ETP Cover Sheet

Title of ETP	The importance and relevance of lab notebooks
Name of IISME Fellow	**Todd D. Seals**
Fellow's year-round email	toddseals@hotmail.com
Sponsor Company	Lockheed/Martin
Name of Mentor	Jeff Larson
National Bd Certificate Area	Adolescence and Young Adulthood Science
Category	Curriculum: **Science** Level: **High**
Objectives	1. Students will be able to perform basic lab procedures and record data obtained in an organized fashion to be used for future reference. 2. Students will build confidence in working as a team instead of as individuals. 3. Students will develop problem solving skills to be used throughout life
Abstract (50 words or less)	This project is basic lab procedures that are performed using basic lab equipment. Students will develop a notebook, which outlines the uses of the equipment and procedures for such use. Finally, students will write down all information pertaining to a lab in this notebook in an organized fashion that could ultimately be used by anyone to obtain the same results.
Describe how your ETP aligns with the National Board Standard stated in your proposal.	My ETP focuses on students actually DOING lab procedures and developing their own resources for future use. The students will be engaged in their work while creating information (basic procedures) that they can use as references for future lab experiments. While the students are constructing their "procedure/equipment" references, they will be focusing on other uses for the material. Throughout the year the notebooks will be used constantly while performing labs. Thus, the notebooks will aid in the student's scientific inquiries.
Resources Needed	Basic lab equipment and supplies. Students will need to provide their own notebooks.
Evaluation/Assessment Measures Used	A visual and verbal assessment will be used for the first two sections of the notebook—equipment and procedures. A rubric will be used for scoring the remainder of the notebook--- lab data and charts/graphs
Formatting specifications	PC _?_ or Mac____ **(Must be in Word or Text Format)** Software used. ____Windows 98_____
Submitted Copy	**Soft and hard copy due to peer coach by the end of the summer fellowship. Also, a copy of the cover sheet signed by school site administrator submitted to IISME, 10420 Bubb Road, Cupertino, 95014 by Oct.1, 2001 to receive $300 grant.**
Mentor Signature and comments	
Administrator's Signature and comments	

Education Transfer Plan

By

Todd D. Seals

“The Importance and Relevance of Lab Notebooks”

The primary objective of this plan is to help the student's present information in an organized fashion in the simplest manner possible and to create a reference bank of material to refer to at the same time. **NBS: Adolescence and Young Adulthood Science #III-Instruction Resources, IV-Engagement, and VII-Science Inquiry**. To do this, I am going to have the students generate a lab notebook that will contain 3 distinct sections. The first section will be comprised of pictures/drawings of general lab equipment and their uses. The second section will be dedicated to specific, yet common, procedures that the students will reference in future lab reports. The third section will be devoted to specific labs that we perform. Each section will have specific requirements that will be assessed using a cumulative rubric. By compiling a notebook for a required science class in this fashion, I hope to give the students an understanding of how organization can play a key part in their lives and future careers. By recording trials, failures, and successes, students should gain the understanding of "progressive resolution". Over time, pieces of information can be linked together to come up with a whole complete idea that would not have had meaning otherwise. A great example of this is Benjamin Franklin. By recording both failures and successes, Ben was able to come up with amazing inventions/discoveries such as electricity, light bulbs, etc. I also want to get the message across that items, such as lab notebooks, are considered legal documents in industry--- therefore scientists have to follow guidelines when writing them. In the past, I have found that explanations for key procedures need to be repeated many times---- thus wasting valuable time. With this system implemented, I will be able to refer students to a past procedure and "tweak" it, if needed, for a current lab inquiry.

The first week of class we will focus on creating the first section and second sections (reference) of the notebooks. For each piece of equipment there will be a mini exercise with a verbal assessment by myself to check for understanding. Upon correct completion of each exercise, students will receive a "stamp" from me. I employ a rubber stopper with a unique pattern I have carved in myself to serve as a "completion by due date stamp". Using this format, no students can copy/cheat on the due date aspect of my assessments.

I. Lab Notebook Section One

In this section, students will have drawings/photos of common lab equipment and the detailed "typical" uses of such equipment. Examples of the equipment should be set out for students to see and handle (carefully for glass items!). The following is a list of equipment students should become familiar with, with a little help from the teacher:

?Beaker(s) various sizes
?Graduated cylinder(s)
?Thermometer(s)
?Powder and liquid funnel
?Hot/Cold water bath
?Erylmeyer flask(s)
?Hot plate
?Triple beam balance
?Scale
?Bunsen burner
?Hot glove
?Test tube(s)/holder
?Meter stick
?Crucible w/tongs
?Mortar and Pestle
?Stirring rod
?Pipette
?Well tray

II. Lab Notebook Section Two

In this section, students will perform mini-labs to understand the procedures of how to use each piece of lab equipment. Upon completion, I will "stamp" their work appropriately. Below is a listing of proposed procedures. Students will be expected to summarize procedures on their own.

Beaker(s) various sizes—Notice how increments INCREASE from the bottom going up on one side and do the exact opposite on the other. One is for adding liquid to the container, one is for pouring out a specific amount…..think about it!! We typically use beakers the most. Used for measuring, mixing, or heating liquids. Measure out: 30ml into the 50ml, 100ml into the 250ml, and 650ml into the 1000ml. Now pour out ~10ml from the 50ml beaker, ~50ml from the 250ml beaker, and 250ml from the 1000ml beaker.

Graduated cylinder(s) --- much SMALLER increments than the beakers, why?_____. When determining the amount of liquid in a container, look at the bottom of the **meniscus** (see photo). Measure out 7.5ml of water into the 10ml graduated cylinder (yellow bottom). Now measure out 75ml of water into the 100ml cylinder (clear plastic).

Hot plate--- Used to heat up a "substance" liquid, solid, or gas. Try not to let a container of liquid completely vaporize or else what may happen? Usually we only use beakers on the hot plates. DO NOT touch foreign substances to the plate!!! We try to set beakers containing liquids on a moderately cool hot plate, why? ALWAYS turn off hot plates at the end of your lab!!!

Thermometer--- Notice the thermometers are in metal sleeves, why? Will that have any effect on our measurement of temperature (observable transfer of heat energy)? Why or why not? Put 200 ml of water into the 250ml beaker. Insert the thermometer CAREFULLY--- don't just drop it in or you will crack the beaker. Let the thermometer sit for 1min. and then determine the temperature where the top of the red line stops. Record this value in degrees Celsius in the box next to your drawing. Set the beaker on the hot plate on number 4 and let sit. Be careful not to touch the hot plate…it's ***HOT***!!! Observe the temp. until it stops rising and record the final value next to your previous value.

Erylmeyer flask(s)--- We use this weird shaped container mostly when we start dealing with properties of gases. Their unique shape makes them difficult to clean!!! Measure out ~25ml in the 100ml flask, ~150ml in the 250ml flask, ~400ml in the 500ml flask, and ~600ml in the 1000ml flask.

Triple beam balance--- Used to measure out exact masses of substances. This piece of equipment needs to be "calibrated" first (made accurate). To do this, push all of the weights to the far left first. Next look at the white pointer mark on the balance arm, this should be pointing directly at the white mark on the balance frame. If the arm mark is higher, turn the weight adjustment knob (located under the silver weight pan) clockwise. If the arm mark is lower, turn the same knob counter-clockwise. Once the marks are equal, you're set to measure masses!! Set block 1 on the weight pan. Move the largest weight (100g increment) to the right first—if it causes the pointer to go too low, put it back in its place. If the mark is still high, push it over one more slot. Keep doing this until the mark goes to low, then push it back one. Next move the medium sized weight (10g increment) one notch to the right until it causes the mark to go too low—then move it back one. Next move the smallest "slider" weight (0.1g increment) to the right until the 2 marks match up perfectly. Now record the mass in the following manner: record the mass of the large weight's position, then the medium weight's position and finally the small weight's position. Using this balance you can accurately determine the mass of an object to the nearest 1/10 (0.1) of a gram. Determine the masses of the blocks marked 1-10 and record in your data table next to your drawing in the row marked "BALANCE".

Scale--- We use the scale for weighing most of the time. However, the scale only goes up to 200g. Determine the mass of the blocks marked 1-10 again and record the values to the X.XX position. These scales can record to the nearest 1/100 (0.01) of a gram. Record these masses under your previous masses in the row marked "SCALE". How close where these results to your previous determination? Calculate the difference and record in the row below marked "DIFFERENCE".

Bunsen burner--- These are the "old school" type of heating devices. We will not be using them as much due to the hazards associated with them i.e.--- burning hair, clothing, eyeballs, etc. To use a Bunsen burner, first hook the gas line up to the "gas spigot" at the lab table. Next turn the "air flow collar" at the base of the burner until it almost completely closed. Open the gas control knob on the burner base 2 turns. Get a match ready and turn on the gas at the "spigot". Hold the match off to the side at the top of the burner. Adjust the flame using the control knob until a steady flame with a blue center is achieved. Dip the niochrome wire loop into the "boogie powder" then hold it in the flame. Write down the color observed next to your picture. Turn off the gas at the spigot when finished.

Hot glove--- Orange glove used to pick up or hold hot objects. DO NOT hold in a direct flame.

Liquid funnel vs. Powder funnel--- one has a smaller "tube", the other has a larger tube. Which is which? Measure out 25 grams of "dandruff dust" into a weight cup using the scale and pour it into a test tube using one of the funnels (powder hopefully). Measure out 30ml of water and pour into a test tube using the other funnel (liquid hopefully). Save water in T.T. for next part!!

Test tube(s)/holder--- Small glass cylinders used to hold small quantities of materials. Commonly used for mixing liquids with liquids or liquids with solids. Holder is a spring type device used to hold a test tube in a flame (from Bunsen burner) or just a hot test tube. Put the thermometer into the test tube and grasp the tube with the test tube holder. Light the Bunsen burner, as before, and hold the bottom of the tube barely in the flame. MAKE SURE TO POINT THE OPEN END OF THE TUBE AWAY FROM PEOPLE!!!! Heat in the flame until the water starts to boil. Remove from the flame, put on hot glove, and record the temp. next to your drawing as indicated. Turn of gas supply and pour out water. Be careful because hot glass looks just like cool glass!!!!

Meter stick--- Used for taking measurements of length.
1000mm = 100cm = 10dm = 1m. Notice on your meter stick there are 2 sides--- one is metric, one is English (inches and feet). We will ONLY use the metric side in this class!! Take the longest measurement possible of blocks 1-10 from earlier. Record the measurement to the smallest increment possible (mm). For example:

Record the longest measurement for each block in the correctly #ed box next to your drawing.

Crucible w/tongs--- Ceramic dish used for baking solids—removing the moisture content usually on a hot plate. Tongs are used to manipulate the crucible once it gets hot. Do not OVERHEAT the crucible or it may crack.

Mortar and Pestle--- like ancient cave-people (politically correct) you too are going to need to grind up "hard stuff" at times. Take a piece of $CaCO_3$; determine its mass using the balance (record mass) and then put into the mortar. You got it…start grinding until it is a fine powder.

Stirring rod

Pipette--- clear plastic dropper. Used to transfer small amounts of liquids by drops. To use a pipette, squeeze the bulb end completely and stick the opposite end down in your liquid. Release the pressure on the bulb end and withdraw your liquid! Put 30ml of water into your 50ml beaker from the faucet. Using your pipette, determine how many drops of water are needed to fill your 10ml grad. cylinder. Record the value next to your drawing. Do NOT use pipettes as "squirt toys".

Well tray--- clear or white plastic tray. We use these a LOT for microchemistry---chemistry on a *micro* scale. Using your pipette, determine how many drops are needed to fill one of the micro wells. Record the value next to your drawing.

Hot/Cold water bath--- beaker with a specified amount of water inside which is either heated on a hot plate to increase temp. or has ice added to drop temp. This "bath" usually has another container that sits inside of it to try and get the contained liquids temp. equal to that of the water baths temp. Put 400ml of ice into a 500ml beaker. Add water to the 400ml mark. Put 20ml of water into a test tube. Place the test tube into the water bath until the temp. of the test tubes water is 5? C. Pour out the ice water and put 400ml of water into the beaker and sit on the hot plate on #6. Put 20ml of water into a test tube and sit it in the water bath until the temp. of the test tubes water is 85? C.

(front cover)

Student Lab Notebook

By:

For: Mr. Seals

I. Section one

Equipment Reference Page

Objective: Draw an identifying/distinguishing picture of each piece of lab equipment and write general uses underneath as indicated. In spaces provided, write answers to the "general lab procedures" for your mini-labs.

Beakers (drawings)

50ml (fig.a) 250ml (fig.b) 1000ml (fig.c)

***General uses:** _____

1.) Why do increments increase in both directions?_____

_____

Graduated Cylinder (drawings)

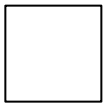
10ml (fig.d) 100ml (fig.e)

***General uses:** _____

1.) Why smaller increments than the beakers?

_____

Hot Plate (drawing) (fig.f)



*__General uses:__ _____

*__Hazards:__ _____

1.) Why not let a liquid completely vaporize?

_____

Thermometer (drawing) (fig.g)

1st water temp.

2nd water temp.

*__General uses:__ _____

1.) Why are the thermometers in metal sleeves? _____

2.) Will the sleeves have any effect on the measurement of temperature? Why or why not? _____

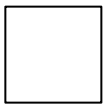
Erylmeyer Flask (drawing)

100ml (fig.h) 250ml (fig.i) 500ml(fig.j) 1000ml (fig.k)

*__General uses:__ _____

1.) Why do you suppose these are so hard to clean? _____

Triple Beam Balance (drawing) (fig.l)



*__General uses:__ _____

Scale (drawing) (fig.m)

*__General uses:__ _____

Data table for mass measurements

BLOCK #	1	2	3	4	5	6	7	8	9	10
BALANCE										
SCALE										
DIFFERENCE										

Bunsen Burner (drawing) (fig.n)

Color observed

*__General uses:__ _____

*__Hazards:__ _____

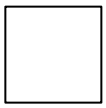
Hot Glove (drawing) (fig.o)

*__General Uses:__ _____

Funnels (drawing)

Liquid funnel (fig.p) Powder funnel (fig.q)

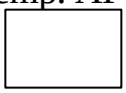
*__General uses:__ _____



Test tube/ holder (drawing)

Test tube (fig.r) Test tube HOLDER (fig.s)

Water temp. AFTER boiling!



*__General uses:__ _____

*__Hazard when heating?__ _____

Meter Stick (drawing) (fig.t)

*__General uses:__ _____

Measurement data table

Block #	1	2	3	4	5	6	7	8	9	10
Length										

Crucible w/tongs (drawing) (fig.u)

*__General uses:__ _____

Mortar and Pestle (drawing)

Mortar (fig.v) Pestle (fig.w)

mass

*__General uses:__ _____

Pipette (drawing) (fig.x)

Drops to fill 10ml cylinder

*__General uses:__ _____

*Something we do **NOT** do with a pipette? _____

Well Tray (drawing) (fig.y)

Drops to fill one well

*__General uses:__ _____

Hot/Cold water bath (drawing) (fig.z)

*draw the ENTIRE setup!!

*__General uses:__ _____

II. Section two

General Procedure Reference Page

Objective: Provide general guidelines for the proper usage of the following equipment. These procedures are to be referenced later when unsure!!!!! Don't forget you have them. As you develop more, add to the list.

P-1 Beaker usage

_____

_____

_____

P-2 Graduated cylinder usage

_____

_____

_____

P-3 Hot plate usage

_____

_____

_____

P-4 Thermometer usage

_____

_____

_____

P-5 Erylmeyer flask usage

_____

_____

_____

P-6 Triple beam balance usage

P-7 Scale usage

P-8 Bunsen burner usage

P-9 Hot glove usage---if you don't get this one you need to go back to kindergarten

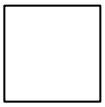
P-10 Liquid/Dry funnel usage

P-11 Test tube/holder usage

P-12 Meter stick usage

P-13 Crucible w/tongs usage

P-14 Mortar and Pestle usage



P-15 Pipette usage

P-16 Well tray usage

P-17 Hot/Cold water bath

***Add additional procedures from here on starting with P-18 and so on. Leave several pages available.**

III. Section three

Personal lab work w/raw data, calculations, and necessary tables or graphs

Objective: Provide clear and precise information that will allow your experiment to be redone and provide the same results in the event you win the lottery and move to Guam!

1.) Results should be clearly presented---- in graphs or charts when appropriate.

2.) Mistakes should have one line crossing them out (mistake still visible) with the change made above original.

3.) You should reference procedures already established using the P-X format.

4.) You must include the sample I.D. of each substance, as well as the common name, at the beginning of each lab test in the **upper left corner**

5.) Initial and date each lab so we know **a.**When it was performed **b.** Who all performed it? Do this in the bottom right corner please.

Example

#001 Sucrose ($C_{12}H_{24}O_{11}$) (sugar)

#002 Grape flavor mix

Purpose: I am comparing the specifications indicated on the Kool-aid packet to "known" concentrations (by taste).

Procedures: Follow procedures per packet instructions.

1 cup = 236.5cm^3 (conversion chart)

1 quart = 0.945L (conversion chart) X 2 = 1.098L (1098ml)

1.) Measure out 236.5cm^3 of sugar per P-2. Add this to a pitcher.

2.) Add flavor mix per packet instructions

3.) Measure out water per P-2. Add this to pitcher

4.) Stir and taste. Does it taste "right"?

Observation: Tastes like crap. It is way too sweet.

Brainstorm: a. Conversion factor--- O.K.

b. Multiplication of conversion factor--- My problem. Used too little water. Need to add some more.

c. Need 1890ml of water, I already have 1098ml.

Procedure 2: 1.) Measure 792ml per P-2. Add to pitcher.

2.) Stir and taste.

Observation 2: Tastes fan-freakin' tastic!! Nice job.

Conclusion: Based on my data, I conclude that the specifications listed on the Kool-aid packet do meet the standard criteria.

*__**Notice**__:

? The original calculated volume of water was crossed out with a single line and replaced with the actual volume.

? The sample I.D.'s are presented first thing

? The lab is initialed and dated at the bottom

Notebook grading rubric

Objective description		Self	Peer	Teacher
Purpose present and labeled that makes sense	(0 1 2 3)			
Sample ID and common name present	(0 1 2 3)			
Procedures referenced properly	(0 1 2 3)			
Results present, clearly presented and make sense	(0 1 2 3 4)			
Tables, charts, or graphs labeled properly	(0 1 2 3)			
Analyst ID present and LEGIBLE	(0 1 2 3)			
Overall neatness	(0 1 2 3)			
Entire lab done on time	(0 1 2 3)			
	Totals:			
	Average:			
Comments by self evaluator:				
Comments by peer evaluator:				