

## **Using a case study that focuses on virus replication and the body's primary response to the infection and subsequent evaluation of issues in epidemiology.**

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### Abstract:

Students will review an actual case study of a woman who works in a nursing home and develops influenza. Through group evaluations and game playing of behavioral issues, evaluation of the effects of vaccines on the epidemiology, and how infectious diseases may spread, students will develop a diagnosis and evaluate courses of action to be taken. A focus on the issues of scientific literacy and the blending of concepts, history, and philosophy will be worked into the case study to help students evaluate and understand the scientific issues of our time.

### Objectives:

The objectives for this 2-week unit are multi-faceted. Through group research, case study, and presentations, students will apply their knowledge to a real life epidemiology study and answer the question: *Why should you care about being scientifically literate?*

- Evaluate and build a definition of what being scientifically literate means to an individual's life in the 21st century.
- Evaluate safety precautions that need to be executed by healthcare workers, lab technicians, and families (average people).
- Illustrate how disease is spread through populations per rate of transmission.
- Research the spread of communicable diseases in the United States.
- Describe influenza virus transmission, infection, and symptoms.
- Explain how vaccines work.
- Define the possible risks of a vaccine and how public health officials determine who should receive the vaccine.
- Use Immunopoly game playing and refine based on responses

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Separate Addendums:

    Immunopoly Game

    AAI Poster Presentation

## Overview

1. Concepts covered in two week unit
  - Basic Lab Safety
  - Scientific Journaling
  - Components & Function of Basic Human Immune System
  - Basics of Influenza
  - Vaccines
  - Ethics vs. Literacy
  
2. Goals of Lab/Activities/Case Studies
  - Effective Problem-solving
  - Evaluation of Scientific Literature
  - Oral and Written Communication
  - Proper Lab Safety
  - Culture Bacteria
  - Develop Knowledge of the Bodies Protective Systems
  - Understand How Disease Spreads
  
3. Recommended Use of Unit
  - Unit is designed for a 2-week period in a basic biology course.
  - In Albuquerque Public Schools (APS), the Unit is designed for Integration into a 6-week 10th grade science unit.
  - Inclusion topics for individual teachers:
    1. Microbiology/Immunology
    2. Human Anatomy/Physiology
  
4. Technical Skills
  - Lab Skills
  - Research replication and application
  - Bacterial identification
  - Experimental set-up and comparison/modeling evaluations
  - Scientific journaling
  - Roll and game play
  - Graphic skills
  - Poster presentation
  
5. Importance to Future Student Choices – Knowledge of:
  - Disease transmission
  - Importance of Scientific Literacy
  - Process of how a doctor evaluates a patient
  - Importance of knowledge in preventing disease

## **Scientific Journaling Guide (Teacher)**

*High School 9th and 10th grades [Bates College, Biology Department, Lewiston NE]*

### Overview

As a teacher, it is important to understand that student journaling is designed to report results to the class, extend the thought process of the individual student, encourage others in the class to question the approach, and contribute to the body of knowledge developed within the classroom setting. But most of all, the information should provide data that help other students interpret their data gathering from the experimental process.

Journaling is a necessary tool that assists student practice in the writing and thinking process and, when shared, enables other students to learn by example. Improvement in student scientific writing will occur only if the process and format is repeated, practiced, read to classmates, and critiqued by everyone involved in the exercise.

### Fundamentals

Special attention to order and organization is essential to the success of the writer. Although, writing and organization varies at the high school level, the creation of a simple outline adds a great deal to comprehension of the scientific method and reinforces the fact that well written papers are divided into distinct sections.

### What to do! When?

1. Develop a list of the major points to be included in each section.
2. Do this as a group for learners who need assistance writing or those who struggle with

## **Introduction to Journal-style Scientific Writing (Student)**

### 1. Overview

Scientific journaling is critical to your ability to report your findings to the class. The following is a step-by-step student guide that must be followed by each student and is to be completed as the Conclusion to the experiment, in essence, the final part to the experiment.

### 2. Expectations

- Start by creating a list of important points learned and observed from the experiment.
- Outline: Take the information in the experiment and place it in an order.
- There should be a minimum of 3 well defined sections
  - Introduction
  - Body
  - Conclusion
- Hints:
  - Be clear and concise
  - Use complete sentences and text that is easy to understand.
  - Make sure every paragraph has a topic sentence.
- Use fewer words.
- Avoid slang, abbreviations and contractions.
- Write in the 3rd person.

C. Listening, Questioning and Discussing:

- 3 = Respectfully listens, interacts, discusses and poses questions to all members of the team and helps direct the group in reaching consensus.
- 2 = Respectfully listens, interacts, discusses and poses questions to others.
- 1 = Has some difficulty respectfully listening and discussing, and tends to dominate discussions.
- 0 = Has great difficulty listening, argues with teammates, and is unwilling to consider other opinions. Impedes group from reaching consensus.

D. Research and Information-Sharing:

- 3 = Routinely gathers research and shares useful ideas when participating in group discussions. Defends/rethinks ideas relating to the group's project goals.
- 2 = Usually provides useful research and ideas when participating in discussion.
- 1 = Sometimes provides useful research and ideas when participating in discussion.
- 0 = Rarely provides useful research or ideas.

E. Problem-Solving:

- 3 = Actively looks for and suggests solutions to problems.
- 2 = Refines solutions suggested by others.
- 1 = Does not suggest or refine solutions, but is willing to try out solutions.
- 0 = Does not try to solve problems or help others solve problems.

F. Group/Partner Teamwork:

- 3 = Consistently makes necessary compromises to accomplish a common goal. Always has a positive attitude about the tasks and work of others.
- 2 = Usually makes necessary compromises to accomplish a common goal. Usually has a positive attitude about the tasks and work of others.
- 1 = Occasionally makes compromises to accomplish a common goal. Occasionally is publicly critical of the tasks or work of other members of the group.
- 0 = Rarely makes compromises to accomplish a common goal and has difficulty getting along with other group members. Is often negative and publicly critical of the tasks or the work of other members of the group.

## High School – Lab Safety Rules

The following Safety Regulations must be observed at all times in the laboratory. All students MUST pass a safety test demonstrating knowledge of the following:

1. NO experiments may be performed which have not been authorized by the instructor.
2. Only use the materials/equipment provided by the instructor in class.
3. Follow all written and verbal instructions carefully and implicitly.
4. NEVER eat or drink in the laboratory. DO NOT taste or touch chemicals/food unless specifically instructed to do so.
5. NO playing, rough housing, running, fighting, or other injurious behavior will be tolerated in the laboratory/classroom.
6. ALL accidents or injuries must be reported to the teacher immediately.
7. Know the proper names and sizes of all glassware and equipment.
8. Ask if in doubt about a procedure or task.
9. Utilize all safety equipment, including safety goggles and/or safety aprons.
10. Know the location of fire extinguisher/blanket, first aid kit, eye wash, safety shower, and fume hood.
11. Dress appropriately for laboratory work. Closed toe shoes must be worn. Confine long hair or loose clothing.
12. Use burners with caution as demonstrated by the instructor. Dispose of matches in a designated container only.
13. Properly dispose of all materials. Place solid waste in trash can, liquids as per teacher instructions.
14. Take only necessary materials to your lab station to avoid damage.
15. DO NOT enter lab prep or storage areas without permission from instructor.
16. Report any problems with equipment to the instructor immediately.
- 17.

## High School Lab Safety Contract for Unit

ALL STUDENTS MUST HAVE A SIGNED SAFETY CONTRACT ON FILE TO PARTICIPATE IN LAB ACTIVITIES.

I, \_\_\_\_\_, have read, discussed, and understood the safety rules listed on these pages. I agree to follow these rules and will comply with all directions issued by my instructor in the laboratory/classroom.

I will conduct myself in a professional, responsible manner at all times.

I will promptly report to the instructor any misbehavior or situation that could endanger the welfare of myself or others.

I will be careful using equipment and supplies, knowing I could be asked to replace broken equipment.

I agree to carry out good housekeeping practices, proper disposal techniques, and protect myself using safety equipment while in the laboratory.

I realize if I knowingly disregard this contract, I will not be permitted to take part in laboratory activities.

Contract for Unit



## **Student Outcomes**

### Lab Skills:

1. Prediction, Journaling
2. Lab measurement and math skills, i.e. flow charts and graphs

### Student expected outcomes on exams:

1. Illustrate and explain how an infectious disease can spread through a population.
2. Evaluate preventative medicine and explain through evaluation of case study and completion of labs
3. Research the replication process of the influenza virus
4. Understand how behavior plays a role in possible infection.
5. Explain the primary biological issues faced everyday that are related to the case study and how the body responds to viral infection and vaccines.

### **Measurable Learning Objectives:**

1. Demonstrate proper lab safety and procedures
2. Produce a well organized journal that reflects the following:
  - a. The scientific method
  - b. Evaluative notes from demonstrations
  - c. A clear understanding of the culminating poster project
3. Research the influenza illness and the rate of transmission through populations, symptoms of infection, age associated attack and rates of morbidity, viral shedding, secondary bacterial infections

Students will:

- Follow lab safety protocol
- Evaluate case study using research, lecture, lab and demonstration information
- Identify personal habits that place a person at risk of contracting influenza
- Develop a poster that focuses on social awareness
- Be able to interpret vital signs of a physical exam and general lab tests

### **90 Minute Class Time**

Timeline for completion:

Day 1:            Student and teacher review of pre-case study (expectation/orientation)

## **Student Expectations**

### Purpose

1. The purpose of this unit is to enable students to understand how disease is spread throughout populations.
2. Enable students to visualize the process a healthcare worker would undergo in diagnosis and treatment
3. Be able to answer ethical and literacy questions that occur on the job and in family setting, i.e. personal habits, vaccines, and advances in medicine
4. Be able to use terms and ideas in game setting

### Introduction

Students will:

1. Develop proper journaling skills essential to appropriate evaluation and diagnosis of a case study
2. Develop and use appropriate lab write-up skills, i.e. scientific method
3. In lab, students will simulate disease transmissions and body protective systems
4. Student will follow lab protocols
5. Students will build concept through game

### Materials

Per Group:

1. Written evaluation of case study (see case study protocol)
2. Lab (refer to appropriate protocols)
3. Demonstration (refer to Teacher and Journal Protocol)

### Background

Journaling is a practice of collecting thoughts about concepts that have been discussed in the classroom. The use of the journal enables the teacher to evaluate a students' ability to process the topic, as well as help the students communicate their ideas to the teacher and class. Journaling is individualized instruction that helps a teacher identify how the student is processing and learning. It is important to use a prompt and work with students on a style that enhances the subject.

## Unit Overview Flow Chart

**Lab**

## **Disease Transmission**

### Teacher Guide Pre-Lab Set-up:

[The formulation of this lab came from UCSF Lessons Project]

Teacher will need to prepare the following material in order to demonstrate disease transmission.

- 25% potassium hydroxide solution
- Phenolphthalein (Ph indicator)
- Vinegar to wash vials and droppers
- Six (6) test tubes and droppers numbered 1-5 & P
- Test tube racks (represent family groups)

### Set-up Classroom:

- Four (4) stations with pre-set test tube rack (5 students or less in group) to represent a family community
- Journal guide on board numbering each family designated by a letter A- ? and each test tube numbered 1-5 & P with #1 & 2 representing Mother and Father and 3-5 representing offspring, and a 6th representing pet (labeled P).
- Have students interact with one family member (exchange test tube contents) and two members outside of their family unit.

### Pre-lab Discussion:

- Lab safety in handling dropper and test tube (safety glasses and gloves required)
- Contamination of tube by touching dropper
- Steps in journaling
- Review prior knowledge
  1. How infections are passed on and name
  2. Lab safety
  3. Scientific method
  4. Personal habits vs. infection

## **Lab: Disease Transmission**

### Lab Protocol

[following information from [www.mayoclinic.com](http://www.mayoclinic.com)]

#### Purpose:

The purpose of this lab is to demonstrate how disease is spread through family groups and then through populations through daily contact. An emphasis is placed on behaviors and how the easiest way to catch most infectious diseases is by contact with an infected person. Simple behavioral changes can reduce chance of infection. Evaluation of the different ways infectious disease can be spread are evaluated and discussed. These include the following:

- Direct: person to person, animal to person, mother to unborn
- Indirect: inanimate object transfer, airborne droplet (particle) transmission, bites/stings, and food contamination

#### Student Materials:

- Test tube
- 3-5 group test tube rack
- Visa Via (whiteboard) marking pen
- Journal

## Lab: Disease Transmission

### Protocol Teacher Section

#### Procedure:

1. For each round of interaction, students will need (per family unit):
  - One test tube  $\frac{1}{2}$  filled with potassium hydroxide solution
  - Six test tubes  $\frac{1}{2}$  filled with water
  - Label tubes in each family group in order to keep track of KOH tube. Be sure the KOH tube is different in each group. (Labels to be 1, 2, 3, 4, 5, P)
  - Prepare behavior cards to be drawn by 1 family member
  - 1 dice
2. Each student received a test tube with clear liquid and dropper. Explain that the liquid in tube represents their body and one of the seven in the family unit is infected with a contagious disease.
3. Student now interacts with one member of the family unit, placing 5 drops into test tube of family member.
4. Student then empties any remaining fluid back into test tube stirring gently with dropper.
5. Roll dice to determine who will draw behavior card. If 5 in group and 6 is rolled, all students draw a card.
6. Have students complete task on card.
7. Have student repeat process with one person outside family group. Be sure that students are charting the interactions.
8. After 2 interactions, one student in family unit tests for the presence of disease by placing 1-2 drops of the indicator into their test tube. Liquid should turn bright pink if infected.
9. If infected this student will pull a vaccine card.
10. Start another round of interactions and have each family unit check for infection. Graph number of infection with number of interactions.
11. Restart with new test tubes and increase number of interactions and behavior cards.

## **Behavior Cards**

*[Behavior cards extension activity has been developed by Lance Powell, June Jordon HS, San Francisco]*

### Sweep Animal Pen

You must trade fluid.

Test tube marked “P” for pet.

### Vaccine Card

Too young to receive vaccine.

Interact with 2 more family members.

### Vaccine Card

Have serious allergy to eggs (anaphylaxis). Interact with 2 members outside family.

### Vaccine Card

Vaccine prevents Influenza.

### Monogamous

You may “trade fluid” with the same person as many times as you want. It does not have to be another monogamous person.

### Polygamous

You may “trade fluid” with 4 different people.

### Promiscuous

You may “trade fluid” with as many people as you can.

### One night stand

You may “trade fluid” with one person one time.



## Lab: “How is Disease Spread Through Populations”

Name \_\_\_\_\_ Date \_\_\_\_\_

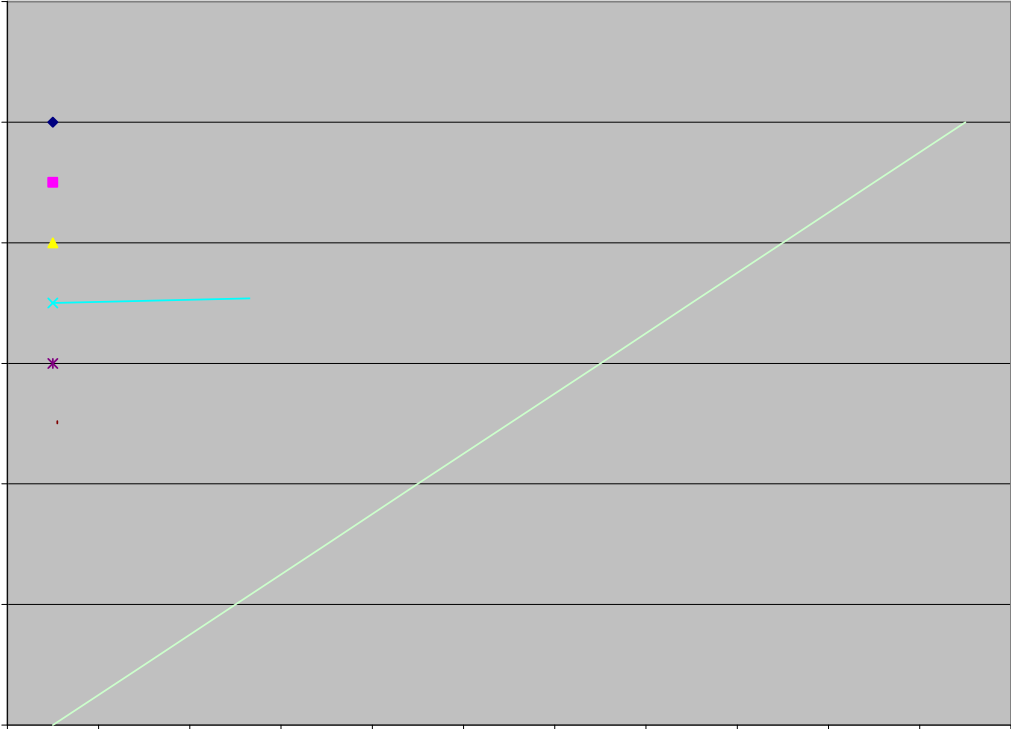
Period \_\_\_\_\_

The following lab will simulate how disease is spread and how simple behaviors can increase or reduce the infection rates.

### Directions:

1. Prep journal with prior knowledge, graphs and charts located on board.
2. Obtain a test tube from family rack. This tube represents your body fluids. In journal, chart all tube numbers and names. One of your family group has been infected with a contagious disease.
3. Choose one family member to interact with. During the interaction, each of you will fill your eye dropper with liquid from your own tubes and let 5 drops fall in your family member tube. **MAKE SURE NOT TO DIP YOUR DROPPER INTO LIQUID OF OTHER MEMBER.**
4. Empty any remaining liquid into your tube.
5. Roll dice. If a 1, 2, 3, 4, 5 come up, that person will draw a behavior card and do what the card says (document in your journal). If 6 is rolled everyone in the group draws a card.
6.
  - 3.

**Theoretical Graph of Disease Spread through Populations**



**“Tree” to Trace Back the Path of Transmission of the Disease**

Interaction  
1

2

3

4

5

## Case Study Analysis (Teacher)

*[Learning with Cases, by Erskine, Leenders & Mauffette]*

### 1. Introduction

- a. A case study is a method of analysis, a learning tool where students are guided by the instructor in direct evaluation of a prepared actual situation. The case study requires the student or student group to evaluate an actual situation involving a decision to be made or problem to be solved.
- b. The preparation by students requires a review of prior knowledge and the development of a journal entry beginning with vocabulary guided by class discussion. Students will learn how the vocabulary is essential to interpretation of the case, how to evaluate a problem, how to make decisions, and how to orally argue a point of view. This method enables students to understand and evaluate how decisions need to be made based on sound evidence and evaluation of the evidence.

### 2. Steps to Evaluate the Case Study

- a. Explain to the students what a case study is and discuss the expected outcomes listed above.
- b. Read the case study to students
- c. Provide guided questions [students section]
- d. Provide group assignments

### 3. Group Work

Group work should be divided into four components.

- a. Pre-class preparation prior to discussion
  - i. Assign prior knowledge reading assignments from vocabulary list
  - ii. Spend several 10-15 minute periods familiarizing students with case
  - iii. Use a full period to analyze case; make diagnosis, and plan culminating project
  - iv. Journal case
- b. Providing a guide list of discussion topics about the case [see case study]
  - i. Assign a group to start discussion (up to individual teacher based on class dynamics)
  - ii. Group must listen carefully and take notes
  - iii. Participating is important and is a part of grade [Rubric student section]
- c. Closure assignments for each group
  - i. Provide 5 minutes at end of each discussion for group to review notes for daily journal.
- d. Daily Journaling [Refer to journaling lesson]

## Helping Students Prepare!

A. You will need a system to guide your student groups. At first the amount of information will seem insurmountable, so here is a method to get started:

1. Quickly read the case to the students
2. Answer the following question in student journals:
  - a. Who are the decision makers in this case, and what is their position and responsibility?
  - b. What is the main issue?
  - c. What is the issue's significance?
  - d. Why has the issue arisen?
  - e. When does the decision maker have to decide, resolve, or act on the issue?
  - f. What is the urgency to the situation?
3. Review case objectives
4. Review case subtitles
5. Review case discussion questions

B. At this point, there are two tasks that will take place in your assigned groups:

1. Detailed reading of the case
2. Analyzing the case

Have the students follow the case study guide [see student section]. Briefly, the sections for the detailed readings are:

- Opening paragraph
- Background information
- Area of interest
- Specific problem
- Alternatives
- Conclusions

Purpose is to thoroughly understand the situation and the decisions that will need to be made. Students must fill out study guide sheet and keep focused on these steps:

- Defining the issue
- Analyzing case data
- Generating alternatives
- Selecting decision criteria
- Analyzing and evaluation of alternatives
- Selection of preferred alternatives
- Developing a plan of action

### C. Defining the Problem:

The problem should be written clearly and concisely while asking the following: what appears to be the problem and how do I know this is a problem? What are the immediate issues that need to be addressed? The problem statement is always written as a question.

### D. Analyzing the Case:

Have students answer these four questions:

- How did the issue arise?
- Who is affected the most?
- What are the constraints and opportunities?
- What do the numbers say?

## Discussion Criteria

A very important concept to understand, students must answer the question of how they are going to decide what the solution will ultimately be. The student must answer the question, “the course of treatment and recommendation I make to the patient must...”

Key decisions should:

- Improve the situation
- Reduce infection to a greater population
- Maintain patient’s trust in knowledge within resources
- Speed implementation
- Be within risk parameters
- Safe with age and history
- Minimize impact

## Structure of Journal Evaluation

1. Title Page
2. Table of Contents
3. Summary
4. Problem Statement
5. Data Analysis
6. Key Decision Criteria
7. Recommendations
8. Action/Implementation Plan

## Case Study (Student Guide)

Group: \_\_\_\_\_

A case study is a description of an actual situation involving a decision that will need to be made by your group.

### Objectives

Students will:

- Use case method analysis to complete guided practice sheet.
- Participate in group discussions, complete assigned readings, and journal
- Work in group to present final case write-up and develop topic for final poster project.

## Case Evaluation - 1st Reading (Student Page)

Group: \_\_\_\_\_

### Directions:

Teacher will read the case to your group. During this time, each student must answer the questions listed below in preparation of a group discussion and first journal entry.

1. Who is the decision maker in this case?
2. What is the issue and explain its significance?
3. Why has the issue arisen?
4. Why does the doctor have to decide?
5. What is the urgency of the situation?

### Computer use:

When the group is ready, a recorder will record the group's answers. As a group, look up the following:

1. Replication and properties of influenza
2. Antigenetic shift/drift
3. Symptomatology
4. Association to age/morbidity rates
5. Person to person transmissions
6. Secondary infections
7. Common organisms involved
8. Epidemics vs. pandemics
9. Antiviral therapy
10. Vaccine and incidence of disease
11. Behavioral effects



## Case Evaluation - 2nd Reading (Student Guide)

Group: \_\_\_\_\_

### Directions:

During the second reading, a member or members of the group will read the case to the group. The other members will summarize the following sections:

1. Define the opening paragraph. (introduce situation)
2. List background information (organization, history, anything of significance)
3. List specific problems (to be made)
4. List alternatives (even those not stated in case study)
5. Conclusion (set-up tasks, limitations, urgencies)

When finished as a group and recorded, complete the following:

1. Define issues
2. List and evaluate data (research required)
3. Generate possible solutions with rationale
4. Select decision criteria
5. Develop action plan
6. Answer guided discussion questions in case study.

## Grading Rubric (Group)

Rubric [Student grading]: 4=Excellent, 3=Good, 2=Fair, 1=Poor

### A. Content:

- 4 = The poster includes all required elements as well as additional information. 10 Pictures/phrases about science.
- 3 = All required elements are included on the poster. 7 pictures/phrases about science.
- 2 = All but 1 of the required elements are included on the poster. 5-6 pictures/phrases about science.
- 1 = Several required elements were missing. Less than 5 pictures/phrases about science.

### B. Visual Organization:

- 4 = Almost all items of importance on the poster are clearly labeled. All items are neatly presented with several graphics appropriate for topic of poster.
- 3 = Several items of importance on the poster are clearly labeled. Most items are neatly presented with an adequate amount of graphics which relate to poster topic.
- 2 = Almost all items of importance on the poster are clearly labeled. Items are somewhat untidy. Some graphics do not relate to poster topic.
- 1 = Labels are too small to view OR no important items were labeled. Items on poster are messy and difficult to read or interpret. Graphics do not relate to the poster topic.

### C. Creativity:

- 4 = Poster uses many creative elements to present poster topic. Pleasant use of color and graphics
- 3 = Poster uses some creative elements to present topic. Good use of color or graphics.
- 2 = Poster uses few creative elements. Limited use of color or graphics.
- 1 = Poster lacks creative elements. Poster uses no color or graphics.

## **Final Report (Student)**

Group: \_\_\_\_\_

### Directions:

The group's final report will be presented to the class in the form of a written paper and ten-slide Powerpoint presentation. The structure of the written report is as follows:

1. Title Page
2. Table of Contents
3. Summary
4. Problem Statement
5. Data Analysis
6. Key Decision Criteria
7. Recommendations
8. Action Plan (implementation)

The structure of the Powerpoint presentation must be:

- Title Slide: #1
- Case Explanation: #2-3
- Problem/Infection: #4-5
- Data: #6-7
- Explanation of Action: #8-9
- Projected Result: #10

Each slide must be carefully correlated to the oral presentation and include pictures and text. The duration of the presentation is 15 minutes and must include each member of the group. Simply reading the paper out loud is NOT acceptable.



5. Arrange elements to direct the viewer where you want them to look.
6. Vary the size and space of elements to create visual interest.
7. Use color to enhance areas or but do not overuse color to distract from the important elements.
8. If space is available, acknowledgements should be included to thank sponsors, research partners, teachers, etc.

Artistic or Visual Poster Presentation:

1. The format for artistic posters is less structures and uses imagery to tell the story.
2. The poster still needs a good visual flow for clarify and understanding of material.
3. An explanation of the visual elements may need to be included for comprehension of research.

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