"I feel like a scientist": Collecting and analyzing data at various grade levels



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Doing science, not just learning about it



In art class, you make art. In a choir or band class, you perform music. In PE class, you exercise. In a writing class, you write.

In too many science classes, students learn about science, but don't DO science.



Process of science (6 skills)

- #1 Given a source of information, determine whether it is reliable & credible.
- #2 Given a graph, table, or model, draw a valid conclusion based on the data.
- #3 Given a set of data, create a graph, table, or model to effectively communicate information.
- #4 Given directions for an experiment, collect and summarize data.
- #5 Given a testable hypothesis, create and carry out an experiment to test it.
- #6 Make observations, then generate a testable hypothesis.



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Which of these skills will they be using MOST often throughout their lives? (This explains the sequence)



Draw a conclusion based on this graph



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Talk about value of a legend, a title, and axes labels

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Does your school do science projects, or several smaller experiments? Why?

Discuss pros and cons





Characteristics of good experimental systems

- Relatively inexpensive
- Nontoxic
- Simple quick to learn system, then "play" with it.
- Use what your school setting offers







Examples of experimental systems for biology

- Choice chambers use guppies or pillbugs
- Jello and fresh pineapple for enzyme activity
- Nail polish impressions of stomata on leaves (microscope lab)
- Albino corn seedlings
- Human physiology reaction time
- Human physiology heart rate





Physics? Chemistry?

- Comparing various insulating materials
- Testing pH of various water samples
- Recording temperature and humidity readings at various times of day.
- Other ideas??





Data collection

- Have them decide how to collect and organize the data don't provide tables.
- Collect enough data to be meaningful
- Have them try to replicate results
 - Did the experiment show some differences or a trend? If so, repeat.
 - Did it not go well? Revise experiment and try again.



Data analysis

- Provide tables of data AND a summary (graph, chart, etc.)
- Statistics: Means -> Std dev. -> slope, t-tests, Chi square, ANOVA?
- By hand or using software?
- Type of graphs
 - Encourage them to graph data in various ways
 - Graphing is all about communication
 - Have them present their <u>rough drafts</u>
 - Improve based on class feedback







Types of graphs

Growth of the mould *penicillium camemberti* (orange bars) and penicillium roqueforti (blue bars) sampled at different level from ripe cheeses



Can the same data be effectively graphed in all of these ways?



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