Science Fair Project

Oak Park Elementary School

Fontana Unified School District

_____ _____

Name Date

SCIENCE FAIR

Dear Parents,

Oak Park is having a Science Fair on February 3rd in the cafeteria. We will send the time home on a later notice. We are doing this to learn the scientific process and stimulate interest in science. At the fair, science projects made by students will be on display. In order to pass science this trimester, all students are required to complete a Science Fair Project.

Student responsibilities - The student is responsible for: (1) selecting a project topic (2) gathering resources and materials (3) meeting science fair rules and time requirements (4) completing the project (5) understanding the project well enough to explain it to someone else.

Parent responsibilities - Assist your child where needed in all of the above areas. Special help is usually needed in the areas of planning projects and working within a time deadline. Remember that the important thing is the learning process through which the child is going. Help your child as much as possible while making sure that your child understands that it is his/her project. You do not have to be an expert in science to help your child. What you don't know, the two of you can learn together. The last parent responsibility is to have fun. Make this an enjoyable learning experience for your child that will encourage him/her to further explore science.

If you have further questions, please contact me, or visit the Science section of our website at:

mrkellysclass.net

This section of the website has many links to help a student choose a topic, complete their project, make their display board, and give their presentation. It also has this entire packet for you reference.

We look forward to seeing you at the science fair.

GOOD LUCK!!

Managing the Project

Whenever a large project is being completed, it is helpful to schedule your time to ensure timely completion of the project. The following schedule will help you manage your time. ✓ Check off the items as you complete them. You will earn 5 points for your Science Fair Project for each week that you complete the work on time.

Points Possible **WEEK ONE**

____ ____ 1. Select a topic for your science fair project.

Points Earned ____ 2. On your "Science Experiment Form" complete the PROBLEM and HYPOTHESIS.

____ ____ 3. Sign up for a conference.

DUE DATE _____

Points Possible **WEEK TWO**

____ ____ 1. On your "Science Experiment Form" or a separate piece of paper, write the PROCEDURE.

Points Earned

____ ____ 2. Fill in the MATERIAL section of your "Science Experiment Form".

____ 3. Sign up for a conference.

DUE DATE _____

Points Possible **WEEK THREE**

____ ____ 1. Conduct your experiment, record your OBSERVATIONS/RESULTS (collect your data).

Points Earned

____ ____ 2. Write your CONCLUSION. Decide on the NEXT STEPS/FURTHER RESEARCH.

____ 3. Sign up for a conference.

DUE DATE _____

Points Possible **WEEK FOUR**

____ ____ 1. Make a display board for your project.

Points Earned ____ 2. Practice your presentation.

____ **DUE DATE** _____

Student's Guide

So, you've been assigned by your teacher to do a science project and you don't know where to begin. Well, a science experiment is nothing more than a way to solve a problem. These pages have been created to give you some ideas and resources, show you how to start, and take you step by step through the scientific process.
A successful science experiment has seven parts:

Question (or problem to be solved)
Research (a review of what has already been done by other scientists)
Hypothesis (what you think the answer will be; an educated guess)
Materials (like the ingredients list for a recipe, everything you need)
Procedure (how to carry out a controlled experiment, like recipe instructions)
Results (your observations, what happened during the experiment)
Conclusion (the answer--if you found one--to the original question or problem)

A caveat: (That means warning!) Most of those books with titles like 175 Fabulous Science Experiments to Do in Your Kitchen don't contain experiments at all. The activities in them are demonstrations of known scientific principles and do not involve manipulating an independent variable to observe its effect on a dependent variable. Chances are these will not be suitable for your science fair project. ASK YOUR SCIENCE TEACHER BEFORE YOU START!!!!!

QUESTION

A question may come from anywhere. For example, one student heard that some scientists have evidence that listening to music by Mozart improves math skills. She decided to test this out, and since she didn't particularly like Mozart, she wanted to test other types of music, too. This became her experimental question:

How does listening to different types of music affect students' math performance?

A good experimental question will usually be stated in this form: How does _____ affect _____? The first blank holds the independent variable (the thing the experimenter manipulates, in this case, the kind of music). The second blank holds the dependent variable (the thing the experimenter measures or observes to see if there is any change).

It's important to choose a problem that you can actually solve. For example, the effect of Interferon on stomach cancer cells will not be a project you can do at home. You'll have the same problem trying to investigate volcanoes and earthquakes. And "How do different kinds of food affect the way my dog behaves?" will be difficult because (a) there are too many uncontrolled variables that may affect the way your dog behaves and (b) there is no objective way to measure your dog's behavior.

RESEARCH

Scientists always need to know what other scientists have done before them. They may try to replicate a previous experiment to see if they get the same results. Or another scientist's experiment may suggest a better way. You need to find out what information there already is on your topic. This way, you won't waste time trying something that's unlikely to produce results.

HYPOTHESIS

This is the part of the experiment where you make a guess as to what you think will happen. It shouldn't be a wild guess, but an educated guess. This means you should use your own observations and find out what others have observed before you decide what you think will happen. The student who wanted to test the effect of music on math performance read a few articles about her subject and then wrote the following hypothesis:

> Some scientists believe that the construction of Mozart's music stimulates the brain in a way that improves math performance. I think that any music that a student likes will improve performance, and music that a student doesn't like will reduce performance.

MATERIALS

This is just a list of what you need to complete your experiment. Be sure to write it in list form (like your mom's grocery list).

> CD player
> CDs (Mozart, rap music, r & b, rock & roll)
> Timed multiplication tests
> Human subjects (Mom, Dad, my 6th grade brother, best friend)

PROCEDURE

This is like a recipe, step by step instructions for what you will do to test your hypothesis. What you need to be careful of here are your variables and controls. In this experiment, there is one independent variable--type of music--and one dependent variable--test performance. All other variables should be carefully controlled. For example, you probably wouldn't want to test your subjects when they are especially tired because this might affect their test performance. Then you wouldn't know if listening to the music affected their test scores. The easiest way to decide what variables need to be controlled is to make a list of all the things that might affect your dependent variable. This student came up with the following list:

> time of day
> general health
> intelligence/math skills
> age
> comfort
> difficulty of test
> practice

She addressed these variables in the following procedure:

- After dinner on day 1, I will give each subject in my experiment a test containing 50 multiplication problems. They will have exactly 1 minute to work. Then I will collect the tests and determine the number of answers correct for each subject.

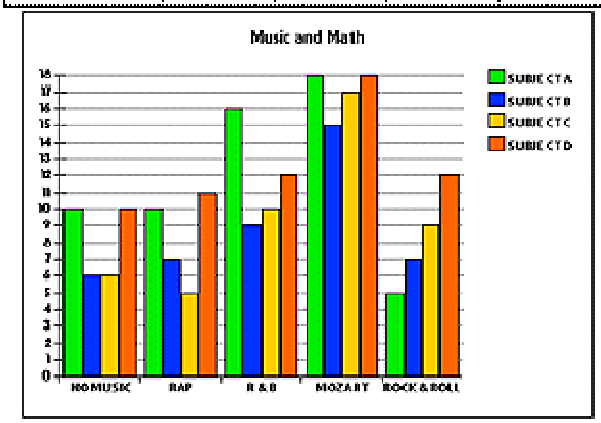
- On day 2, I will play a Mozart CD for exactly 30 minutes during dinner. After dinner, they will take another multiplication test, exactly like the first test except with different problems.
- On days 3, 4 and 5, I will repeat step 2, except I will play a different kind of music each day.
- After the fifth day, I will ask each subject which music he or she preferred, and I will tabulate the scores for each subject.

Your procedure must be complete and clear enough that another person could follow it and do the exact same experiment you do.

RESULTS

This is the part where you tell what happened. In this case, the student used a table to hold her data and calculations, and then made a graph. They looked like this:

TYPE OF MUSIC	SUBJECT A	SUBJECT B	SUBJECT C	SUBJECT D
NO MUSIC	10	6	6	10
RAP	10	7	5	11
R &B	16	9	10	12
MOZART	18	15	17	18
ROCK & ROLL	5	7	9	12



CONCLUSION

This is the hardest part of the project. Here you use your data and observations to try to answer your experimental question. Your conclusion must match your data. You should include in this part an evaluation of the reliability of your results, any other information you might have learned, and suggestions for further experimentation. This student concluded:

> When I look at the average test scores, all of my subjects scored highest after listening to Mozart, and the average score was quite a bit higher than their scores with Rap and Rock & Roll music. Everyone's scores were lowest with Rock & Roll.
>
> All subjects improved their scores from day 1 to day 4. I think this might be because they got better with practice, but it doesn't explain why all scores dropped on day 5. Perhaps there is something about Rock & Roll music that actually decreases math performance.
>
> According to my results, there does seem to be a connection between Mozart and math scores, but not between preferred music and math scores, so my hypothesis has not been proven. For my next project, I will test more people, and I will test each kind of music more than one time. I will mix up the order of days that I play each kind of music so that practice won't make a difference.

Here are some basic guidelines for writing your conclusion:
Answer your experimental question based on your results. Does music affect math scores? *All* music? *Some* music? If it does affect scores, how?

How reliable is your conclusion? That is, how certain are you that your results are accurate? Can you generalize from your data--do you think it is true for all people and all music? To decide this, you should consider the following:

Error of measurement: In this case, if the student used a kitchen timer to time how long she played the music, then she could only measure to the nearest minute. This means she could be as much as one minute off.
You should identify any error of measurement you might have and tell how it might have affected the results.

Validity of your testing instrument: Does your test measure what you want it to? In this case, the student used a multiplication test. She might have had different results if she had used a word problem test.

Uncontrolled variables: Did something unforeseen occur that could have affected your results? This student played her music at dinner and gave her math test immediately after. But what if Uncle Larry and Aunt Eunice dropped by one night, talked so loud they couldn't hear the music, and stayed so long they couldn't test for another hour?
Describe any uncontrolled variables and tell how they might have affected the results.

Sample size and number of trials: Here's a rule of thumb: a larger *random* sample is always better than a small chosen sample. And more trials are always better than less. Larger samples and more trials help to verify your results.
What else did you learn that wasn't part of your experimental question? For example, this student learned that besides possible affecting math scores, everyone in her family reported feeling calmer after listening to the Mozart. Her younger brother said he didn't like the music, but that it seemed to help him concentrate. This information could lead to...

Ideas for further experimentation: Here you should tell what other questions you might investigate (How does music affect stress levels? might be a good question) and how you would improve on the experiment you just did.

Whew!

The Display Board

From *Janice VanCleave's Guide to the Best Science Fair Projects*, Janice VanCleave (John Wiley & Sons, Inc., 1997)
This is an example of a good display board.

Maximum size: Table project : 122cm wide X 76cm deep X 198 cm tall (4ft. wide X 2.5ft. deep X 6.5ft. tall)

These are maximum measurements, so your display may be smaller than this. A three-sided backboard is usually the best way to display your work. Sturdy cardboard or other heavy material is easier to work with and is less likely to be damaged during transportation to the fair. Wooden panels can be cut and hinged together. Some office supply stores sell inexpensive pre-made backboards.

Your science fair display represents all the work that you have done. It should consist of a backboard, the project report, and anything that represents your project, such as models made, items studied, photographs, surveys, and the like. It must tell the story of the project in such a way that it attracts and holds the interest of the viewer. It has to be thorough, but not too crowded, so keep it simple.

The title and other headings should be neat and large enough to be read at a distance of about 3 feet (1 m). A short title is often eye-catching. You can purchase, at office supply stores, self-sticking letters of various sizes and colors for the title and headings and stick them to the backboard. You can cut your own letters out of construction paper or stencil the letters for all the headings directly onto the backboard. You can also use a word processor to print the title and other headings.

Construction should be durable with all parts firmly attached. Your display board should look professional, something that a businessperson might use, not a little kid. It should attract the attention of a viewer and make them want to come over and read about your project.

You want a display that the judges will remember positively. So before you glue everything down, lay the board on a flat surface and arrange the materials a few different ways. This will help you decide on the most suitable and attractive presentation.

Regulations

For All Projects Involving Humans as the Subject of Research:

The Code of Federal Regulations 45 CFR 46 §46.102 defines

- "Human Subject" means a living individual about whom an investigator (whether professional or student) conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information. In order for the obtaining of private information to constitute research involving human subjects, the identity of the subject must be readily associated with the information.
- "Minimal Risk" means that the risks of harm anticipated in the research are not greater, considering probability and magnitude, than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.

Examples of unacceptable risk include: (1) ingestion or physical contact with any potentially hazardous materials including toxic chemicals, known or suspected pathogens or carcinogens, or exposure to ionizing radiation; (2) intentionally inducing emotional stress through questioning or invasion of privacy; (3) physical stress to pregnant women or anyone suffering debilitating physical illness; and (4) psychological stress to the mentally handicapped or those suffering psychiatric disorders. This list is intended to be illustrative, not exhaustive.

The regulations of the Fair are intended to protect human subjects, both physically and psychologically. The regulations supplement, and do not supplant, relevant State and Federal regulations dealing with such protection.

For All Projects Involving Tissue Samples:

Live tissue samples must be taken either from a continuously maintained tissue culture line already available to institutional researchers, or from animals already being used in an on-going institutional research project.

Students may not be involved in the direct acquisition of these samples from living human or vertebrate animals.

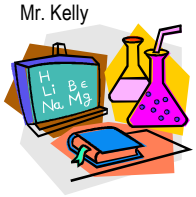
For All Projects Using Any Live Vertebrate Animal, Excluding Humans:

The State of California Education Code §51540: In the public elementary and high schools or in public elementary and high school school-sponsored activities and classes held elsewhere than on school premises, live vertebrate animals shall not, as part of a scientific experiment or any purpose whatever:
(a) Be experimentally medicated or drugged in a manner to cause painful reactions or induce painful or lethal pathological conditions.
(b) Be injured through any other treatments, including, but not limited to, anesthetization or electric shock.
Live animals on the premises of a public elementary or high school shall be housed and cared for in a humane and safe manner.

Display Safety Concerns:

- All project displays must adhere to all San Bernardino, State, and federal laws for public safety. Lasers must be appropriately shielded. Projects must sustain their own weight.
- No hazardous materials may be exhibited at the project display. This includes, but is not limited to, acids, unsecured glassware, mercury (including glass thermometers), hazardous microbes, carcinogenic and radioactive materials, open flames, and unsealed foodstuffs which may attract pests. For these items, the substitution of illustrations or photographs is encouraged. A more complete list of disallowed display materials will be included in your confirmation letter. Materials in violation of this rule will be marked and must be removed by the participant before judging will be allowed. The judgment of the Director of Judging is the final authority on permissible materials.
- The California State Science Fair will disqualify any project deemed unsafe.

The display of live or preserved animals is not permitted. Projects may not display photographs of procedures detrimental to the health and well being of vertebrate animals. Photographs of surgical procedures may not be exhibited.



Science Experiment Form

Name_____
Grade_____
Teacher's Name_____
Room Number_____
Title _____

Every experiment in science should be designed to answer a question (what, why, or how). The experiment should be recorded, dated, and written in a clear, concise manner.

PURPOSE: (What question do you want to answer?)

_____
_____

HYPOTHESIS: (What do you expect will happen?)

_____
_____

MATERIAL: (What did you use for your experiment? Be as precise as possible.)

_____
_____

PROCEDURE: (What are the exact steps to complete your experiment?)

_____
_____
_____
_____

OBSERVATIONS/RESULTS: (What actually happened? Record minute by minute or day by day etc.)

_____
_____
_____
_____

CONCLUSION: (Why did it happen? What new information did you learn?)

_____
_____
_____
_____

NEXT STEPS or FURTHER RESEARCH: If you were to conduct this experiment again, what might you change or research further? This is a very important part of your project.

_____
_____
_____
_____

Science Fair Project Rubric

Name _____
Date _____

This is the rubric that will be used to score your project.

I. SCIENTIFIC THOUGHT (30 points)

1. Both problem and hypothesis are identified and clearly stated. (Max = 2)
2. The problem is manageable and capable of being investigated. (Max = 2)
3. The hypothesis is derived literature search made prior to the experiment. (Max = 2)
4. The procedure for gathering data and making observations is detailed to allow for repetition by other. (Max = 3)
5. Experiment is designed to yield valid, reliable and accurate data. Variables are identified and controlled. (Max = 5)
6. The student has used a sufficient sample size and/or has repeated the experiment to provide sufficient data for analysis. (Max = 5)
7. Data/observations are organized and presented in the journal section of the notebook as original entries (not copied). (Max = 4)
8. Data/observations are summarized on tables or graphs. (Max = 2)
9. Conclusions formulated are logical, based on the data or observations collected, and relevant to the problem/hypothesis. (Max = 3)
10. Remaining unanswered questions are acknowledged. (Max = 2)

Subtotal (Max = 30) ☐

II. THOROUGHNESS (15 points)

1 . Student has prepared an in depth annotated bibliography which cites sources of information other than encyclopedias and textbooks. (Max = 4)
2. The complete project is documented in a notebook which is organized, neat, and accurate. (Max = 4)
3. The project demonstrates a depth and/or breadth of study. (Max = 4)
4. It is evident the student committed considerable time and effort in developing the project. (Max = 3)

Subtotal (Max = 15) ☐

III. CLARITY (10 points)

1. The display is effective reflecting neatness, organization, and a logical progression. (Max = 5)
2. The student clearly communicates an understanding of the goal, procedure, and findings. (Max = 5)

Subtotal (Max = 1 0) ☐

IV. SKILLS (15 points)

1. The student demonstrates the acquisition and use of laboratory and observational skills. (Max = 3)
2. The student demonstrates the acquisition and use of design and construction skills. (Max = 3)
3. The student demonstrates the acquisition and use of computational skills. (Max = 4)
4. The project was accomplished by the student. (Max = 5),

Subtotal (Max = 15) ☐

V. CREATIVITY (30 points)

1. The student's project is original, stemming from ideas conceived by the student as opposed to those found in a Laboratory test or provided by others. (Max = 6)
2. The student has used equipment and/or materials creatively to obtain data/observations. (Max = 12)
3. The student shows creative ability or originality in the analysis, interpretation, and application of data. (Max = 12)

Subtotal (Max = 30) ☐

GRAND TOTAL (Max = 100) ☐