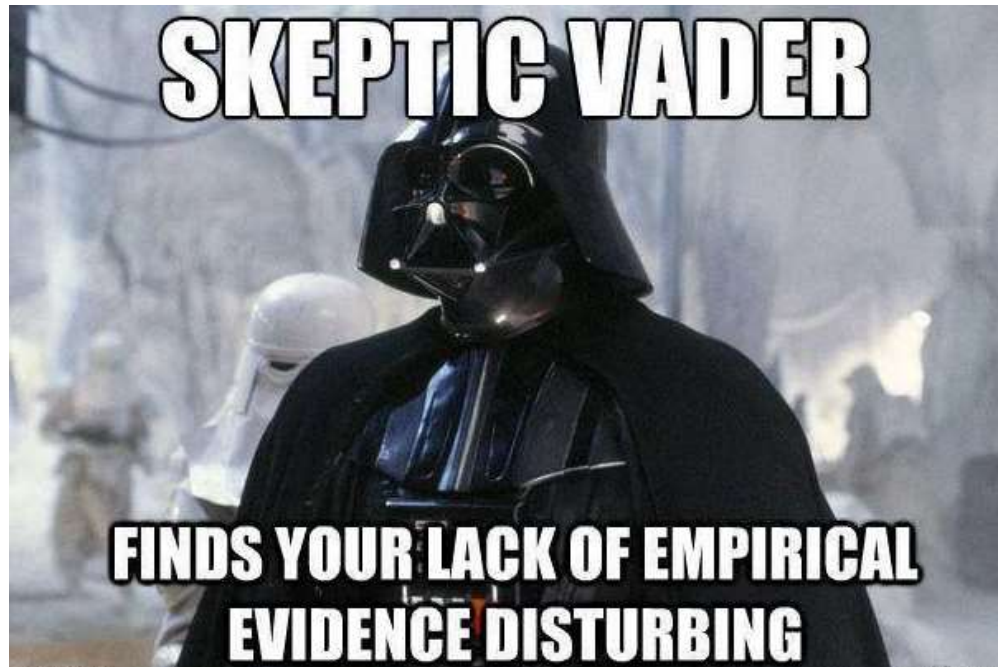


Wednesday, July 31, 2019

**Welcome to Investigative Science
with Mr. Fireng**



1. Get out your stampsheet
2. Get out your homework
3. Write tomorrow's homework in agenda
4. START WORKING QUIETLY

Investigative Science

Learning goal: Properly apply all steps in the scientific method when problem solving.



Consistent
Observable
Natural
Predictable
Testable
Tentative

Six
Criteria
of
Science

4
Design,
complete,
valid
conclusion

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Design &
complete

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Know
steps,
follow
directions

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Investigative Science

Learning goal: Properly apply all steps in the scientific method when problem solving.



Review

Consistency : The results of observations and/or experiments are reasonably the same when repeated.

Like... when things are dropped....

they fall....

where? Down, EVERYTIME!



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Investigative Science

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Review

Observability : The event or evidence of the event, can be observed. (sometimes with the aid of microscopes, telescopes, Geiger counters, etc.)

Some plants eat meat.

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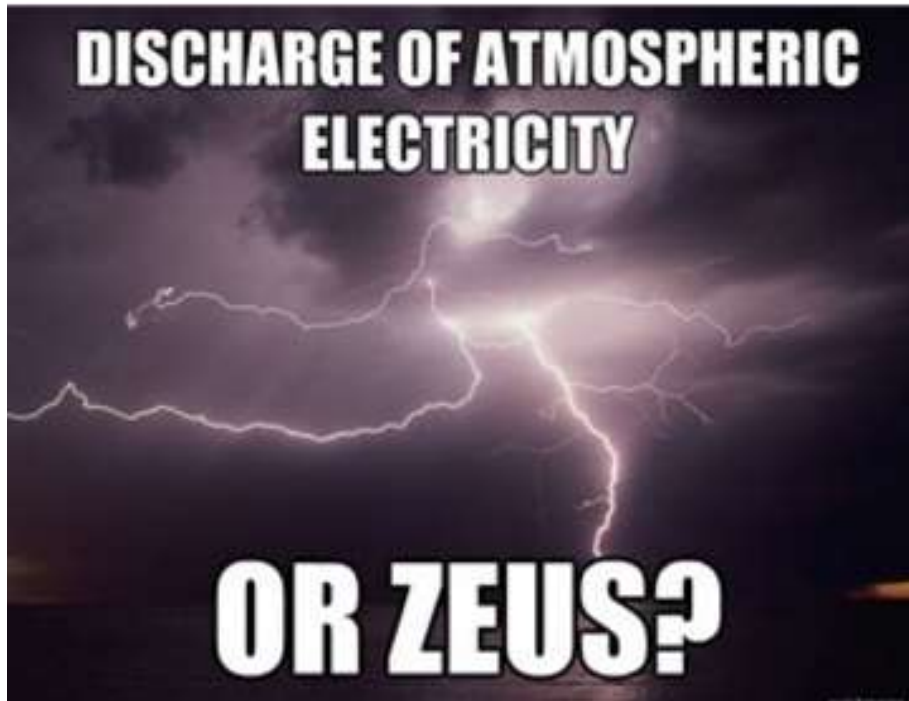
Investigative Science

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Review

Natural : A natural cause must be used to explain why or how the event happens, not the supernatural.



*Green plants
convert
sunlight into
energy.*

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Investigative Science

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Review

Predictability : able to be predicted and can be tested to see if the prediction is true or false

Without sunlight (or artificial light), green plants will die.



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Review

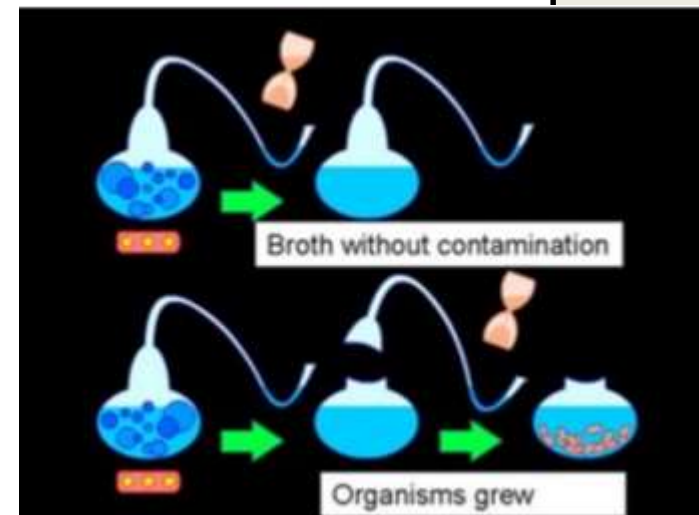
Testability : the event must be testable through the processes of science, and controlled experimentation.

Life comes from life and cannot come from non-life.

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Design,
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Investigative Science

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Review

Tentativeness : Able to be revised or changed if new information arises.

- 1. The number of human chromosomes was once "known" to be 48, but is now considered to be 46.***

4

Design, complete, valid conclusion

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Design & complete

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Know steps, follow directions

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Investigative Science

Learning goal: Properly apply all steps in the scientific method when problem solving.



Review

What is Science?

- **Science meets all six criteria**
- Limited to natural world- use scientific processes
- Offers explanations for events-subject to revision(tentative)
- Not able to answer all the questions in the universe, nor solve all the problems

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Design,
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Review

**If it's not
science, what is
it???**

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Investigative Science

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Review

Emerging Science

- ✦ may not meet 1 or 2 criteria; It may lack technology or knowledge. Ex: Chiropractors
- ✦ Tends to conform to CONPTT, but falls short in one or two criteria
- ✦ Consistent observations and predictions limited by knowledge and/or technology

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Review

Non-Science

- ✦ **Topics may be very logical and important but does not meet criteria of CONPTT, Ex: Religion, philosophy**
- ✦ **Non-science topic areas may be very logical, based on good reasoning and are very important to society, but simply do not fall within the realm of science. Science is based on evidence, not faith**

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Design, complete, valid conclusion

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Design & complete

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Know steps, follow directions

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Investigative Science

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Review

False Science

- ✦ Also known as pseudoscience
- ✦ Topics portrayed as a legitimate science Ex: astrology, creation science



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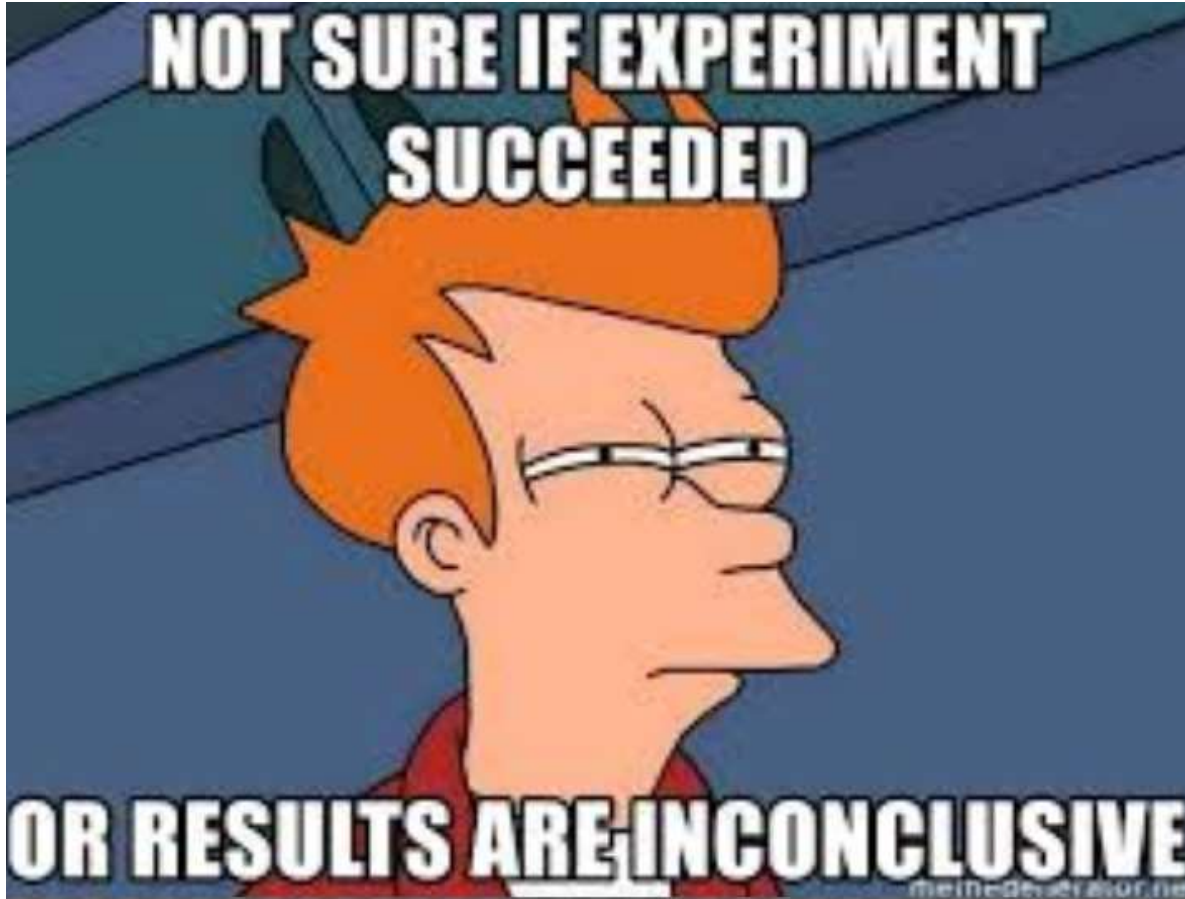
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Know steps, follow directions

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So, if it is science, what now! We need a controlled experiment



Know steps, follow directions

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Know the steps

Science basics (These are all review)

Qualitative observation: An observation using your senses, just words, no numbers.

Quantitative observation: An observation that includes a number and/or a measurement.

Inference: an interpretation that explains an observation.

Independent (*Manipulated*) variable (*IV*): The variable you manipulate in the experiment.

Dependent (*Responding*) variable (*DV*): The variable you measure, it is affected by changing the IV.

Control Variable: The variables keep constant in the experiment..

Control group: A group that remains under normal conditions during an experiment

An **experimental group** is the **group** in an **experiment** that receives the variable being tested.

One variable is tested at a time. The **experimental group** is compared to a **control group**, which does not receive the test variable.

Experimental Question: A formal cause-effect question. Asks about the relationship between two variables.

** Must be in “How does the _____ affect _____?”
(*Independent variable*) (*dependent variable*)

Hypothesis: A possible explanation for a set of observations or to a scientific question; must be testable.

Hypothesis: If the _____ is used, the _____
(*Independent variable*) (*dependent variable*)

will increase because _____

Conclusion: A summary of what is learned in an experiment.



Identifying the parts of a experiment

But how are experiments developed? Not really one way.. This is just one path.

1. Make an observation (senses, instruments, data, previous experiments, etc..)
2. Ask an informal, how, what or why question about observation
3. Find evidence that helps you come up with an answer to your informal question
4. Make an inference (informal hypothesis) that may explain an observation and answer your question
5. Design an experiment that will help answer your question
6. Identify variables, one variable you will change (independent), one variable you will measure (dependent) and the variables you need to control
7. Identify the control group to compare your results to.
8. Change your informal question into an experimental question (How does... affect..)
9. Change the inference to a formal hypothesis (if, then, because...)
10. Conduct experiment and determine if the data supports or disproves your hypothesis.
11. Report your results!! Ask new questions!!



Know
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Identifying the parts of a experiment

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Identifying the parts of a experiment

Mr. Fireng tried salted caramel for the first time and he thought it tasted delicious! He wondered if salt can improve the taste of sweets? He remembers reading an article that stated that combining salt sugar and fat can improve the taste of food. So he thought that yes, adding more salt to sweets would improve the taste. He decided to test this by adding various amounts of salt and measuring the quality of the ice cream. He came up with the experimental question; how does the amount of salt affect the quality of ice cream? His hypothesis was, If the amount of salt increases, then the quality of the ice cream will increase because the salt will make it sweeter. He made four batches of ice cream. One batch of ice cream had no salt. The other three had more and more salt. He tasted the ice cream and rated the texture, saltiness, sweetness and over all flavor on a scale from 0-4. He discovered that his hypothesis was supported by the data! As the amount of salt increased, the ice cream tasted better and better!



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Write what is in red!



Identifying the parts of a experiment

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Mr. Fireng tried salted caramel for the first time and he thought it tasted delicious! He wondered if salt can improve the taste of sweets? He remembers

reading an article about the taste of food. He was curious about the taste. He decided to measure the amount of salt in the question; how much salt will increase the taste of cream. One day he tried salted caramel. He tasted all the flavors on the data! As the amount of salt increased, the ice cream tasted better and better!

How are Experiments developed?

1. Make an observation (senses, instruments, data, previous experiments, etc...) **Look for something that was noticed, seen or experienced!**
2. Ask an informal, how, what or why question about observation

Make an observation (senses, instruments, data, previous experiments, etc..) **Look for something that was noticed, seen or experienced!**



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Identifying the parts of a experiment

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Make an observation (senses, instruments, data, previous experiments, etc..) **Look for something that was noticed, seen or experienced!**

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Identifying the parts of a experiment

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Ask an informal, how, what or why question about observation

This is a basic, who, what or why or I wonder question. This can be changed to an experimental question later...

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Identifying the parts of a experiment

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Find evidence that helps you come up with an answer to your informal question **Look for observations, data from instruments, information that was heard or read, could be data from a previous experiment..**

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Identifying the parts of a experiment

Mr. Fireng tried salted caramel for the first time and he thought it tasted delicious! He wondered if salt can improve the taste of sweets? He remembers reading an article that stated that combining salt sugar and fat can improve the taste of food.

So he thought that yes, adding more salt to sweets would improve the taste.

He decided to test this by adding various amounts of salt and measuring the quality of the ice cream. He came up with the experimental question; how does the amount of salt affect the quality of ice cream? His hypothesis was, If the amount of salt increases, then the quality of the ice cream will increase because the salt will make it sweeter. He made four batches of ice cream. One batch of ice cream had no salt. The other three had more and more salt. He tasted the ice cream and rated the texture, saltiness, sweetness and over all flavor on a scale from 0-4. He discovered that his hypothesis was supported by the data! As the amount of salt increased, the ice cream tasted better and better!

Make an inference (informal hypothesis) that may explain an observation and answer your question

This uses previous experience and evidence that explains the observation and answers the informal question

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Identifying the parts of a experiment

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Design an experiment that will help answer your question

Explanation of test, here is where the variables are identified

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Identifying the parts of a experiment

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Identify variables, one variable you will change (independent), one variable you will measure (dependent). **The independent variable is the one changing, the dependent is being measured.**

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Identifying the parts of a experiment

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Mr. Fireng tried salted caramel for the first time and he thought it tasted delicious!

He won
article t

Also found in the experimental question!

So he thought that yes, adding more salt to sweets would improve the taste. He decided to test this by adding **various amounts** of salt and measuring the **quality of the ice cream**. He came up with the experimental question; how does the **amount of salt** affect the **quality of ice cream**? His hypothesis was, If the amount of salt increases, then the quality of the ice cream will increase because the salt will make it sweeter. He made four batches of ice cream. One batch of ice cream had no salt. The other three had more and more salt. He tasted the ice cream and rated the texture, saltiness, sweetness and over all flavor on a scale from 0-4. He discovered that his hypothesis was supported by the data! As the amount of salt increased, the ice cream tasted better and better!

Design &
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What is the independent variable?

What is the dependent variable?



Identifying the parts of a experiment

Mr. Fireng tried salted caramel for the first time and he thought it tasted delicious!

And the hypothesis!!!

He thought that yes, adding more salt to sweets would improve the taste. He decided to test this by adding **various amounts** of salt and measuring the **quality of the ice cream**. He came up with the experimental question; how does the **amount of salt** affect the **quality of ice cream**? His hypothesis was, If the **amount of salt** increases, then the **quality of the ice cream** will increase because the salt will make it sweeter. He made four batches of ice cream. One batch of ice cream had no salt. The other three had more and more salt. He tasted the ice cream and rated the texture, saltiness, sweetness and over all flavor on a scale from 0-4. He discovered that his hypothesis was supported by the data! As the amount of salt increased, the ice cream tasted better and better!

What is the independent variable?

What is the dependent variable?

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Identifying the parts of a experiment

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Identify the control group to compare your results to.

In the experiment, one test group is not changed, it is “controlled”

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Identifying the parts of a experiment

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Change your informal question into an experimental question (How does... affect..) **Must be “How does (independent variable) affect the (dependent variable)?**

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Identifying the parts of a experiment

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Change the inference to a formal hypothesis (if, then, because...) **Look for “if.. Then, because....”**

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Did the results support or disprove Mr. Fireng's hypothesis?
Look at the results! **Remember, never say PROVE! ONLY SUPPORTS..**

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Identifying the parts of a experiment

But how are experiments developed? Not really one way.. This is just one path.

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11. Report your results!! Ask new questions!!



Know steps, follow directions

1
Know the steps

OK! Lets try it!



Identifying the parts of a experiment

Mr. Fireng tried salted caramel for the first time and he thought it tasted delicious! He wondered if salt can improve the taste of sweets? He remembers reading an article that stated that combining salt sugar and fat can improve the taste of food. So he thought that yes, adding more salt to sweets would improve the taste. He decided to test this by adding various amounts of salt and measuring the quality of the ice cream. He came up with the experimental question; how does the amount of salt affect the quality of ice cream? His hypothesis was, If the amount of salt increases, then the quality of the ice cream will increase because the salt will make it sweeter. He made four batches of ice cream. One batch of ice cream had no salt. The other three had more and more salt. He tasted the ice cream and rated the texture, saltiness, sweetness and over all flavor on a scale from 0-4. He discovered that his hypothesis was supported by the data! As the amount of salt increased, the ice cream tasted better and better!



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What was the observation? **Mr. Fireng tried salted caramel for the first time and he thought it tasted delicious!**



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Identifying the parts of a experiment

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What was the informal question? **He wondered if salt can improve the taste of sweets?**

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Identifying the parts of a experiment

Mr. Fireng tried salted caramel for the first time and he thought it tasted delicious! He wondered if salt can improve the taste of sweets? He remembers reading an article that stated that combining salt sugar and fat can improve the taste of food. So he thought that yes, adding more salt to sweets would improve the taste. He decided to test this by adding various amounts of salt and measuring the quality of the ice cream. He came up with the experimental question; how does the amount of salt affect the quality of ice cream? His hypothesis was, If the amount of salt increases, then the quality of the ice cream will increase because the salt will make it sweeter. He made four batches of ice cream. One batch of ice cream had no salt. The other three had more and more salt. He tasted the ice cream and rated the texture, saltiness, sweetness and over all flavor on a scale from 0-4. He discovered that his hypothesis was supported by the data! As the amount of salt increased, the ice cream tasted better and better!

What evidence was used to answer the question? **He remembers reading an article that stated that combining salt sugar and fat can improve the taste of food.**

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What was the inference (informal hypothesis) **So he thought that yes, adding more salt to sweets would improve the taste**

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How was the question going to be tested? **He decided to test this by adding various amounts of salt and measuring the quality of the ice cream**

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Identify variables: independent variable: **amounts of salt**, dependent variable. **and measuring the quality of the ice cream.**



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Identify the control group to compare your results to. **One batch of ice cream had no salt.**

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What was the experimental question **How does the amount of salt affect the quality of ice cream?**

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What was the formal hypothesis **If the amount of salt increases, then the quality of the ice cream will increase because the salt will make it sweeter.**

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Did the results support or disprove Mr. Fireng's hypothesis?
Look at the results! **the ice cream tasted better and better! It was supported.**

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