Appendix H – Lessons on shape

Figure H‑1 is split into two columns. The first column outlines the lesson detail that was developed for the teachers to use in class. The second column describes the background to or purpose of the particular aspect of the activity. In addition the aspect of distribution that was being attended to ((1) the notion of distribution; (2) shape of distributions; (3) predicting distributions; and (4) contextual knowledge) is noted.

| **Lesson Number** | Activity detail | Background/purpose to the particular aspect of the activity |
| --- | --- | --- |
| **Lesson Two** | 1. Students make 15 “squares” of paper from an A5 sheet. Get students to label their 15 “squares” of paper with the numbers 1-15 in the top left hand corner. This is to help with identification later on.
 | Organisation/preparation  |
| 1. Using the prepared PowerPoint presentation, show each of the 15 graphs for a very short time, 1-2 seconds and get students to sketch the shape they see in the quick glimpse.
 | Looking at the gross shape of the data rather than specific detail. Use bigger sample sizes so that the shape was clearer. Large population/sample to help make the shape more “obvious”.**(2) shape of distributions** |
| 1. When all 15 graphs are drawn students should check with their neighbour and compare what they have sketched for each graph. At this stage the teacher can put up the 15 “teacher” sketched shapes and they can compare against these as well.
 | Students to compare their sketches with the view that they might decide that one was better than the other, and also compare this with the teacher graph and what the teacher graph might offer that theirs doesn’t. A more generalised shape.**(2) shape of distributions** |
| 1. Get pairs of students to sort one set of graphs into similar shapes. Collate responses from the class and arrive at a consensus as to which shapes are similar. Use the teacher shapes on the board.
 | Grouping the shapes was about trying to see the patterns that are there. Generally statistical graphs fall into a limited group of patterns, there is not an infinite number of patterns. **(2) shape of distributions***Notes: Symmetric LS RS uniform* |
| 1. For each group get students to describe the shape they see using words that they are comfortable with. Note these words under each of the groups of graphs.
 | Starting with student language for the shapes that they see to give a foundation for the development of statistical language. **(2) shape of distributions** |
| 1. Introduce the statistical words used for describing graphs – teacher prepared resources. Have a good discussion with the students about what they think the different words mean both in everyday and statistical sense. Get the students to suggest which words might best go with which group of graphs.
 | Gave students the language to see what they do with the language, see how much of it is intuitive. **(2) shape of distributions***Then have the conversation with at the end about what the words mean.*  |
| **Lesson Three** | 1. Hand out strips of graphs. Get students to cut and paste the graph and their sketch into their book under each of the description words. Allow room for the variable, justification, other examples and the description. Suggested layout below. Need about six pages in double spread. This will become a reference resource for students
 | research 005.jpgOrganisation of graphs, but also to start a “library” of contexts that are similar shapes. Building their contextual knowledge library.**(4) contextual knowledge** |
| 1. Put up the list of variables that made the graphs. Before students match them with the graphs get them to predict what shape they think the graph of the variables will be and why. Discuss as a class. Collect ideas on the board.
 | Consideration of what the data might look like; want students to think about data before they sketch it. That is to get students to think about what might be sensible values for a particular variable. The prediction is also about thinking about the shape of the data and using contextual knowledge to decide on what the shape might be. Understanding when data is incorrect, cleaning data. Getting the students to start to think about the context a bit more, building their contextual knowledge.**(3) predicting distributions***Note: E.g. right foot length, reaction time, attendance, birth months* |
| 1. Get students to match the context with the graph – get them to use the mix and match labels initially and record the final context in their book with their justification. Add the variable and the unit to the graph.
 | Organisation, but also using their contextual knowledge and information from previous activity to see what makes sense.  **(4) contextual knowledge** |
| 1. Once this is finished get students to look back at their graphs from the previous lesson and decide which “shape” they are. Add these contexts in the appropriate space.
 | Organisation, but also building their contextual knowledge library for different variables with the same shape.**(2) shape of distributions****(4) contextual knowledge** |
| **Lesson Four** | A. Review activity: Mix and match – statistical graphs and shape descriptors Resource: mix’n’match activity – shape descriptors* Students place the statistical graphs under one of the headings. There may be different numbers of graphs under each of the headings.
* Add the contexts (and paste the graph) to the other examples in the work done previously.
 | Further work on deciding on shapes. Adds to the “library”. Opportunity to check use of language, especially with skewed graphs.**(2) shape of distributions****(4) contextual knowledge** |
| B. Describing distributionsDiscuss with students what key features of a graph to describe are. * Put the challenge out if they had to draw the graph from the description only what info would they need. Collect ideas from the class.
	+ Suggest may be: shape, description of range, median/centre, middle group, and peak(s) – there may be other features, discuss as a department first.
 | About developing what makes a good description.**(1) notion of distribution****(2) shape of distributions****(4) contextual knowledge** |
| * Model for #9 and #4. Model this process for the students.
	+ Talk out loud your thinking and get them to contribute.
	+ Eg. What shape is the graph? Write the first sentence explaining the use of approximately and the use of the variable and the group we are talking about.
	+ What values do the heights range from and to?
	+ Write the next sentence and so on. The questions should be around the features you decided on with the class.
	+ Remember to include the CONTEXT. **Variable, values and units**.
	+ Use active reflection that is making descriptions correct and complete.
 | Modelling the thinking process for students when writing a description, also modelling the language to use, including the intertwining of the context throughout the description including especially the variable, values and units. **(1) notion of distribution****(2) shape of distributions****(4) contextual knowledge** |
| Examples:#9 Graph is: heights in cm of Yr 5-10 studentsThe distribution of heights for these year 5-10 students is approximately symmetrical and unimodal. The heights range from 116cm to 200cm. The median height is about 155cm and the middle group of heights is between 142cm and 167cm. #4 Graph is: reaction times in secs of yr 4-13 studentsThe distribution of reaction times for these yr 4-13 students is right skewed. Nearly all of the reaction times are tightly bunched between 0.2 and 0.6 secs. There are some reaction times slower than 0.6 secs and they spread out to 3.15 secs. The graph of reaction times peaks at about 0.4 secs and is approximately symmetrical between 0.2 and 0.6 secs. |
| * Students to do rest of the descriptions for homework, one per night over the next few weeks. Review these at the beginning of the following lesson, remembering to model good practice (see above).
 | To continue to develop their descriptive skills over the whole unit of work, to keep the focus in this area and provide plenty of practice at writing descriptions, a new skill to be developed.**(1) notion of distribution****(2) shape of distributions****(4) contextual knowledge** |

Figure H‑1. Detailed lesson planning for teaching experiment four

# Context: variables and population

List of the variable and populations for the 15 graphs. Read left to right and then down as with the masters.

|  |  |  |
| --- | --- | --- |
| Number of skips in 30 secs: 2003 C@S Yr 5-8 students | Birth month: 2003 C@S Yr 5-10 students | Weight-kg: Kiwi Kapers Great Spotted Kiwi |
| Reaction time-secs: 2007 C@S Yr 4-13 students | Right foot length-cm: 2003 C@S Yr 5-10 students  | Attendance-percentage half days: Yr 9-13 students |
| Hair length-cm: 2007 C@S Yr 4-13 students | Household debt-$: Synthesised Unit Record File based on NZ data | Height-cm: 2003 C@S Yr 5-10 students |
| AsTTle test results: Yr 9 reading | Number of years living in NZ: 2005 C@S Yr 10 students  | Age-years: Everyone at a high school |
| Time to school-mins: 2009 C@S Yr 9-13 students  | Index finger length–mm: 2009 C@S Yr 9-13 students | Cell phone ownership-months: 2009 C@S Yr 9-13 students |

# Photocopy masters

Statistical terms for describing shapes of distributions

|  |  |
| --- | --- |
| **symmetrical** | **bimodal** |
| **trimodal** | **unimodal** |
| **uniform** | **long tail to the right** |
| **long tail to the left** | **bell shaped** |
| **normal curve** | **right skew** |
| **left skew** | **negatively skewed** |
| **positively skewed** |  |

Actual graphs – for students print 2 pages per A4 sheet; for teachers enlarge to at least A3 and laminate.

|  |  |  |
| --- | --- | --- |
| 1. | 2. | 3.  |
| 4. | 5.  | 6. |
| 7. | 8. | 9. |
| 10.  | 11. | 12. |
| 13. | 14. | 15. |

Contexts for graphs –for students to use copy 2XA4 sheet and give to pairs;

|  |
| --- |
| **Age-years: Everyone at a high school** |
| **Number of years living in NZ: C@S Yr 10 students**  |
| **Hair length-cm: 2007 C@S Yr 4-13 students** |
| **Time to school-mins: 2009 C@S Yr 9-13 students**  |
| **Reaction time-secs: 2007 C@S Yr 4-13 students** |
| **Household debt-$: Synthesised Unit Record File based on NZ data** |
| **AsTTle test results: Yr 9 reading** |
| **Index finger length–mm: 2009 C@S Yr 9-13 students** |
| **Right foot length-cm: 2003 C@S Yr 5-10 students**  |
| **Number of skips in 30 secs: 2003 C@S Yr 5-8 students** |
| **Attendance-percentage half days: Yr 9-13 students** |
| **Cell phone ownership-months: 2009 C@S Yr 9-13 students** |
| **Birth month: 2003 C@S Yr 5-10 students** |
| **Weight-kg: Kiwi Kapers Great Spotted Kiwi** |
| **Height-cm: 2003 C@S Yr 5-10 students** |

Teacher “sketched” graphs – for teachers enlarge to at least A3 and laminate.

|  |  |  |
| --- | --- | --- |
| 1. | 2. | 3.  |
| 4. | 5.  | 6. |
| 7. | 8. | 9. |
| 10. | 11. | 12. |
| 13. | 14. | 15. |

Mix’n’match activity – copy one between 2 and cut up

|  |  |  |
| --- | --- | --- |
| Life expectancy for women at birth for different countries | New York Marathon winning times | Land area of different countries  |
| Number of gold medals by country at the Olympics from 1920-2004 | Life span in years of 1146 artists | Number of goals scored during standard play time in World cup soccer games from 1978-2002 |
|  Earnings – top 360 golfers 2010 PGA tour | Age of golfers - top 360 golfers 2010 PGA tour  | Number of rounds of golf played – top 360 golfers 2010 PGA tour |
|  Weight in kg of female kiwis – Kiwi kapers | Age in years of Nobel laureate in Physics 1970-2010 |  Unemployment rates for males and females in different countries |