

LOGBOOK – DAY 1 DATE : 15 JUNE

RESEARCH ORIENTATION

This is a lesson on researching conducted by your teacher You may have this orientation lesson any day in week one.

Definitely something that has real use

Biology/ Chemistry

Possible Ideas:

- Can ~~any~~ bleeding ~~stop~~ be stopped at a faster rate using some artificial method?

- Identifying ~~the~~ a way to detect bacterial growth on food

- Something to do with Hygiene!!!

Very Important to all people

Hygiene ???

Already been invented by someone else - Vettigal

Teacher Sign Off that you have taken notes on the research orientation lesson

[Empty box for teacher sign-off]

INTRODUCTION/READING THIS DOCUMENT/CLASS  
DISCUSSION/QUESTIONS

Initial ideas ~~hard~~  
How do ~~hand~~ dryers affect spread of microbes in  
a bathroom? (Possible Question)

~~Final idea~~  
↓  
Too Hard to Measure

Do Hand Dryers Affect Microbe Growth on Hands Palms  
(Most Likely Question to investigate)

Go to the bathrooms and use agar plates to test  
microbe growth in a few specific areas.

~~Review~~

Decided to use <sup>5</sup> agar plates to see microbe growth  
in the bathroom before and after using hand dryers  
in a pilot test tomorrow to see a close representation/  
estimate.

(Look for things that have been done before)

Teacher Sign Off that you have read and understood the SRP instructions

[Empty box for teacher sign-off]

RESEARCHING SRP QUESTION

What topic(s) are you interested in investigating?

Make notes on your research findings and keep references.

Remember you need to write a "Background Information" summary  
on your project as part of your report.

Pilot Testing began today using 5 agar plates  
to test specific areas in the bathroom.

Hand palm, Hand backs, Body Upper/Middle/Lower

Swabbed before and after using hand dryers

Placed in incubator

Question 1: On the palm of the hand, is the count of bacteria  
less after using the hand dryer than before washing?

Question 2: On the back of the hand, is the count of bacteria  
less after using the hand dryer than before washing?

Question 3: On the upper body, is the count of bacteria less after  
using the hand dryer than before washing?

Question 4: On the middle torso, is the count of bacteria less after  
using the hand dryer than before washing?

★ Two Variables: Handwashing method? Hand dryer?

★ If there is more, where did it come from? (Eg. Hand →  
Environment? Or anywhere else?)

★ Compare pilot test results with previous knowledge

Teacher Sign Off that you have written background notes

[Empty box for teacher sign-off]

RESEARCH AND OUTLINE A METHOD

Make a list of sites you are visiting and record references

Decide on a general question

References

- 1) Best et al (2015) reported use of air dryer was associated with greater spread of airborne microbes than other drying methods.
- 2) Best et al (2014) reported warm air dryers result in increased microbial cross contamination via airborne dissemination to environments.
- 3) Huang et al (2012) reviewed existing evidence and indicated removal of bacteria by warm air dryers might be affected by handwashing technique. They also reported that warm air dryers removed less bacteria than paper towels.
- 4) Yamamoto et al (2005) reported that after hands were washed with non anti-bacterial soap, both warm air dryers and paper towels reduced bacterial count, with paper towels removing more bacteria.
- 5) Gustafson et al (2000) reported after the use of non anti-bacterial soap, the use of warm air dryers in removing bacteria from washed hands did not differ from paper towels.

Known: air dryer works ✓ paper towel works better ✓  
more bacteria spread in the air after using warm air dryer ✓

Less Known: 1) Which is better: use or no use of warm air dryer after soap washed hands?  
2) Where does the additional airborne bacteria come from?

Teacher Sign Off that you have written down and come up with a general or specific question

WRITING THE METHOD AND ORDERING EQUIPMENT

What variable (factor) will you change? (This is called the independent variable)

To make the investigation fair, you will need to keep everything else the same. Write a list of everything you will need to keep the same.

It is important to repeat an investigation several times. Why?

How many times will you repeat your investigation?

What variables need to be controlled?

What will you measure in this investigation?

What equipment do you need to order? Your teacher will collect your equipment order.

Key Variables:	Equipments
Use vs. No. use of air dryer	- Agar Plate x 24
Outcome Variable:	- Cotton Buds x 31
Microbe counts	- Coin, Permanent Marker
Controlled Variables:	- Sticky Tape, Ruler, Scissors
• Drying Time and Technique	- Incubator
• Washing Time and Technique	- Warm air dryer (JD McDonald)
• Cleanliness of Hands	(On second floor of N Block)
• Distance of air dryer from hands	Sample Size: $N = \left[ \frac{Z_{\alpha/2} + Z_{\beta} \times SD}{\Delta} \right]^2$
• Temperature of incubator	Assume SD = 1.45 (reference Yakamoto) (log SD = 0.15)
• Time in incubator of agar plate	$\Delta = 1 \text{ count (min. meaningful)}$
Paired Design to control variables	$\alpha = 0.05 \quad Z_{\alpha/2} = 1.96 \text{ (Two Tailed)}$
	$\beta = 0.10 \quad Z_{\beta} = 1.282$

$\therefore N = 22.1 \approx 23$  (get 24 to increase Power)

Teacher Sign Off that you have written the method and ordered equipment

WRITING THE METHOD AND ORDERING EQUIPMENT

Today I went to the incubator to check my Pilot test results. I counted the number of colonies in each agar plate and the results are below:

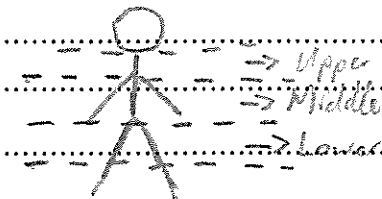
Hand Palm	Hand Back	Lower Body
Before: 140	Before: 87	Before: 200
After: 50	After: 124	After: 220

Upper Body	Middle Body
Before: 120	Before: 110
After: 200	After: 200

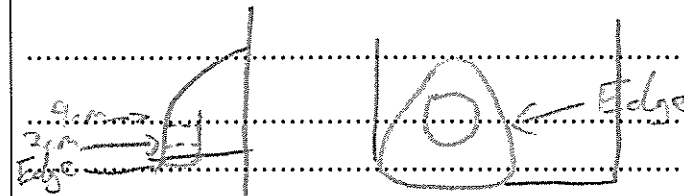
From these results, I believe that hand dryers do get rid of bacteria on the palms of the hands, confirming previous studies that they work. (See Huang et al and Yamamoto et al). The pilot test also confirms that the hand dryer spreads more bacteria into the environment and nearby bystanders and the user, as the count on the body dramatically increased. (See Best et al) I believe that the lower body count didn't rise dramatically like the others due to the fact that the hands partially blocked the air flow and resulted in more air moving towards other areas of the body.

BEGIN TO CARRY OUT THE TASK AND COLLECT DATA

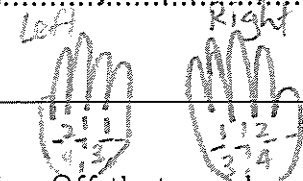
Raw data (results) is recorded here  
 The pilot test was conducted in the bathroom of the second floor of the N Block, and I used 5 agar plates to see the microbe count before and after using the hand dryer on 5 separate areas which were the upper/middle/lower body and hand palms and hand backs using cotton buds.



Part 2 of the project is to record the microbe count of the warm air dryer at different times during the day. I will record the edge, 2 cm in and 4 cm in the air dryer at 9:00, 11:00, 13:00 and 15:00. I swabbed the circumference for each time. This will be done on 2 days.



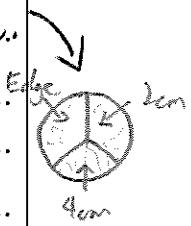
Part 3 requires 24 volunteers to wash their hands and use anti bacterial soap for 15 seconds before drying one of their hands with a hand dryer and the other left doing nothing. Swabbing is from chosen from 4 sections of both hands and then onto an agar plate and incubator.



Teacher Sign Off that you have begun the task

CONTINUE TO CARRY OUT TASK AND COLLECT DATA

20/06 Today I carried out Part 2 of my project which was to investigate the warm air dryer at different periods of time. In the morning I went to the same bathroom and swabbed the edge, 2cm and 4cm inside the WAD at 9:00 using a cotton bud. I then sticky taped the agar plate and labelled the areas on the agar plate. I repeated this at 11:00, 13:00 and 15:00.



22/06 Today I went to the incubator to check on the agar plates after 48 hours in 30°. Most of it had grown quite well and there were some trends I could see. It appeared that the edge had the most bacteria and their number continued to grow as the day passed, but the microbe count decreased as the day passed 2cm inside the WAD. This result was very interesting so I needed to do the test again tomorrow.

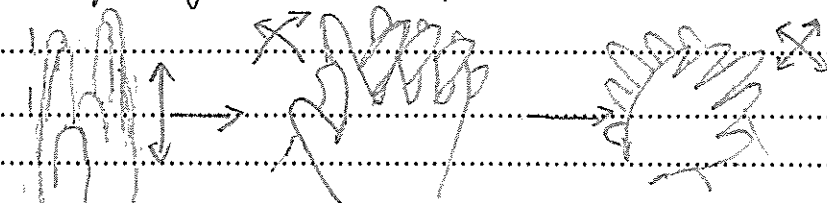
	Microbe Count		
	Edge	2cm	4cm
9:00	10	6	5
11:00	11	5	7
13:00	12	3	2
15:00	26	2	2

Today I also did Part 3 of my project in our science lesson. I gathered my equipment and took 6 participants at a

Teacher Sign Off that you have continued to carry out the task and begun to collect data

CONTINUE TO CARRY OUT TASK AND COLLECT DATA

22/06 Time to the bathroom. I told everyone except the tested volunteer to stay outside the bathroom and asked for their consent verbally to which all of them agreed to participate. For each participant I did a coin toss to see which hand would be controlled and which would use the air dryer for randomization. Each person would then apply two jobs of soap after wetting their hands with soap water and rub their hands together for 5 seconds before interlocking fingers and rub all surfaces for another 10 seconds and rinse their hands for 15 seconds. They then shook their control hand with a towel to rid excess water while the other hand was dried using a hand dryer for 15 seconds. I then randomized their hands into 4 sections and swabbed 1 section. I got through 12 people today before placing the incubator plates into the incubator. \*Hands were all 10cm from WAD



23/06 I took pictures of the WAD and the bathroom for further research and to illustrate data better. I also repeated Part 2 again today. (See previous page).

Teacher Sign Off that you have continued to carry out the task and begun to collect data

REFERENCING LESSON CONDUCTED BY YOUR TEACHER

24/06 Today I did the final 12 samples for Part 3, but this time I did the samples in groups of 3 because the previous time volunteers complained it was time consuming. It was more efficient today so I finished quite quickly. I placed the agar plates into the incubator. I also checked the results of the first 12 samples of Part 3 after 48 hours of incubation. ~~They~~ The results mostly showed that air dried hands had more colonies than controlled hands, but some of the colony numbers were quite erratic.

27/06 Came to school today to check samples from Part 2 and Part 3. Agar plates from Part 2 have been incubated for 96 hours which is double the amount of time from the other bunch. The results

	Edge	Microbe Count		Followed the previous trend but still found that 4cm inside had indistinct results, possibly due to temperature further inside killing microbes?
		2cm	4cm	
9:00	12	3	1	
11:00	13	3	3	
13:00	16	2	4	
15:00	17	1	4	

Agar Plates from Part 2 were incubated for 72 hours, but they still followed the trend that aired hands had more bacteria than controlled hands.

Teacher Sign Off that you have taken notes on referencing

COMPLETE THE REPORT

Start to write the electronic copy of the report. When completed it must be uploaded to "Assignments" on your class canvas page by the due date.....

Part 3 Results

Samples	Alred	Control	Sample	Alred	Control
1	3 L	33 R	13	5 L	5 R
2	20 R	9 L	14	11 R	1 L
3	88 L	4 R	15	50-I	50-I
4	100 R	7 L	16	12 L	1 R
5	30 L	12 R	17	16 L	16 R
6	27 L	43 R	18	2 R	19 L
7	25 R	11 L	19	24 L	2 R
8	24 R	16 L	20	33 L	4 R
9	19 R	7 L	21	3 L	6 R
10	3 R	12 L	22	4 L	11 R
11	2 R	5 L	23	50-I	50-I
12	12 R	7 L	24	50-I	50-I

50-I - Sample Obtained Inconclusive. Will reduce sample size to 21 and will use non-parametric Wilcoxon Ranked Test (Matthews & Newson)

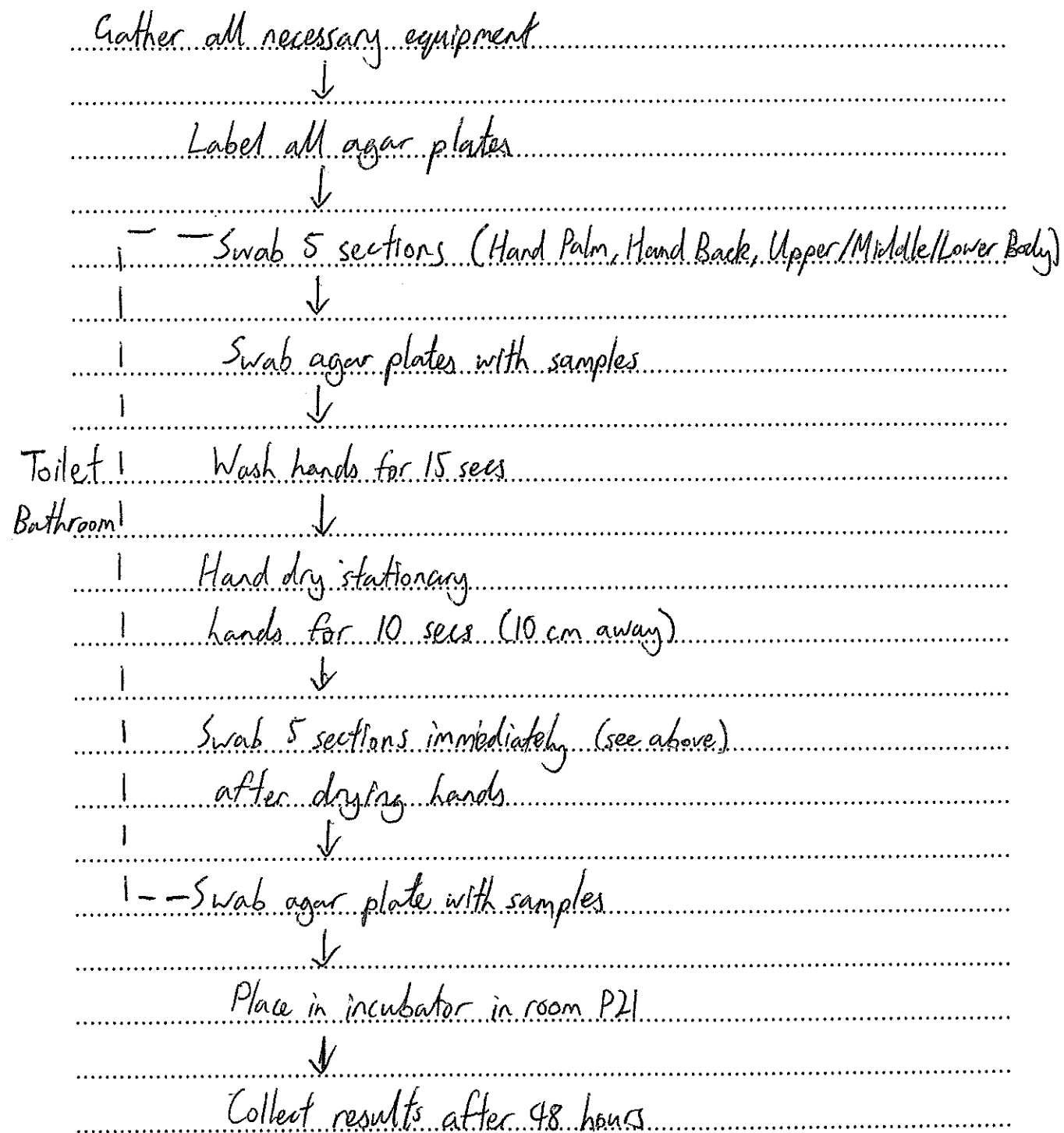
R: Right Hand L: Left Hand

Teacher Sign Off that you have continued to write your report

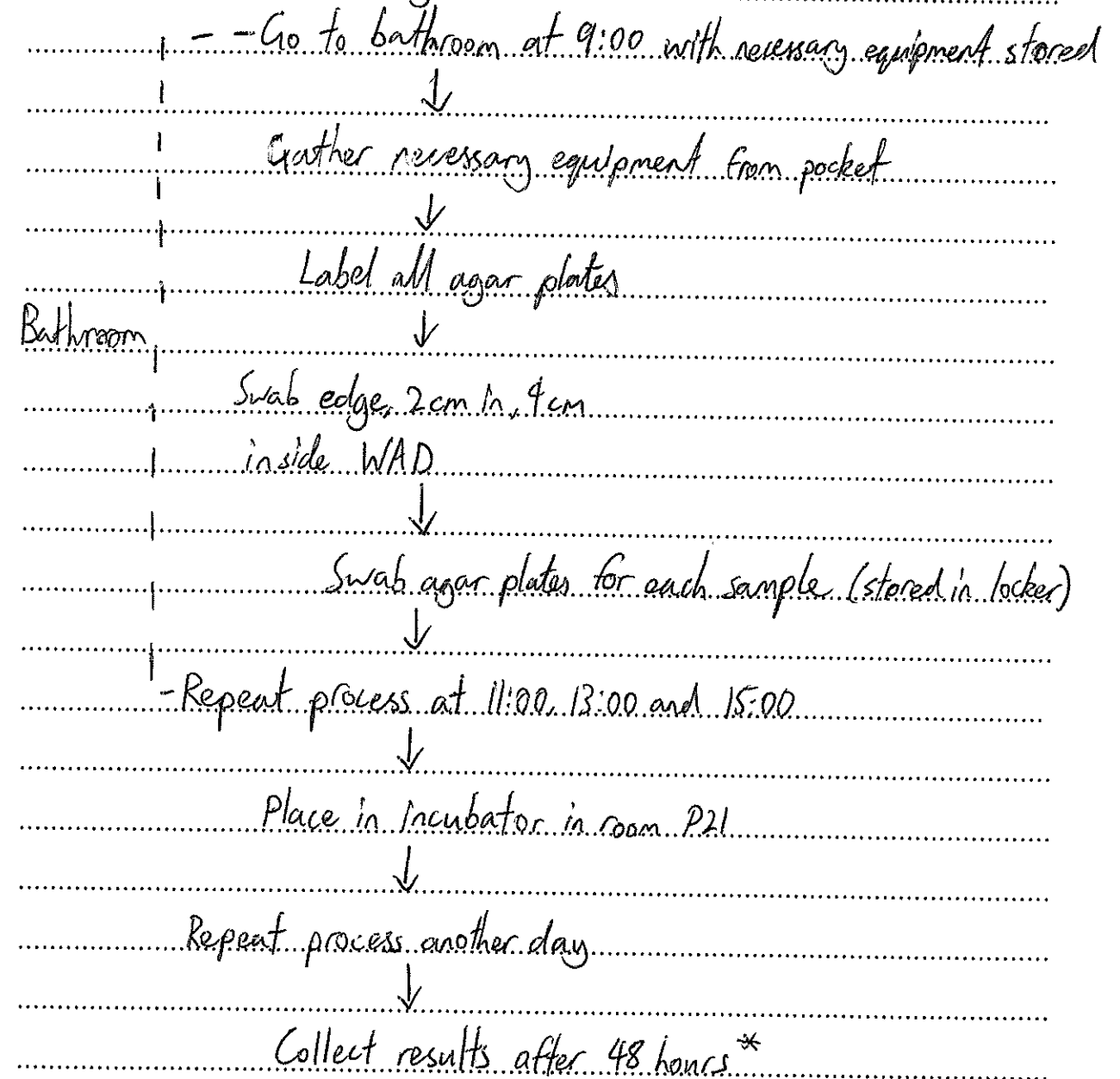


## Notes

### Flow Chart Pilot Test



### Flow Chart WAD Investigation



\* Because agar plates were not available before Wednesday afternoon, the second batch of samples was completed on Thursday. Because I checked with teachers that Saturday was unavailable, I counted microbial growth on samples on Friday (24 hours) and Monday (96 hours)



# Flow Chart Hand Investigation

Gather necessary equipment



Gather volunteers and ask for consent



- - - Label all agar plates



T	H
H	H
T	H
T	T

~~Swab 3 sections~~

Do coin toss randomisation for left/right hand and sample sections



Wash hands with anti-bac

soap for 15 secs (standardised hand washing method)

T=Tail

H=Heads



Dry 1 hand stationary with WAD

Dry 1 hand naturally by shaking

Bathroom



Swab 1 section of palm on both

hands immediately after drying onto agar plate



- - Repeat process with next samples on each volunteer



Place in incubator



Collect results after 48 hours\*

\* 24 hours and 72 hours visual check