



Be A Scientist



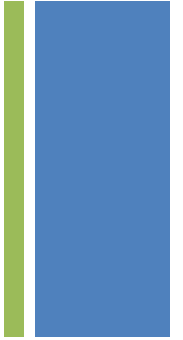
MARTIN LUTHER
KING JR
MIDDLE
SCHOOL



Community Resources for Science

Elise Zolczynski, Program Manager
Traci Grzymala, Project Coordinator

Mary Wildermuth, UC Berkeley



Let's Introduce Ourselves!



Be A Scientist

- Piloted last year at King Middle School
- UC Berkeley scientist mentors guide a small group of 7th grade students to explore individual scientific questions
- NGSS (Next Generation Science Standards):
 - Authentic experience to engage in scientific practices
 - Develop critical thinking skills
 - Emphasizes cross-disciplinary concepts
 - Integration of science & engineering





Be A Scientist – Goals

- Develop 7th grader interest in science
 - Have fun with science!
 - Bring out students' natural curiosity!
- Provide equal access to scientific experimentation
 - **YOU** provide mentorship & individual attention
 - **WE** provide supplies & support
 - **EVERY** student participates as part of normal curriculum
- Develop a student's understanding of the scientific process



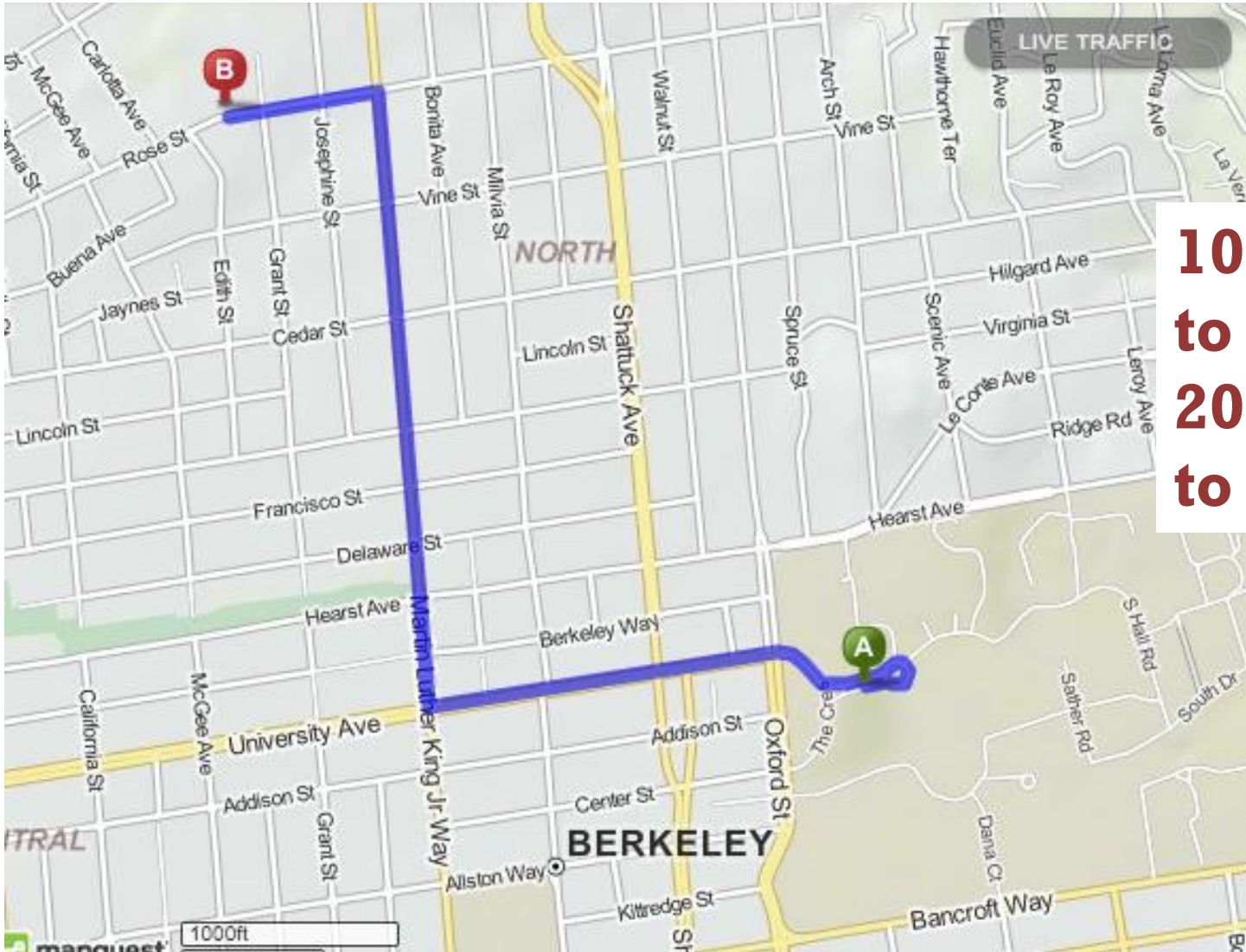


Timeline

Week:	Date:		Objective
	Thursday	Friday	
1	Oct. 8	Oct. 9	Meet Students & Define Scientific Question of Interest
2	Oct. 15	Oct. 16	Refine testable question, hypothesis, experimental design, materials list
3	Oct. 22	Oct. 23	Run Experiment
4	Oct. 29	Oct. 30	Run Experiment, Analyze Data
SKIPPED WEEK			
5	Nov. 12	Nov. 13	Analyze data, Work on Final Report
6	Nov. 19	Nov. 20	Student Final Report



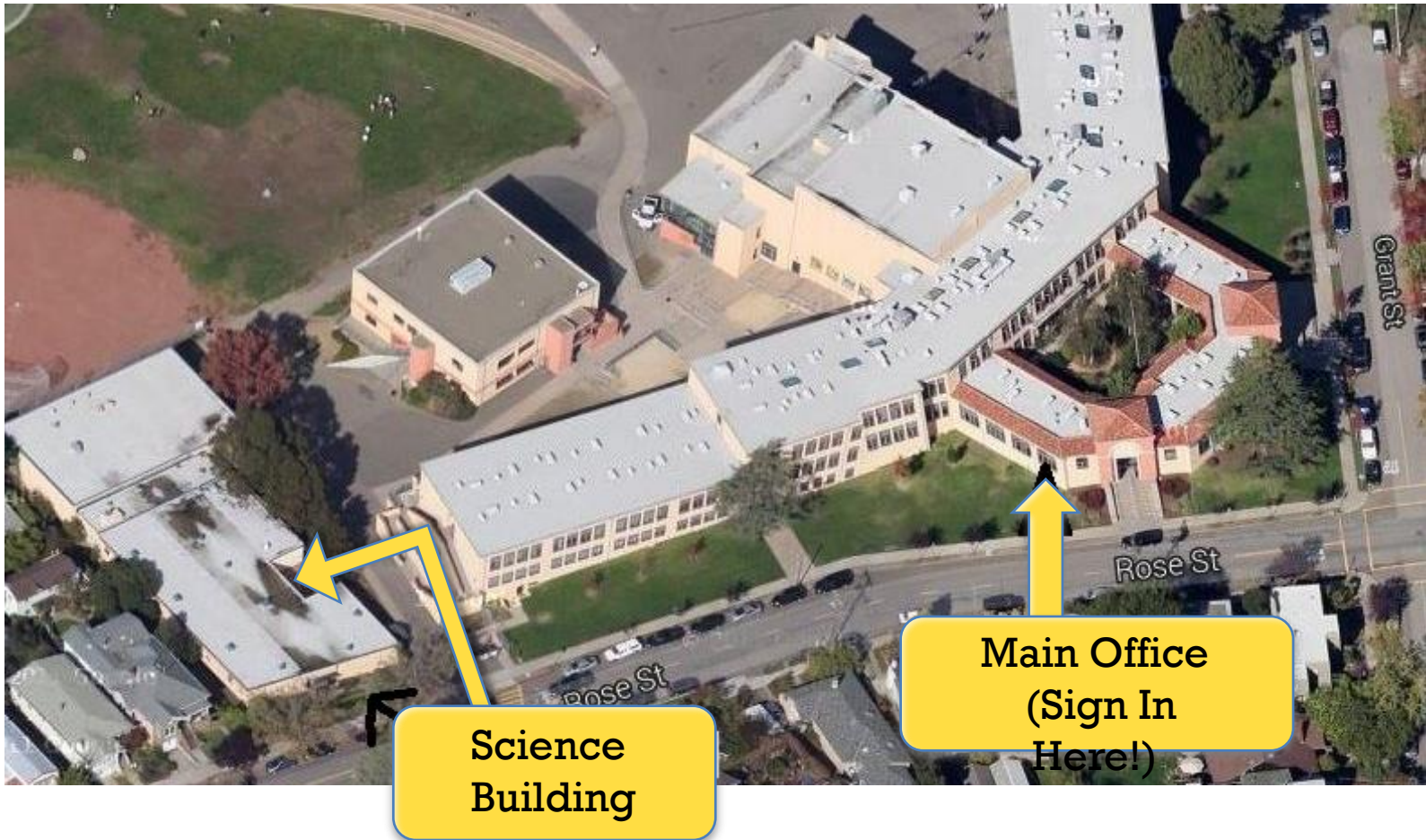
King Middle School: 1781 Rose Street, Berkeley, CA



**10 minutes
to bike,
20 minutes
to bus!**



King Middle School: Room Number: S5





People Involved

■ CRS Staff:

■ Traci
Grzymala



■ Elise
Zolczynski



■ Teachers:

■ Jay Cohen



■ Erika So
(Student
Teacher)



■ Cal Professors:

■ Dr. Mary
Wildermut
h





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The Students!

- 7th Graders – 12-13 years old
- First time they have **SCIENCE ONLY** lab periods
- Each mentor has group of 3-5 students
 - Jay will provide student groupings
 - Expect a group with mixed needs
 - Learning disabilities
 - ESL students
 - High performers
 - Distribute attention to all students
 - You will get pertinent information prior to your first day!





Working with Middle School Students

- Be enthusiastic!
- Students are very social & easily distracted!
 - They need to be OCCUPIED with tasks
 - Be clear in directions
 - Break tasks down into smaller chunks
- Unmotivated/Disinterested Students:
 - Try your best to figure out what they're interested in
 - Realize that it has nothing to do with you
- Behavioral/Disciplinary issues:
 - Talk with Jay/Erika





Managing a Group

- Start with one person for individual check-in, and move around your group
 - May need to adapt for some students who need more attention
 - Give them a clear, specific task to work on so you can move on to someone else
- Make sure to give attention to each of your students
 - You will have to strategize this depending on your group
 - Some students may require more of your time
 - Students will work at different paces





Managing a Group (cont'd)

- Direct questions to those students who are distracted:
 - Have you finished x?
 - Do you need help with x?
 - What's your next step?
 - Show me what you've done so far
- If someone is dominating discussion:
 - Thank them for the input, you want to give others a chance to speak as well
 - Direct question to a specific student
- Keep track of your students!





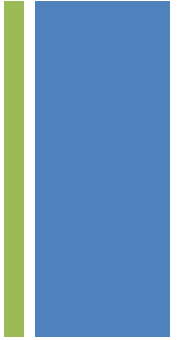
Student Preparation Prior to Program

- This year, students have learned:
 - Tools & skills of a scientist
- Prior to Day 1 of Program:
 - History/background of the scientific method
 - Program expectations
 - Scientific Question, what makes a good one





Student Preparation During Be A Scientist



- Throughout the program:
 - The students have science class 3 other times each week
 - Jay will prep them on material for the coming week
 - It is **NOT** your job to teach!



Lab Period Structure

1 hour 30 minutes

Time:		Objective
10 minutes	Teacher Intro	Jay will introduce day's objectives & introduce science warm-up
10 minutes	Group Discussion	Not a lecture! Keep short & focused! Start with check-in question, Reiterate objectives for the day, Clarify key concepts, Check for understanding of day's goals & concepts
55 minutes	Student Work	Students should work independently, mentor should check in with each student frequently to keep on track and modify experiment as needed
10 minutes	Clean Up	Clean any equipment used; return materials
5 minutes	Teacher Wrap-up	Jay will wrap-up and dismiss students



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Project Packet

- Project packet: 
- Students will be filling this out as they go along
- Refresh and reiterate concepts previously discussed in class
- They will get credit for this packet

Follow along
week by week
with your packets!

Name _____

Class Period: _____

Be A Scientist Project

The goal of Be A Scientist is for you to investigate a scientific question of interest to you, to develop your scientific skills, and build on your curiosity and excitement about science! You will have a scientist mentor from UC Berkeley to guide you through each step of the process. Have fun!

Scientific Method

A way to ask and answer scientific questions by doing experiments and making observations.

🍏 **Testable Question:** The question you will try to answer by designing and conducting an experiment.

🍏 **Hypothesis:** An educated guess based on facts.

🍏 **Experiment Design:** The plan for the experiment.

🍏 **Materials:** The "stuff" you need to complete your experiment.

🍏 **Procedure:** The step-by-step instructions you will follow to do your experiment.

🍏 **Data & Observations:** The information you record during the experiment.

🍏 **Analysis:** The graphic (picture) representation & interpretation of your results.

Conclusion & Reflection: The summary of your experiment, what you learned and what you would do next

🍏 Part 1: Summary

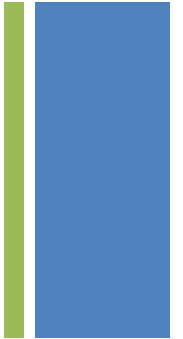
🍏 Part 2: Accept or Reject Hypothesis



Week 1: Introductions

- 30 minutes: Mentor introductions
- 3 minutes to talk about yourself:
 - Try to put YOUR scientific question in the format of:

How does _____ affect _____?
 - **Example:**
 - How does the history of beetles affect their distribution across the planet?
 - Why do you love science?
 - What got you interested in science?
 - What interests do you have outside of being a scientist?
- Make this visually interesting and FUN!!!
 - Models, pictures, & props encouraged!



CLAIRE



**BUT
THAT'S
OK!!!**

+

I'm doing a PhD in Mechanical
Engineering



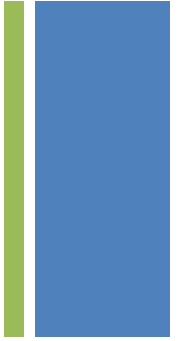
Solar Hot
Water



- We can use **HEAT** to make

ENERGY!!!





Practice 3-minute Intros!



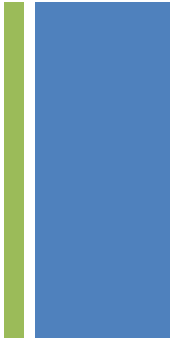
Week 1: Group Discussion

- Split into assigned groups
- Introduce yourself again
- Have students introduce themselves
- **Check-In question:**
 - If you could choose a science superpower, what would it be?
 - Examples:
 - Have microscope vision!
 - Shoot liquid nitrogen out of my fingertips!
 - Something FUN!





Week 1: Testable Question



- What's a scientific question?
 - See what students already know
 - Question that can be answered by designing/conducting experiment
- What are some of the things we need to think about when coming up with our question?
- **Independent vs dependent variable**
- Controls, replicates



Week 1: Testable Question

- Student Question Format: **“How does ____ affect ____?”**

- ***Example:***

How does the type of material an ice cube is wrapped in affect the time it takes for it to melt?

Make sure
students are
writing
everything down
in their packet!



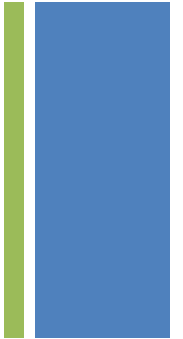


Week 1: Things to Remember

- Once your student has a question, DON'T SWITCH QUESTIONS!
 - No switching after week 2
- **You want your students to have questions with good chances of success!**
 - Increases student buy-in, confidence, and enthusiasm!
 - *We will come back to this later!*
- Students will be exploring wide range of topics
 - Remember that you are **guiding** them through the process
 - All about the methods & process of science!
 - Can also consult with other mentors or Cal Professors in our resource network



Week 2: Hypothesis, Experimental Design, & Materials!



■ Check-in Question:

- What is your scientific question?
- If you do NOT have one yet, what are you thinking of doing?

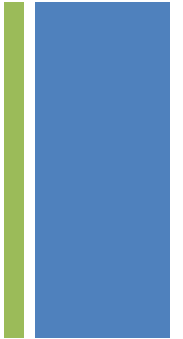
■ Discussion:

- Hypothesis
- Experimental Design
- Detailed materials list

■ Expect faculty member from Cal (Professor Wildermuth)



Week 2: Hypothesis



- Student Hypothesis Format: **“If _____, then _____”**

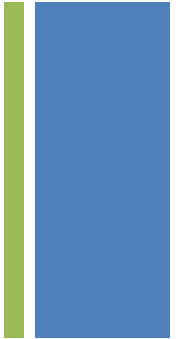
- ***Example:***

If I wrap ice cubes in different materials (cotton, aluminum foil, wool), then the one wrapped in cotton will take the longest amount of time to melt.

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Week 2: Experimental Design



- Experimental Design is the plan for the experiment
- Should include controls and replicates

- ***Example:***

I will wrap 3 ice cubes in cotton, 3 ice cubes in foil, and 3 ice cubes in wool, and then use a stopwatch to measure how long it takes for each ice cube to completely melt. I will also have 3 unwrapped ice cubes as a control.

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Week 2: Materials

- The materials and equipment must be available at King OR hardware/grocery stores
 - i.e. an electron microscope would not be appropriate equipment!
 - If **YOU** have access to things from Cal lab/stockroom, you can bring these in (i.e. dry ice, non-household chemicals)
 - But it is YOUR responsibility to bring these Cal lab supplies!
- Current Materials Inventory in folder

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[illegible]



Week 2: Things to Remember

- At the end of Week 2
 - EACH STUDENT must have a testable question
 - You must supply a materials list for each student
 - Prof. Wildermuth or other UC Berkeley faculty members & CRS staff will review these



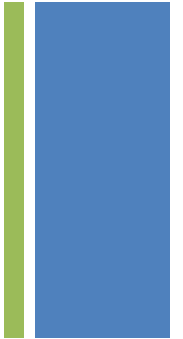


Week 3: Step-by-step Procedure, Data Tables & The Experiment

- **Check In Question:** What is your hypothesis?
- Discussion:
 - Designing a procedure
 - Don't forget replicates and controls
 - Data tables
 - Start the experiment



Week 3: Step-by-step Procedure



■ ***Example:***

- 1. Gather required materials***
- 2. In advance, measure 10 mL of water into each compartment of ice cube tray***
- 3. Place ice cube tray in freezer at least one day before experiment***

- Students can exchange written procedures with a partner

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Week 3: Data Tables

- Importance of measuring and tracking data
- Each student must create a data table prior to start of their experiment

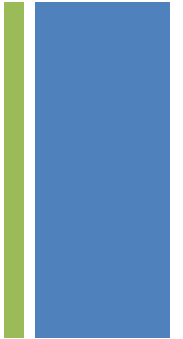
- ***Example:***

Time	Temperature
Minutes	Degrees Celsius
0 min.	0° C
2 min.	0° C
4 min.	0° C
6 min.	0° C
8 min.	7° C
10 min.	25° C
12 min.	44° C
14 min.	62° C
16 min.	80° C
18 min.	95° C
20 min.	100° C
22 min.	100° C
24 min.	100° C
26 min.	100° C

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Week 3: The Experiment



- Students that are ready can start their experiment
- Materials distribution
 - Mentor specific bins
- Safety attire
- Supervision of students
 - Working outside



Week 4: Running Experiments

- **Check-in question:** Any data to share? What do you need to start (or continue) running your experiment today?

- **Reminders:**
 - Make sure students are:
 - taking measurements
 - recording them
 - making notes of observations

 - Check in with each student during their experiment
 - Is there something that needs to be changed in the experimental design?
 - Emphasize that experimental revision is an important part of science

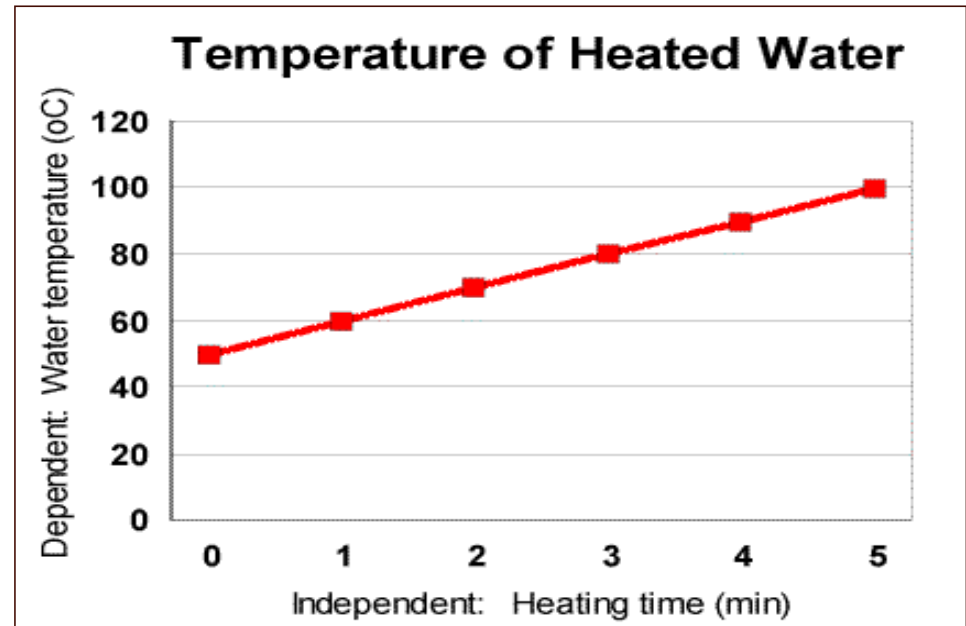


Week 5: Data Analysis, Graphing & Conclusions

■ **Check-in question:** What data do you have so far?

■ **Discussion:**

- Interpreting & Analyzing Data
- Conclusions



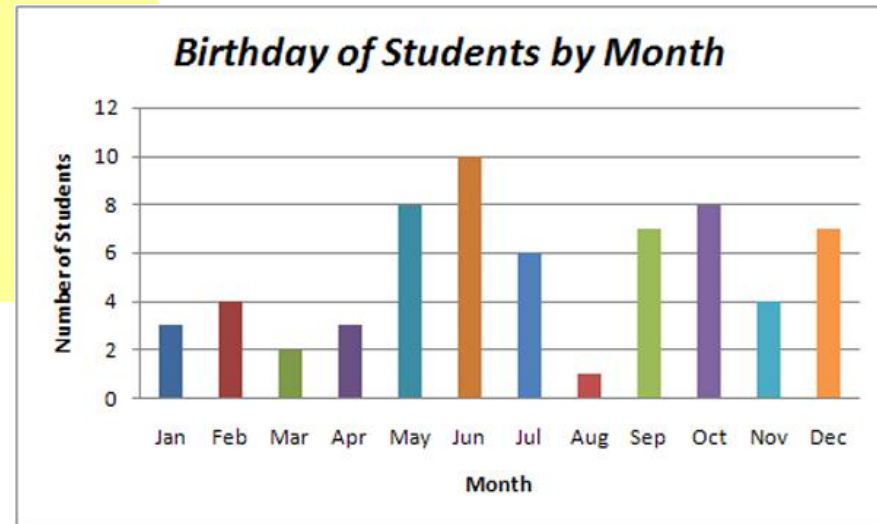
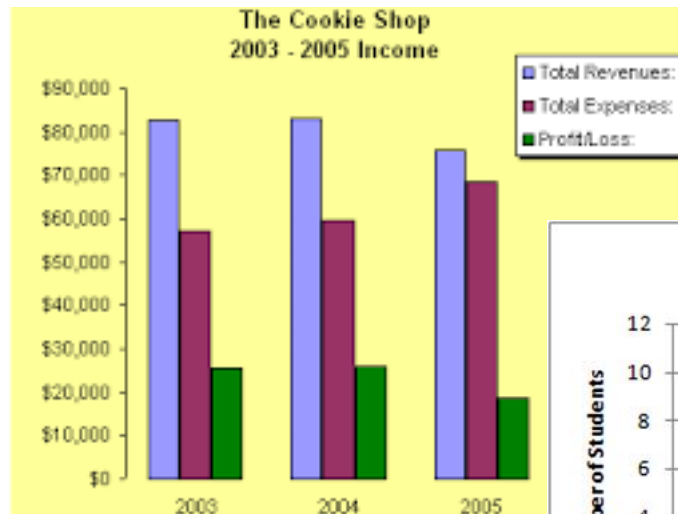
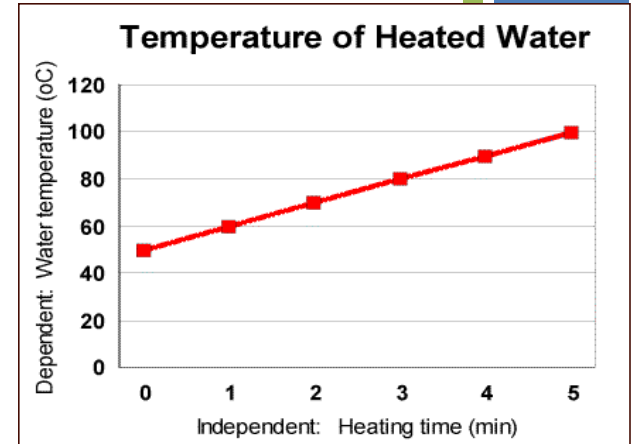


Week 5: Data Analysis & Graphing

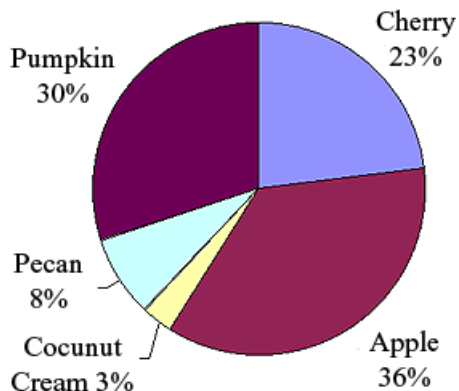
■ Graphing

- Types of graphs
- When to use each type

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Pie Preferences



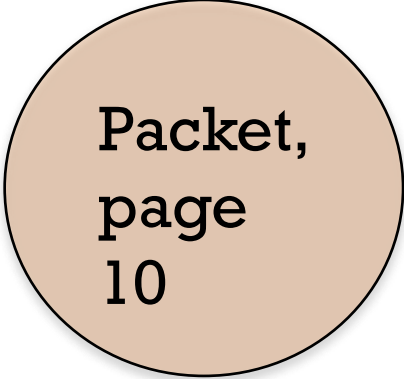


Week 5: Conclusions

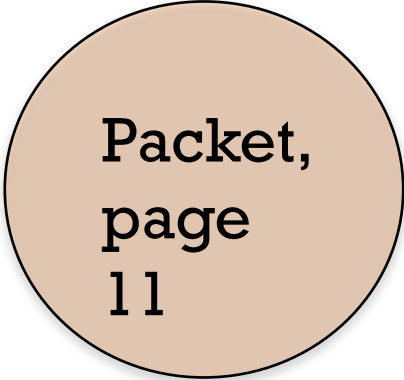
- Conclusions

- Part One – Summary

- Part Two – Accept or Reject Hypothesis



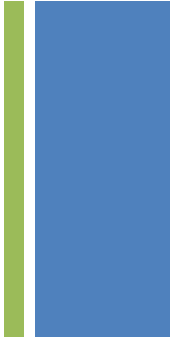
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Week 6: Presenting Results



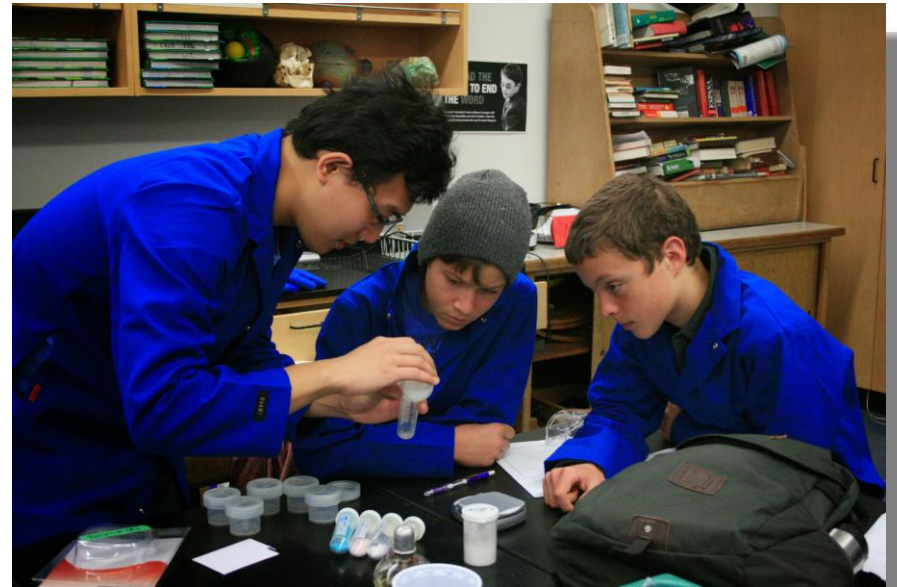
- **Check-in question:** What was one success and one challenge of this project?

- **Discussion:**
 - Reflections
 - What would you change about your experiment, if anything?
 - What did you learn?
 - What related questions would you want to ask in the future?



Week 6: Presenting Results

- Students present and discuss results & conclusions
- Science mentors share research topics with students





Project outcomes

- Completed Packet
- Typed report
- Excitement about science!





The Key to Success:

Choose a Great Scientific Question!

- What are the student's interests? Do they already have something in mind?
 - The goal is to have it **be of interest and exciting** to them
 - Narrowing it down
 - Can approach this as a group
 - Think, pair, share
- Goal is for student to come up with their own question
 - Default experiments available for students having trouble
 - They can choose one or adapt it
 - Provided in the form of a question
- ScienceBuddies.org – good resource



The Key to Success:

Choose a Great Scientific Question!

“How does _____ (**independent variable**)
affect _____ (**dependent variable**)?”

- Should be a question student doesn't know the answer to
 - Maybe YOU don't know the answer!
- Hands-on (no surveys)
- **Measurable** results
- *1.5ish class periods for experiments*
- Keep the scope realistic
- Can run experiments at home, but **highly encourage** in class
 - Need teacher permission to do at home



The Key to Success:

Choose a Great Scientific Question!

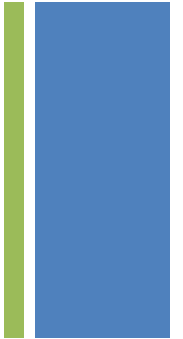
- **Generally, no plant growth experiments**
 - Seed germination or testing on established plants is OK
- **No experiments on vertebrates (i.e. mice)**
 - Invertebrates should be CAREFULLY considered
- **Human subjects can be used**
 - Participants must do so voluntarily
 - Data is private (not identifiable)
- **Don't be afraid to constrain/revise if necessary**
- **Be aware of lab safety**
 - any experiments with fire/flame must be approved by UC Berkeley Faculty, teacher, and School Principal – and must use flammable (blue) lab coats
- **If unsure, ask CRS staff OR Jay first**
 - CRS and UC Berkeley Faculty also review all experiments

**Consider
variables &
make sure
results
are
quantifiable**

**Experimental
Guidelines**



Sample Past Questions



A

How does the reaction of different household acids with baking soda affect the circumference of a balloon attached to a beaker?

B

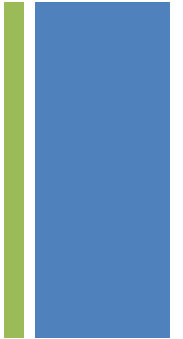
How does changing scents affect ability to determine flavor?

C

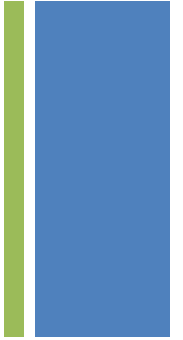
Does a person's age affect whether or not they will take and eat a candy that is placed in front of them?



Sample Past Questions



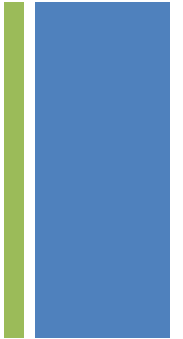
A	How does the reaction of different household acids with baking soda affect the circumference of a balloon attached to a beaker?	GOOD
B	How does changing scents affect ability to determine flavor?	NEEDS REVISION
C	Does a person's age affect whether or not they will take and eat a candy that is placed in front of them?	ALTERIOR CANDY MOTIVE



Testable Question Activity!



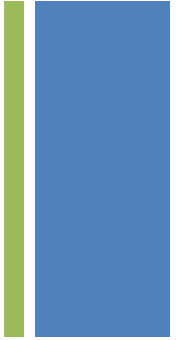
Logistics - General



- Arrive on time!!!
 - Thursdays 8:45am students first have breakfast
- Sign in at the school office **EVERY TIME**
 - Write your name on visitor sticker
- Bikes
 - Bring into storage room (across from Jay's class)
- Don't use student bathrooms
 - Ask teacher for key
- NO communication with students outside of school
- Information about individual students is confidential
 - i.e. don't share with fellow volunteers or other students



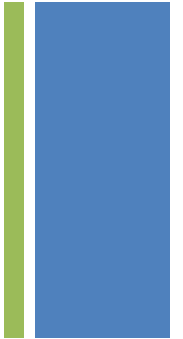
Logistics - Absences



- You are making a commitment to participate in this program for all 6 weeks
- If you **MUST** be absent, let us know **ASAP!**
- You are responsible for:
 - Finding a substitute
 - Briefing him/her on your students & their respective experiments
 - Telling us who you found



Debriefing & Communication



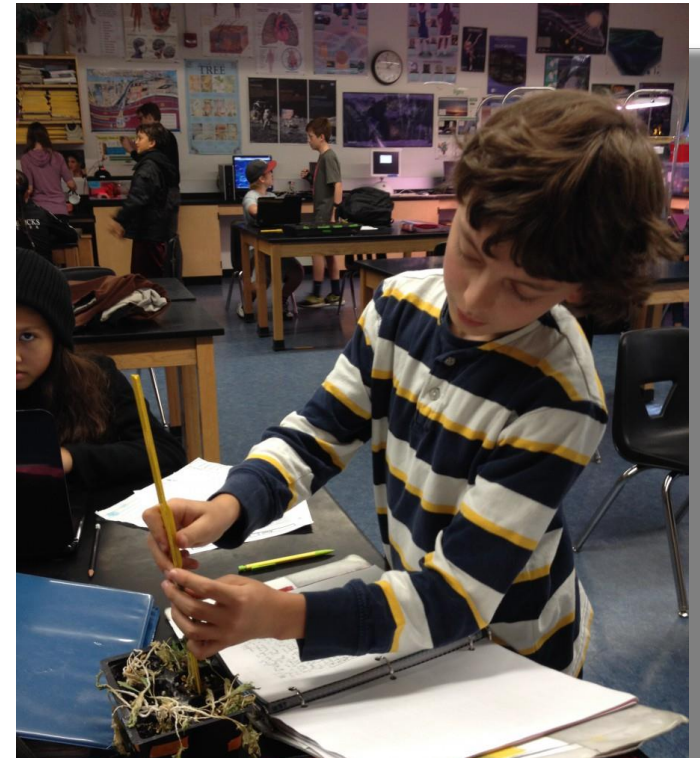
- You can talk with Jay after class if needed
 - Also available via email
 - Student issues
 - Experimental set-ups
- Contact us about anything logistical
 - Absences
 - Supplies
- **Weekly Email from CRS**
 - Goals and reminders for the following week
 - Feedback surveys
- Mid-program coffee hour
 - After week 2
 - Share feedback





Final Notes:

- Someone from CRS will ALWAYS be in the classroom
- Cal Professors (Prof. Wildermuth and others) will be there during week 2 to go over testable questions & material lists





Thank you!!!

- Questions?
- Intake Form (blue form)
- Homework:
 - Look over the packet!
 - Create a PowerPoint for your 3 minute intro
 - Send to me (traci@crscience.org)
 - Research project ideas
 - Sciencebuddies.org

Be a Scientist?
Volunteer Intake Form

Full Name: _____
Nickname/Preferred Name: _____
Mailing Address: _____
City: _____ State: _____ Zip Code: _____
Date of Birth: _____
Driver's License ID: _____
Educational Title: _____
Grad Student (in Year) _____ Post Doctoral _____ Visiting Scholar _____
Languages: Are you fluent in a language other than English? (Circle one) _____
If yes, which language? _____
How did you find out about the program?
Department _____
Friend/Labmate _____
Your PI/Advisor _____
VSPA _____
BASIS _____

