

# Bionic Eye Teaching Sequence

A maths/science teaching sequence for year level 9 of the Australian Curriculum

## Module 1 - Detailed design

### Learning Outcome

Students identify challenges that impact participation in society when vision is impaired.

### Module summary

Students gain an awareness of vision impairment through first-hand experience. They attempt a series of everyday tasks with their normal vision and while wearing vision-impairing goggles. Students record the amount of time taken to perform each task, with and without impaired vision, and collate data to determine the most difficult tasks of those encountered. Students reflect upon how impaired vision impacts upon participation in society.

### Key concepts and key skills

Students record and tabulate data while performing a series of tasks. Students draw graphs to represent their data. Students draw conclusions about living with vision impairment from the data they have collected.

### Design descriptors

- Students brainstorm to construct a class representation of the challenges that face visually impaired citizens.
- Students experience a series of visual impairment experiences that provide an awareness of the challenges encountered when vision is impaired. They record time taken to complete each task.
- Students collate class results to determine the tasks that are most difficult to complete if vision is impaired and then compare to video footage of visually impaired citizens.
- Of the challenges faced, students identify how other senses can compensate for the loss of vision.

### Assumptions/Prior knowledge

Students are able to perform the everyday tasks that comprise the challenges. Students can use a timer and can calculate averages and percentages. Students are able to record and collate data. Students know how to draw simple bar graphs and pie charts.

### Misconceptions

Students believe that it is impossible to fully participate in society if you have a disability; students believe that disabilities need to be cured.

### Education Design team

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### Australian Curriculum links

*Science / Level 9 / Science Inquiry Skills / Processing and analysing data and information*

Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (AC SIS169)

- presenting data in tables and processing them into graphical forms
- analysing graphs to generate conclusions from data

*Science / Level 9 / Science Inquiry Skills / Communicating*

Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (AC SIS174)

- presenting results and ideas to group discussions

*Mathematics / Level 9 / Statistics and Probability / Data representation and interpretation*

Identify everyday questions and issues involving at least one numerical and at least one categorical variable, and collect data directly and from secondary sources (AC MSP228)

- collecting data with and without visual impairment goggles

Compare data displays using mean, median and range to describe and interpret numerical data sets in terms of location (centre) and spread (AC MSP283)

- presenting results using box and whisker plots

# Learning activities

## Part 1 – introduction to the bionic eye unit

**Classroom resources: Bionic-Eye-Introduction-Presentation.pptx**

In this part of the lesson, students will activate their prior knowledge and start to form new questions relating to how the eye works, and what it's like to be visually impaired.

During the lesson, students will start to think about some questions related to vision and undertake a brainstorm of what they know about visual impairment and some everyday tasks that would be challenging for the visually impaired.

These questions are intended to be used to stimulate discussion around the challenges that impact participation in society when vision is impaired. These first questions are intended to create some cognitive dissonance for students individually – leading students to quickly consider a new perspective. Students are led down a path of questioning, and then asked to consider the questions from a new perspective to get them thinking in the space of visual impairment.

### QUESTIONS

Before introduction of the topic of vision impairment these questions are to be considered by each student briefly but kept to themselves.

- When you talk to people, what are some of the cues that you look for, to give you clues about how they feel?
- Have you ever noticed the textured tiles near the edge of the road by traffic lights and train platforms? What do you think they are for?
- How long does it take you to read one page of a book?

Then the students are to flip the perspective and imagine that they are blind. The real question for consideration is how might someone who couldn't see answer these questions differently, and why?

## Part 2 – Brainstorming about vision impairment

**Teacher notes: 01-Brainstorming.docx, 02-Challenges-Visual-Impairment.docx**

Questions for students to consider during brainstorm so that they discuss what they know about visual impairment and the challenges faced by visually impaired people.

- What do you know already about visual impairment?
- What are some of the challenges that visually impaired people might face?

Working in groups, students brainstorm to construct a class representation of the challenges that face visually impaired citizens using the questions above as a prompt. These ideas can be noted on butcher's paper, a brainstorming app or on any other space.

## Part 3 – Class discussion of challenges faced by vision impairment

**Teacher notes: 03-Enhancing-Student-Participation.docx**

Student groups share their ideas with the class and participate in class discussion, helping teacher to group related ideas. Teacher writes ideas on the white-board and groups related ideas together. These ideas are then examined in an open class discussion.

Questions to promote student interest following their brainstorm

- Are vision impairments treatable?
- How do we assist people with vision impairments to participate in society?
- What questions do you have now?

For the question 'What questions do you have now?' you may choose to create a board of questions that students can add question they now have to that can be revisited throughout the unit and be the basis for other activities.

## Part 4: Creating the goggles and the box and whisker plots

**Teacher notes:** 04-Flipped-Classroom.pdf

**Classroom resources:** Materials-for-challenges.docx

**Video:** How to create Box and Whisker plots.

In this part of the outcome, students will complete two tasks at home. They will:

- a) Create some visual impairment goggles they will need for their next lesson.
- b) Complete a direct computer based instruction task

The students will watch an instructive video that explains how to create box and whisker plots with the data that they will collect in the following class, and be guided in how they will split up their data to create those box and whisker plots at home following their investigations. The class time following becomes the time to complete research with their peers.

### HOMEWORK TASKS

Prior to the homework students will need to split into the pairs that they will be working in during the following lesson. These pairs then need to allocate themselves jobs for creating vision impairment goggles. There are two types of goggles. One student per pair should create one type of visual impairment goggles for homework.

Within the Materials for challenges.docx there are the following sections:

- Protocol for Making Vision Impairment Goggles
- Template – Vision Impairment Goggles

Each student will need a copy of each to prepare for the next lesson.

Students must also watch the instructional video: How to create box and whisker plots.mp4 for homework.

## Part 5: introduction to visual impairment challenges

**Teacher notes:** Causes\_of\_Vision\_Impairment.docx, Visual\_impairment\_challenges.docx

**Classroom resources:** Materials\_for\_challenges.docx

Teacher provides groups with cards describing Macular degeneration and Retinitis Pigmentosa. Students should have their visual impairment goggles 'A' & 'B' created for homework. Teacher asks students to assign which goggles are representative of which disease.

The teacher will select how many activities each pair performs depending on the amount of time available. If students had suggested particular activities that they thought would be particularly challenging during the introduction to this unit, then the teacher should incorporate these if they are easy to set up and have no safety implications.

Following an introduction to each challenge, students will make predictions about which activities they believe will be most difficult with and without visual impairment, and record their predictions on their worksheets.

This activity is set up using workstations. Each station is designed for up to 6 students working in pairs. Student 1 (S1) and Student 2 (S2) will be used throughout this plan in order to describe how each activity will run.

**Note:** \*\*Include the ball catch, as this one is particularly challenging with the visual impairment goggles.

## PART 6 – visual impairment challenges

**Student worksheets:** [Vision\\_Challenges\\_Worksheet.docx](#)

**Classroom resources:** [Materials\\_for\\_challenges.docx](#)

**Video:** [Constructing Box and Whisker plots](#)

Students should complete between two and three stations each by the end of the class. Generally one student will record the results to the station datasheet while the other student performs the challenge. Station data sheets are for the class data, and should stay at the stations when students move between the different challenges.

As part of each challenge, students should be encouraged to reflect on the difficulties they encountered and document possible ways to overcome these difficulties. Students should identify how other senses can compensate for the loss of vision. The station descriptions have questions on them to encourage students to reflect on their experiences in these ways.

### JIGSAW BOX PLOT TASK

Following completing the activities at the challenge stations, the students will have recorded their results to the class datasheet. For homework, the class data will then be graphed for each station in order to compare the difficulty of the tasks with and without vision impairment. This is completed as a jigsaw activity with the students splitting up the work to be done between students on the challenge stations that they finish on. This will be completed in several steps:

1. Students will need to divide up their data into the three different treatments. Each student should have one part of the class dataset copied into his or her workbook.
2. For homework, students will work through their part of the data that they have generated from the visual impairment tasks and create box and whisker plots to represent the class data. Students will first need to:
  - a. order the data from highest to lowest values.
  - b. calculate their 5 number summaries.
  - c. produce box plots that represent their part of the class data (every student should produce a box and whisker plot – even if they are doubling up.)

Each student from the same challenge station **MUST** use the same scale on their number lines to represent their data so that box and whisker plots can be put together and compared in parallel during the next class.

Students will have watched the demonstration video [How to create box and whisker plots.mp4](#) to guide them in

completing this task. If students are unsure, they should be referred to this video again in order to familiarise themselves with what they need to do.

A guide that demonstrates recording of class data and jigsawing it back together is available: [putting bwplotdat together.mp4](#)

Alternatively, you could get students to make a copy of all data collected at their challenge station and complete all three parallel box and whisker plots for homework.

## PART 7 – collation of results and analysis of box and whisker plots

Students will have created their box and whisker plots in preparation for this lesson, so in this class you will need to use the class data sheets to display and analyse the box and whisker plots.

Ask students to cut out and place their box and whisker plots on the class challenge station data sheets in the respective places for control, Macular Degeneration and Retinitis Pigmentosa.

If students have completed the three parallel box and whisker plots for their challenge station as homework, you could now jigsaw the students into groups that were made up of students from each of the different challenge stations. Each student would then each need to talk about the box plots generated for their challenge station's data guided by the questions below. As each group would be made up of students from different stations, each group would be able to discuss the difficulty of each challenge station with each type of visual impairment.

### QUESTIONS FOR COMPARISON OF DIFFICULTY OF TASKS WITH VISUAL IMPAIRMENT USING BOX AND WHISKER PLOTS

These questions are intended to guide them in analysis of their data in order to briefly compare the results for completing the tasks under each condition.

- Which group had the highest time? Does it look like one group found it significantly more difficult to complete this challenge?
- Were there any outliers in your data? How did this affect the whiskers for the plots at this station?
- Which group had the highest median time for this challenge? Which visual impairment made it most difficult to complete this challenge?
- Which group had the lowest median time for this challenge? Do you think this accurately reflected the difficulty of this task?

## Part 8 – reflection on challenges encountered and comparison with experience of people living with visual impairment

### Student worksheet: Reflection\_worksheet.docx

Play short video “What it’s like to go blind”  
(BuzzFeedYellow, 2014)

Teacher asks students to reflect on their experience of the challenges and to compare them with the visually impaired people using the student reflection worksheet.

Reflection worksheet - I USED TO THINK..., BUT NOW I THINK...

A routine for reflecting on how and why our thinking has changed (Harvard Project Zero, 2016).

The student reflection worksheet is to reflect on how their thinking may have changed over the duration of completing Outcome 1. Responses to these prompts may also be written in students’ Science workbooks.

Students have a prompt that encourages them to write a response using each of the sentence stems:

- I used to think....
- But now, I think...

Purpose: What kind of thinking does this routine encourage?

This routine helps students to reflect on their thinking about a topic or issue and explore how and why that thinking has changed. It can be useful in consolidating new learning as students identify their new understandings, opinions, and beliefs. By examining and explaining how and why their thinking has changed, students are developing their reasoning abilities and recognizing cause and effect relationships.

Launch: What are some tips for starting and using this routine?

Explain to students that the purpose of this activity is to help them reflect on their thinking about the topic and to identify how their ideas have changed over time. For instance you could say something like:

“When we began this study of visual impairment, you all had some initial ideas about it and what it was all about. In just a few sentences, I want to write what it is that you used to think about vision impairment. Take a minute to think back and then write down your response to “ I used to think...”

Now, I want you to think about how your ideas about visual impairment have changed as a result of what we’ve been discussing. Again in just a few sentences

write down what you now think about visual impairment. Start your sentences with, “But now, I think...” “

Have students share and explain their shifts in thinking. It is good to do this as a whole group so that you can probe students’ thinking and push them to explain.

## Part 9 – class discussion of group reflections and learning outcome

### Teacher notes: The right questions the right way.pdf

Guide class discussion around the students’ experiences of the challenges and what they have learnt about visual impairment from their experiences and the information provided during the unit.

Link back what they know now to what they were thinking in Parts 1,2 & 3.

Did they manage to answer any questions that they had after completing part 3?

What do they now know that they didn’t know before?

Do they think they might answer some of the initial questions differently now, when considering them from the perspective of a visually impaired person?