

YuMi Deadly Maths

Year 7/9 Teacher Resource:

SP – The humanoid project

(A statistical survey – continuous and categorical data)

Prepared by the YuMi Deadly Centre
Faculty of Education, QUT



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ACKNOWLEDGEMENT

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Year 7/9 Statistics and Probability

The humanoid project

(A statistical survey – continuous and categorical data)

Learning goal	Students will: <ul style="list-style-type: none">• collect data and calculate the mean, median, mode and range for large data sets, using digital methods• graph the data and interpret and analyse the statistics.
Content description	Statistics and Probability – data representation and interpretation Year 7 <ul style="list-style-type: none">• Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data (ACMSP171)• Construct and compare a range of data displays including stem-and-leaf plots and dot plots (ACMSP170) Year 9 <ul style="list-style-type: none">• Identify everyday questions and issues involving at least one numerical and at least one categorical variable, and collect data directly and from secondary sources (ACMSP228)• Construct back-to-back stem-and-leaf plots and histograms and describe data, using terms including 'skewed', 'symmetric' and 'bi modal' (ACMSP282)• Compare data displays using mean, median and range to describe and interpret numerical data sets in terms of location (centre) and spread (ACMSP283)
Big idea	Statistics – continuous vs discrete. Categorical data is discrete. A large set of data values can be summarised using measures of centre (mean, median and mode) and measures of spread (range). For categorical data, mode is a suitable measure of the centre of the data. Statistics are meaningfully applied to summarise large data sets.
Resources	Measuring tapes or rulers to measure the heights of students.

Reality

Local knowledge For this lesson we are using the context of building a robot. If appropriate, show students a YouTube video on human-like robots: <https://www.youtube.com/watch?v=jraxzsXxJ28> (skip the intro and start at 1:38).

Prior experience Check students' understanding of continuous vs categorical data and that they know how to calculate mean, median, mode and range; check they have experience with bar charts and dot plots.

Kinaesthetic **The Year 7 (or 9) Humanoid Project**

It is the year 2050 and the school has decided to order a human robot (a humanoid) for each year level in the school to help the Head of the Year Level with jobs around the school.

To build the humanoid, the Human Robot Company would like to know the body dimensions and some of the favourite things that a person in that year level likes so that the humanoid can engage with the students more meaningfully. We are in charge of deciding on the dimensions and the "likes" of the Year 7 or 9 humanoid to give to the robot company.



<https://magazine.seats2meet.com/robots-artificial-intelligence/>

Note: If the humanoid concept is not appropriate for your students, work with finding out about the average Year 7 or 9 student. You could change this to have a female and a male humanoid, thus splitting the statistics collected into two categories, more suitable for Year 9.

Abstraction

Body

Part 1: How will we decide on the dimensions for the Year 7/9 humanoid?

Height is continuous data. The most appropriate measure of the centre of continuous data is mean or median.

Conduct a survey of the Year 7 (or Year 9) students to determine the average body dimensions of students in Year 7/9. Conduct this survey over the whole year level or if that is not possible conduct it within your class.

Students are to work in small groups to measure the following body lengths. Take care to clearly determine the start and finish of the body length required.

Body length	Measurement
Overall height	
Top of head to chin	
Neck length	
Neck circumference	
Arm length: top of shoulder to wrist	
Hand length: wrist to longest finger	
Torso length: top of shoulder to top of hip	
Leg length: top of leg to floor	

Obviously you could take many body measurements: length of feet, circumference of head, and so on.

Collect the raw data by having students enter their data (or their group's data) into the teacher's Excel file.

Hand/Mind

Part 2: How will we decide on some typical likes for Year 7 or Year 9 students?

What does a student in Year 7/9 typically like? What is their favourite musical artist, song, sport, colour, computer game, food, takeaway food? etc.

Collectively decide on the questions to ask.

What is your favourite ...	Answer
Musical artist	
Song	
Sport to play	
Sport to watch	
Colour	
Fresh food (fruit/vegetable)	
Takeaway food	
Computer game	

Conduct a survey within your year level or your class. This data will be categorical data. Decide whether the questions should be closed (i.e. provide options for each question) or open. If it is open, students will need more insight to interpret the data. The closed data is much easier to interpret.

Again collect raw data by asking students to enter their data into the teacher's Excel file.

Mathematics

Language/symbols survey, data, mean, median, mode, range, analyse, report, measure of centre (Where is the middle of the data?), measure of spread (How spread out is the data?)

Practice

Analyse, interpret and report on data

Collate the data for all classes into an Excel file using different tabs in Excel for each class and make the file available to the students.

Analysis

Part 1: Calculate the mean, median and range for each body length measurement. Decide whether to report on the mean or the median. Discuss the impact of the range on each measurement.

Part 2: Calculate the most popular item (mode) for each of the categories, including second or third preferences if appropriate.

Report on the results

Informally, have students calculate results, discuss appropriate measure to use (mean, median or mode), discuss the range, draw appropriate graphs in class and provide simple analysis of the measure of the centre and the range.

More formally, have students submit a report for the Humanoid Robot Company as follows:

- Working individually or in pairs, students are to prepare a report for the Humanoid Robot Company about the dimensions and likes for the humanoid (male and female).
- The report needs an introduction, the summary statistics, graphs (back-to-back stem-and-leaf plots and/or histograms) and more detailed interpretation of the statistics and graphs, including comparison of the genders and use of the terms 'skewed', 'symmetric' and 'bi modal' as well as final recommendations.

Introduce the humanoid

Draw a life-size image of the average Year 7/9 student (with their likes) and invite the principal of the school to come and meet the average student. (Thanks to Dakabin State High School for this idea.)

Reflection

Validation

Find other surveys about typical families or typical households; e.g. "QuickStats" from the Australian Bureau of Statistics gives a quick view of census data for any region:

http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/3GBRI?opendocument

Extension

Consider whether we should expect the average height of the Year 7 students to be equal to the sum of the averages of the parts. If not, why not?

Analyse the open categorical data more fully by considering more trends in the data rather than just reporting on the mean.

Teacher's notes

- This activity can be adjusted to suit Year 7 or Year 9:
 - The requirements for Year 7 can be met by calculating summary statistics and drawing simple graphs such as stem-and-leaf plots and dot plots. Simple interpretation of the summary statistics can be achieved by commenting on the range for each measurement.
 - The requirements for Year 9 can be met by collecting separate data for males and females, drawing back-to-back stem-and-leaf plots, and using the summary statistics to compare these two groups of data.
- Ensure students have a sound understanding of mean, median, mode and range before undertaking this activity.
- Suggestions in Local Knowledge are only a guide. It is very important that examples in Reality are taken from the local environment, have significance to the local culture and come from the students' experience of their local environment.
- Where possible students need to be taught the skill of visualising: closing their eyes and seeing pictures in their minds, making mental images.
- Useful websites for Aboriginal and Torres Strait Islander perspectives and resources: www.rrr.edu.au; <https://www.qcaa.qld.edu.au/3035.html>
- Explicit teaching that aligns with students' understanding is part of every section of the RAMR cycle and has particular emphasis in the Mathematics section. The RAMR cycle is not always linear but may necessitate revisiting the previous stage/s at any given point.
- Reflection on the concept may happen at any stage of the RAMR cycle to reinforce the concept being taught. Validation, Application, and the last two parts of Extension should not be undertaken until students have mastered the mathematical concept as students need the foundation in order to be able to validate, apply, generalise and change parameters.