

The weight of school bags

Annotation

Rahera poses a question about a wider population (year 8 students in New Zealand) that requires a sampling method to generate the data. The variables are clear from the question (mode of transport and weight of school bag), and Rahera is able to use the data she collects to answer the question.

Rahera collects multivariate measurement and category data (the measurement variable is bag weight, and the category variable is mode of transport). She uses a sample of year 8 students to generalise about year 8 students across New Zealand. Her data requires “cleaning” and sorting. She removes any person who does not answer one of the two questions regarding her two variables, and she sorts her data into three basic groups. She groups bus and train together as they are both forms of public transport, and she excludes the two bike and one “other” response as these groups are not enough to be reliable when making generalisations. She notes the unusual data value of 0 and chooses to include it as it is explainable as “no bag” and differs from those students who simply did not answer the question.

Rahera uses different displays to analyse her data. The box-and-whisker plots summarise each category and allow Rahera to make direct comparisons. The mean and median calculations also allow her to make comparisons. The dot plots provide contrasting information. They show the number of students in the sample that use each type of transport and more clearly show the distributions of the results.

Rahera’s conclusion summarises the findings from her analysis and generalises results without making assumptions. She considers the context within her conclusion.

Problem: The weight of school bags

The students in this year 8 class have completed the 2011 CensusAtSchool New Zealand survey. The teacher gives them the following task:

Explore the data from CensusAtSchool New Zealand and pose investigative questions about a particular population that can be answered with the data.

Student Response

Rahera’s work sample is as follows:

Question

Do year 8 students in New Zealand who walk to school tend to carry lighter bags than year 8 students in NZ who go by car or bus/train?

Plan

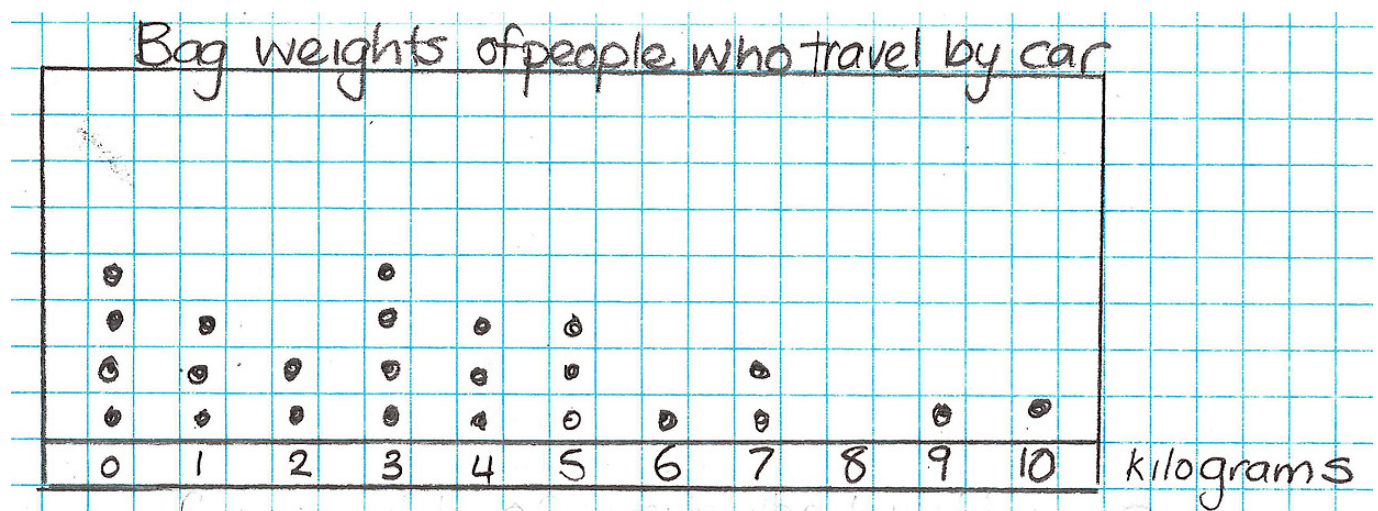
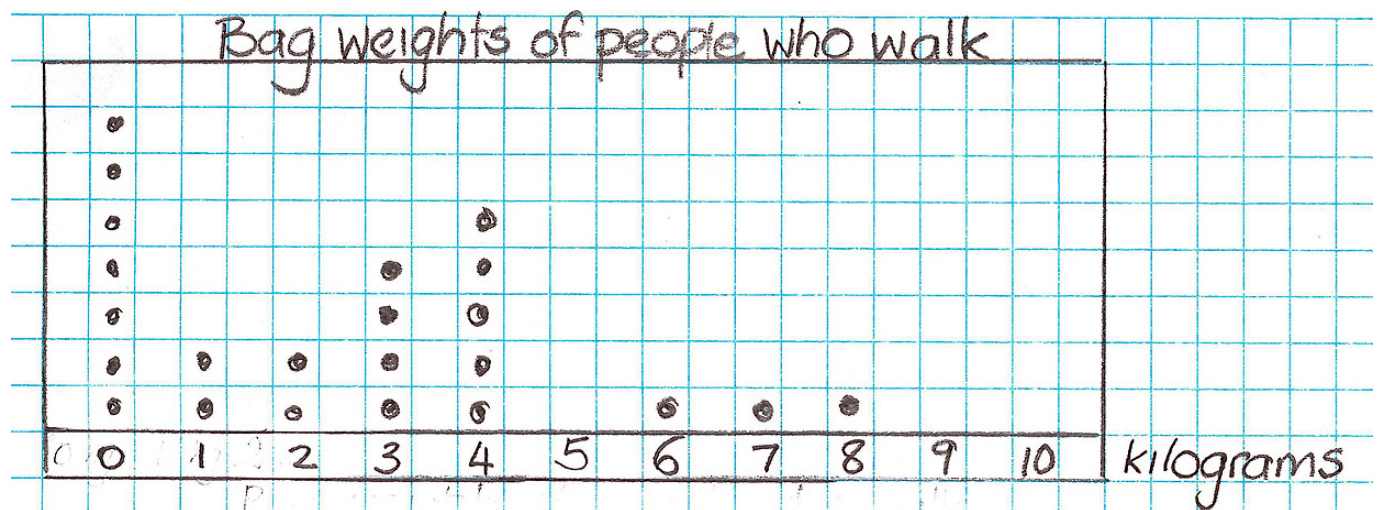
Take a random sample of 100 year 8 students in New Zealand by using the random sampler from CensusAtSchool New Zealand at www.censusatschool.org.nz

Resulting data

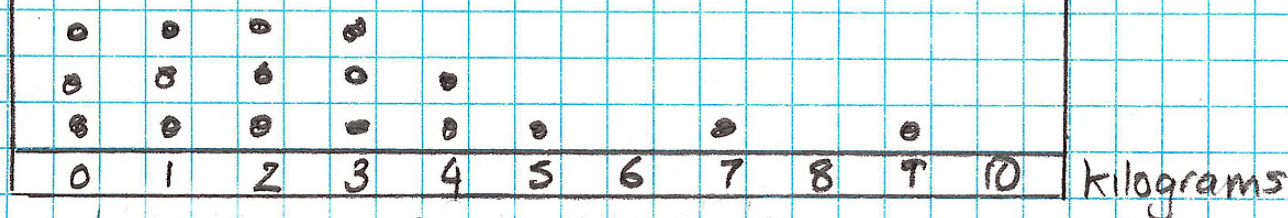
Mode of Transport	Bag weight in grams
Car	3000, 10000, 4000, 1000, 2000, 300, 400, 500, 2800, 3500, 1000, 6000, 500, 4100, 7000, 5000, 5000, 3000, 4000, 3700, 9000, 5000, 1000, 7000,
Bus	900, 2500, 5000, 3000, 3000, 7000, 2600, 4000, 3000, 1300, 2000, 300, 4000, 1000, 500
Walk	300, 4000, 4000, 4200, 7000, 500, 400, 3000, 0, 2300, 500, 8000, 3200, 500, 1700, 1500, 2000, 4000, 300, 4000, 3600, 6900, 3900
Train	9000, 1000
Bike	500, 5100
Other	3000

Analysis

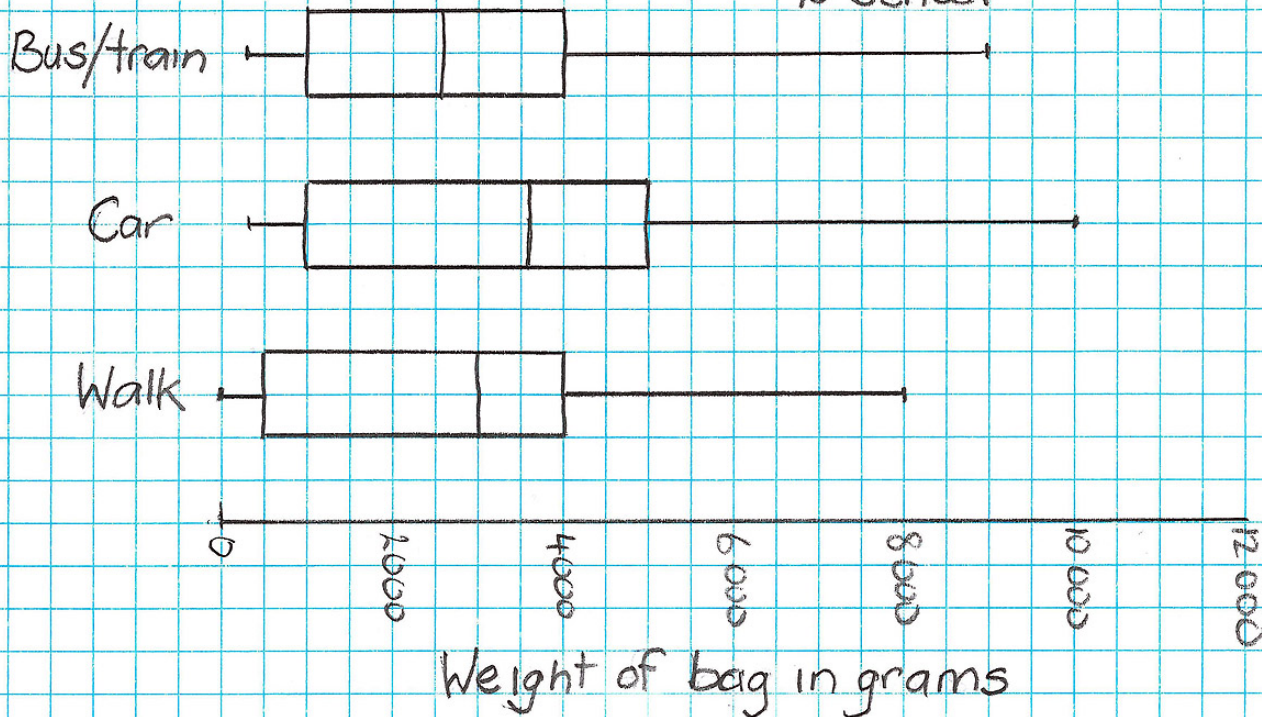
Median bag weights: walk = 3000 g, car = 3600 g, bus/train = 2600 g



Bag weights of people who travel by bus/train



Weight of school bags for different modes of travel to school



There is a big range in the bag weights of students in year 8 - one person had a bag that weighed 0 (which I took to mean no bag at all), and one bag was 10 kilograms. Most people had bags weighing less than 5 kilograms. The distribution of bag weights for the three modes of transport is similar. The medians are close; bus/train: 2.6 kilograms, walk: 3 kilograms and car: 3.6 kilograms. There is not a lot of difference in bag weights according to the different mode of travel to school. People who come by car have slightly heavier bags than those on foot or public transport, but we can't tell whether they came by car because they had a heavier median bag or whether they put more things in their bag because they were coming by car.

Conclusion

From this data, it does not seem that students who walk carry lighter bags than students who travel by bus or train because I can see that the medians are within the overlap of the boxes. I know that if I took another sample I might get a different picture of the bag weights for year 8 students.

Teacher: Can you tell me what you did?

Rahera: First I got a random sample of year 8 students from the CensusAtSchool data. Then I deleted all the other columns, and also I took out anyone who didn't answer one of the two questions about bag weight or how they travelled to school.

Teacher: Why did you do it that way?

Rahera: Well, my question was about year 8 students, so my sample only needed year 8 students in it. I wanted to know about New Zealand year 8 students, so I took quite a big sample of 100. But because I had to delete some, I ended up with less. I had to delete the ones that didn't answer, because I couldn't include their results. Next time, I think I would take a larger sample so that I am left with more.

Teacher: What else did you do?

Rahera: I grouped the bus and train people together because there weren't many train people and I decided that public transport was kind of the same. I left out the "Other" section because I didn't know what kind of transport it was, so I couldn't group it. There were a few people that answered their bag weight as 0, so I assumed it meant they had no bag at all - but I left it in because they did answer the question, and I know sometimes people don't bring a bag to school, just money for their lunch.

Teacher: Can you tell me anything else?

Rahera: I used box-and-whisker graphs to see if there was one group that looked heavier than others, but it didn't show much difference. So I calculated the mean and medians for each group to see if one was more. Then I did dot plots, so I could see the shape of the data and see if that showed more walkers to have lighter bags.

Teacher: Could you have done it another way?

Rahera: I could have done histograms instead of dot plots.

Teacher: What did you find out?

Rahera: That there is a big range of bag weights. Possibly the people who walk have lighter bags than the people who drive, but people who take a bus or train have bags just as light as the people who walk.