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Interpreting Graphs From Newspapers – Evidence Of Going Beyond The Data *

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Abstract

Two studies were undertaken in primary school to explore how students interpret graphs taken from The Straits Times. The purpose of the studies was to determine how the students read, interpret and go beyond the data. In one study 20 Primary 3 students were interviewed and asked questions about a pictograph and a bar graph with table. In the other study 24 Primary 5 students were interviewed and asked questions about a bar graph and a line graph. In each study students were divided into High Ability, Medium Ability and Low Ability based on the school mathematics performance. An analysis of the data shows that the majority of students are able to read and interpret graphs. The students had most difficulty when they are faced with questions involving "reading beyond the data". Low ability students had more difficulty than other groups. Even when reading and interpreting the data low ability students tend to be more limited in their explanations.

Introduction

The use of data can be found everywhere in our information society. Statistics is central to an education in today's world. One only has to read a newspaper or magazine or listen to the TV or radio to find examples of sports' scores, financial transactions, weather statistics and so on.

To be literate in society, the ability to read, interpret and analyse statistical graphs and tables is a necessity. Gal and Garfield (1997) indicated that an aim of statistics education is to enable students to become informed in statistics so that they will be able to comprehend and deal with uncertainty, variability, and participate effectively in an information-laden society. Others working in the field such as Curcio and Artzt (1996) and Bright and Friel (1998) support this view.

Bar graphs, pictograms, pie charts, line graphs and charts are the most basic representations of data we come across as adults through our experiences with the media. Students need to learn to make sense of these published reports in the media. Graphs are also an integral part of the school curriculum so students also need to learn to interpret results and critically analyse data from statistical investigations and projects undertaken in school.

Research Question

The importance of the statistical representations led to the following research question:

Are students able to make sense of data in social contexts such as that found in the media?

Very Brief Literature

Wainer (1980) investigated grades 3 – 5 students' responses when faced with a set of tables, graphs, and charts. He found that while very young students had little difficulty reading the graphs the students often had problems in going beyond the very basic interpretation. Barclay (1987) also found that students often have considerable difficulties going beyond just reading and a low level of interpretation of a graph. Although many current statistics courses require students to calculate or find statistical information in a table or graph there is limited opportunity to interpret, analyse and predict from data (Garfield, 1993).

Watson (1997) conducted a study to determine students' statistical understanding in the context of a media report. The sample was 229 grade 6 and grade 9 students. The results indicate that while most students have a basic understanding of statistical terminology many are unable to apply it in a social context.

It has also been found that line graphs are more difficult than pie charts, bar charts, and tables and that there are indications that the line graphs were relatively more difficult when answering "elementary" reading off questions, but easier for comparisons (Wainer, 1980; Åberg-Bengtsson, 1992).

This very brief overview supports the contention that investigating graphs in a social context is a useful activity and that there is some, but limited, evidence that students can go beyond the data. No studies of this type have been done within the Singapore context and it appeared to be valuable to investigate this topic using Singapore students.

Methodology

The methodology was similar in both studies. Students were divided into high medium and low ability and presented with graphs. In the primary 5 study half the students from the high-ability (HA), middle-ability (MA) and low-ability (LA) groups (based on the semesteral examinations for the appropriate groups) were interviewed on their interpretation of the selected bar graph and other half were interviewed on the line graph. In the primary 3 study a parallel procedure was followed using a different bar graph (incorporating a table) and a pictograph. The four graphs are included at the end of this paper.

In the individual interviews the questions asked were based on the students interpretations of the graphs and, as such, there was not a set of structured interview questions.

Results

This section of the paper will be a brief summary of two of the key results of the studies. It will focus on the data as they relate to reading/interpreting the data and going beyond the data.

(1) Reading/interpreting the data.

Generally students could correctly read and interpret the information given in the graphs. The results show that virtually all the students were able to do this for the graph they were given to discuss. This will be illustrated by using one graph from primary 3 and one from primary 5

For the visiting a doctor graph primary 5 students were able say things relating to most people visiting a Western GP, etc. It is worth noting that the low ability students tended to think more in terms of personal experience and give less complete answers. A student response could be in terms such as "their Mum" taking them to a western doctor. Some of the high ability students also tried to give a rationale for their answers. For example, explaining that you go to a Western GP since you recover faster that using Chinese medicine.

For the jobs graph primary 3 students were able to describe the situation, talking about people being retrenched, losing their jobs, etc. Again, the low ability students tended to give less complete answers. In fact, without prompting it was often not possible to be sure if they comprehended the situation, but with the interviews it was clear that they did even if they did not initially volunteer the information. Two students in the HA group were identified the worst hit groups in their initial explanations, but the rest of the students did not do this initially. However, when prompted to look at the issue of age/educational qualification/occupation they were able to do so. Apparently, they could interpret the information but did not tend to see it an important enough to mention without being directed towards the appropriate data. Within the context of this discussion some students suggested potential reasons such as they have bad attitude, they don't work hard enough and their education quite low.

(2) Going beyond the data

When asked to predict what their classmate would do if she were sick, two of the high ability students (Primary 5) were able explain their choice of visiting a Western GP in terms of the data in the graph. They would use the idea of chance since it was the most common option. However, others from the different ability groups tended to argue in terms of family, say, without reference to the statistical data.

Initially, none of the students linked the data on unemployment and who is still hiring to suggest what could be done to help the unemployed (a difficult task). However, when prompted during the discussion some students suggested training might help (reasonable suggestion based on the various discussions one finds in the media). There was no specific linking of this suggestion to the data, per se.

Summary

These are just some illustrations based on a couple of the graphs to illustrate the nature of the data collected. It seems reasonable to conclude that the students could read and interpret the graphs but had more difficulty predicting from the data. High ability students were better than low ability students in terms of both the quality of their

explanations and their ability to explain. Also, it is often the case that the “higher-order explanations” do not come naturally for many students; they have to be prompted to give these more “complex and deeper” explanations.

Recommendation

This reports two small-scale studies undertaken in Singapore classrooms. The applicability of the following recommendations depends on match between your classroom and students used in this research. However, hopefully they prove useful in your own deliberations about classroom practice.

It appears that the students do not tend to go beyond the data. However, some can and when prompted other students also are able to “predict or make suggestions”. One possible reason could be that students are provided with opportunity to “go beyond the data”. The present curriculum stressed low level skills such as data reading; local textbooks do not have “go beyond the data” questions. If students are to develop skills in this area, we should ask prediction questions starting with very young children. It is **recommended** that teachers provide opportunities for students to read beyond the data to make predictions as it is an important objective in statistics education. Teachers should be encouraged to ask questions about the data such as “What do the data tell us?”, “Tell me a story about the data”, and so on.

We realise that it could be argued that such opportunities should be left until secondary school students. However, there is evidence from these students that it is possible at this level to appreciate an inferential task and for most students to gain valuable experience in taking part in one.

We have only stated one recommendation in this brief paper. However, it is fundamental if we are to achieve the TSLN vision of our educational system and meet the objective of teaching higher order thinking skills to our students.

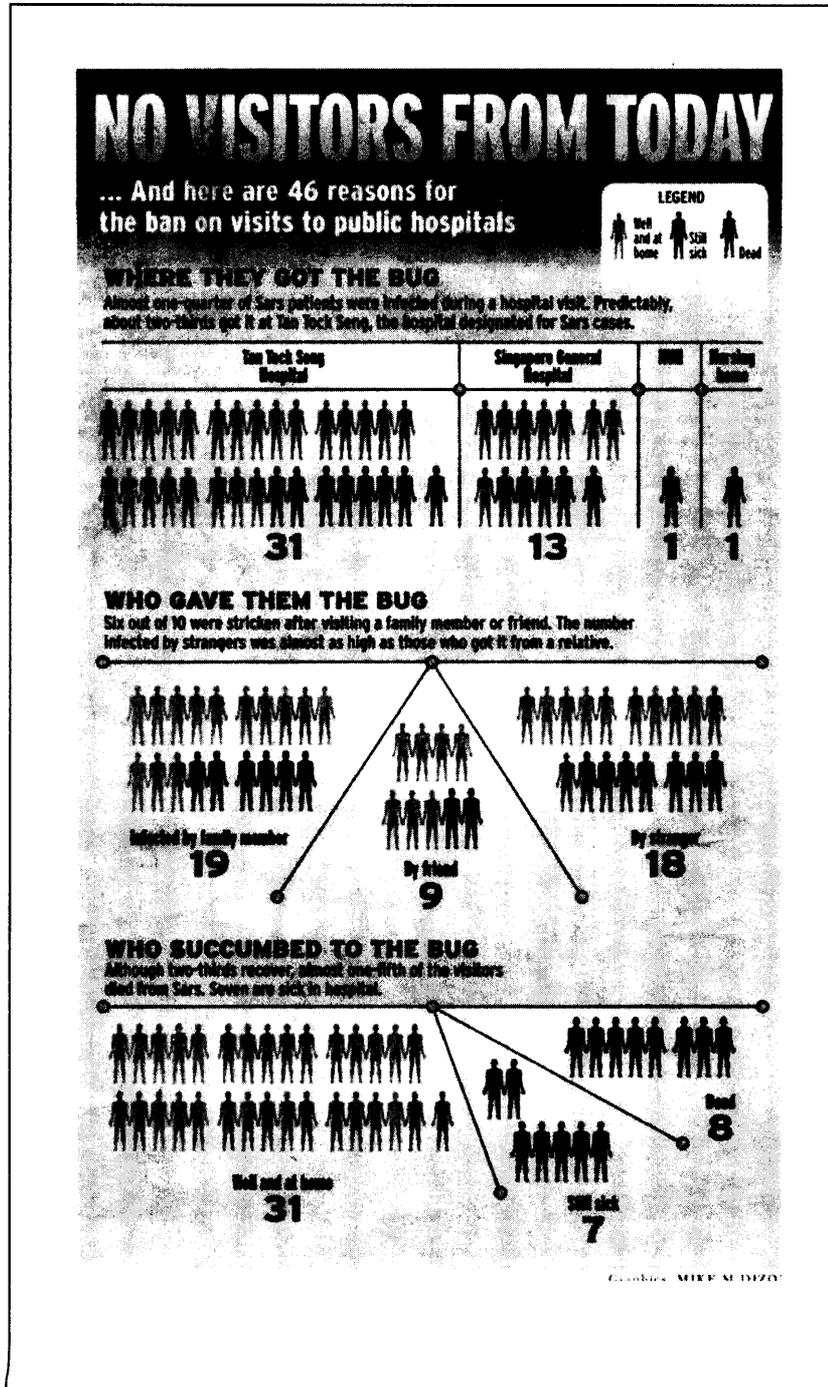
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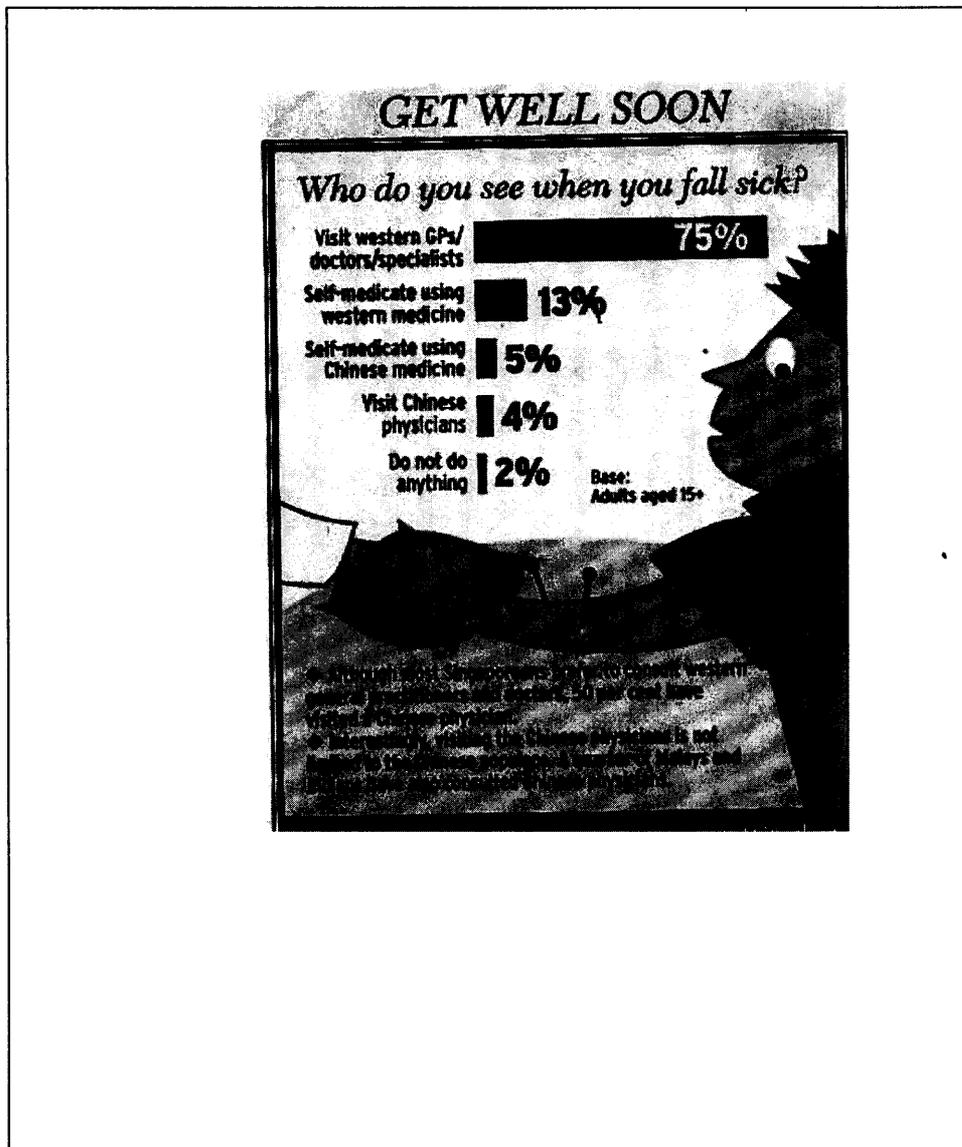
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- * This report is a combination of two Master degree dissertations done by Goh Sock Lai and Bay Wee Fon. There were differences in the questions asked, etc. The report focuses on the common themes from the two studies.

Pictograph used with primary 3
 (The Straits Times, 29 April 2003)



Bar Graph used with primary 5



Line graph used with primary 5

