***Science Fair: Research Design – Part 2 (detailed plan) (Due: Tues Nov 6, 2012)***

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In one or two sentences, state your ***Research Question***:

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**Hypothesis:** What do you think the results might be? Explain your reasons (why do you think the results might turn out this way?)

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**Experimental design:** Explain***in detail*** the procedures you will follow in order to test your hypothesis. Describe and explain every step, including:

1. Preparation of experiment
2. set-up of equipment
3. control and experimental groups
4. sample size
5. strategies for collecting quantitative and qualitative data
6. strategies for analysing data
7. method and format for reporting results, etc.

Make sure that the data you collect and your analysis processes are relevant to the research question and hypothesis that you are exploring!

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Draw a **diagram** of your experimental set-up:

What is the ***control group*** in your experiment?

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What is the ***experimental group*** in your experiment?

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Which measured variable is the ***Dependent Variable*** in your investigation?

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Which measured variable is the ***Independent Variable*** in your investigation?

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List the variables (factors) that you need to keep **constant**:

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**Measurement and Observations:**

***Quantitative Observations:*** What quantities will you measure, in order to explore your **research question**?

***Qualitative Observations:*** What **other observations** will you make?

***What equipment*** will you need?

***Independent* and *Dependent* Variables**

(summarized from: <http://nces.ed.gov/nceskids/help/user_guide/graph/variables.asp> )

An **independent variable** is a variable that isn't changed by the other variables you are trying to measure. For example, someone's age might be an independent variable. Other factors (such as what they eat, how much they go to school, how much television they watch) aren't going to change a person's age. In fact, when you are looking for some kind of relationship between variables you are trying to see if the independent variable causes some kind of change in the other variables, or dependent variables.

A **dependent variable** is something that depends on other factors. For example, a test score could be a dependent variable because it could change depending on several factors such as how much you studied, how much sleep you got the night before you took the test, or even how hungry you were when you took it. Usually when you are looking for a relationship between two things you are trying to find out what makes the dependent variable change the way it does.

Many people have trouble remembering which is the **independent variable** and which is the **dependent variable**. An easy way to remember is to insert the names of the two variables you are using in this sentence in they way that makes the most sense. Then you can figure out which is the independent variable and which is the dependent variable:

***“(Independent variable)*** *causes a change in* ***(Dependent Variable)*** *and it isn't possible that* ***(Dependent Variable)*** *could cause a change in* ***(Independent Variable)”.***

***For example: “****(Time Spent Studying) causes a change in (Test Score) and it isn't possible that (Test Score) could cause a change in (Time Spent Studying)”.*

We see that "Time Spent Studying" must be the independent variable and "Test Score" must be the dependent variable because the sentence doesn't make sense the other way around.

In the **solar cooker example,** the first variable under consideration is derived from the research question itself. The research question makes clear that we are concerned specifically with *bread baking*, rather than other possible questions about solar cookers, such *cost effectiveness*, or *convenience of use*. Since baking bread requires that a specific oven temperature be maintained over a period of time, ***sustained*** ***oven temperature*** is the ***dependent variable*** in this investigation. A possible ***independent variable*** that the researcher might choose to investigate is the ***colour of the reflecting surface*** of the solar cooker.

In the experiment, only the colour of the reflecting surface should be varied and tested against oven temperature. All other factors must be maintained as constants (e.g. shape of the cooker, brightness of heat source/sun, location within the cooker where the thermometer is placed, etc, etc). In this way, the researcher will be able to determine whether or not the oven temperature depends on the colour of the reflecting surface.