Curriculum level: 5+

Teacher's Notes: Sugar guzzlers

The purpose of this activity is to carry out a statistical investigation in the same way a statistician would. It may take from 1 to 3 lessons. It is centred around investigating a claim made in an article in the NZ Herald in May 2005 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

After this lesson students will:

- *have experienced how the PPDAC cycle can be used to solve a real problem*
- *know that data can be manipulated*
- *how to select an appropriate average for a dataset.*

There are several ways of investigating this problem. Students could gather data from the class, download a sample from the 2005 CensusAtSchool database (Question 22, columns BM to BW) or use the set of data collected from Census At School made available below. **See DATASET 1.**
The questions in this activity have been written to encourage students to use the number of drinks they had yesterday to estimate the typical number of drinks they have in one day and use this data to estimate the weight of sugar they took in drinks yesterday and then multiply this by the number of days in a year. A table containing the weight of sugar in each drink is provided.
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? 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. You could 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. 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.

Ask the class how they would test the claim made by the newspaper. You might want the students to work in small groups so they can discuss their work with each other. This will establish the need for data and lead to the PPDAC. (Most questions on the worksheet are discussion questions that encourage student to talk statistics.)

Resources checklist

For each group:

□ Graph paper or access to computer or calculator

Problem

Write a problem to solve in the form of a question that will need data to answer.
For example, Is the typical amount of sugar students in your class drink in a year likely to be 6Kg? Introduce the problem posing stage of the PPDAC, the need to write a question that we can answer using statistics. Formulating and defining a statistical question is important as it tells students what to investigate and how to investigate it. An example of a problem question could be: Is the typical amount of sugar a student in my class (or on Census At School) drinks in a year likely to be 6kg?

You may like to establish the problem question with the class. You could discuss:
How will you identify what classifies as sugar in a drink? What is a drink? Is soup a drink? Will students remember what they drank over a year, a week or the day before?

Plan

Group discussion questions:
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. Can you remember all the drinks you have had this year? This is a stimulus question to encourage students to think about how they would approach the problem.
3. What do you typically drink in one day? Were your drinks yesterday typical of what you usually drink in a day? Students could note down what they drink on a typical day. Yesterday's drinks if yesterday was typical.
4. How would you go about gathering data to answer your question? Who would you survey? How many people would you ask? What drinks would you include? Further stimulus questions to encourage thinking around the problem. This activity has been written for to allow for both collecting data from the class and obtaining it from CensusAtSchool or using the data sets provided below. 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. Alternatively, the teacher could take a random sample from CensusAtSchool and place the data on an OHT, activeboard, photocopies, etc.
Sample size is not important at this stage. Usually at least 30, but for this activity, smaller samples are fine.
5. How would you go about using the data you collect to work out the typical amount of sugar a student drinks? How would you measure the amount of sugar in each drink? The amount of sugar in each drink is given on the label. Fruit juice, while it may not have sugar added contains about the same amount as coke or other soft drink. A table showing the amount of sugar per serving of each drink is supplied.
6. Write down your plan. 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

Data

using sample data provided.
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 with the same headings as the CensusAtSchool survey has been inclued.

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

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. Find your row in the table. Is the amount you drink typical? Do they drink what appears to be an average amount or do they far more/less than other students?

3. 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).

4. What is the most common drink? What is the least popular drink? Draw a graph that shows the popularity of each type of drink.
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. Which student drinks the most? Which student drinks the least? Draw a graph to show how many drinks each student drinks in a day. 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.

6. What would you predict the amount of typical amount of sugar a student drinks in a year 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.

7. Draw a graph or graphs to show the number of drinks each student drinks in a day. 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 for the students in your sample? Give a reason you why you 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.

	Water	Fruit juice	Cordial	Fizzy drink	Diet fizzy drink	Sports drink	Milk -not flavoured	Smoothie or shake	Tea or coffee	Hot Chocolate or Milo	Other	TOTAL yesterday	TOTAL for year
Sugar in grams	0	26	25	27	0	24	11*	22	0+_	10+_**	20***		
student												g	**kg**

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 10+ 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.

10. Why do you think the amount of sugar per cup of Tea/Coffee and Hot Chocolate/Milo is incomplete? What will you do about this? Students add different amounts to their tea/coffee or Milo. 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. For example, assuming 2 teaspoons of sugar for all drinks, Coffee = 0 + 8 = 8, Milo = 10 + 8 = 18.

11. How are you going to use this table to work out the typical amount of sugar a student drinks in a year? 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.

12. In a table (see below) record the amount of sugar each student drinks in a year. Extend the example provided.

13. Draw a graph of 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. Is the amount of sugar you drink in a year typical? Are you in the middle clump, the middle of the range? Students usually enjoy being included in the data and comparing themselves to other students, and relating to the context on a personal level helps keep the problem in mind.

15. How would you describe the spread of the data? Trials have shown from 28Kg to about 45kg to be most frequent. The shape of the data could also be discussed.

16. What is the 'average' amount of sugar a student in your sample drinks in a year? Give a reason you why you think this. Encourage students to give statistical evidence for their conclusions. 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.

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

I noticed that…

I wondered if… (I notice/I wonder can and should be used 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. 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 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.