



# **Bring Your Middle School Labs into the 21st Century!**

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# 21st Century Skills Overview

A profound gap exists between the knowledge and skills most students learn in school and the knowledge and skills they need for success in their communities and workplaces.

[http://www.p21.org/overview/p21-faq#what\\_framework](http://www.p21.org/overview/p21-faq#what_framework)



# **COMMON CORE**

## **STATE STANDARDS INITIATIVE**

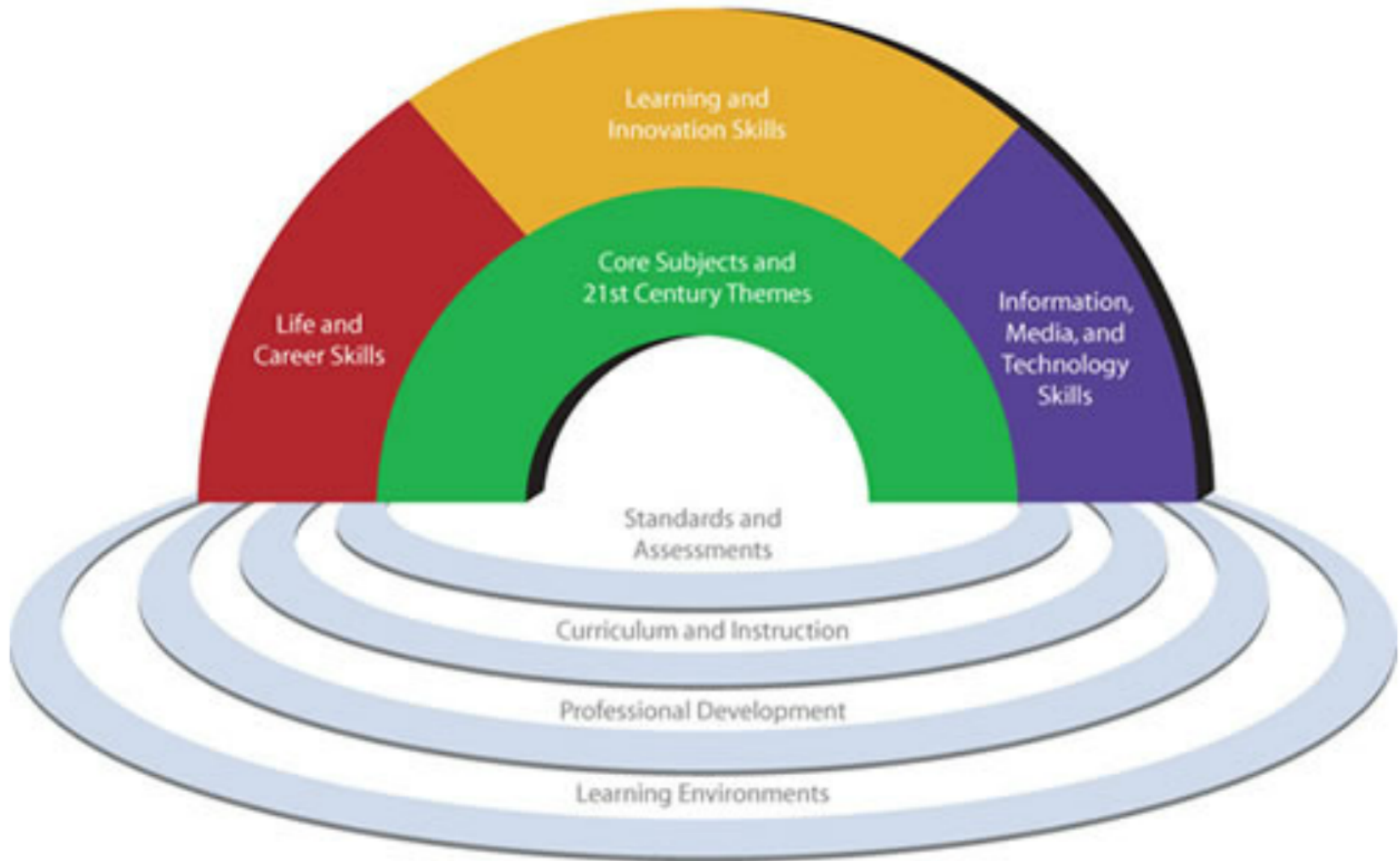
PREPARING AMERICA'S STUDENTS FOR COLLEGE & CAREER





**NEXT GENERATION**  
**SCIENCE**  
**STANDARDS**

# 21st Century Skills

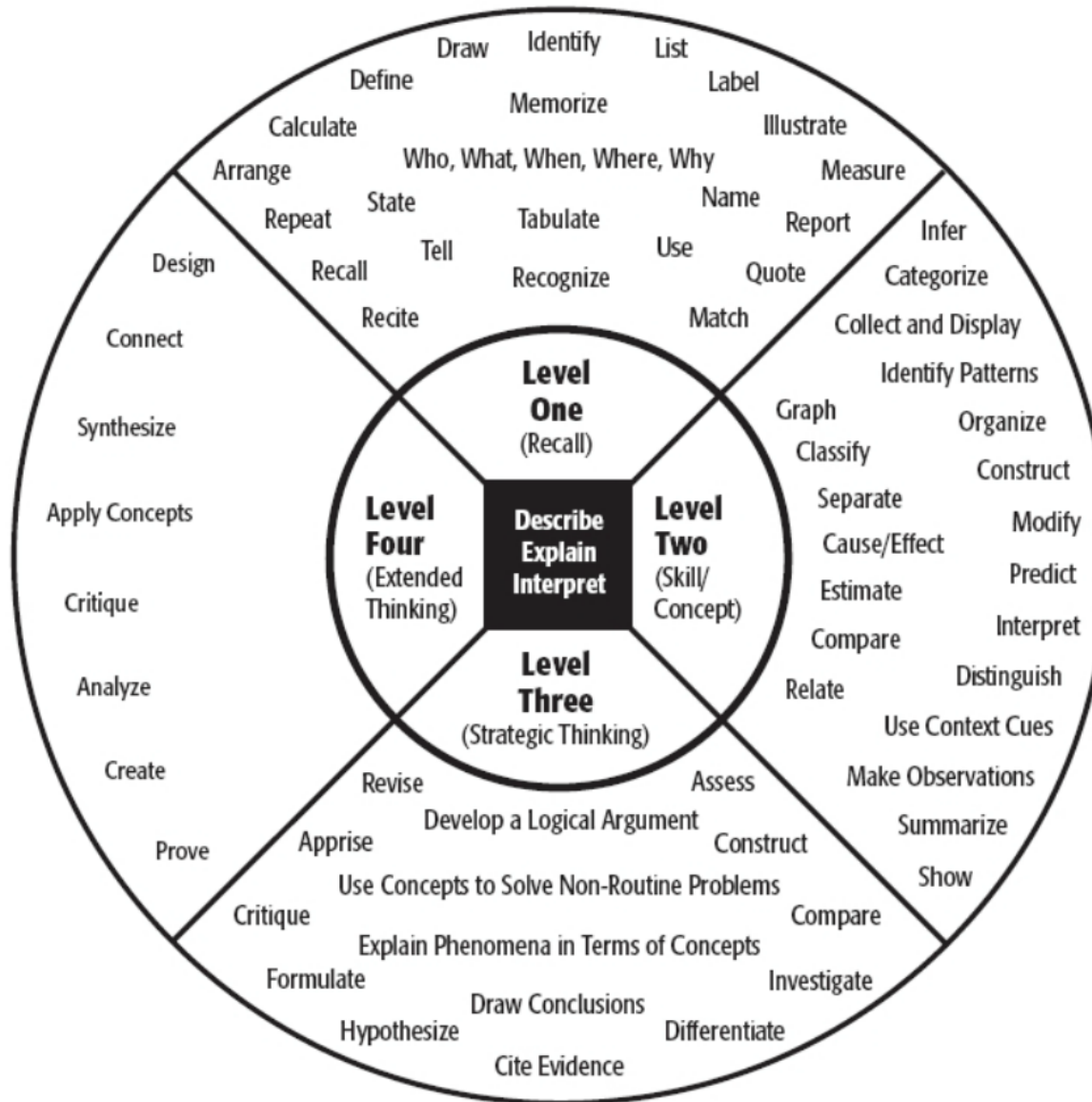


# Learning and Innovation Skills

(4C's)



# Depth of Knowledge (DOK)



# 21st Century Skill Set Rubric

	Level 1	Level 2	Level 3	Level 4
Creativity	Little or no opportunities for students to develop these skills.	Few opportunities for students to develop these skills.	Some opportunities for students to develop these skills.	Many opportunities for students to develop these skills.
Critical Thinking				
Communication				
Collaboration				

# The Volcanic Eruption Lab: 20th Century Style

Objective:

Construct a model of  
an explosive volcanic  
eruption



# The Volcanic Eruption Lab: 20th Century Style

## Materials:

Vinegar

Alka Seltzer

E-flasks

Rubber stoppers

Pie tins



# The Volcanic Eruption Lab: 20th Century Style

Procedure:

1. Add vinegar to e-flask
2. Add 2 Alka Seltzer tablets
3. Cap with stopper
4. Observe





# The Volcanic Eruption Lab: 20th Century Style

Data:

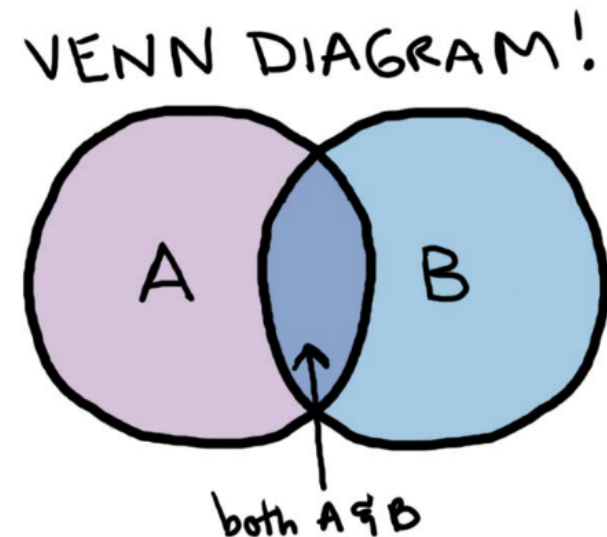
Draw the eruption



# The Volcanic Eruption Lab: 20th Century Style

Conclusion:

- Explain what caused model to erupt and how that relates to an actual eruption.
- Make a Venn diagram comparing a real volcano to your model.



# Applying the Rubric

Creativity: Level 1

Critical Thinking: Level 2

Communication: Level 1 or 2

Collaboration: Level 2

Depth of Knowledge: Level 1 & 2



# Revised Lab: 21st Century

Research:

Use primary sources to research causes of volcanic eruptions.





# Revised Lab: 21st Century

## 2. Create Collaborative Groups

- Heterogeneous
- Homogeneous
- “Six Thinking Hats”

### Six Thinking Hats®

Blue Hat



Process

White Hat



Facts

Red Hat



Feelings

Green Hat



Creativity

Yellow Hat



Benefits

Black Hat



Cautions



Stock Number 80703  
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porative

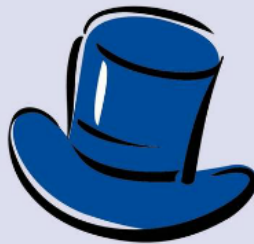
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# Six Thinking Hats®

**Blue Hat**



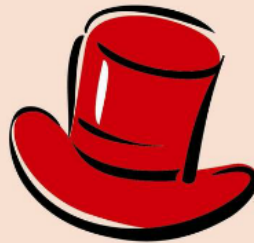
Process

**White Hat**



Facts

**Red Hat**



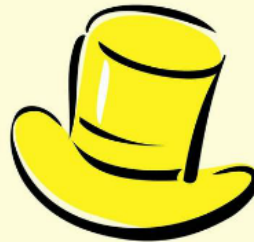
Feelings

**Green Hat**



Creativity

**Yellow Hat**



Benefits

**Black Hat**



Cautions



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# Revised Lab: 21st Century

## 3. New Objective:

Construct a working model of an explosive volcanic eruption from common household items.





# Revised Lab: 21st Century

## 4. Research and Brainstorm:

Use the following steps to brainstorm:

- Clearly define the topic
- Generate many ideas
- Do not change, criticize, or evaluate
- Encourage participation
- Continue until all ideas have been presented



# Revised Lab: 21st Century

Evaluate the results of the brainstorm:

- Clarify
- Categorize
- Rank
- Finalize idea
- Teacher approval



# Revised Lab: 21st Century

5. Formulate a hypothesis:

“A model of an explosive eruption can be constructed with baking soda and vinegar in a closed container.” (DOK 3)

# Revised Lab: 21st Century

## 6. Predict

If we..., Then ..... will happen. Because....

IF we use baking soda and vinegar in a closed container to construct a model volcano, THEN it will erupt like a real explosive volcano, BECAUSE vinegar and baking soda mixed in a closed container will produce gas pressure, which is what causes a real volcanic eruption. (DOK 3)



# Revised Lab: 21st Century

## 7. Design a Procedure:

- Students formulate a set of procedures to test their hypothesis (DOK 3).
- Students test their hypothesis.



# Revised Lab: 21st Century

## 8. Collect Data:

- Describe or summarize the eruption (DOK 2).
- Draw and label your model using scientific vocabulary (DOK 1).
- Analyze, critique, and revise your model (DOK 3 & 4).
- Retest if time permits.

# Revised Lab: 21st Century

## 9. Draw a Conclusion:

Students make a claim:

Their volcano did (or did not) erupt like a real volcano. They conclude this lab by writing an argument to support that claim with valid reasoning, utilizing evidence from texts-books, internet sources, etc., while evaluating their reliability (DOK 4).

# Applying the Rubric

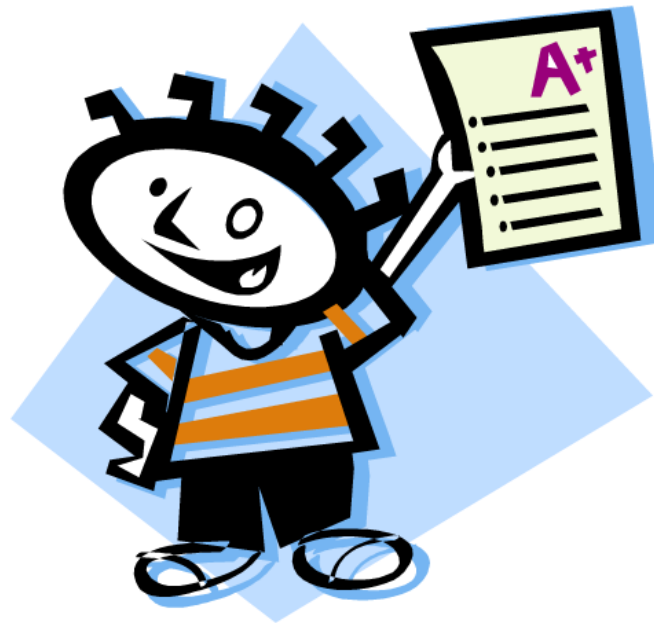
Creativity: Level 3 and 4

Critical Thinking: Level 3 and 4

Communication: Level 3 and 4

Collaboration: Level 3 and 4

Depth of Knowledge: Level 1, 2, 3, and 4





# Bonus Round

As a grand finale, you can demonstrate an explosive volcanic eruption using liquid nitrogen, a plastic soda bottle duct taped to a brick, and a trash can full of water.

[http://classes.colgate.edu/kharpp/Depth\\_Charge/](http://classes.colgate.edu/kharpp/Depth_Charge/)





YouTube

# Key Revisions



# Volcano Demo



# The Natural Selection Lab

## 20th Century Style

Objective:

You are a specific animal and must compete with two other species for the same food. The animal with the most food survives and reproduces.





# The Natural Selection Lab

## 20th Century Style

### Materials:

- Forks, knives, & spoons
- Pie tins
- Cheerios
- Calculator
- Graph Paper



# **The Natural Selection Lab**

## **20th Century Style**

### Procedure:

- Assign a utensil to each student.
- Distribute the Cheerios.
- Hunt for 1 minute.
- Count the number of Cheerios.
- Calculate the next generation.

# The Natural Selection Lab

## 20th Century Style

Data

Animal Species	# food items eaten by species	Total # food items eaten	% of total food eaten by species
Fork			
Knife			
Spoon			

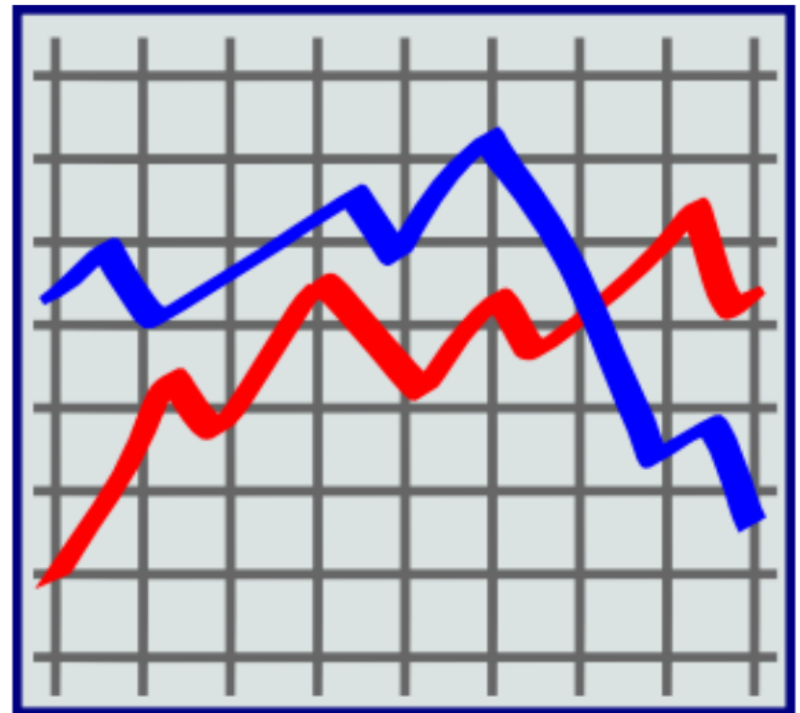


# The Natural Selection Lab

## 20th Century Style

Analysis:

Use the data collected to create one line graph showing the changes in all three species over four generations. (DOK 2)



# The Natural Selection Lab

## 20th Century Style

### Conclusion:

- What is the genetic variation? (DOK 2)
- Which animals were most and least successful? (DOK 2)
- How did the population change? (DOK 2)
- What do you predict will happen over time? (DOK 2)
- In nature, how do adaptations affect competition? (DOK 3)

# Applying the Rubric

Creativity: Level 1

Critical Thinking: Level 2

Communication: Level 1

Collaboration: Level 2

Depth of Knowledge:

Levels 2 and 3



# Revised Lab: 21st Century

## Research

- Use primary sources to research natural selection
- Play online natural selection game



<http://science.discovery.com/games-and-interactives/charles-darwin-game.htm>

# Charles Darwin Game

INTRO

NATURAL  
SELECTION

SURVIVAL GAME

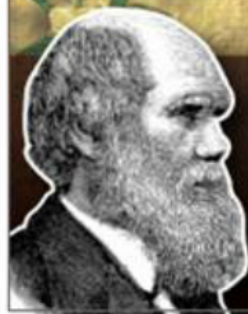
QUIZ

DARWIN'S BIO

GLOSSARY

CREDITS

WHO WANTS TO LIVE  
**A MILLION**  
YEARS?



Welcome to "Who Wants to Live a Million Years?"  
- the game show based on my rules of natural  
selection. Your species will have to survive a  
changing - and sometimes cruel - environment.



**PROCEED**

# Revised Lab: 21st Century

## 2. New Objective:

Using the materials provided, create a utensil that will collect more food in a given time than any other species.





# Revised Lab: 21st Century

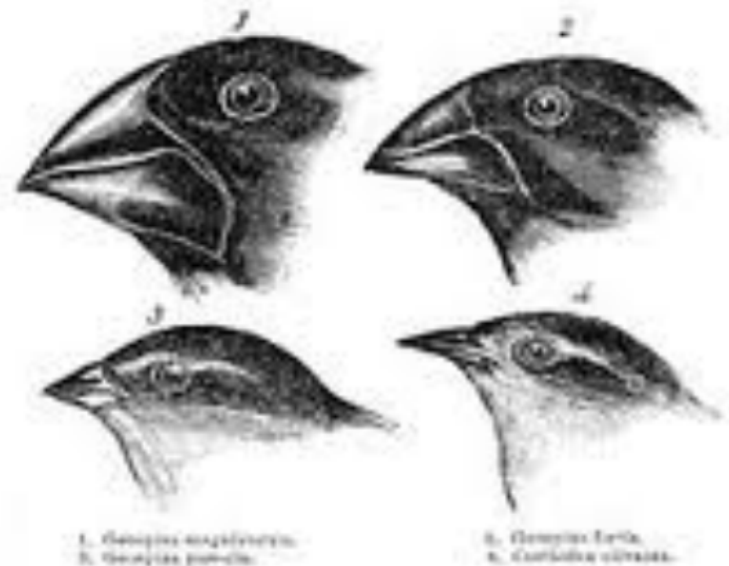
## 3. Create collaborative groups:

- Use the following “Habits of Mind” to encourage student idea generation:
  - Defer judgment
  - Seek quantity
  - Encourage all possibilities
  - Look for combinations
- Finalize the design
- Teacher approval

# Revised Lab: 21st Century

## 4. Formulate a Hypothesis:

- A tool can be constructed which will allow enough food to be gathered to survive and reproduce.





# Revised Lab: 21st Century

## 5. Procedure:

- Students will create a utensil out of the materials of their choosing.



# Revised Lab: 21st Century

## 6. Procedure cont.

Students will compete with one another for a variety of food sources.



## 7. Data

### Revised Lab: 21<sup>st</sup> Century

Utensil Description:	# of food items eaten	Survive? (Y/N)
Generation 1		
Generation 2		
Generation 3		
Generation 4		
Generation 5		

# Revised Lab: 21st Century

## 8. Presentation:

Students present their species' findings to the rest of the class.

- Iron Chef Method



# Revised Lab: 21st Century

## 9. Conclusion

- Which types of utensils were most/least successful and why? (DOK 2)
- What are some examples of successful hunting adaptations in the wild? (DOK 3)

# Revised Lab: 21st Century

Conclusion cont...

- If only a few of the utensils are considered the most fit, then why are there so many variations among species in nature? (DOK 3)
- If you could revise your utensil, what would it look like? Draw a picture. (DOK 3)

# Applying the Rubric

Creativity: Level 3

Critical Thinking: Level 3

Communication: Level 3

Collaboration: Level 4

Depth of Knowledge: Level 1, 2, 3, and 4



# Key Revisions





## **Your Turn**

Feel free to make a utensil out of the provided materials, and compete with your neighbors for a specific food source.

Or just enjoy the candy.

Thanks for coming!

## Contact Info

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Thanks for Coming!!

