How students travel to school: Rubric

http://topdrawer.aamt.edu.au/Statistics/Assessment/Assessment-tasks/Prediction-from-a-pictograph

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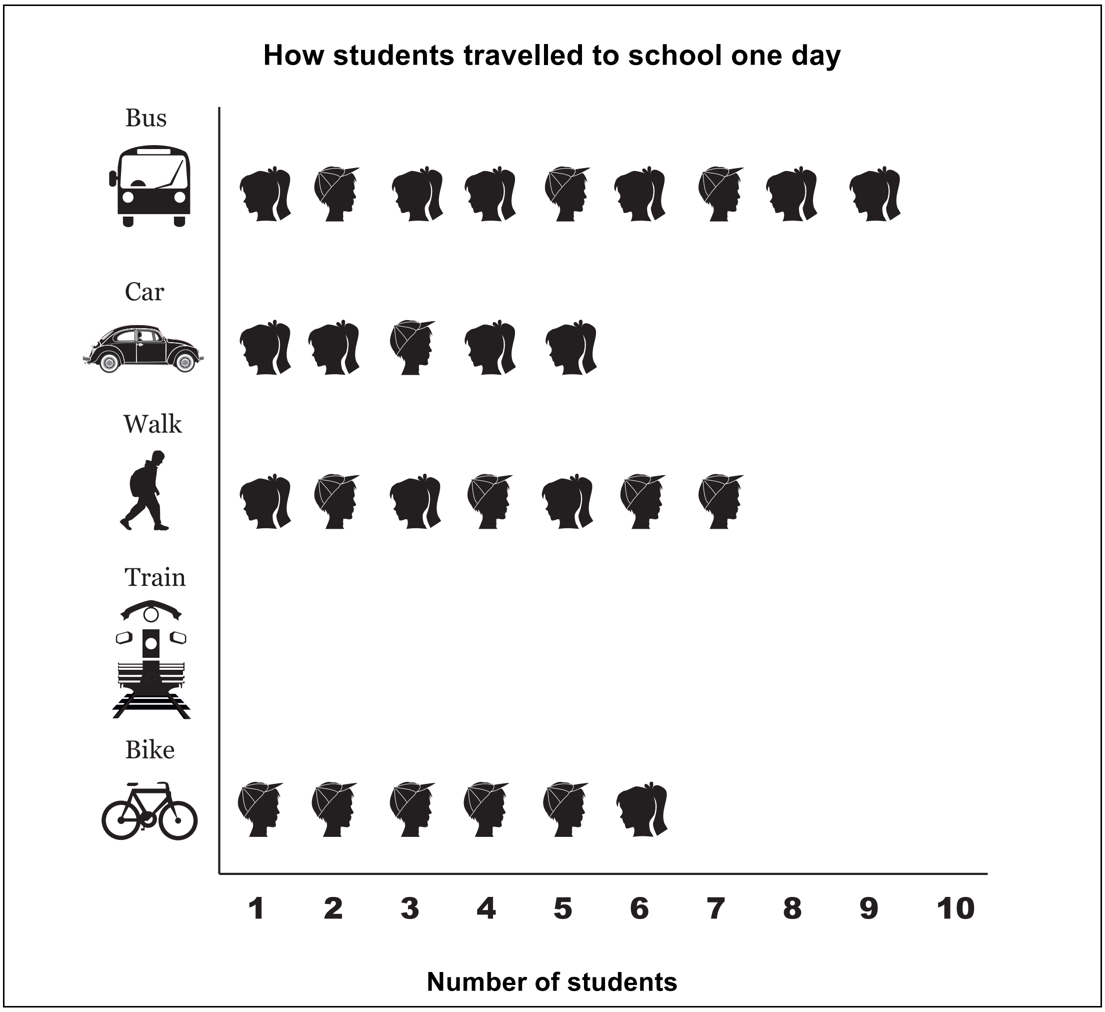

1. Would the graph look the same everyday? Why or why not?
2. A new student came to school by car. Is the new student a boy or a girl? How do you know?
3. What does the row with the train tell you about how the children get to school?
4. Tom is not at school today. How do you think he will get to school tomorrow? Why?

AAMT — TOP DRAWER TEACHERS
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Question 1

Most students appreciate that changes are likely to occur and language like 'might' and 'could' reflect this.

- *No, someone could be sick.*
- *It might rain.*
- *The bus might break down.*

Question 2

A question with no certain 'correct' answer needs to be handled carefully as some students have an expectation that in mathematics there is always a right answer. Four levels of student response reflect increasing involvement with the graphical representation.

Level 1: At the lowest level are responses that include personal experience and inability to speculate based on the pictograph.

- *Girl, because at our school more girls come by car.*
- *Girl, it is just a guess.*
- *Can't say, impossible to tell, because there isn't enough information on the graph.*

Further discussion can encourage consideration of the possibilities when full information is unavailable.

Level 2: At the next level are responses that engage the context and graph but in a non-statistical fashion. Some reflect basic uncertainty.

- *Girl or boy, there is a 50% chance of each.*

Many students interpret the order represented on the pictograph as significant.

- *Girl, because she is the last one on the graph.*
- *Boy, because it goes two girls, one boy, and then two more girls, so then it should be a boy.*

This may reflect the early emphasis on detecting patterns in the mathematics curriculum.

Level 3: Two frequency approaches are seen at the next level of response. Some students appear to consider the frequencies of boys and girls (either in the row with the car or overall) and feel the need to balance the genders.

- *Boy, because there are 14 girls and 13 boys so they need one to make it even.*
- *Boy, because there's only one boy in the cars.*
- *Boy, 4 girls, 1 boy! The odds are on another boy.*

The last response reflects the 'gambler's fallacy' of compensating for previous outcomes in a context expected to produce an even outcome. The contrasting use of frequency in the graph is to view the majority of girls, either in the car row or the class overall.

- *Girl, because there are more girls than boys.*
- *Girl, the majority of people who come in the car are girls.*

Level 4: The highest level of response combines the focus on the majority with appropriate uncertainty.

- *4/5 chance girl, because there are 4 girls and 1 boy.*
- *Probably a girl but could easily be a boy. It's a guess – more girls currently travel by car.*

Few students are likely to include such qualifications but it is the type of consideration that needs to be encouraged from the beginning of prediction and decision-making with data.

Question 3

Again the most appropriate responses allow for variation and uncertainty about the information given.

Level 1: At the lowest level of response a few students appear to misinterpret the question or provide brief responses without further explanation. Answers of '0' and 'none' appear to refer to frequencies, whereas 'nothing' is inappropriate as the blank row does provide information on how children get to school. Most students respond at a level that makes a definitive statement about the situation with no qualification.

- *Children don't like going to school by train.*
- *No one lives that far away to need to catch a train.*
- *There are no trains close to the school.*

Level 2: The most common explanation is a straight declaration.

- *No one catches the train.*
- *They all walk or go by bike or car or the bus.*

Level 3: The most complete responses imply a degree of variation or uncertainty of what might happen on other days.

- *No one caught the train that day.*
- *They might take the train.*

Question 4

This is another prediction question and is likely to elicit many levels of response reflecting increasingly appropriate reasoning in relation to the information in the graph.

Level 1: Students may have difficulty in engaging with the information presented.

- *Car, it's just a guess.*
- *Don't know, because it doesn't say anything about Tom.*

They may comment about previous behaviour without making a choice.

- *The same way he normally comes. There is no need to change.*

Level 2: The next level includes responses that make up stories for Tom.

- *Bike, because it might be a nice day.*
- *Car, because he has been sick and might be too weak to walk or ride anymore.*
- *I don't know, he might not come tomorrow.*

Some responses at this level make suggestions based on the patterns in the graph.

- *Car, because he would complete the car row pattern.*

Level 3: As with Question 2, some students use Tom to balance other features in the graph.

- *Car, because there is only one boy in the car list.*
- *Train, train would not be included if no one used it.*

A few also take an 'anything can happen' view.

- *I don't know, because he could come any way.*

Level 4: A frequency approach is shown in responses at the next level in two ways.

- *Bus, because most people catch the bus.*
- *Bike, because lots of boys come by bike.*

Level 5: Finally at the highest level of response, a few responses include an element of uncertainty in their predictions.

- *Probably bus, because it is the most popular.*
- *Bike, given the data, more boys go to school by bike, so Tom is more likely to go by bike.*
- *Bus or bike, because the bus is the most popular way and most boys take the bike.*
- *Probably bus or walk, because that's what most kids do.*

For all parts of this task there is the opportunity for debate and consideration of likelihood based on the information presented. That students suggest contextual explanations from their own experience or explanations based on patterns should not be condemned. In both cases students should be encouraged to begin to see these explanations as assumptions that contribute to the prediction made. Even students who predict based on the frequencies shown in the pictograph need to be aware that they are assuming the pattern of class behaviour that produced the graph will continue. Students should be encouraged to incorporate all types of information available and come up with balanced alternatives that include the possibility of variation and uncertainty.