# LBS Data Interpretation and Reflection day Class Dot points

**Here are some notes from our conversations about report writing.**

# Overarching Report writing tips

* When referring to the literature, paraphrase ideas.
* When writing the introduction, I often look at three journal articles relevant to my experiment at the same time to see how they have introduced the main ideas needed to understand what they are about to do. I look at these three at once and draw ideas from all three in a single sentence/sentences so I’m super certain I’m not repeating exactly what they said- but I’m saying the most important things.
* Have a go at reading/skimming through some other reports to give you an idea of structure.
* We are not using statistics in this report, we are describing graphs (the averages and standard errors). The graphs are enough to show our data for now!!
* Also ***See my report writing document for a simple summary of Science report writing***

# Title

* Descriptive of your main finding OR your overarching aim/question
* Can include pun/alliteration if you want☺
* E.g. “To bee or not to bee: Dust is the question” (Title of my thesis chapter on whether honeybees like coal dust or not) However, this title is missing the descriptive part so ideally it would have a pun AND a descriptive part to it.
* E.g. [Mines over matter: Effects of foliar particulate matter on the herbivorous insect, Helicoverpa armigera](https://onlinelibrary.wiley.com/doi/abs/10.1111/jen.12560)

**Conversation about Title suggestions:**

* Testing which artificial flowers attracted the most pollinators
* Artificial flowers and insect pollinators

# Abstract

* A catchy hook sentence (to get people excited to keep reading)
* 1 sentence about why it’s important (broader context)
* 1-s sentences about what you did. (summary of methods)
* 1-2 sentences of some key findings
* 1 sentence about why your findings are significant in the broader context.

# Introduction

**Tips when writing the introduction**

* Use the “upside down triangle” from the broadest information to the most narrow information.
* This sets up the IMPORTANCE of this work. Makes people get excited and want to read about your amazing experiment because it is so valuable!
* Links to the broader literature introduces the main concepts and context (look at the introductions of the papers we have shared, these will give the information you need.

**Group discussion Summary:**

1. Pollinators are important, under threat
2. Pollinators have been shown to like these things…
3. Citizen science- this is a collaborative project
4. What we know about pollinators already in terms of place i.e. Blue mountains/Sydney basin
5. Not much research has been done here so we should do a study
6. Hypothesis (can be a few)

**Our conversation about the introduction:***What is the who, what, when, where and why that we have to introduce for people to understand our experiment?*

* What studies have already been done
* who conducted our experiment. Introduce
* introduce citizen science
* [What] insects- what kinds are attracted to what
* [when]: why is this important at this time: preserving bees, keeping them alive climate, habitats, what is our prior knowledge
* why circle pattern
* literature on what they prefer
* they like blue and yellow
* surroundings plants are important
* what we hope to get out of this whole thing
* we wanted to see if artificial flowers could be used in the field, if they would attract pollinators at all.
* what characteristics about flowers do pollinators like about flowers the most.

are they attracted to the design? [possible further question from our study]

as in shape and depth, materials etc?

# Methods

**Note: Tips on writing the methods section:**

1. ACTIVE and PAST tense i.e “**We did science**” not “Science was done” Not “We are doing science”
2. Always full sentences, (not dot-points)
3. Enough detail so that someone can do the same thing as us if they want to☺
4. We brainstormed to remind ourselves of the methods. A good place to refer back to is our experimental “**how to guides”** for more details☺
5. This is a good place for **A DIAGRAM OF OUR EXPERIMENTAL LAYOUT** e.g. the flowers and the flower circle;)

**Group conversation about methods:**

* We made artificial flowers out of paper and plastic plates. And other materials such as pipe-cleaners. Some complex flowers and some simple flowers. For easy replication, we used yellow and blue to be attractive to pollinators and sugar water as nectar. We used black as a control.
* We planted them in a circle. We found the middle point and measured out the distance (distance apart) in the sun.
* We counted all the different pollinators that landed and drank. For 10 mins. Saw what other plants were near by, bingo walk, videos.
* Sizes of flowers, how they were made, locations of sites
* Backyard gardens in the Sydney basin.
* Yellow flowers
* Flowers with pipe- cleaners – to attract more bees
* Yellow, Blue, Control (Black) with paper and plastic, and two complex flowers

# Results

Tips on writing results

* Describe the main patterns in the graphs. E.g. What is the biggest? Smallest? Most Least? Are there any ‘outliers’ (weird bits that look very different from the rest of the results)
* Describe the most important information.
* Don't explain WHY you think this might be YET (but DO in the discussion!)
* This is the section where you **put all the graphs** you talk about in!

**Our conversation about results:**

**Graph: Average insects interacting with flowers**

* flower A had more bees interacting
* G had none
* paper is more attractive, apart from the blue plastic which is more attractive (in *discussion* can talk about why this might have been the case)

**Graph: Average insects Drinking**

* it says 0.1…
* lots of zeros!!!!
* the standard error is what we need for our data…
* Large standard error is an indicator of great variability! when overlapping the perceived difference is probably not ‘real’.

**Graph: Insect visitors to gardens**

* One stands out [ie. There is an outlier]
* a big difference to everything else
* what does that suggest?
* something else might be changing it, that isn’t included in our results
* it could be that the environment is slightly different to everything else
* could have just measured wrong
* the trend was that, the increase in real flowers didn't’ affect the amount of insects that came to the real flowers.

**Graph: total insects seen in all the gardens on all the flowers**

* Other insect is the biggest total was honey bee
* Then second bee
* Then leaf cutter bee.

**Graph: comparing colours**

* Yellow flowers are more popular
* Black flowers are the lowest, but not by much from the blue
* standard error is missing from the graph, likely to be inaccurate representation

**Graph: comparing plastic and paper (only simple ones)**

* we need the standard error
* as a small sample size anyway we would probably need to see what stands out.
* Both received insect visitors

# Discussion

**Tips when writing the discussion**

* What are the MAIN FINDINGS
* Did we prove our hypothesis correct? Do I results suggest something different?
* Don't repeat the results but refer to the results to discuss WHY they might be that way. Compare and contrast different results from different graphs to draw conclusions
* If we don't have strong enough evidence to show something, that is fine! We can say that there is not enough evidence. Or if we think we need more replication and we think that will support a trend we can sort of see, we can say there is “preliminary evidence to suggest that…. However further studies with greater replication etc are needed…”
* Can take guesses here.. why do you think the results turned out like they did? Can suggest future studies to test these guesses
* Link to the literature!!! Do our results agree with other experiments that did similar things? (Like the ones in the introduction)
* What would you do differently if you did this experiment again?
* What would you recommend other scientists study in the future based on our experiment

**Our conversation about the discussion**

*What were our main findings?*

* pollinators were attracted to our artificial flowers. This is a method that could be used more in future
* there were flies and wasps [not just bees]
* more replicates needed
* fancy mostly yellow (a) [was a winner]
* *Can we trusts that it's a winner?*
* yes because the error bars don't overlap.
* The flower A had a nectar guide in the centre
* the yellow flower A had petals, pipe-cleaners.
* if A was the favourite, what might be a ‘mechanism’, as in the reason why pollinators were more attracted)?
* because bees are used to petals and not use to a circle flower
* the complexity of it.
* it has more decoration
* could suggest further studies to try and isolate what is so attractive about ‘A’ to pollinators

*What were the limitations?*

* more replicates [would make us more sure]
* We didn't have as many replicates as we liked
* not all of flower B had nectar guides even though they might have meant to.
* the order of the flowers in the circle. We Should have put that in our methods.
* How did we do we choose which order to put the flowers in?
* we did it randomly
* Even though we know what flowers surrounded the artificial flowers in one garden, we didn’t know what flowers were next door
* There’s not many studies of pollinators in the blue mountains anyway, so our results are valuable

*Any changes we would make if we did it again?*

* *we could**arrange them [artificial flowers] in the same order*
* we could make them look more like flowers to see if that made them more attractive
* make sure we make the different materials actually the same colour
* be more deliberate with our complex flowers

*Do we think it’s worthwhile to do more with artificial flowers?*

* use paper not plastic.
* paper worked at least as well as plastic if not better and could be used in future experiments (cheaper and more environmentally friendly)

*How could we gather more data next time?*

* maybe in depends on the issues on rejecting the samples [the data sheets that weren’t filled out]
* We asked participants to do a lot of hard work
* the easier you make it for people the more data you’ll get, but balanced with the quality of information we gather
* if asking for volunteers could ask them to let us know if they can’t complete it and why, so we can factor that in for future citizen science projects

# Conclusion/recommendations (the last paragraph of the discussion)

* Summarise the main findings again
* Offer recommendations for future study in this area (remember you are now the world leading experts in this particular field of study because you are the ones who have done it!)
* A summary closing sentence to remind everyone how important and amazing the work you did is!

**Conversation about Conclusions**

* Pollinators (Bees?) prefer yellow to blue in our experiment
* Artificial flowers attracted insects
* We have preliminary findings about attractiveness and more work should be done.