

*The following examples of student work illustrate achievement at the mathematics standards for years 7 and 8.*

## Superhero Statistics

The task used in this illustration was linked to an English unit on the literary convention of the “superhero” in film and literature. The class had investigated the characteristics of superheroes and their various powers. The teacher then connected this work to the 2009 Census at School question “Which superpower would you most like to have?” The multichoice responses included: invisibility, flying ability, telepathy, ability to freeze time, or super strength. Data was available through the Census at School website, and the students were familiar with the Data Viewer tool: [www.censusatschool.org.nz/2010/data-viewer](http://www.censusatschool.org.nz/2010/data-viewer)

The task relates to achievement objectives for Statistics from the mathematics and statistics learning area in *The New Zealand Curriculum*.

### Superhero Statistics



*Using the Data Viewer on the Census at Schools website, explore at least two variables within the Superpower response data. Keep track of your investigation on an Excel® spreadsheet by inserting a text pane or text boxes as you create tables and graphs. It must be clear to a reader how you followed a question through the data and what conclusion you reached from your analysis of the information in the tables and graphs.*

Some features of students' work used to make judgments in relation to the mathematics standards are described below.



### Superhero Statistics 1 of 2

#### New Zealand Curriculum: Level 4

In solving problems and modelling situations, students will:

##### Statistics

- plan and conduct investigations using the statistical enquiry cycle:
  - determining appropriate variables and data collection methods
  - gathering, sorting, and displaying multivariate category, measurement, and time-series data to detect patterns, variations, relationships, and trends
  - comparing distributions visually
  - communicating findings, using appropriate displays (statistical investigation)

#### Mathematics Standard: By the end of year 7

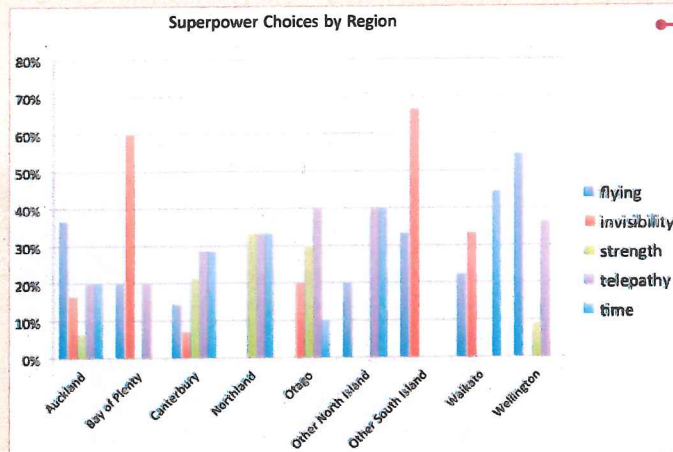
##### Statistics

- investigate summary, comparison, and relationship questions by using the statistical enquiry cycle:
  - gather or access multivariate category and measurement data
  - sort data and display it in multiple ways, identifying patterns and variations
  - interpret results in context, accepting that samples vary and have no effect on one another

Superpower choices in the regions – I asked for a sample of 100 kids of all ages.

I wonder if kids in different places wish they had different powers?

I can see that not all kids think the same things. Being invisible is way more popular in Bay of Plenty and some parts of the South Island, and flying is way more popular in Wellington! Canterbury, Northland, and Otago have lots of kids who wish for super strength. I wonder if this has something to do with boys having different preferences from girls?

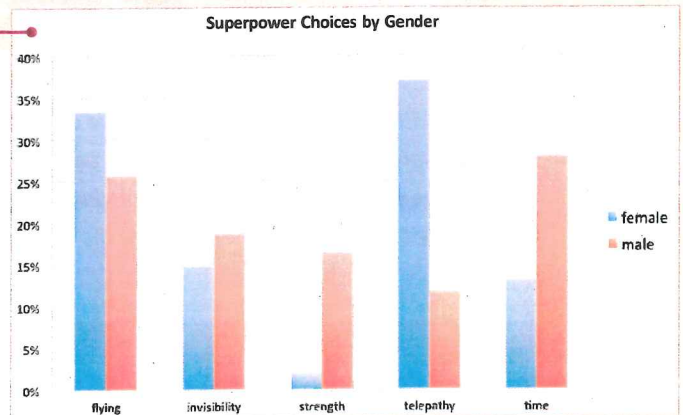


Mikaylah accessed the superhero response data through the Data Viewer and cut and pasted tables of data into an Excel® spreadsheet to create her own data displays.

So I looked at superpower preferences in relation to gender. I found out that there was a difference. Girls choose flying and telepathy more than boys do, and boys choose strength and ability to freeze time more than girls do. They are about the same for being invisible. I think it's funny that girls want to read other people's minds and boys want to freeze time. I wonder why they want to stay in the same time and not go into the future?

	flying	invisibility	strength	telepathy	time
female	33.30%	14.80%	1.90%	37.00%	13.00%
male	25.60%	18.60%	16.30%	11.60%	27.90%

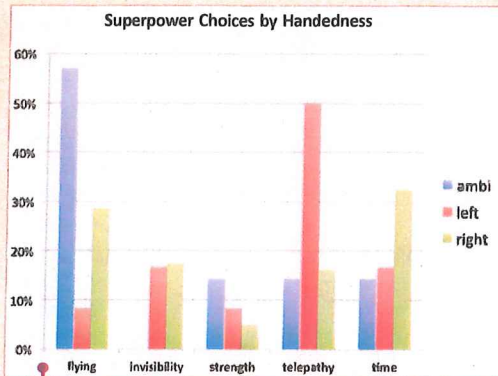
Mikaylah "read" the graph and identified patterns in the data. She then asked more general questions about boys' and girls' preferences, based on these patterns.





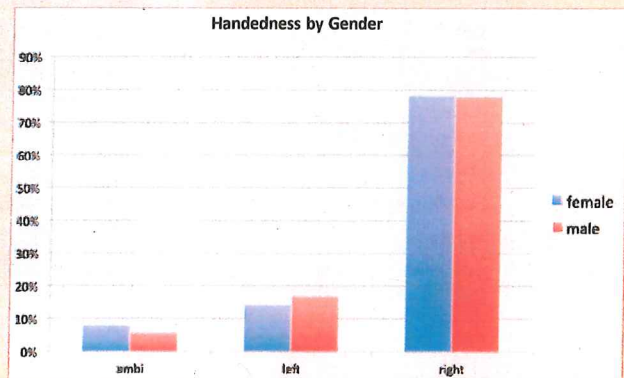
Superhero Statistics 2 of 2

Then I thought if boys and girls had different ideas about superpowers, maybe other groups did too. So I chose the variable of handedness. I thought it would be the same for each group, but NO! Most ambidextrous people want to fly, half of left-handed people want to have telepathy, and right-handed people want to freeze time more than the others. This made me think about the boys and girls, and I thought maybe there were more left-handed girls or something.



Mikaylah was thinking about the possible relationships between variables. Her decision to check the differences found in the third graph by also exploring gender was related to her earlier finding about differences in relation to gender.

	ambi	left	right
female	7.80%	14.10%	78.10%
male	5.60%	16.70%	77.80%



So I put in the variables of handedness and gender and found out that there are about the same number of boys and girls in each group. And that showed that the relationship between handedness and superpowers wasn't because there were more boys or girls in a group.

My teacher suggested I look at my sample sizes. About 15% of people in my sample are left-handed, about 7 girls and 8 boys. Even fewer are ambidextrous. So, it's really too small a sample to draw conclusions from.

Mikaylah understood the effect of sample size on drawing reliable conclusions.

Maybe it has to do with their brains - if you are left-handed you use more of your right brain, the other way for right-handed, and ambidextrous people use both sides. This could be a good investigation.

The teacher asked Mikaylah about what her next step would be if she followed through on her last finding.

I would do this study again with a much larger sample and see if I got the same results. If I did, I would need to find out if the different parts of your brain make you interested in different things.

Discussion

This task provides some of the evidence needed to show that Mikaylah is achieving at early curriculum level 4 and the year 7 standard in Statistics. She has demonstrated that she is able to access multivariate category data and display it in ways that allow her to investigate comparison and relationship questions. She can interpret data displays in context and understands that samples can vary.





Superhero Statistics 1 of 2

**New Zealand Curriculum: Level 4**

*In solving problems and modelling situations, students will:*

**Statistics**

- plan and conduct investigations using the statistical enquiry cycle:
  - determining appropriate variables and data collection methods
  - gathering, sorting, and displaying multivariate category, measurement, and time-series data to detect patterns, variations, relationships, and trends
  - comparing distributions visually
  - communicating findings, using appropriate displays (statistical investigation)

**Mathematics Standard: By the end of year 8**

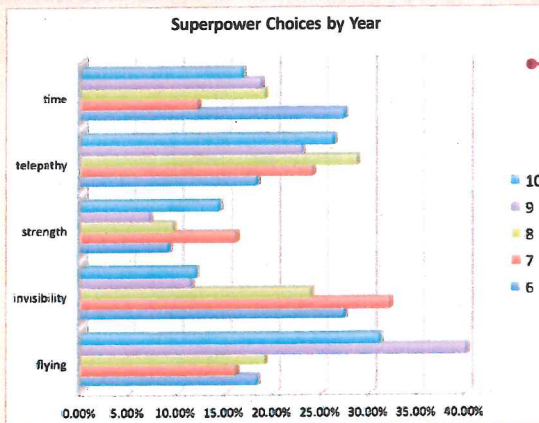
**Statistics**

- investigate summary, comparison, and relationship questions by using the statistical enquiry cycle:
  - gather or access multivariate category, measurement, and time-series data
  - sort data and display it in multiple ways, identifying patterns, variations, relationships, and trends and using ideas about middle and spread where appropriate
  - interpret results in context, identifying factors that produce uncertainty

I wondered what superpowers each year group would choose.

The college students chose **FLYING** more, and the primary students chose **INVISIBILITY** and **TELEPATHY** more.

I'm not sure why. Maybe people in college are thinking about getting their driver's licence and want to go zooming around. And maybe people in primary school are getting into trouble and want to be invisible and cause mischief. I don't know.

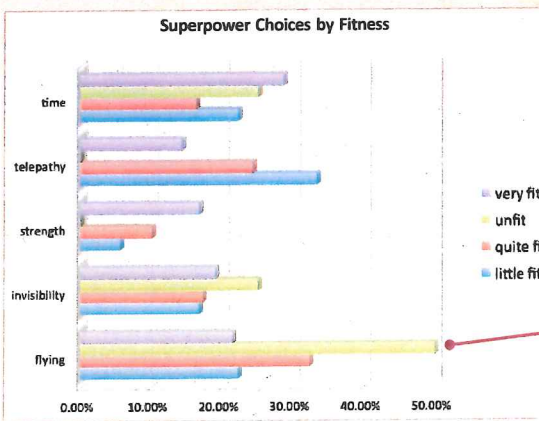


Tyson accessed the superhero response data through the Data Viewer and cut and pasted tables of data into an Excel® spreadsheet to create his own data displays. He started his investigation by accessing data related to age and attempted to draw some conclusions about the results within the sample.

I then tried the fitness variable and found out that people who were **UNFIT** most wanted to be able to fly. But then I realised that there were only 2 people, even though the category looks big on the graph, because there were only 4 people that said they were unfit out of 200.

I then wondered if there was a difference between boys and girls: how fit they said they were and what power they would choose.

	flying	invisibility	strength	telepathy	time	Total	Row n
little fit	22.20%	16.70%	5.60%	33.30%	22.20%	100.00%	54
quite fit	32.30%	17.20%	10.10%	24.20%	16.20%	100.00%	99
unfit	50.00%	25.00%	0.00%	0.00%	25.00%	100.00%	4
very fit	21.40%	19.00%	16.70%	14.30%	28.60%	100.00%	42



Tyson then chose a category variable (fitness) and evaluated a finding given in percentages as not being reliable because it was only based on 4 people out of a sample of 200.



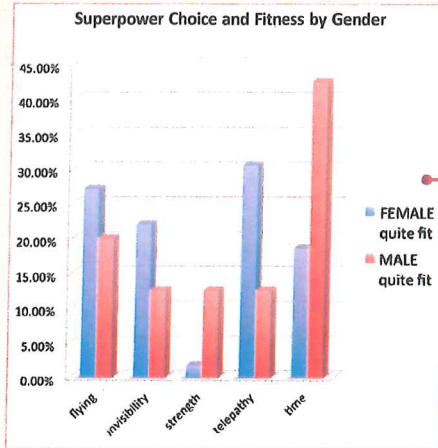
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I made two tables and then used the **QUITE FIT** from both because they were close together in number (40 and 59), so the percentages wouldn't be out of whack, like with the people who wanted to fly before.

This time I found out that females who are quite fit chose everything except **STRENGTH** (and nearly a third or 30% chose **TELEPATHY**), but males who were quite fit mostly chose **TIME FREEZING**.

**STRENGTH** was quite low, maybe because people who are already fit feel pretty strong.

	flying	invisibility	strength	telepathy	time	Total
FEMALE quite fit	27.10%	22.00%	1.70%	30.50%	18.60%	100.00%
MALE quite fit	20.00%	12.50%	12.50%	12.50%	42.50%	100.00%



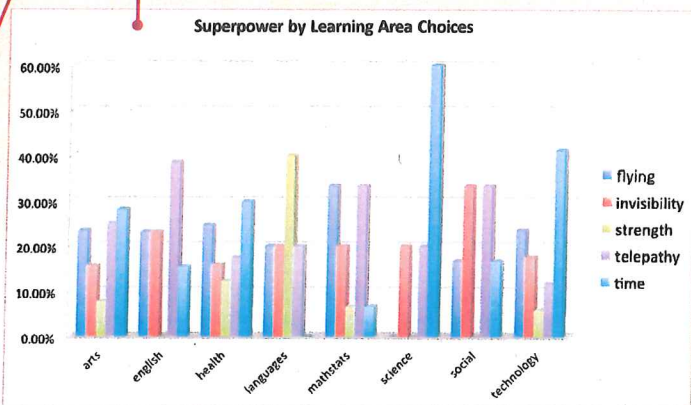
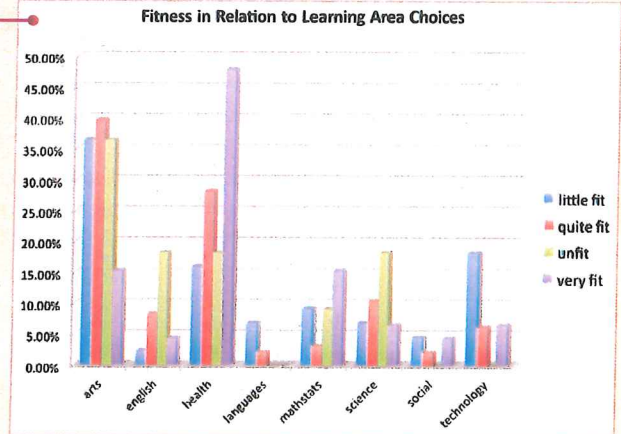
Tyson followed the relationship between fitness and superpower choice by gender, ensuring he was looking at data for reasonable-sized samples.

I started thinking about fitness and its connection with superpowers and favourite learning area. I wondered if people who picked **HEALTH** would tend to be fitter, and that was true.

I also found out that people who like **HEALTH** best chose **TIME FREEZING** and **FLYING**, but not that much more than the other three powers. **SCIENCE** had much more variation in the responses, from 60% who wanted to **FREEZE TIME** to none who wanted to **FLY**.

I think fitness is the investigation to look at. Maybe doing a fitness and strength test and then asking what physical superpower people would want. I could see if they chose something they are good at or something they wish they could do.

Tyson then followed the line of enquiry from fitness to interest in the learning area of health, relating these to superpower preferences. He generated an original research question from his analysis and kept the relationship between fitness and superpowers through to the proposed statistical investigation.



Discussion

This task provides some of the evidence needed to show that Tyson is achieving at curriculum level 4 and the year 8 standard in Statistics. He has demonstrated that he is able to access multivariate category data and display it in meaningful ways. He is also able to identify patterns and relationships and how a small sample size can produce uncertainty. He understands how percentages relate to the actual numbers within the data and therefore when they can be misleading.

