EXPERIMENTAL DESIGN SCORING EXPLANATION

Experiment: a process in which some treatment is applied to a number of subjects and its effects observed

1. STATEMENT OF PROBLEM
Non-yes/no question that defines the topic of the experiment
It is NOT the same as the topic area or assigned problem
It defines the specific relationship you wish to study
It can be a statement or question, but not a yes/no question
It must be clearly testable with the materials provided

2. HYPOTHESIS
A statement predicting the relationship between the independent and dependent variables that can be tested
The hypothesis must predict a relationship or trend
It must take a stand
It needs to includes the independent and dependent variables
If (the independent variable) (increases/decreases) then (the dependent variable) will (increase/decrease/remain the same)
A brief rationale should be included

3. VARIABLES
Factors that can change in an experiment
Independent variable (IV): the manipulated variable
A variable that is purposely changed or manipulated
The IV should be operationally defined (units!)
Operationally defined: clearly stating how a variable will be measured or described
You should test 3-5 levels of the IV
Levels of the independent variable: the values of the independent variable that one tests
Dependent Variable (DV): the responding variable
The variable that changes in response to the changes in the independent variable
The DV should be operationally defined
Constants (Controlled variables)
Factors that don’t change in the experiment: factors with a fixed value
These can be other possible independent variables that you are choosing to hold constant
At least 4 should be listed

4. EXPERIMENTAL CONTROL: the standard of comparison (SOC)
A trial used to detect and measure hidden variables
The control can be a zero treatment, a level of IV, or an outside control
The control is often specific to the goal of your experiment
You should include a rationale for why you choose the control you did
5. MATERIALS
A listing of all the equipment used in an experiment
The materials should be listed separately from the procedure
It should include everything you use, but not any extra materials
You should include model numbers and brands where appropriate

6. PROCEDURE
A listing of exactly how one did an experiment
It should contain enough information so another could repeat the experiment
You only need to write for one level of IV, then say repeat steps ____
You should have repeated trials at each level of the IV
Diagrams are extremely helpful
Qualitative data: data based on a non-standard scale
Quantitative data: data based on measurement

7. QUALITATIVE OBSERVATIONS
The stuff you notice during the course of the experiment
They should include a qualitative representation (description) of the data
You should include procedural irregularities
Also include any extra information that you notice but doesn’t directly relate to the DV
You should include observations throughout course of experiment

8. QUANTITATIVE RESULTS
Data Table
A chart that displays the data collected in an experiment
Make sure the table is organized
The table should have a title
All columns and rows should be labeled including units
Use correct significant figures
Significant figures: the number of digits in a number that have meaning
Include ALL raw data
Include a summary table of important data
Calculated values should be in their own columns

9. GRAPHS
A pictorial representation of the data
Be sure to use an appropriate type of graph, generally a bar or line graph
Any trends in data should be represented
Graphs should have titles
All axes should be labeled including units
Use an appropriate scale
Include a figure legend to briefly explain the graph

10. STATISTICS
Include a measure of central tendency (mean, median, mode)
Measure of central tendency: value at the center or middle of a data set
Mean (average): found by adding all the values obtained and dividing by the total number of values
Median: the middle value when all the values are arranged in order of increasing or decreasing magnitude
Mode: the value that occurs most often
Include any other appropriate statistics
Measure of variation (range, standard deviation, frequency table, histogram)
Range: the difference between the highest value and the lowest value
Standard deviation: a measure of how closely individual data points are arranged around the mean
Frequency table: measure of variation for qualitative data; lists the categories in one column and the number of times each occurred in another
Histogram: a pictorial representation of a frequency table
Regression line – Line of best fit showing the trend of the data
Percent error: measure of how close an experimental value is to the expected value

11. ANALYSIS OF RESULTS
An explanation of the data obtained including any trends found and relevant statistics
Include a discussion of what the data means
Discuss trends and what they mean
Include statistics and what they mean
Discuss unusual data points, include why they may have occurred and whether they are statistically significant
Do not just restate the data, discuss it.
It’s ok to throw out ideas that you aren’t sure of

12. POSSIBLE EXPERIMENTAL ERRORS
A statement indicating any sources of error in an experiment
Random Error: error introduced because of limited precision of instruments. It can be either higher or lower than correct value
Mess-up Error: error introduced into an experiment because of a known mistake done by the experimenter or because of a faulty/poor procedure
Systematic Error: error introduced because of faulty equipment. It is normally only higher or lower than correct value
This is a separate section from analysis of results.
You should discuss important information about data collection
Give possible reasons for errors
Discuss the possible effects of errors on the data

13. CONCLUSION
A statement describing the purpose, major findings, and explanation of findings of an experiment
A one paragraph summary of your experiment
You should include the purpose of doing the experiment
You should restate your hypothesis
You should evaluate your hypothesis according to the data
Does the data support your hypothesis?
Give reasons to accept or reject your hypothesis
Don’t include lots of numbers in your conclusion

14. RECOMMENDATIONS FOR FURTHER EXPERIMENTATION AND PRACTICAL APPLICATIONS
Give at least one suggestion to improve the particular experiment you did
(Other than we need better equipment or more time)
List another possible experiment to examine your same hypothesis
Give at least one suggestion for a future related experiment
Give at least one practical application for the specific experiment done