

# Teachers Explanatory Notes

## TI-15 Explorer™: How Do You Measure Up?

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This Unit is made up of 6 student tasks. The aim is to engage students in a range of tasks that involve similar mathematical concepts to help them better understand the ideas involved. It is not essential that each task is completed by the class but they have been put together to sequentially develop the concepts of mean, median and mode as well as learning to organise, analyse and represent data. A student assessment task has also been included.

### Students need to know that:

- Data organised in different ways may tell us different things. It may tell us some things we need to know and mask other information needed. How we organise data depends on the information we want.
- New questions may require the data to be reorganised in a different format.

### Students need to be able to:

- Make suggestions as to how to classify and sequence data so questions can be answered.
- Systematically collect, organise and record data to answer questions or look at the characteristics of the data of a group.
- Summarise data in diagrams, tables and graphs that show frequencies for different categories.

As teachers it is our role to **model effective strategies or processes** involved in collecting, organising and reorganising data so it can be readily interpreted and the results communicated to others and give to the students the opportunity to experiment.

**Mean, mode and median can be used to describe the characteristics of a group or set of data.** This is not an easy concept for students to grasp and working out averages using formula is unlikely to help students understand their meaning. By exploring sets of data students have generated and analysed themselves and that have relevance to them means they are more likely to develop a sense of what '**typical**' is.

**Mean:** The *mean* or average height is found by adding the heights of all the students and dividing by the number of students.

**Median:** The middle height can be identified when all the heights are arranged in order from shortest to tallest. For example, if there are 27 students then the middle height will be the height of the 14th person in the line. If there are 28 students the median would be between the 14th and 15th student's height. To calculate this value the heights of these two students would be added together and divided by 2.

**Mode:** This is known as the most common occurring height. There can be more than one mode in a set of data.

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Specific teacher notes for each of the tasks 1-6 can be found after the calculator section.

### Use of the TI-15 Calculator

Sensible use of the calculator is important. The availability of the calculator allows students and teachers to work quickly and efficiently with real data. The calculator will assist students to calculate the average of a set of data but the value of the activities lies in the discussion it generates about the appropriate use of data in real life contexts. Calculators remove the pressure of tedious calculations and allows students to think.

Specific instructions on how to use the calculator can be found in the corresponding PowerPoint presentation.

### Lessons target the following keys and functions on the calculator:

Calculator can be used for general calculations involving whole and decimal numbers beyond the students ability to mentally calculate.

**Memory function keys** (Store to Memory, Memory, Recall) to work out average (frequency tables) – use the Memory Keys to add products to find the average

**Backspace key** to remove a digit incorrectly entered

**Fix key** for rounding to specified place value

When entering lists of data the advantages of this calculator are:

- Use of the backspace key to remove a digit incorrectly entered without the need to start again.
- All data entered on the calculator can be viewed using the scroll bars. Students can scroll through the entries to check all data has been entered correctly.
- The calculator can be used to round decimals to a given number of places. Students may need to report on data in terms of percentages and the calculator can be used for this purpose.

When new functions are introduced to students they can highlight the keys involved on a copy of the calculator key pad and record in their own way the steps involved. Students can then refer back to their own instructions if they need further assistance to operate that function.

### Task 1 – Class photograph

- Whole class activity
- Role of the calculator – not required
- Materials – paper tape, class photographs

**When a group class photograph is taken we are asked by the photographer to order or group ourselves according to height.**

1. **Brainstorm** – What categories could we use to sort ourselves according to height?  
E.g. tall – medium – short  
below average – average – above average  
less than average – average – more than average
2. Ask students to group themselves according to the chosen categories. Students can be asked to justify their choice of category.
3. **Discuss** – How could we represent this data? What does this data tell us about our class heights? Represent data and report on findings.
4. **Discuss** – What is the typical height of students in our class? Who thinks they are about average in height? How can we tell without measuring?
5. Students line up in order of height eg. ascending or descending order. Identify the student or students who represent the median height.

**Discuss** – Why does ordering students according to height assist the photographer to take a group photo? Organise class for a mock photograph.

### **Key information:**

- If there is an **odd number** of students the student in the middle of the line represents the midpoint.
  - If there is an **even number** of students then two students will represent the midpoint. The median would be between these two heights.
6. Use paper tape to represent the median height. Place a strip of paper tape across the doorway at the median height. Students can use this indicator to find out if they are the same or more or less than the median.

### **Task 2 – What is the average height for your group?**

- Group activity (4 or 6 students)
  - Use of the calculator – not required
  - Materials – paper tape, string
1. **Student Investigation** – Find a way to represent the average height for the members of your group. You have a choice of using string or paper tape.  
**Note:** No height measurements are to be taken in cm.  
Students are told they can't order themselves according to height.

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2. **Share ideas** – What do we mean by average height?  
What strategies could we use to represent the average?

### Possible strategies:

- Mark on the given tape or string all the heights of group members. Fold the length of tape or string into a number of equal sections depending on the number of students in the group eg fold tape into 4 equal pieces for a group of 4. Cut one section to represent the mean.
  - Students could cut a length of tape to represent their height and then tape the strips showing individual heights together and then fold.
3. Use the paper strip to identify anyone in the team who is exactly the average height or less or more than the average.
4. **Report on the findings** – oral or written.  
Describe the strategy the group used and any conclusions made.
5. **Share ideas** – How do the paper strips in each group compare?

### Task 3 – Our typical height

- Whole class activity
  - Use of the calculator – fix keys, store to memory, memory recall – see student guides in the powerpoint
  - Materials – TI-15 Explorer™, height measure
1. **Student Investigation** – What can we find out about the height of the students in our class? Students to pose questions about our class heights that can be answered using data.
- What is the average class height? Who is the average height?
  - What is the most common height?
  - What is the median height?
  - What is the range of heights? Who is the tallest and shortest student?
2. **Collect data** – Students are asked to have their height measured in cm by two different students. Record measurements on a card. Compare measurements taken and suggest reasons for variations. Round measurements to the nearest cm.
- Use the Fix keys on the calculator. Eg. Height measurement – 154.7cm Press – Fix then 1. key in 154.7 press Enter = Display will show 155.*
3. **Representing data** – Create a **line plot** on the floor. Students asked to stand behind their height shown on the line plot.

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**Share ideas** – How can we use this information to answer some of the questions posed? Which questions can't be answered?

Students to present data on the line plot on grid paper using an x to represent each piece of data above the marked baseline.

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150 151 152 153 154 155 156 157 158

Create a **frequency table** to record data (from line plot)

Height (cm)	Tally	Frequency
150	III	3
151	II	2
152	II	2

Students to order themselves in height from tallest to shortest (hold card showing height in cm).

**Ask** – What questions can be answered using the ordered measurements? (median, mean)

**Share ideas** – How can we calculate the mean/average height in cm?

Demonstrate how the calculators memory function can be used to calculate the mean or average height. Refer to the table showing the frequency for each height.

*Use store to memory and memory recall keys Refer to instruction sheet in powerpoint.*

### Task 4 – What a Record!

- Whole class/group task
- Use of calculator – general calculations
- Materials – Worksheet: What a Record! TI-15 Explorer™ and spreadsheet as shown

Create a spreadsheet showing data related to height measurements for the class.

Name	Age	Gender	Height (cm)

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1. **Look at the Human Physical Records** – background information on the worksheet.  
Ask students to compare their height to the tallest and shortest men and women  
– record differences.

The calculator could be used to convert metres to centimetres and calculate differences in totals. If an incorrect digit is entered the **backspace key** can be used to delete it and the correct digit can be added.

2. **Find out** –
  - If the tallest man/women joined the class what effect would it have on the class mean height? Would it affect the median and the mode?
  - If the shortest man joined the class what effect would it have on the class mean height?
  - What items around the school are the same height as the tallest and shortest men?

### Group investigation – Who are the record holders?

Tallest girl? Tallest boy? Tallest 13 year old/12 year old?

Allocate each group a subgroup to report on. Eg. girls, boys, age group.

- Report on – mean, mode, median and range of heights for the targeted group.
- Create tables, line plots and graphs to represent data (refer to class spreadsheet).  
Students are reorganising/sorting data for further analysis.

**Whole class** – Present group findings to class. Compare.

**Share ideas** – Discuss reasons for variations in sub-groups.

### Task 5 – How many hand spans tall are you?

- Whole class/group task
- Use of calculator – general calculations, Fix keys – student guide in powerpoint
- Materials – TI-15 Explorer™ calculator
- Worksheets: How Many hand spans tall are you? Part 1 and 2

#### Part 1 – Worksheet

Discuss background information – body measures used to measure length (worksheet).

Investigation – How many hand spans tall are you?

Identify key information needed?

Record the number sentence that will be entered on the calculator

Introduce the Fix keys to round answers to 2 decimal places

#### Part 2 – Worksheet

Group investigation – What is the average height of your group in hand spans?

Identify key information needed

Enter data on a spread sheet – see sample on worksheet

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WS2

WS3

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**Share ideas** – How can we calculate the average height in hand spans?

What other information does the spread sheet tell us about your group's height in hand spans? What are the advantages and disadvantages of using hand spans to compare measurements? Share your findings with class.

### Task 6 – Chance to Win!

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- Whole class
- Use of the calculator – general calculations
- Materials – Worksheet : Chance to Win, TI-15 Explorer™

Your local video store is giving you a chance to win a stack of DVDs the same as your height.

Fill in the entry form.

Ask students to work out how many DVDs they would receive if they won.

What information is needed to work it out?

What number sentence would you key into the calculator?

Work out the value of your prize if the average DVD costs \$22.50. What number sentence would you key into the calculator?

**Share ideas** – Win a stack of books to match your height.

What data would you need to collect to work it out?

What problems might occur if books were the prizes?

### Assessment Task – How many jelly beans in the jar?

**Materials** – TI-15 Explorer™ calculator, number cards, bag or container for cards.

**Note:** Part of this task is to be completed by students individually and the other part they are required to work with a group.

#### Students will be asked to:

- Create a set of data by taking a number card with an estimate on from a bag 25 times. Record.
- Write a report about data- include mean, mode, median and range.
- Use tables, lists and line plots/graphs to represent data.
- Place tables/ lists /graphs in the centre of their group mixed up. Take it in turns to read report about data and other group members must identify the tables/lists and graphs that match the description.
- Complete self assessment section.
- Compare all the data from group members and identify any sets of data with similar characteristics. Record observations.