Exploring EAL/D pedagogy and Interventions to improve reading comprehension skills in 7-10 Science.

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Introduction

Bonnyrigg High School's presentation is about enhancing students' comprehension skills in Reading for Stage 4 and 5 Science classes. The initiative began through the 2023 Leading EAL/D Education project, funded by the Department of Education, Multicultural Unit, an evidence-based, whole-school approach study. Over the course of 2 terms, our team focused on the inquiry question on exploring EAL/D pedagogy and intervention in improving reading comprehension in two of our EAL/D Science classes. The choice behind this inquiry question stemmed from Bonnyrigg High School's culture, where we have already established and maintained streamlined EAL/D classes and co-teaching practices for various KLA since 2019. In this fifth-year mark, we were curious to see the effectiveness of these practices based against evidence and data. We also came to this decision as a means for the executives to review and revise their 2025 School Improvement Plan.

Context

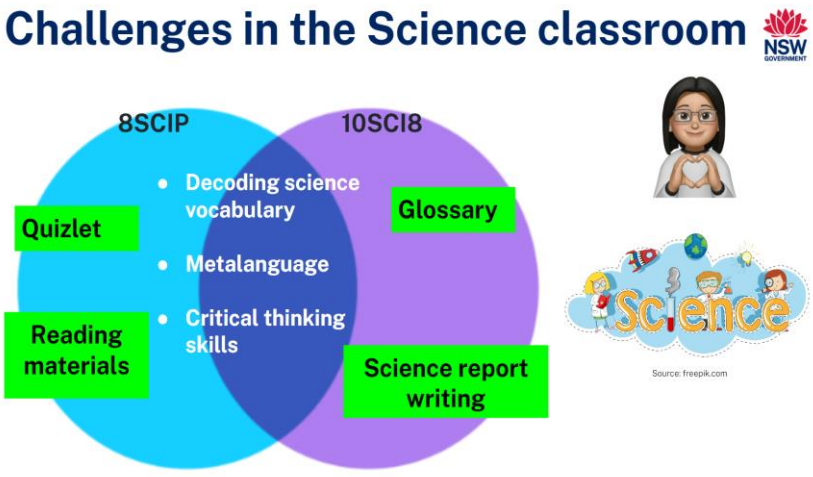
Bonnyrigg High School is a partially selective high school located in Bonnyrigg, which is in South-Western Sydney. There are 1610 total enrolments in the school, where 91.4% of our students are LBOTE and 63% of our students come from EAL/D backgrounds. Additionally, we also have 68 refugee students and 30 international student enrolments.

Bonnyrigg High School's Leading EAL/D Education Project takes place in two of our EAL/D classes: 8P Science and 10SCI8. 8P is an EAL/D class in all key learning areas. The class receives EAL/D co-teaching support in their science lessons.

Case Study

So, what were the common issues found in Stage 4 and Stage 5 science classes at the Bonnyrigg High School?

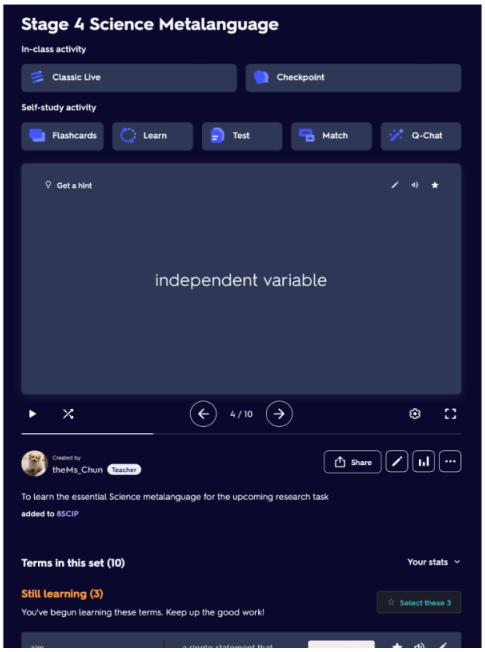
Limited science vocabulary, limited understanding of the metalanguage used in science context and ability to critically analyse a reading text. Therefore, in order to strengthen students' cognitive skills in our

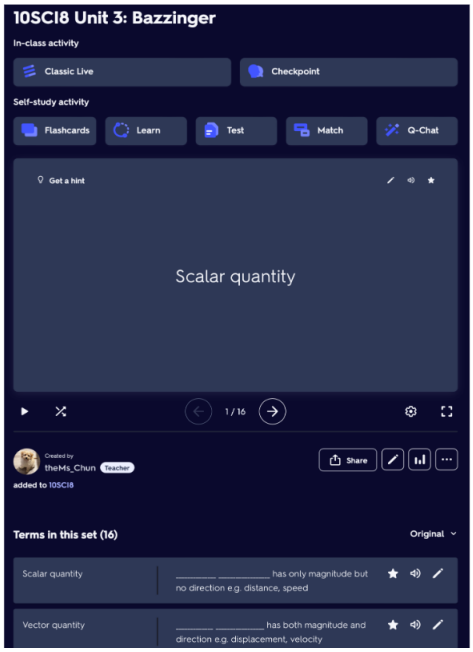


science classroom four different teaching strategies were chosen and **investigated in this project: Quizlet,** glossary, reading comprehension and science report writing.

Every week, we used Quizlet to promote student awareness of the definitions of the scientific vocabulary

Quizlet - context-based Science vocabulary acquisition





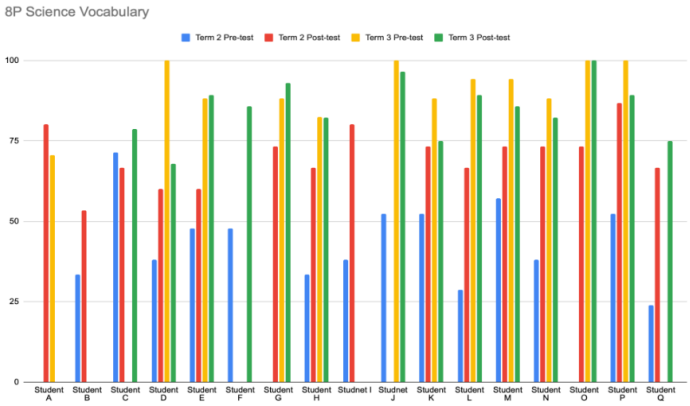
to increase their exposure to the terminology related to the topic. Quizlet also offers a variety of activities such as Classic Live, mix and match word finder and a study set.

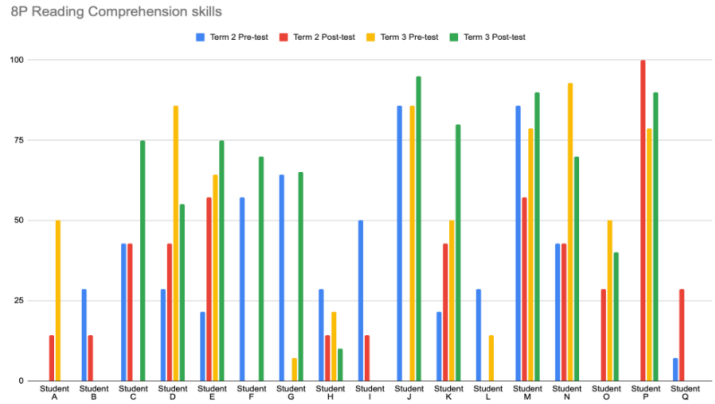
In Year 8 Science, students were given at least two different reading tasks to complete weekly. At the start of this project, explicit instructions were given to the class on how to complete this activity (e.g., locating and highlighting the key terms and summarising the content). As time progressed, students were able to identify and highlight the main points in each paragraph confidently and use the highlighted keywords to complete the worksheet with minimum supervision. However, there were still some challenges that we faced along the way such as creating and/or using the appropriate level of the reading materials and time constraints such as having a program to complete.

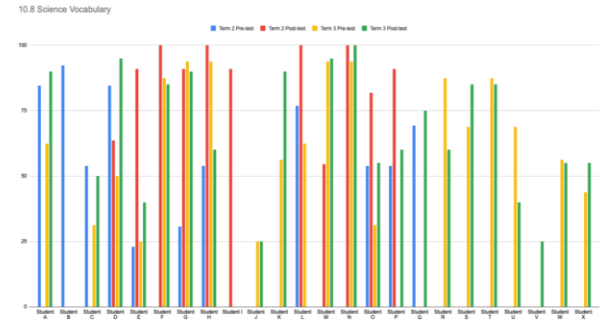
Meanwhile, in Year 10 Science, we aim to promote critical thinking using their existing knowledge of the topic gained in Stage 4. As can be seen in this evidence, students were able to write the chemical equations using their existing knowledge and new skills learned in class.

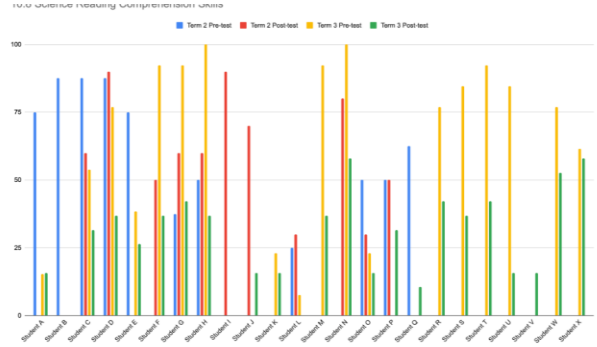
Data & Outcomes

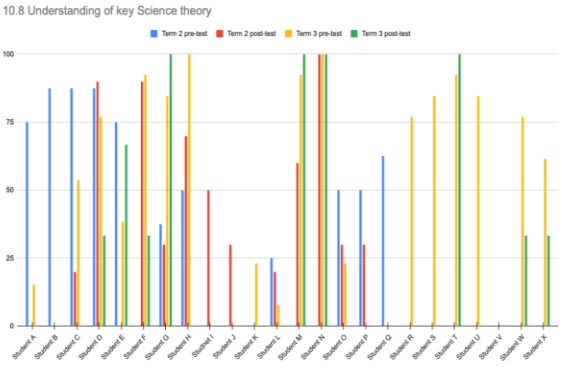
Data collected showed an average growth of 30.51% over the two terms. The trend indicated significant growth in students' vocabulary acquisition in the Term 3 pre-test and a slight decrease in the final post-test. On the other hand, the average increase in students' reading comprehension in science was 10.55%. The most noticeable growth occurred in students' Term 3 pre-test for vocabulary and comprehension components. The most significant factor among the anomalies included learning unfamiliar Science topics before students were fully immersed in the vocabulary and content knowledge before undertaking the comprehension tests.

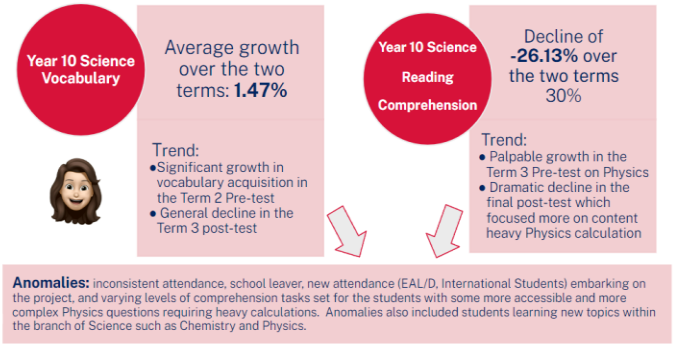










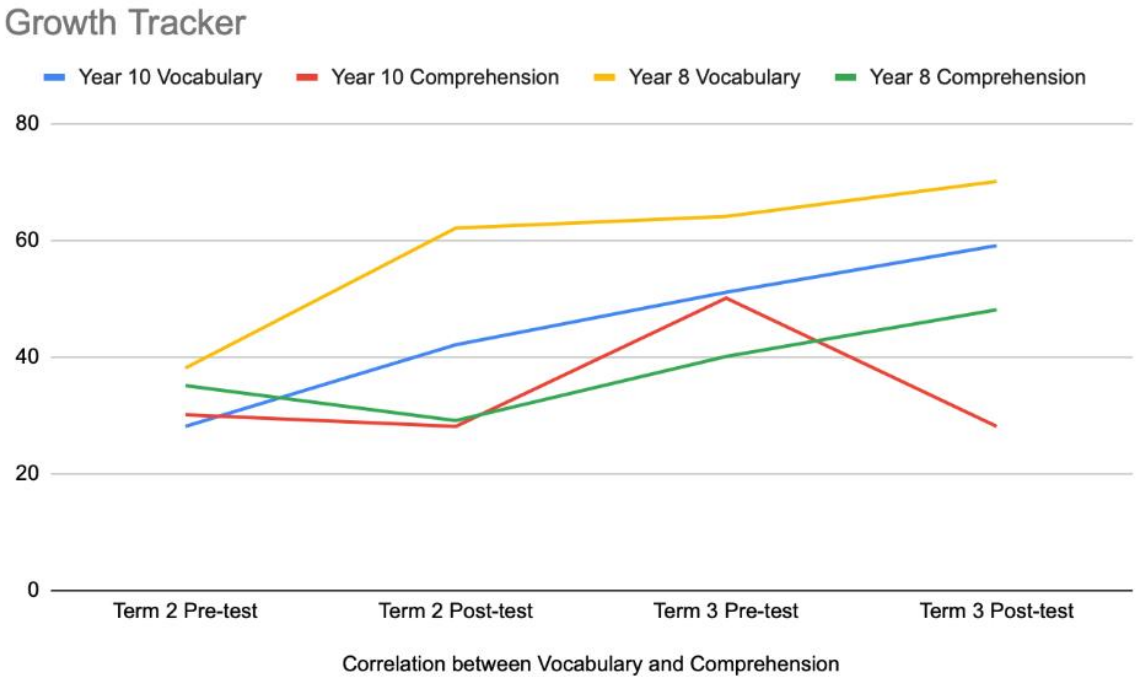


In comparison, there was an increase of 1.47%, indicating students' enhanced vocabulary acquisition for the Year 10 Science class, where the significant growth was during the Term 2 pre-test. General decline trended for their Term 3 post-test. There was a decline of -26.13% over the two terms despite visible

growth in the Term 3 pre-test on Physics. Data, however, indicated an increased understanding of the basic Science theory studied during the term.

Anomalies include inconsistencies in the number of students who undertook the post-test whilst needing to complete the pre-test. The most significant factor of varying levels of comprehension tasks set for the students with more accessible and more complex Physics questions, which required heavy calculations, was the underlying contributor to the discrepancy in the decline of the comprehension skills.

Correlation between Vocabulary enhancement and Students' increased reading comprehension in science

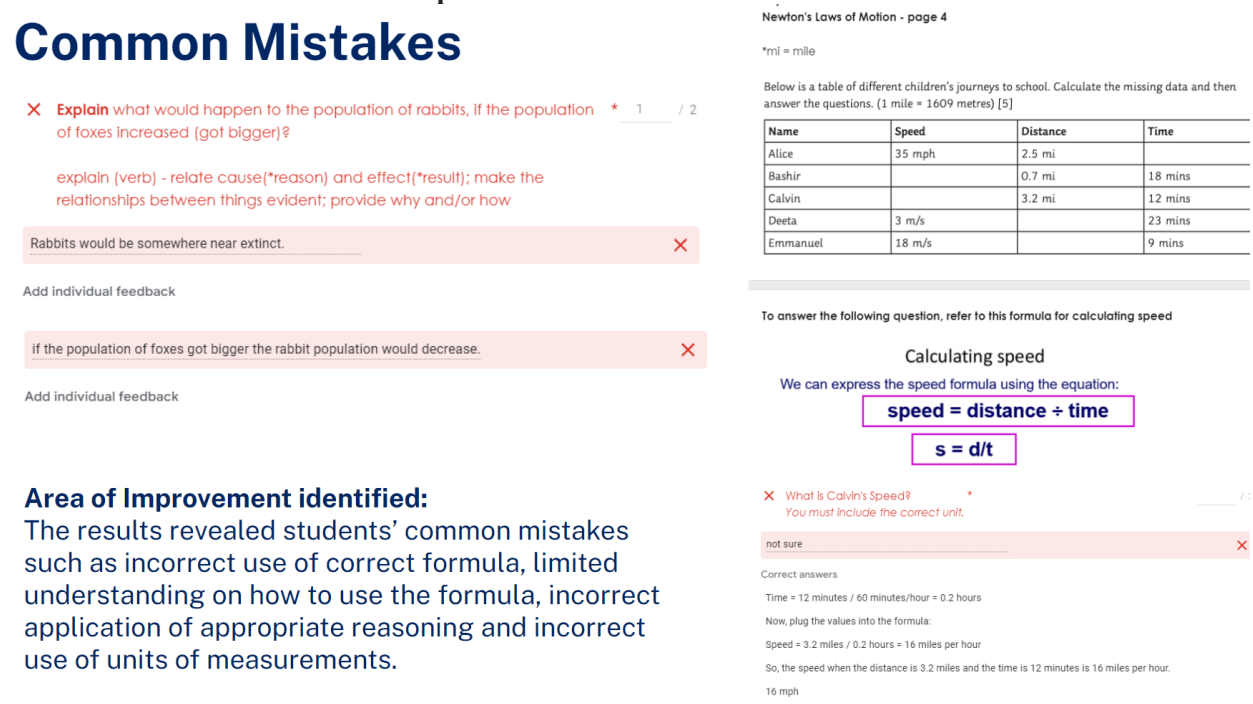


Correlation between Vocabulary and Comprehension

Although there were positive correlations between exposure and retention of context-based Science vocabulary and the enhancement of student reading comprehension skills, the data showed it was not the case for the Year 10 Science case study. We deduced, this was due to their lack of exposure to more in-depth learning concepts as students progressed from Stage 4 to 5, including heavy calculation in specific Science topics and more critical thinking. As a result, students struggled to apply critical thinking skills when analysing a question.

Also, the anomalies included the Physics calculations, which this project's scope did not consider.

Common Mistakes and Area of Improvement identified:



The results revealed students' common mistakes and patterns such as incorrect use of the formula, limited understanding on how to use the formula, incorrect application of appropriate reasoning and units of measurements.

As previously mentioned, the lessons had to keep pace with the school's scope and sequence and other factors such as newly arrived students who required additional assistance in everyday lessons as well as time constraints contributed to these common mistakes.

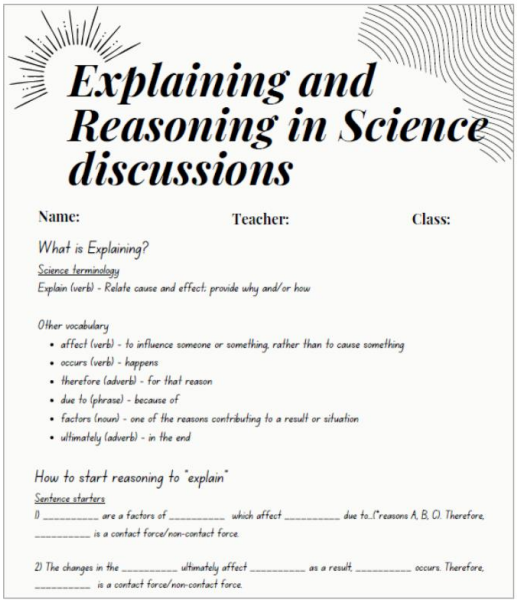
Interventions

We also noted that many EAL/D learners in particular the new arrival, international and refugee students in Australia struggled to write a scientific report largely because they are not familiar with the form and function of scientific genres. There are four major genres that use scientific language including experimental report, informational report, argument, and explanation.

According to Tang and Rappa (2020), past research studies have reported that reading comprehension and writing skills are interrelated. Students with good reading fluency and high metalanguage skill are more likely to have comprehension of the lesson, formulate their ideas independently than students with low reading fluency and metalanguage skills.

To test our hypothesis, our team had decided to investigate the impacts of implementing explicit instructions and using a generic science report template with our EAL/D science classroom.

Sentence starters



Explaining and Reasoning in Science discussions

Name: Teacher: Class:

What is Explaining?

Science terminology

Explain (verb) - Relate cause and effect; provide why and/or how

Other vocabulary

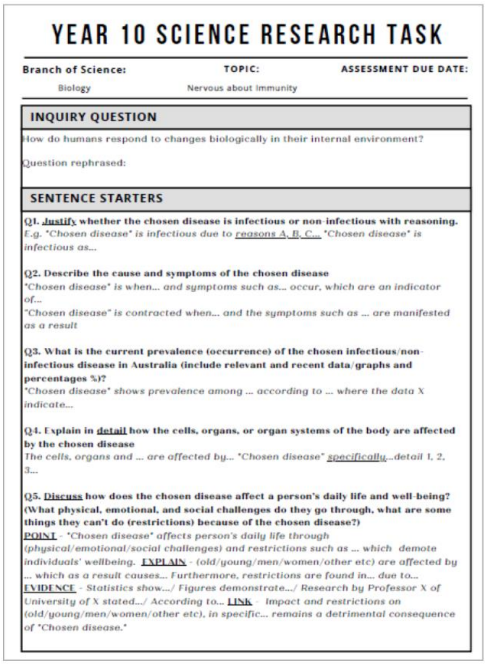
- affect (verb) - to influence someone or something, rather than to cause something
- occurs (verb) - happens
- therefore (adverb) - for that reason
- due to (phrase) - because of
- factors (noun) - one of the reasons contributing to a result or situation
- ultimately (adverb) - in the end

How to start reasoning to "explain"

Sentence starters

1) _____ are a factors of _____ which affect _____ due to..("reasons A, B, C). Therefore, _____ is a contact force/non-contact force.

2) The changes in the _____ ultimately affect _____ as a result, _____ occurs. Therefore, _____ is a contact force/non-contact force.



YEAR 10 SCIENCE RESEARCH TASK

Branch of Science:	TOPIC:	ASSESSMENT DUE DATE:
Biology	Nervous about Immunity	

INQUIRY QUESTION

How do humans respond to changes biologically in their internal environment?

Question rephrased:

SENTENCE STARTERS

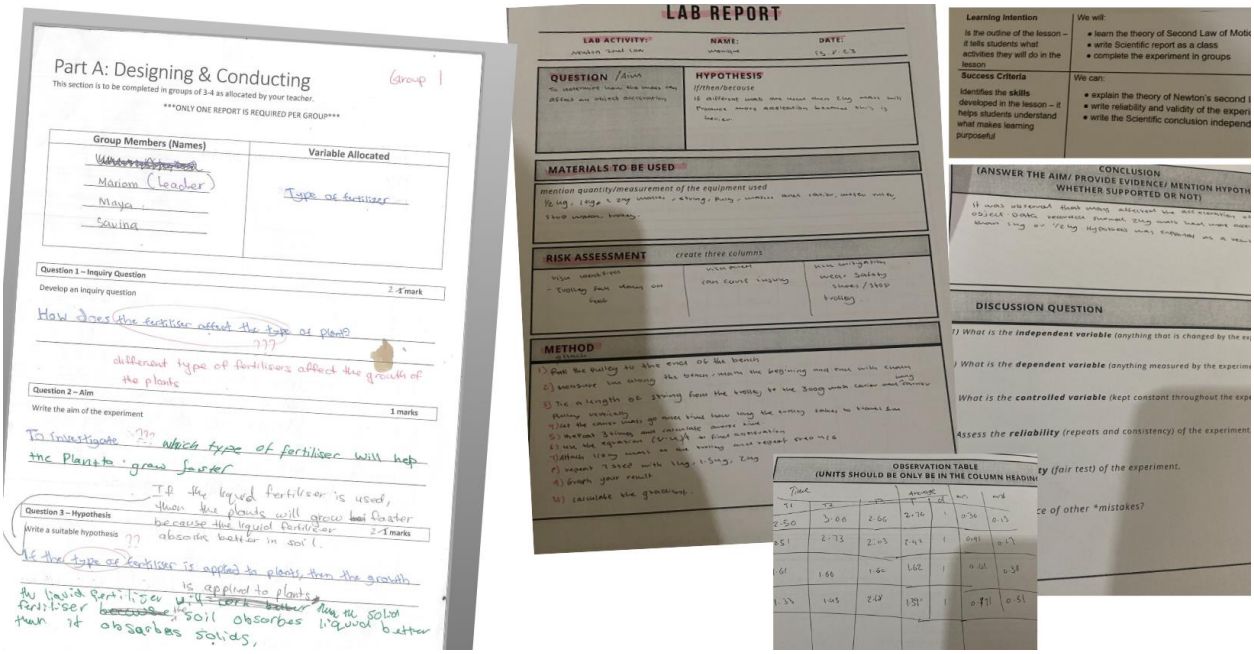
Q1. Justify whether the chosen disease is infectious or non-infectious with reasoning.
E.g. "Chosen disease" is infectious due to reasons A, B, C... "Chosen disease" is infectious as...

Q2. Describe the cause and symptoms of the chosen disease
"Chosen disease" is when... and symptoms such as... occur, which are an indicator of...
"Chosen disease" is contracted when... and the symptoms such as ... are manifested as a result

Q3. What is the current prevalence (occurrence) of the chosen infectious/non-infectious disease in Australia (include relevant and recent data/graphs and percentages %)?
"Chosen disease" shows prevalence among ... according to ... where the data X indicate...

Q4. Explain in detail how the cells, organs, or organ systems of the body are affected by the chosen disease
The cells, organs and ... are affected by... "Chosen disease" specifically...detail 1, 2, 3...

Q5. Discuss how does the chosen disease affect a person's daily life and well-being? (What physical, emotional, and social challenges do they go through, what are some things they can't do (restrictions) because of the chosen disease?)
POINT - *"Chosen disease" affects person's daily life through (physical/emotional/social challenges) and restrictions such as ... which demote individuals' wellbeing.* **EXPLAIN** - *(old/young/men/women/other etc) are affected by ... which as a result causes... Furthermore, restrictions are found in... due to...*
EVIDENCE - *Statistics show.../ Figures demonstrate.../ Research by Professor X of University of X stated.../ According to...* **LINK** - *Impact and restrictions on (old/young/men/women/other etc), in specific... remains a detrimental consequence of "Chosen disease."*



Part A: Designing & Conducting — Group 1

This section is to be completed in groups of 3-4 as allocated by your teacher.

ONLY ONE REPORT IS REQUIRED PER GROUP

Group Members (Names)	Variable Allocated
Mariam (leader)	Type of fertilizer
Maya	
Sawina	

Question 1 – Inquiry Question — 2-3 mark

Develop an inquiry question

How does the fertiliser affect the type of plant?

different type of fertilisers affect the growth of the plants

Question 2 – Aim — 1 marks

Write the aim of the experiment

To investigate which type of fertiliser will help the Plant to grow faster

Question 3 – Hypothesis — 2-3 marks

Write a suitable hypothesis

If the liquid fertiliser is used, then the plants will grow faster because the liquid fertilizer absorbs better in soil.

If the type of fertiliser is applied to plants, then the growth is applied to plants

the liquid fertiliser will ~~cork better~~ than the solid fertiliser ~~because~~ the soil absorbes liquid better than it absorbes solids,

LAB REPORT

LAB ACTIVITY: NAME: DATE:

QUESTION

HYPOTHESIS

MATERIALS TO BE USED

RISK ASSESSMENT — create three columns

METHOD

Learning Intention — We will:

Success Criteria — We can:

CONCLUSION (ANSWER THE AIM/ PROVIDE EVIDENCE/ MENTION HYPOTH... WHETHER SUPPORTED OR NOT)

DISCUSSION QUESTION

1) What is the **independent variable** (anything that is changed by the ex...

) What is the **dependent variable** (anything measured by the experim...

What is the **controlled variable** (kept constant throughout the exp...

Assess the **reliability** (repeats and consistency) of the experiment...

...ty (fair test) of the experiment.

...ce of other *mistakes?

OBSERVATION TABLE (UNITS SHOULD BE ONLY BE IN THE COLUMN HEADIN...

Time			Average			
T1	T2	T3	T	d	m/s	m/s
2.50	3.06	2.66	2.74	1	0.36	0.13
2.51	2.73	2.03	2.43	1	0.41	0.17
1.61	1.66	1.66	1.62	1	0.61	0.38
1.33	1.45	2.49	1.51	1	0.71	0.51

It was noted in students' work samples that they struggled with unfamiliar sentence structures in science contexts due to the demands of academic language in the Science report. Therefore, to further enhance students' writing skills, EAL/D teachers assist the classroom teachers by preparing a range of sentence starters that can be utilised in the classroom.

As seen in this data, the strategies added in as interventions for the lessons show a growth of 21.49% for the Year 8 Science class and 3.38% for the Year 10 Science class. The discrepancies noted here are for the international students, who had less time for vocabulary retention as the lessons had to keep up with the pace of the school's curriculum. The overall message nevertheless is that there has been growth for both Years 8 and 10 Science classes. Furthermore, this ties in with Vocabulary strategies, which have been practised with the EAL/D teacher and the class teacher.

Throughout the project, we have implemented pre-and post-tests with both of our Stage 4 and 5 classes. Furthermore, weekly Quizlet and pre-and post-tests were created based on the topics and learning activities covered in our Stage 4 and 5 science classes. By establishing a baseline with the pre-test, we monitored and measured student growth for each of the targeted learning outcomes. The collected data also informed us of the effectiveness of the teaching strategies implemented throughout this investigation.

Using the data collected from the weekly Quizlet and pre-and post-tests, we were also able to identify which topics students already know and which topics students need additional help with. We were also able to identify which students perform above and below standard and their ability to retain the learning concepts taught during our lessons.

Moving Forward

Going forward, students in Year 8 Science have begun and will continue to participate in a station activity during which they complete activities developed to enhance their comprehension and use of tier 3 scientific vocabulary.

Again, looking forward, for students in Year 10 Science, margin questions *(as suggested by a variety of EAL/D publications)* will be added to scientific texts to encourage the use of reading strategies for tier 3 scientific vocabulary.

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