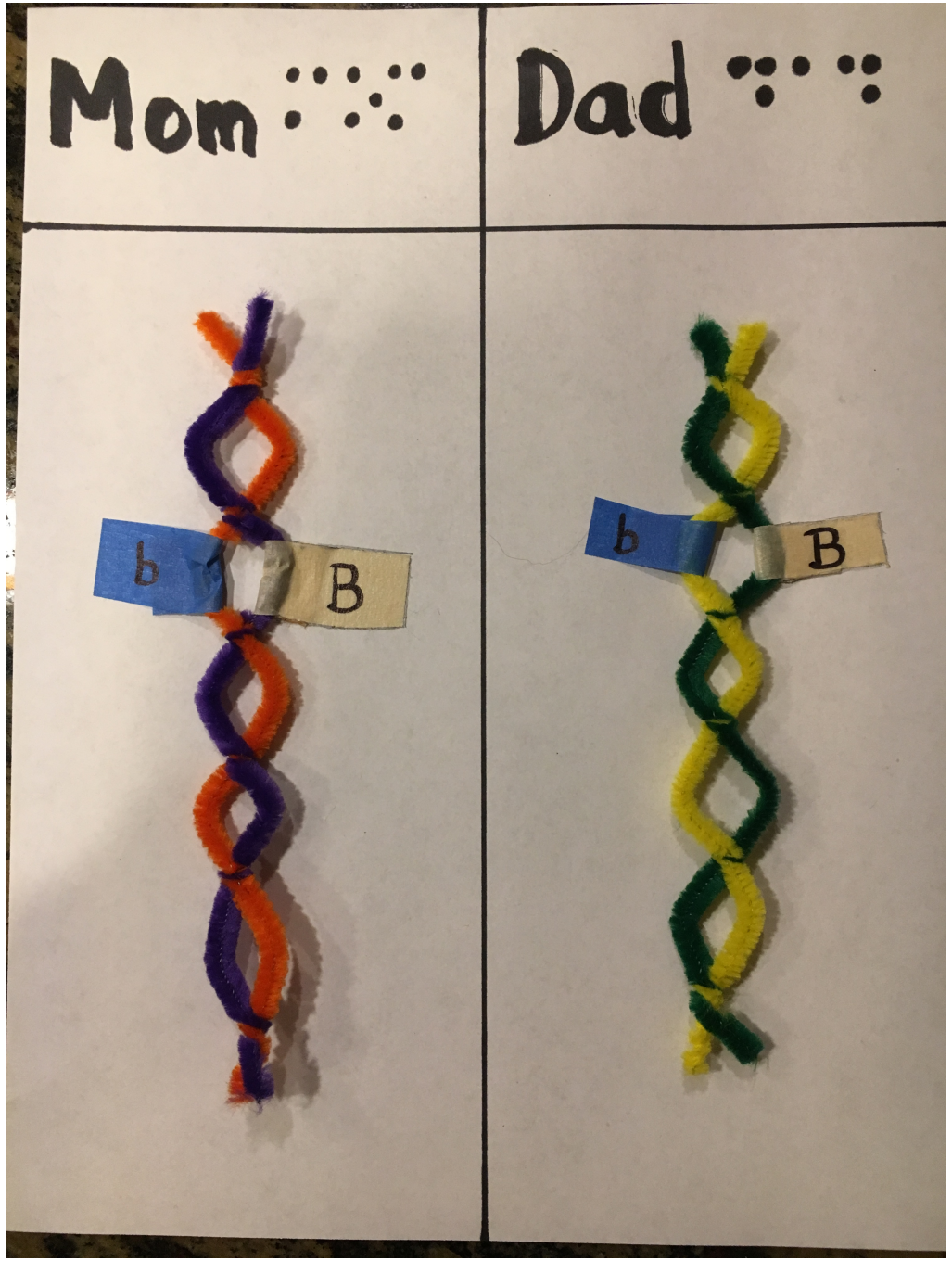
Cell



OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities



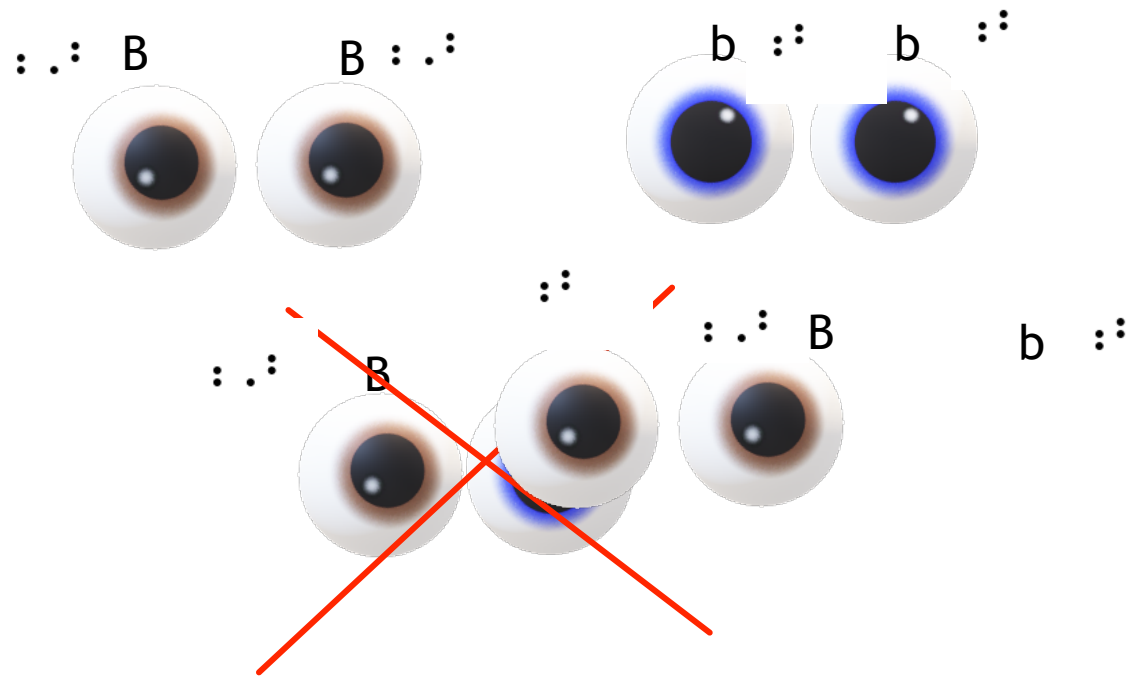
OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities



OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

B is the brown eye gene
b is the blue eye gene
Capital letters are stronger (dominant) and mask the lower case letters

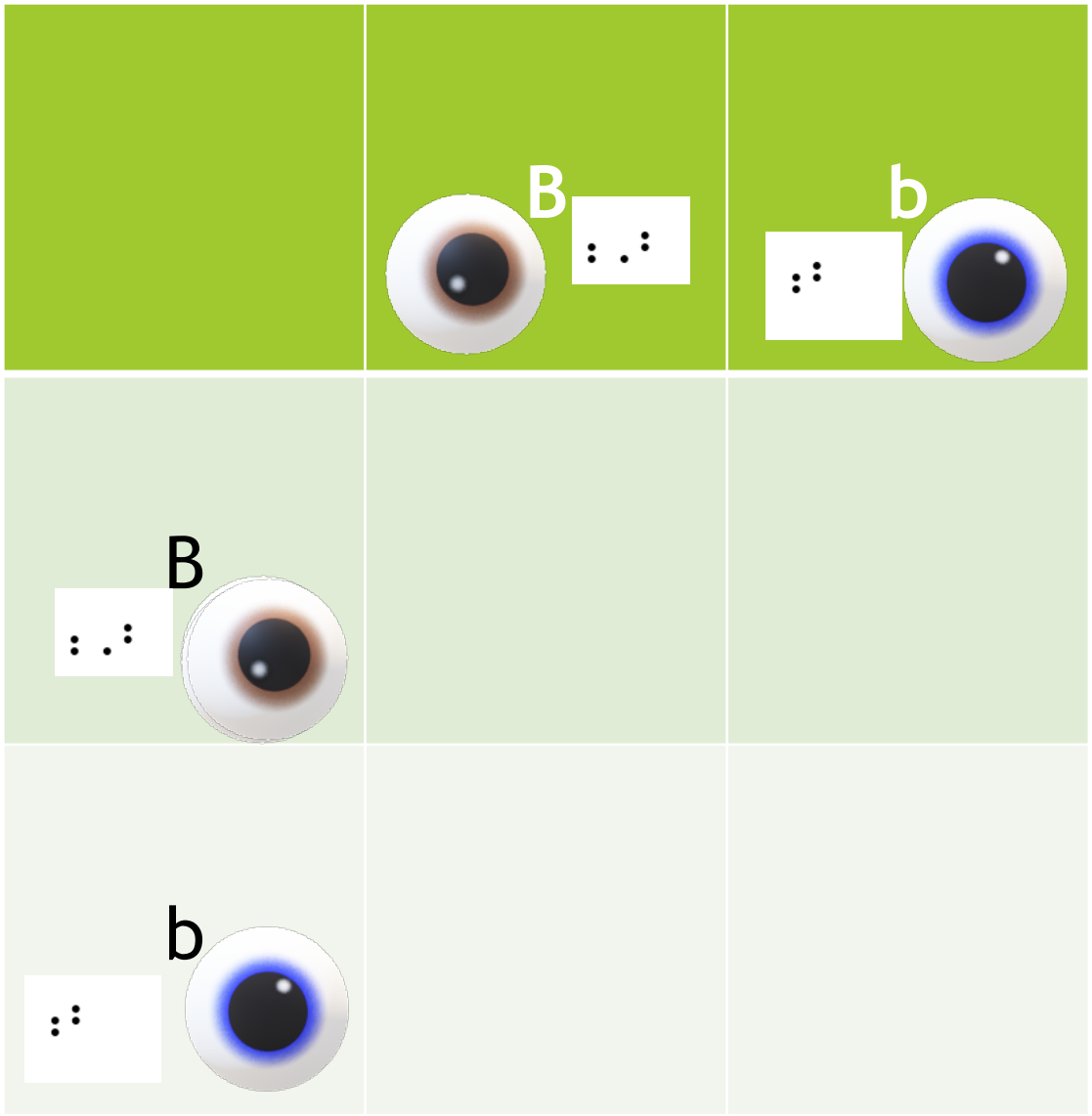
BB = brown
Bb = brown
bb = blue



2. Develop and use models

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

- Use models
  - Simulate a phenomena
  - Test a design



Brown is strongest.
Blue eyes only if there are <u>two blue</u> genes.

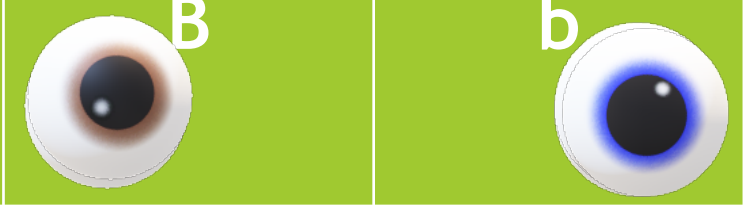
OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

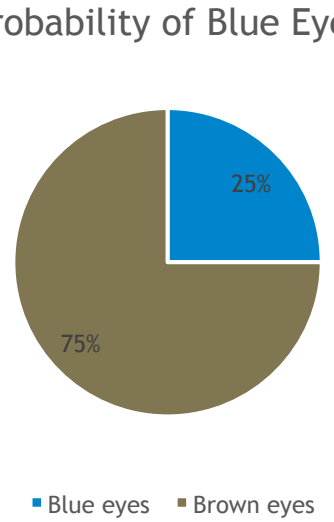
3. Plan and carry out investigations

- 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)

	B	b
B		
b		

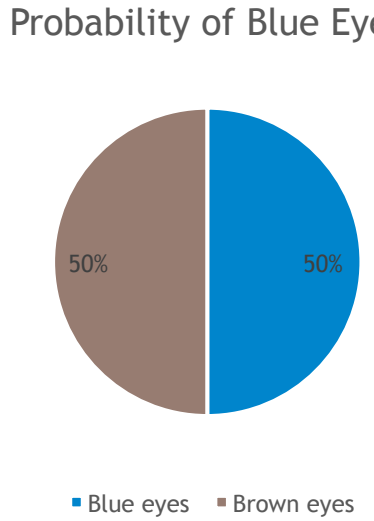




Note: simplified example--more than one gene controls eye color.

OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

	b	b
B		
b		



OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

4. Analyze and interpret data

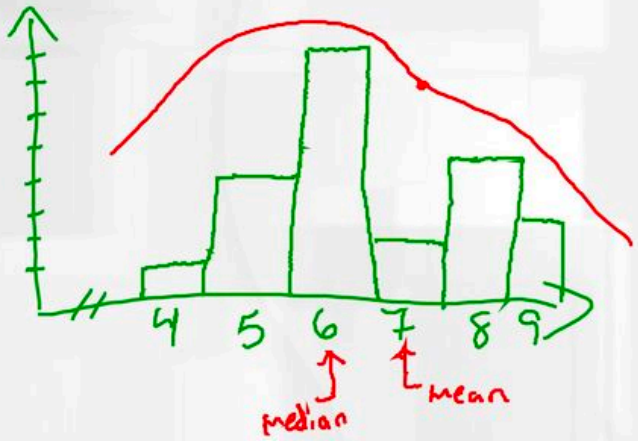
- Use in science to determine meaning
- Use in engineering to test solutions

- 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)

How many hours of sleep does the average high school or college student sleep?

Find the mean, median, mode, range and identify the distribution.



mode: 6hrs
median: 6hrs

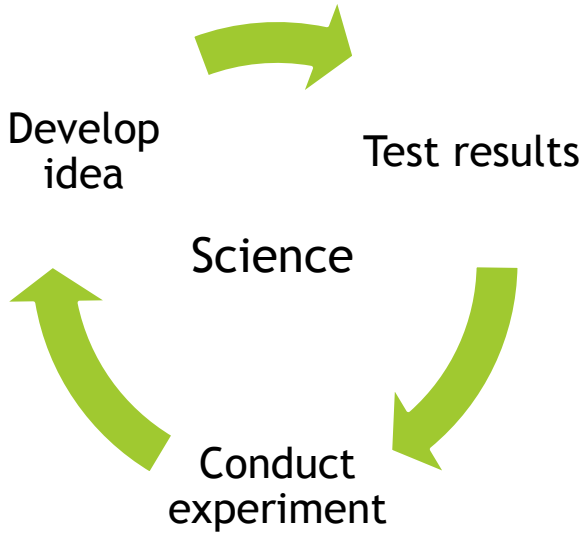
7hrs
Range: 9-4=5
mean > median
skewed right
(positively)
distribution

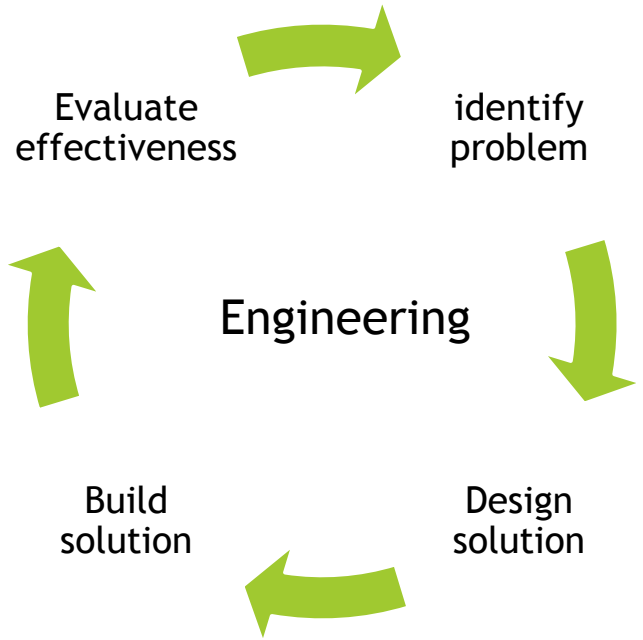
https://slideplayer.com/slide/12982697/

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)

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





OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

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)

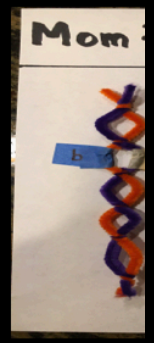
Conclusion

- Pre
- If da
hav

Our class data

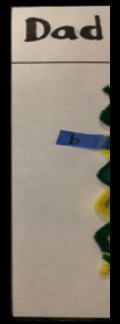
Our data

Procedure



Problem

- If _____dad_
eyes, then chi



Eye Color

Joey, Javier, and Josaphina

OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

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

The Mouse Test

As a test, a team of scientists gave mice two different kinds of mtDNA. The mice did not do well. Compared with normal mice, the test mice moved less. They also ate less. They were more nervous. The mice had more trouble thinking. It seems that carrying mitochondria from both parents is bad.

So why is it so hard to say if you are more like your mother or father? This is because where your genes come from is only part of the answer. Only some of those genes actually get used.

Genes from your dad are more likely to be used. So, you can look more like your dad and are more related to your mom.

Madeleine Beekman is a professor at the University of Sydney in Australia.

https://newsela.com/read/lib-convo-parents-dna-genetics/id/36880/

CRISPR/Cas9 mediated high efficiency knockout of the **eye** color gene Vermillion in Helicoverpa zea (Boddie)

- Abstract: Scientists want to learn to control what genes are expressed or passed from parents to children.
- Problem: Can we make corn earworms not have red eyes?
- Method: Use CRISPR gene to control parts of DNA
- Results: corn earworms did not have red eyes
- Conclusion: Yes, we can make corn earworms not have red eyes.

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).

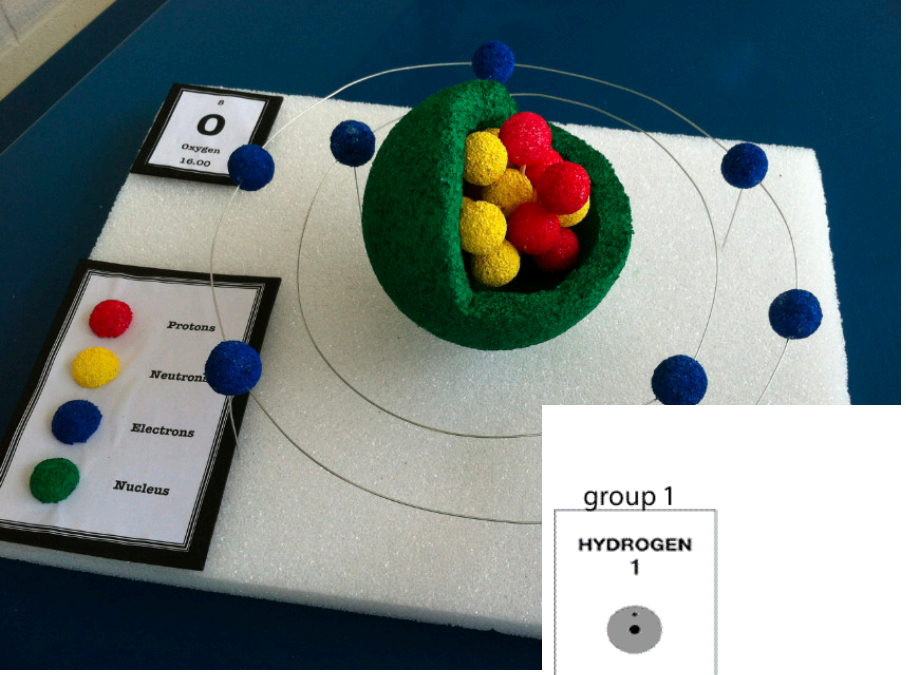
- "Who (List 2) need(s) what (List 1) because why (List 3)."

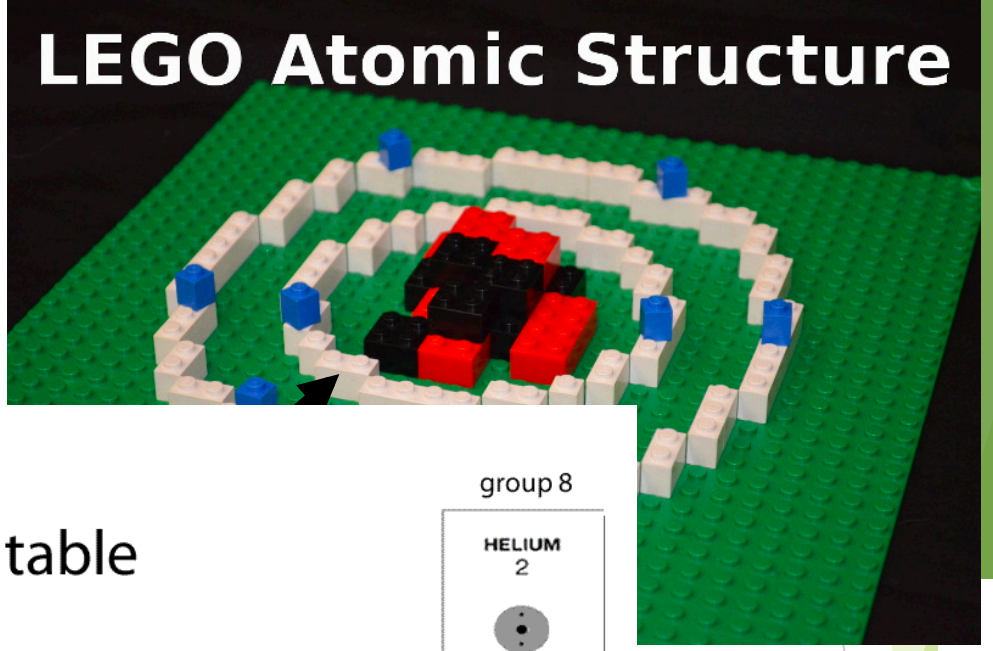
OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

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

HS-PS1 Matter and Its Interactions		
HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.		
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 construct a model (e.g., a model that shows an atom's nucleus as made of protons and neutrons, and is surrounded by electrons) to describe the relationships between elements in the periodic table and the structure of atoms (e.g., arrangement of the main groups of the periodic table reflects the patterns of outermost electrons).	**PS1.A: Structure and Properties of Matter** • Recognize that that elements are organized in the periodic table horizontally by the number of protons equal to the number of electrons (in a neutral atom) in the atom's nucleus. • Recognize that properties vary in a regular pattern across the rows (periods) and down the columns (families or groups) in the periodic table. • Recognize the importance of the atom's outermost electrons in determining the chemical and physical properties of an element. • Predict the properties of elements using the periodic table.	**Patterns** Work with peers to show how patterns may be observed and can provide evidence for causality in explanations of phenomena (i.e., repeating patterns of the periodic table reflect patterns of outer electron states).





Periodic table

group 1	group 2	group 3	group 4	group 5	group 6	group 7	group 8
HYDROGEN 1							HELIUM 2
1.01							4.00
LITHIUM 3	BERYLLIUM 4	BORON 5	CARBON 6	NITROGEN 7	OXYGEN 8	FLUORINE 9	NEON 10
6.94	9.01	10.81	12.01	14.01	16.00	19.00	20.18
SODIUM 11	MAGNESIUM 12	ALUMINUM 13	SILICON 14	PHOSPHORUS 15	SULFUR 16	CHLORINE 17	ARGON 18
22.99	24.31	26.98	28.09	30.97	32.07	35.45	39.95
POTASSIUM 19	CALCIUM 20						
39.10	40.08						

OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

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)

OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

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

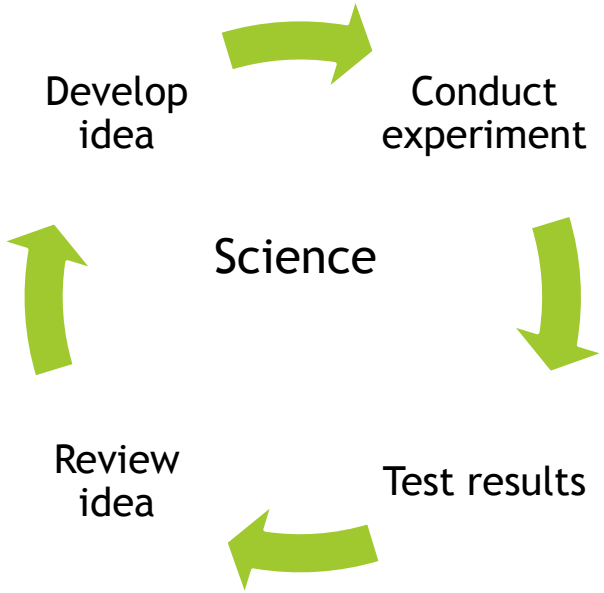
OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

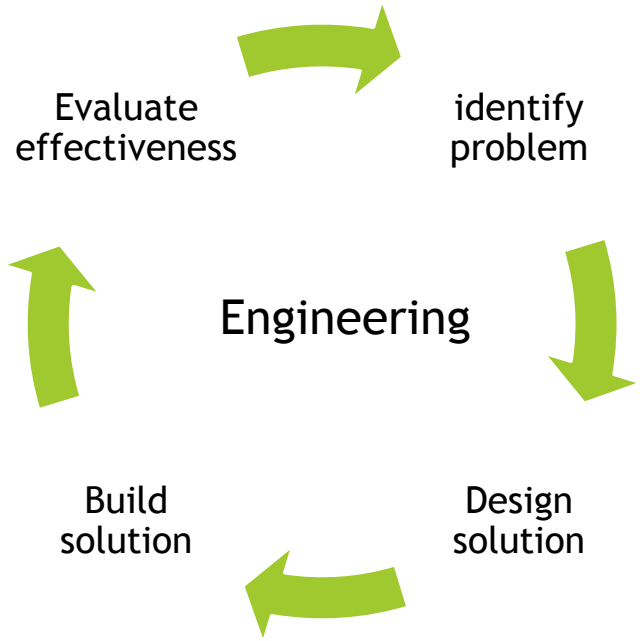
5. Use mathematics and computational thinking

- 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)





OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

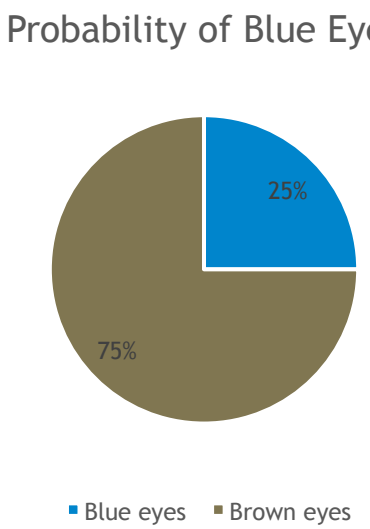
7. Engage in argument from evidence

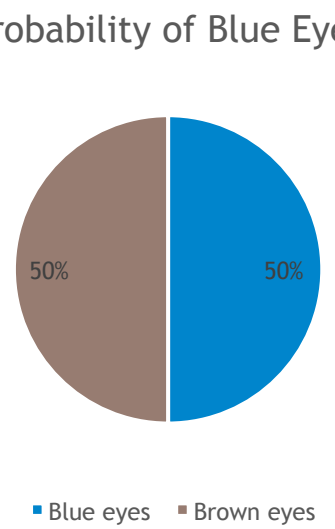
- In science, decide the best explanation for a phenomena
- In engineering, decide the best solution to a problem

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)
4. Evaluate all arguments to find the best explanation/ solution (yes/no, agree/disagree, good better/best, vote/tally votes)





OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

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

OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

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/

OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

Evaluation

- https://www.surveymonkey.com/r/KDC7KYQ

OTL Education Solutions
Opportunities to Learn Transformed for Students with Disabilities

Thank you!

Thank you!

Thank you!

Thank you!

Thank you!

OTL Education Solutions

www.otltransformed.com

DebbieTaub

Thank you!