Group Members: ANS

Design Your Own Experiment : a Health & Biology Interdisciplinary Learning Experience

The Heart of Scientific Literacy: understanding scientific investigation & experimental design

Purpose:

The purpose of this activity is for you to explore the process of scientific investigation through a health lens. You will consider ways in which data is collected to inform your health and well being. You will create and carry out a valid experimental design in the fitness room or small gym. Your experimental design must yield reliable data. You will analyze the data to make a claim and support it with evidence. In short, you will carry out a scientific investigation from start to finish to grow in scientific literacy and make informed decisions about your health.

DRIVING QUESTIONS

What are the key components of a well designed experiment?
What data can be collected in a fitness room? Will that data inform my health?
How will I design and carry out an experiment in the fitness room, safely?
What equipment and instrumentation will I need?
What quantitative data will I collect and analyze?

Prior Knowledge:

Students should know and be able to apply the following terminology & concepts:
variable, independent variable, dependent variable, hypothesis, constants, control, quantitative data, repeated trials, average (mean), graphing, & Claim-Evidence-Reasoning

Materials:

As you plan your experiment, consider the equipment and Instrumentation available for use:

- Treadmills
- Stationary bicycles
- Rowing machine
- Cross trainers
- Gymnastics matts
- Stability Balls
- Balancing Bubbles
- Hula Hoops
- Pull-up Bar
- Yoga Mats
- Bar bells, dumb bells, & free hand weights
- Cones
- Resistance Bands
- Crossfit Ropes
- Trampoline
- Bench press
- Abdominal bench
- Kettle bell
- Medicine Balls
- Jump ropes
- Gymnasium
- Basketballs and other sport equipment upon request
- Box jumps
- Meter sticks
- Blood pressure cuffs
- Personal Apple Watch or FitBit

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Quantitative Data:

As you plan your experiment, consider the types of quantitative data you can collect depending on the equipment and instrumentation that you choose to use:

- heart rate
- distance
- height
- weight
- incline
- repetitions
- speed
- resistance
- age
- steps
- blood pressure

Procedure:

1. Use the ***design template*** provided to organize your experiment.
2. Look at the lab materials and instrumentation available to you. Consider what you will use and what quantitative data you will collect. Develop a hypothesis to test. Clearly express the hypothesis you will be testing on the ***design template***. Then consider a name for your experiment and write it on the ***design template***.
3. Identify the independent variable, dependent variable and control group in your experiment. Consider the variables that should be held constant. Clearly express these on the ***design template***.
4. Determine how you will manipulate your independent variable and how many trials you will carry out for each. Clearly label this on the ***design template***.
5. Write a clear description of your procedure on the ***design template***. It should be detailed and step by step, so that another person outside of your group could repeat the experiment if they wanted to.
6. Determine how you will organize your data in a data table and what type of graph you will produce. Note these on your ***design template***.
7. Make a list of all safety considerations for your experiment on the ***design template***.
8. Have your teacher check off your experimental design before proceeding with experimentation. ✅**ANS**
9. Begin your experiment and collect your data. When you have completed the experiment, analyze your data, graph it using *Google Sheets*, and draw a conclusion. Make sure your conclusion reflects on the hypothesis, is unbiased, objective and includes a claim, evidence and reasoning. Make sure to add all of this to your ***design template***.
10. Clean up your equipment! :)

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DESIGN YOUR OWN EXPERIMENT *design template*

TITLE: The title should be simple and give a clear indication of the purpose and contents of your experiment.
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HYPOTHESIS: A well-developed hypothesis is testable. It can be written as an "if … then …" statement.
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INDEPENDENT VARIABLE: The independent variable is the variable manipulated by the experimenter. It is the variable the experimenter purposefully changes.
ANS

- How will you manipulate your independent variable? ANS
- What will be your control group, standard for comparison? ANS

DEPENDENT VARIABLE: The dependent variable responds to the independent variable.
ANS

CONSTANT VARIABLES: Constants are variables you keep the same to increase the reliability and validity of your experimental design, so that the experimenter knows that the results are solely dependent upon the manipulation of the independent variable, and not any other factor.
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MATERIALS: The materials section is a list of all materials, equipment, and instrumentation that are required to complete the experiment. Drawings of the experimental setup can be included in this section.
ANS

PROCEDURE: The procedure includes detailed, step-by-step statements of how the experiment is to be performed.

1. ANS
2. ANS
3. ANS …

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SAFETY CONSIDERATIONS SPECIFIC TO YOUR EXPERIMENTAL DESIGN:
Examples: move to space mindful of others, have a spotter if using the bench press, use equipment properly the way it is intended, always look in front and behind before using free weights, and make sure you have appropriate space to carry out an exercise.
ANS

DATA COLLECTION: Data for this experiment should be quantitative. The quantitative data should be organized into tables.

- Will you have the time & materials to do repeated trials, and if so, how many will you do? ANS
- What quantitative data will you collect? ANS
- Create a table and collect your data **below**.

DATA ANALYSIS & GRAPHING: Graphs allow the experimenter to easily identify trends in the data. Remember the independent variable will be graphed on the X-axis and the dependent variable will be graphed on the Y-axis. Graphs also must be labeled.

- What type of graph will you use in order to easily identify trends? ANS
- Graph your data using Google Sheets and import it in the space **below**:

CONCLUSION: Conclusions reflect on the hypothesis and specifically reference observations and data collected. It is objective and unbiased. It has a claim which is supported with evidence and reasoning.

- Is your hypothesis supported by the data collected - yes or no? ANS
- Make a CLAIM: ANS
- Support it with EVIDENCE in your data: ANS
- Explain the REASON: ANS
- Reflect: What might you do differently or what might you do next? ANS

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Design Your Own Experiment Interdisciplinary Experience *rubric for grading*

0	1	2	3	REQUIREMENTS & EVALUATION CRITERIA
				Hypothesis, IV & DV, Constants, Control Group, Materials, Procedure and Safety
				Title for your experiment is simple, clear & purposeful.
				Hypothesis is testable.
				Independent variable is specific and defined.
				Clearly labeled how you will manipulate your independent variable.
				Dependent variable is specific and defined.
				All extraneous variables held constant are listed to increase validity.
				A control group is established; a standard for comparison.
				# of repeated trials to yield similar data is indicated.
				Procedure is detailed and can be easily followed by others.
				The materials and instrumentation are listed.
				All safety considerations are well thought out and explicit.
				Data Collection & Data Table
				Data table is organized and displays the collected data and mean of repeated trials.
				Data collected is quantitative and can be graphed.
				The data table is labeled, and the IV & DV can be easily identified.
				Data Analysis & Graph
				Graph has a title that is purposeful.
				Graph displays the independent variable along the x-axis.
.				Graph displays the dependent variable along the y-axis.
				Data points are accurately represented.
				Both axes are properly labeled.
				You illustrated the linear regression of your points.
				You described in detail the trends that you see on your graph.
				Conclusion
				Conclusion references the hypothesis and whether or not it is supported by the data.
				Conclusion states a claim.
				Claim is supported with specific evidence from the data and graph.
				A reason is provided.
				Conclusion is objective.
				General
				Equipment cleaned and put back.
				Group worked collaboratively and cooperatively.
				All group members are indicated.