Music and Memory

A “complete” lab (MYP lab) and lab report!
MYP Labs are “complete” labs

- Explanation - the “complete” part means that this will be a step by step process for this first lab.

- As we build on our science skills, less of the lab will be given to you over the course of the school year.

- This means one by one each step of these types of labs will be provide by YOU, the student, and not by me, the teacher.

- Before you take those important steps, you need to fully understand what are the steps for a lab and what the expectation is for each step.

- This lab is your chance to ask questions! If you do not ask, I assume you KNOW and UNDERSTAND.
Our Topic:

- Music is powerful. It has the potential to evoke emotions and personality. Because of the profound effects music has on the human race, it has been a common link between cultures around the world for centuries. Not only does music provide entertainment and beautiful sounds, but it has an amazing effect on memory and learning.

- It has been found that people who study music have better GPAs and are higher achievers than those who aren’t involved in music. It is also true that Hungary, Japan and the Netherlands are the top three academic countries in the world and they all place a great emphasis on music education and participation in music.

- But what about listening to music and completing cognitive (thinking required) tasks?
What is the lab and experiment?

▪ Test subjects will be asked to listen to music while completing a task. They will also be asked to complete the same task, with minor modifications, without music.

▪ The project addresses a perennial argument between adults (especially parents and teachers) and children: is it a GOOD IDEA to listen to music while you are studying?

▪ You will need to complete a “Pre-Lab” assignment before being allowed to start the lab.

▪ If you do not complete the pre-lab assignment, you will no longer be in your assigned group and will have to complete the pre-lab during class and come in to tutorials in order to complete the experiment. You will then be behind and will have to spend personal time catching up the rest of the class.

▪ What’s the moral? Do the pre-lab when assigned!!
Pre-Lab and Lab resources

- What is available to help me and where do I find it?

Music and Memory Pre-Lab

Instructions: Answer the following questions in order to be ready to start the experimentation portion of the lab.

1. After reading the article, what is the author communicating about electronics and important learning tasks?

2. Using the science dictionary link on flippeystudio.science.com, define these vocabulary terms so that you understand more when you research and experiment:
   - Memory
   - Retention
   - Short term
   - Long term

3. Check out these resources:
   - Write 3-4:

   **You’ll Never Learn!**
   
   Students can’t resist multitasking, and it’s impairing their memory.

   By Annie Murphy Paul

   Living rooms, dens, kitchens, and even bedrooms: investigators followed students into the space where homework gets done. Pens poised over their “study observation forms,” the observers watched intently as the students—in middle school, high school, and college—2,631 in all—opened their books and turned on their computers.

   For an hour of an hour, the investigators from the lab of Larry Rosen, a psychology professor at California State University-Dominguez Hills, marked down once a minute what the students were doing as they studied. A checklist on the form included: reading a book, writing on paper, typing on the computer—and also using email, looking at Facebook, engaging in instant messaging, texting, talking on the phone, watching television, listening to music, surfing the Web. Sitting unobtrusively at the back of the room, the observers counted the number of windows open on the students’ screens and noted whether the students were wearing earbuds.

   Although the students had been told at the outset that they should “study something important, including homework, an upcoming examination or project, or reading a book for a course.” It wasn’t
Lab Steps

These are also “Lab Report Steps”
Get out your lab report pages now:

- How to understand the helpful tips on these pages.
- Boxed information
- Criterion B and C?
- Instructions/explanations
• How **do** you come up with a title?

“Sure fire” method:

1. Think about what your experiment is about
2. Do you know what your variables are?
3. What is the simplest way to phrase it?
Problem and Question

▪ What is our problem?

▪ Based on the topic, let’s brainstorm some possible questions.
What are variables again?

- Independent: what causes the results
- Dependent: the result(s) of the experiment, the thing you measure
- In our case, the independent variable is not listening to music and then listening to music. This factor is changed ON PURPOSE in order to measure (dependent) how well a person does a task.
Examples of Variables

- Here are some other examples of dependent and independent variables in scientific experiments:

- A scientist studies the impact of a drug on cancer. The independent variables are the administration of the drug - the dosage and the timing. The dependent variable is the impact the drug has on cancer.

- A scientist studies the impact of withholding affection on rats. The independent variable is the amount of affection. The dependent variable is the reaction of the rats.

- A scientist studies how many days people can eat soup until they get sick. The independent variable is the number of days of consuming soup. The dependent variable is the onset of illness.
Hypothesis – read the explanation...

- Then read what you have written down for the problem, question and variables.

- Now, think about how to phrase your hypothesis –

- A starting point: “If the subject __________________ then the rate of __________________ will increase.

- What goes in the blanks?
Materials – read the explanation…

- Computer with internet access
- An iPod or other personal music device
- Pencil and paper to take data
- A lot of people to act as test subjects (your group members, then the class, etc)
1. Choose a test subject.
2. Sit him or her at a computer.
3. Go to http://www.play.vg/games/52-Concentration.html (or you may find a similar game)
4. Allow the test subject to play the game once - the reason for doing this is because people naturally get better at tasks early, and less later. You want your test subjects to be decent at the task, without having enough time to get bored of it. Don’t collect this data.
5. On the second and third time, allow the test subject to wear headphones and play music of their own selection or something you have chosen. Have them play the game, and record their completion time in a data table.
6. Have them do the game one more time, but without music. Record their completion time.
7. Everyone in your group should complete the test, we will combine the class data, and eventually all of the 8th grade data.
8. Compare both ‘with music’ and ‘without music’ times for all subjects. Which was better? Did certain people do better and others worse? What might age or gender mean in this experiment?
9. Find a way to graph your data, so people understand the results of your experiment!

Remember, this procedure has to be repeatable!
Data table (a quick walk through):

▪ You should show all the data you took during the experiment in a table form.

▪ It should be set up BEFORE you start collecting data, so where should a dependent variable be on a table? And the independent?

▪ Always set up your table so the Dependent Variable is the column variable and the Independent Variable is the row variable.
Row = across, column is vertical (up and down)

<table>
<thead>
<tr>
<th></th>
<th>Region 1</th>
<th>Region 2</th>
<th>Region 3</th>
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</thead>
<tbody>
<tr>
<td>March</td>
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<td>April</td>
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<td>June</td>
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<tr>
<td>July</td>
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</tbody>
</table>
Data Table (cont’d):

- What might be an appropriate title?
- What else could we/should we add to the table? *(it is NOT complete as is)*
- Tables are mainly of RAW data, but what we graph is MANIPULATED (Averaged) data. So you need a final space for that data too.
- Remember, you are collecting data to get ANSWERS for your experimental question!
- Based on these answers you will attempt to prove or disprove your hypothesis!

<table>
<thead>
<tr>
<th></th>
<th>Task – with music</th>
<th>Task – with music</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person 1</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Person 2</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>Person 3</td>
<td>12</td>
<td>20</td>
</tr>
</tbody>
</table>
### RAW Data Table

<table>
<thead>
<tr>
<th></th>
<th>Task – with music (T1)</th>
<th>Task – with music (T2)</th>
<th>Task – without music</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person 1</td>
<td>6</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Person 2</td>
<td>17</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Person 3</td>
<td>12</td>
<td>20</td>
<td></td>
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<tr>
<td>Averages</td>
<td></td>
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</tbody>
</table>

- Why did I call it “RAW”?
- How do we calculate the average for each column?

These numbers are the results, or the dependent variable.
Whole class data:

- We will take each group’s averages and put them into one large data table on board.
- Everyone will gather this data (write it down).
- Make another data table to record this new information – **TITLE it!**
- This is the data you will graph – NOT your group’s raw data!

<table>
<thead>
<tr>
<th>Task – with music (T1)</th>
<th>Task – with music (T2)</th>
<th>Task – without music</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 2</td>
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<td>Group 3</td>
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<td>Group 4</td>
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<tr>
<td>Group 5</td>
<td></td>
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<tr>
<td>Group 6</td>
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</tbody>
</table>
For any type of graph:

- Generally, you should place your independent variable on the x-axis of your graph and the dependent variable on the y-axis.

- Be sure to label the axes of your graph — don't forget to include the units of measurement (grams, centimeters, liters, etc.).

- If you have more than one set of data, show each series in a different color or symbol and include a legend with clear labels.

- Different types of graphs are appropriate for different experiments. These are just a few of the possible types of graphs:
  - A **bar graph** might be appropriate for comparing different trials or different experimental groups. It also may be a good choice if your independent variable is not numerical.
  - An **xy-line graph** shows the relationship between your dependent and independent variables when both are numerical and the dependent variable is a function of the independent variable.
Graph example:

What else makes this graph easy to read?

Are there things that you would change about the graph?
A note for this lab!!

- If you notice the table and graph sections, the space is very limited.

- It is completely fine if you would like to use another piece of paper(s) to build your data table and graph.

- Simply put a note to me on these sections and then attach the papers to the lab report pages when you turn this in.
Interpreting Graph Patterns: an example

- Before we begin, what does “identifying” mean? And “patterns”?

- **Identifying Patterns**: Explain what your data is showing using words like “increase” or “decrease”, and phrases such as “the data shows…” or “the dependent variable…” This can be just a sentence or two.

- How might you start the analysis of this graph?

- Hint: Summarize what the graph is showing…

![Graph of Flashlights (medium drain device)](image)
Conclusion

The steps of a proper conclusion
It states on the lab report: *First paragraph – explain any research completed or background information (remember you did a pre-lab!), state the purpose of the experiment, the question you intend to answer, your variables and your hypothesis. Then briefly explain how you did the experiment.*

How can we begin?
Paragraph two:

- Second paragraph – summarize your collected data and qualitative observations. Explain what you think the collected data means for the experiment. If a graph was made, analyze the trends and patterns you found. This would be a sentence or two from your analysis section above.

- What does SUMMARIZE mean?

- Are there other terms that are confusing as well?
Third paragraph - explain whether your hypothesis was proven, disproved or inconclusive, based on the data collected. Specifically state relevant data that was collected in order to justify your claim about the hypothesis.

What is the first step that you are asked to complete?

And the second?
Fourth paragraph - Don’t give the procedure again, but do point out possible sources of error that may have occurred in the collection of data and suggest improvements to the procedure if you were to do this lab again. And/or, you may discuss an extension to this experiment.

Again, what are you being asked to do?

Why do you think the last sentence has “and/or”? 
Assessment Rubrics

- You will be assessed in 2 different criterions for MYP Labs, Criterion B and C.
  - Criterion B is “Inquiring and Designing” – this means that this grades on how you prepare for the lab and design the lab.
  - Criterion C is “Processing and Evaluating” – this means that we are looking at the experiment itself and how the results are communicated
- This year, you will be asked to assess yourself the day you turn in the lab.
  - Take time now to read the first rubric, Criterion B, really pay attention to the bolded words of each strand – match it to those sections you saw on the lab pages.
  - Then read the teacher comments boxes.
- Let’s discuss!
## Criterion B: Inquiring and Designing – Music and Memory Lab

<table>
<thead>
<tr>
<th>Achievement Level</th>
<th>Level Descriptor</th>
<th>Student</th>
<th>Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The student does not reach a standard indicated by any of the descriptors below.</td>
<td></td>
<td>What I am checking for:</td>
</tr>
</tbody>
</table>
| 1-2               | The student is able to:  
|                  | i. state a problem or question to be tested by a scientific investigation, with limited success – question is stated, but lacks clarity  
|                  | ii. state a testable hypothesis – hypothesis is stated  
|                  | iii. state the variables – the variables are listed and labelled  
|                  | iv. design a method, with limited success – procedure is present but incomplete | | • Is there a question?  
|                  | • Is there a hypothesis?  
|                  | • Are the variables stated?  
|                  | • Is the procedure there? |
| 3-4               | The student is able to:  
|                  | i. state a problem or question to be tested by a scientific investigation – question is stated  
|                  | ii. outline a testable hypothesis using scientific reasoning – hypothesis is stated and applies to the problem, scientific language is lacking  
|                  | iii. outline how to manipulate the variables, and state how relevant data will be collected – variables are listed and labelled correctly, data table is present  
|                  | iv. design a safe method in which he or she selects materials and equipment – pre-lab is incomplete or not done well, materials and equipment are chosen | | • Is there a question?  
|                  | • Is there a hypothesis?  
|                  | • Are the variables stated?  
|                  | • Is the procedure there? |
| 5-6               | The student is able to:  
|                  | i. outline a problem or question to be tested by a scientific investigation – question has variables stated, scientific language is somewhat lacking  
|                  | ii. outline and explain a testable hypothesis using scientific reasoning – hypothesis is testable and uses scientific language  
|                  | iii. outline how to manipulate the variables, and outline how sufficient, relevant data will be collected - variables are outlined and labelled correctly, variables are as specific as possible, data table is present and columns are labelled  
|                  | iv. design a complete and safe method in which he or she selects appropriate materials and equipment – pre-lab is completed, materials are listed, safety is not considered well, procedure is adequate | | • Is there a question?  
|                  | • Is there a hypothesis?  
|                  | • Are the variables stated?  
|                  | • Is the procedure there? |
| 7-8               | The student is able to:  
|                  | i. describe a problem or question to be tested by a scientific investigation – question has variables specifically stated and uses scientific language.  
|                  | ii. outline and explain a testable hypothesis using correct scientific reasoning – hypothesis is specific and clearly outlined, can be tested by the experiment  
|                  | iii. describe how to manipulate the variables, and describe how sufficient, relevant data will be collected - variables are described and labelled correctly, variables are as specific as possible, data table is present and columns are labelled and described  
|                  | iv. design a logical, complete and safe method in which he or she selects appropriate materials and equipment – pre-lab shows effort and thought, materials are defined well, with correct amounts, and the method made for the experiment is safe | | • Is the question well stated, using learned vocabulary and variables?  
|                  | • Hypothesis has specific variables, is written in a testable way and uses the vocab learned.  
|                  | • Are the variables clearly labelled in every step that uses them?  
<p>|                  | • Pre-lab is well done, procedure takes into account safety and required materials. |</p>
<table>
<thead>
<tr>
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<th>Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The student does not reach a standard indicated by any of the descriptors below.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>i. collect and present data in numerical and/or visual forms – data table(s) and graph(s) are present</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>ii. accurately interpret data – data is explained and graphed</td>
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<td></td>
<td>iii. state the validity of a hypothesis with limited reference to a scientific investigation – hypothesis is stated as how it related to the experiment</td>
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<tr>
<td></td>
<td>iv. state the validity of the method with limited reference to a scientific investigation – student states the method and procedures</td>
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<td></td>
<td>v. state limited improvements or extensions to the method – states lessons learned from lab</td>
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<tr>
<td>3-4</td>
<td>i. correctly collect and present data in numerical and/or visual forms – data table is labelled and data has units, graph is titled, labelled and plotted</td>
<td></td>
<td>• Data table and graph has variables and units correctly labelled.</td>
</tr>
<tr>
<td></td>
<td>ii. accurately interpret data and describe results – data is explained, conclusions based on data are somewhat attempted</td>
<td></td>
<td>• Data is discussed in written form</td>
</tr>
<tr>
<td></td>
<td>iii. state the validity of a hypothesis based on the outcome of a scientific investigation – hypothesis is accepted or rejected based on collected data</td>
<td></td>
<td>• Did the steps followed in the lab help or hinder the investigation?</td>
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<tr>
<td></td>
<td>iv. state the validity of the method based on the outcome of a scientific investigation - student states that the method and procedures work or not</td>
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<tr>
<td></td>
<td>v. state improvements or extensions to the method that would benefit the scientific investigation – improvements to the lab and/or methods stated</td>
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<tr>
<td>5-6</td>
<td>i. correctly collect, organize and present data in numerical and/or visual forms - data table(s) is labelled with correct units, graph(s) is titled, labelled and plotted, all are organized</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>ii. accurately interpret data and describe results using scientific reasoning - data is explained well, conclusions based on data are described using scientific language</td>
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<tr>
<td></td>
<td>iii. outline the validity of a hypothesis based on the outcome of a scientific investigation – hypothesis is accepted or rejected based on collected data, outlined steps are given to explain validity</td>
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</tr>
<tr>
<td></td>
<td>iv. outline the validity of the method based on the outcome of a scientific investigation - student outlines the method and procedures and how they affected the results</td>
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<tr>
<td></td>
<td>v. outline improvements or extensions to the method that would benefit the scientific investigation – improvements to the lab and/or methods are outlined; further ideas are mentioned</td>
<td></td>
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</tr>
<tr>
<td>7-8</td>
<td>i. correctly collect, organize, transform and present data in numerical and/or visual forms – data table(s) and graph(s) are both correctly labelled with units and important information, organized and accurate</td>
<td></td>
<td>Most often missed part of the conclusion: what did you learn, how did you learn it and what would you do differently next time (method/procedure). Also, what experiment would you want to do now?</td>
</tr>
<tr>
<td></td>
<td>ii. accurately interpret data and describe results using correct scientific reasoning – data is used to explain findings, adds to conclusion and creates new scientific understandings</td>
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<td></td>
<td>iii. discuss the validity of a hypothesis based on the outcome of a scientific investigation – discussion of how hypothesis is proven or not, is based on specific evidence from data</td>
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<tr>
<td></td>
<td>iv. discuss the validity of the method based on the outcome of a scientific investigation – student discusses the method and procedures and how they affected the results</td>
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<tr>
<td></td>
<td>v. describe improvements or extensions to the method that would benefit the scientific investigation – improvements to the lab procedure are described as well as some new research ideas given</td>
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</tbody>
</table>
Lab Report is due!

Pull out your lab report and turn to the rubrics
Steps to complete:

- Start with Criterion B, look at each strand (red circle) and read the bolded words. Start at the 7-8 box and see if you meet the criteria in this box, for each strand. If not, go to the next box, the 5-6 box. When you find the strand that most closely matches what you have, put a checkmark. **Do all 4 strands.** They may not be in the same box, in fact, they frequently are NOT!

<table>
<thead>
<tr>
<th>Achievement Level</th>
<th>Level Descriptor</th>
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<th>Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-8</td>
<td>The student is able to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i.</td>
<td>describe a problem or question to be tested by a scientific investigation – question has variables specifically stated and uses scientific language.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii.</td>
<td>outline and explain a testable hypothesis using correct scientific reasoning – hypothesis is specific and clearly outlined, can be tested by the experiment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii.</td>
<td>describe how to manipulate the variables, and describe how sufficient, relevant data will be collected – variables are described and labelled correctly, variables are as specific as possible, data table is present and columns are labelled and described</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iv.</td>
<td>design a logical, complete and safe method in which he or she selects appropriate materials and equipment – pre-lab shows effort and thought, materials are defined well, with correct amounts, and the method made for the experiment is safe.</td>
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<td></td>
<td>i. √</td>
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</table>

- Is the question well stated, using learned vocabulary and variables?
- Hypothesis has specific variables, is written in a testable way and uses the vocab learned.
- Are the variables clearly labelled in every step that uses them?
- Pre-lab is well done, procedure takes into account safety and required materials.
Second step to complete:

- Now do Criterion C, look at each strand (red circle) and read the bolded words. Start at the 7-8 box and see if you meet the criteria in this box, for each strand. If not, go to the next box, the 5-6 box. When you find the strand that most closely matches what you have, put a checkmark. Do all 5 strands.

### Criterion C: Processing and Evaluating – Music and Memory Lab

<table>
<thead>
<tr>
<th>Achievement Level</th>
<th>Level Descriptor – The student is able to:</th>
<th>Student</th>
<th>Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-8</td>
<td>i. correctly collect, organize, transform and present data in numerical and/or visual forms – data table(s) and graph(s) are both correctly labelled with units and important information, organized and accurate</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii. accurately interpret data and describe results using correct scientific reasoning – data is used to explain findings, adds to conclusion and creates new scientific understandings</td>
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<tr>
<td></td>
<td>iii. discuss the validity of a hypothesis based on the outcome of a scientific investigation – discussion of how hypothesis is proven or not, is based on specific evidence from data</td>
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<tr>
<td></td>
<td>vi. discuss the validity of the method based on the outcome of a scientific investigation – student discusses the method and procedures and how they affected the results</td>
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<tr>
<td></td>
<td>iv. describe improvements or extensions to the method that would benefit the scientific investigation – improvements to the lab procedure are described as well as some new research ideas given</td>
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</tbody>
</table>

| 7-8               | ii. |         | Most often missed part of the conclusion: what did you learn, how did you learn it and what would you do differently next time (method/procedure). Also, what experiment would you want to do now? |