Science Skills:
Improving Student Lab-Note-Taking Skills
A Real-Life Example

David Schmitter

Abstract
Abstract: Students usually don’t know how to record observations, data, etc. This activity was a way for me to bring my own research lab notebook to show them how important this skill is and to have them compare a useful set with a non-useful set of lab notes.

Keywords:

This activity may be reproduced as long as the original author and credit to the University of Nebraska are maintained.

Funded by the National Science Foundation and the University of Nebraska

© 2004 University of Nebraska
Improving Student’s Lab Notes

The lead teacher led the students during a lab. The lab consisted of the students burning a sugar cube and crushed sugar and recording their observations. I noticed that their notes were very minimal. The teacher and I designed this activity early in the first semester after I had observed, and really did not leave a good impression of what they did during the lab. Their notes typically consisted of one or two words and included little detail. It would be impossible to repeat the experiment from their notes. The lead teacher and I designed this activity to get them to improve their lab notes.

The activity consisted of two parts. For the first part I photocopied onto transparencies two pages from my own lab notebook. We did this to show the students the amount of detail that I need to use when I am recording information for my experiments. The first page from my lab notebook demonstrated my thought process while trying to fix a piece of equipment. The page was filled entirely of prose explaining what I attempted and what worked and what did not. At the bottom of this page I had a picture drawn of the broken piece that I fixed. I mentioned the necessity to use pictures when something is hard to explain. The second page from my lab notebook consisted of a large data table. It was meant to show the students the importance of organizing their data in a clear way.

The second part of the activity involved looking at lab notes from their lab that I created. I created two sets of notes for the lab that they had done. One set was very similar to the notes they had taken: they had very little detail and it would be impossible to repeat the lab from the notes. We showed the notes to the students and we talked about what was good and bad about them. Then I showed the students a second set of notes that I created. This second set of notes was very detailed. It had data organized in tables, and included descriptions of each of the steps in the process. We then talked about why these notes were better than the first set.

If I were to repeat this activity, there are things that I would repeat and there are things I would change to improve it. I think it was advantageous for the students to see notes from a real lab notebook. It gave them a chance to get an understanding of the importance of lab notes. I also think that it was important to show them the picture I drew in my lab notebook so that they could see lab notes are not just words and numbers. Comparing the sets of notes related to the lab they did was important as well. It gave them a chance to see how they could improve notes in a lab they did. Sharing this idea allowed other scientists to do similar activities with their students.

However, one thing that could be improved would be to continue this concept with the students throughout the year. The lead teacher and I did not follow through on this concept by reminding the students frequently about their lab notes.

Included below are the copies from my lab notebook that I used, as well as the notes I made from the lab the students did.
Began last part of Sugar cube lab. 
We will burn the first cube whole and burn the second cube after crushing it with a mortar and pestle.

<table>
<thead>
<tr>
<th>Sugar Cube to be burnt whole:</th>
<th>Sugar Cube to be crushed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass of Al Boat: 12.5 g</td>
<td>Mass of Al. Boat: 12.4 g</td>
</tr>
<tr>
<td>Mass of Boat and Cube: 14.1 g</td>
<td>Mass of Boat &amp; Whole Cube: 13.7 g</td>
</tr>
<tr>
<td></td>
<td>Mass of boat and Cube after crushing: 13.6 g</td>
</tr>
<tr>
<td>Mass of Cube: 1.6 g</td>
<td>Mass of Whole Cube: 1.3 g</td>
</tr>
<tr>
<td></td>
<td>Mass of Crushed sugar: 1.2 g</td>
</tr>
</tbody>
</table>

It appears that we lost some sample when we crushed it. Looking at the mortar, we saw some sugar in the bottom of the pestle.

Side Note: Aluminum boats were made from typical Aluminum foil found in any store and folded such that there was only one layer of one foil separating the sugar from the flame.

Time A: Lit Bunsen Burner with O-Ring stand ~ 10 cm above the metal part of the Bunsen Burner, the very top of the burner, before the flame.

Time B: Bunsen Burner burning well. Slits on burner are all of the way open.

Time C: Placed Boat with whole sugar cube above the flame on the O-Ring stand. The sugar cube was positioned to be directly above the flame, this was a little difficult since we wanted to avoid burning ourselves.

Time D: Cube is beginning to melt into a black, gooey liquid. There is a yellow-ish smoke coming from the cube.

Time E: Cube is predominately the black liquid goo. There is more yellow smoke coming from the cube and it absolutely reeks. Smells like burnt marshmallows.

Time F: Since time was running out, Mrs. Rippe took the Bunsen Burner and lifted it closer to the Al foil. This caused a large plume of the yellow-ish smoke to rise up from the black goo, and the black goo caught on fire. We turned off the Bunsen Burner.
After allowing the foil to cool, we placed the foil with the burnt sugar cube onto a triple beam balance to mass it out. We had to use a different balance because the original balance that we used was already being used.

Mass of Foil and Burnt Black Goo: 13.5 g  
Mass of Black Burnt Goo: 1.0 g  
Mass of Sugar Cube lost to reaction: 0.6 g

Time G: Placed Foil with crushed sugar cube on it over the Bunsen Burner with most of the sugar positioned directly above the flame. The O-Ring stand was about 8 cm above the Burner; we lowered it to increase the heat to the sugar cube.

Time H: Powdered sugar began to smoke and smell. It is forming black goo similar to the goo when we burned the whole cube.

Time I: Sugar lit itself on fire. We turned off the Bunsen Burner and allowed the sugar to burn.

Time J: Massed out the melted powdered sugar.

Mass of Burnt Powdered Sugar and Al foil: 12.8 g  
Mass of Burnt Powdered Sugar alone: 0.8 g  
Mass of powdered Sugar lost to reaction: 0.4 g

Sugar Cube Lab – Lab Notes Example #2

Mass of Al boat and Sugar Cube: 14.1  
Mass of Al boat and crushed sugar cube: 13.6

Time A: Placed sugar cube above flame to begin burning it.

As the cube heated, the sugar began to melt into a goo. It also gave off some smoke and smelled very bad.

Time F: Sugar cube lit itself on fire. Removed from heat.

Mass of Al boat and melted Sugar cube: 13.5

Time G: Placed crushed sugar cube above flame.

This had the same reaction as the whole cube burning.

Time I: Powdered sugar lit itself on fire. Removed from heat.

Mass of Al boat and melted powdered sugar: 12.8
5" CQIB reads 6.1 x 10^-3 Torr
Turned on TPA

When I tried to turn on TPA, it immediately turned itself off. Strange. So I turned off the VPC power and turned it back on. Still would not turn on. Then I switched the two 5" Tor gauge cables. This time we could see that the main chamber was reading to below 1 x 10^-3 Torr, but the compaction chamber Ion gauge would not turn on. I switched the cables back. This is clearly a problem with the controller. After skimming through the manual, I turned the VPC off and checked the fuse column. I fused, there was a break in the fuse.

Brooke:

Mark & I agree this is probably the problem. I will go to the electronics shop to get a new one.
<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Power (Amps)</th>
<th>Voltage (Volts)</th>
<th>Current (Amps)</th>
<th>Power (Watts)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00</td>
<td>2.93 x 10^2</td>
<td>240</td>
<td>.07</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>8:00</td>
<td>9.01 x 10^2</td>
<td>270</td>
<td>.12</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>9:18</td>
<td>9.08 x 10^2</td>
<td>293</td>
<td>.19</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>8:18</td>
<td>9.12 x 10^2</td>
<td>291</td>
<td>.25</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>8:20</td>
<td>9.16 x 10^2</td>
<td>304</td>
<td>.31</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>8:30</td>
<td>9.20 x 10^2</td>
<td>310</td>
<td>.33</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>8:51</td>
<td>9.20 x 10^2</td>
<td>312</td>
<td>.33</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>9:00</td>
<td>9.20 x 10^2</td>
<td>312</td>
<td>.33</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>9:12</td>
<td>9.24 x 10^2</td>
<td>313</td>
<td>.33</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>9:22</td>
<td>9.24 x 10^2</td>
<td>313</td>
<td>.33</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>9:43</td>
<td>9.24 x 10^2</td>
<td>309</td>
<td>.33</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>9:53</td>
<td>9.24 x 10^2</td>
<td>303</td>
<td>.31</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>10:02</td>
<td>9.28 x 10^2</td>
<td>292</td>
<td>.35</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>10:10</td>
<td>9.28 x 10^2</td>
<td>284</td>
<td>.36</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>10:17</td>
<td>9.32 x 10^2</td>
<td>278</td>
<td>.37</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

10:25 Stopped sputtering after about 2.25 hrs
10:37 Stopped Scraping. Opened GUN and GUN
11:23 Began Scraping
11:32 Stopped Scraping
1:00 Began Scraping
1:10 Stopped Scraping
2:33 Began Scraping
2:48 Stopped Scraping