

Teacher's Notes: Sugar guzzlers

This activity may take from 1 to 3 lessons. Spend some time discussing the context with the students. What does 6kg look like or feel like? Is the claim reasonable or over the top?

You might want the students to work in small groups so they can discuss their work with each other. Most questions are discussion questions that encourage student to talk statistics. The purpose of this activity is to carry out a statistical investigation in the same way a statistician would.

After this lesson students will know:

- How PPDAC (Problem, Plan,...) can assist in their statistical learning
- That data can be manipulated
- How to select an appropriate average for a dataset.

You may like to introduce the activity by asking students what their favourite drinks are and to guess how much sugar is in each drink. This information is on the students' worksheets so don't hand them out until after the activity is introduced. You could also relate 6kg of sugar to something the students experience like three 2 litre milk bottles full of sugar or a whole desk full of sugar.

The article that claims that the average student drinks 6kg is from the New Zealand Herald. Here is the link: <http://www.nzherald.co.nz/index.cfm?ObjectID=10127574>

Resources checklist

For each group:

- Graph paper or access to computer or calculator

Problem



Formulating and defining a statistical question is important as it tells students what to investigate and how to investigate it.

For example: How will you identify the average student? What is a drink? Is soup a drink? Will students remember what they drank over a year, a week or the day before?

There are several ways of investigating this problem. The questions in this activity have been written to encourage students to either work out the total amount of sugar the class drinks in a year and then divide that by the number of students in the class or to identify the average (mean or median) student in terms of the amount of sugar they drink in a day and then multiply that by the number of days in a year.

Plan



1. How would you answer the question now, before you gather the data? Justify your answer. Students learn more effectively if they are encouraged to make predictions and then to test them and reflect on the difference between their prediction and the result. To justify, students need only make sensible assumptions

2. How are you going to work out the amount of sugar your class or a sample from CensusAtSchool drinks in a year? This activity has been written for to allow for both collecting data from the class and obtaining it from CensusAtSchool.

3. Can you remember all the drinks you have had this year? No

4. What do you drink in a typical day? Was yesterday typical? Students should note down what they drink on a typical day. Yesterday's drinks if yesterday was typical.

5a. How many people are you going to ask? Student to decide.

5b. What is a suitable sample size? Usually at least 30, but for the benefit of this activity, smaller sample are fine.

6. Where are you going to obtain your data? Students will need to decide where they are going to obtain their sample. If they are going to use class data, a serving's sheet has been included in the teacher support sheet. Students taking a sample from CensusAtSchool will require access to computers: Alternately, the teacher could take a random sample from CensusAtSchool and place the data on an OHT, activeboard, photocopies, etc.

So what is your plan? How are you going to work out what the average amount of sugar your class or the sample drinks?

7. Write your plan in your books. Remember to include the reasons you think this is a good plan. Students should select their own sample size and method and provide justification. (This may be modified if you are using sample data provided.)

Data



Students may record their data in any format as long as it is clear and easily manipulated. A table is usually the best format. A table has been included that mirrors the drinks in the CensusAtSchool survey.

A dataset has been included for classes/teachers that cannot access the CensusAtSchool dataset or lack time to collect their own dataset. **See DATASET 1.**

Analysis



Have a look at the data you have collected.

- 1. What do you notice?** When students look at the data table they should notice features like who drank the most and least, what was the most popular and least popular drinks. This will help them to select the correct scales for their graphs.
 - 2. Are there any students who stand out because they drink a lot or a little of one kind of drink.** By looking at extreme values, students can decide what data needs cleaning (if any).
 - 3. How many drinks were consumed in total?** Read from the table of data. Answer can be found from table in very bottom right corner of the data table.
 - 4. What is the most common drink? Draw a graph to show this and the rest of data from the table.** Most common drink-usually water: A bar graph would be an appropriate graph. They may like to order drinks from most to least popular, as this will make the graph easier to read.
 - 5. What would predict the amount of sugar drunk by an average student to be now?** Students should be encouraged to make another prediction now they have looked at the data in the table. You might like to extend students by finding out how the number of drinks students drink relates to the amount of sugar they drink. Do students who drink more also consume more sugar? They could also find out factors about students who drink more sugar e.g. does it relate to age, or amount of physical activity? Encourage students to explore the data and generate hypotheses. The data to explore these questions are available from CensusAtSchool online.
 - 6. Find your row in the table. Do you seem normal?** Do they drink what appears to be an average amount or do they far more/less than other students?
 - 7. Draw a graph or graphs to show the number of drinks each student drunk. Can you show this in a more summarised way?** Students should be encouraged to create their own graphs rather than being told which graph to use so that they have ownership of the data detective and discovery process. It doesn't matter which graphs they use to plot the data, as long as they are investigating the stories in it and the graph is suitable for the type of data.
 - 8. How would you describe the spread of the data?** They will probably find that not all students drink the same number of drinks or the same types of drinks. This means the plotted data is not uniform. One of the key aims of statistics is to deal with the variation in data and to say whether it is natural or random or whether it is explained by other factors. You might like to ask students to think about what the graph would look like when their parents or grandparents were at school.
 - 9. What is the 'average' number of drinks a student drank? Give a reason you why think this.** What average will they use? Mean, mode or median. Can they justify their choice of average? One avenue students can follow is to find the average amount students drink in a day and then the average amount of sugar per drink. From here they can find the average amount of sugar consumed in a year.
- Here is some information about the amount of sugar in each type of drink.**
- 10. How are you going to use this to work out the amount of sugar an average student drunk?** One way is to simply multiply each drink each a student consumed by the amount of sugar in each drink. This will give each student a sugar consumed amount in grams. They could then multiply that by 365 (sugar consumed in a year) and divide by 1000 (convert into Kg). Naturally, students will come up with many different methods as well and should be encouraged to do so. DATASET 2 contains value for the sample data given.
 - 11. Why do you think the sugar per cup of Tea/Coffee and Hot Chocolate/Milo is incomplete?** Students add different amounts to their tea/coffee or Milo.
 - 12. What values are you going to assume for these types of drinks?** Students will need to come up with an 'average' that students add to their hot drinks. 1 or 2 teaspoons of sugar may seem reasonable (I.e. For 2 teaspoons of sugar for all drinks. Coffee = $0 + 8 = 8$. Milo = $4 + 8 = 12$.

A teaspoon of sugar is about 4g.

Note Milk* This is an average of all no-flavoured milks (green, blue light green etc.)
Hot Chocolate or Milo** Assumes drink made with water. If made with milk change 4+ to 15+
Other*** Consists of flavoured water (6~9 g per 250 ml) to energy drinks (29~35 g per 250ml).
 Once again, an average has been taken.

13. Graph this information. You may have to draw several graphs to show all the information. Once again, let students graph what THEY think is important.

14. How many days does it take you to drink 6kgs of sugar? Use their formula for finding an average and modify it to answer this question e.g. Formula: $A = \text{average amount drunk per day}$, $B = \text{average sugar per drink}$, $n = \text{number of days}$. $ABn = 6$. So $n = 6/(AB)$. There are many different ways they could formulate this.

15. Are you in the middle clump/range? Students usually enjoy being included in the data and comparing themselves to other students.

In your books record your thoughts about your graphs using these sentence starters:

I noticed that...

I wondered if... (The I notice/I wonder can and should be as often as possible. Try asking students what they notice/wonder throughout the whole investigation).

Conclusion

Student's conclusions should relate back to their original question. They should also mention any features they had noticed or wondered about and investigated.



From the trials and the data, 6kg guzzled in a year is far lower than what the students will actually work out the answer to be. Trials have shown from 28Kg to about 45kg to be most frequent. It is not known if the article considered most drinks or simply artificial drinks (such as soft drinks and cordials), ignoring products such as milk, hot drinks and so on. Students may still be quite surprised at the amount of sugar that sneaks into their daily diets.

Reflection

As a class reflect on the activity to communicate results, draw overall conclusions and to consolidate student learning. Students should be able to justify how they decided who or how many drinks was 'average'. This question tests students' concept of 'average' and so may provide a good discussion point during class reflection time. They may choose the most common number, (mode) or they may choose the number of drinks in the middle of the bump of plotted data. This would also lead to a discussion of spread and shape of the plotted data. The investigation also uses the term likely so you could discuss probability concepts too.

DATASET 1

Drinks in a day	Water	Fruit juice	Cordial	Fizzy drink	Diet fizzy drink	Sports drink	Milk - not flavoured	Smoothie or shake	Tea/coffee	Hot Chocolate Milo	Other	Total
Me												
A	1	3	0	0	0	0	1	0	0	0	0	
B	3	0	0	0	0	0	2	0	0	0	0	
C	1	1	0	1	0	0	0	0	0	0	0	
D	0	0	0	2	0	0	4	1	0	2	1	
E	2	0	0	2	0	0	1	0	1	1	0	
F	3	0	0	0	2	0	1	0	1	1	0	
G	1	0	0	2	0	0	0	0	0	0	3	
H	2	2	0	0	0	0	2	2	1	1	1	
I	0	0	4	0	0	0	0	0	1	0	0	
J	3	0	2	1	2	0	0	0	0	0	0	
K	5	0	0	0	0	0	2	0	0	0	0	
L	2	0	0	0	1	0	0	0	0	0	0	
M	1	0	0	0	0	0	3	0	0	3	0	
N	5	1	0	0	0	0	2	0	0	1	0	
O	4	0	0	2	0	0	0	2	0	0	0	
P	12	0	0	0	0	0	0	0	0	0	0	
Total												

DATASET 2

Drinks in a day	Water	Fruit juice	Cordial	Fizzy drink	Diet fizzy drink	Sports drink	Milk – not flavoured	Smoothie or shake	Tea/coffee	Hot Chocolate Milo	Other	Total in grams for 1 day	Total kg for 1 YEAR
Me												g	kg
A	1	3	0	0	0	0	1	0	0	0	0	89	32.5
B	3	0	0	0	0	0	2	0	0	0	0	22	8
C	1	1	0	1	0	0	0	0	0	0	0	53	19.3
D	0	0	0	2	0	0	4	1	0	2	1	156	57
E	2	0	0	2	0	0	1	0	1	1	0	77	28.1
F	3	0	0	0	2	0	1	0	1	1	0	23	8.4
G	1	0	0	2	0	0	0	0	0	0	3	114	41.6
H	2	2	0	0	0	0	2	2	1	1	1	150	54.8
I	0	0	4	0	0	0	0	0	1	0	0	104	38
J	3	0	2	1	2	0	0	0	0	0	0	77	28.1
K	5	0	0	0	0	0	2	0	0	0	0	22	8
L	2	0	0	0	1	0	0	0	0	0	0	0	0
M	1	0	0	0	0	0	3	0	0	3	0	57	20.8
N	5	1	0	0	0	0	2	0	0	1	0	56	20.4
O	4	0	0	2	0	0	0	2	0	0	0	98	35.8
P	12	0	0	0	0	0	0	0	0	0	0	0	0
Total	45	7	6	10	5	0	18	5	4	9	5		

Note: Tea/coffee and Hot chocolate have all used 1 teaspoon of sugar added.

Example student N; $5 \times 0 + 1 \times 26 + 2 \times 11 + 1 \times (4+4) = 98$ g. $98 \times 365 / 1000 = 35.8$ Kg of sugar for 1 year.