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A Comparison of Learning Preferences and Perceptions of High School Students for Statistics

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# A Comparison of Learning Preferences and Perceptions of High School Students for Statistics

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## Abstract

This paper is based on analysis and comparison of data collected from high schools in two different parts of the world. The first sample (Group 1) was selected from the year 12 students in the Darling Downs region of Queensland in Australia and the second sample (Group 2) was selected from year 12 students in Tehran, Iran. Although both groups of students possess similar characteristics in terms of topic and level, they have been exposed to different teaching methods. For instance, students from Tehran would have learned mathematics and statistics in a very traditional manner. That is mainly *chalk and talk*. However, the Australian students have been exposed to more flexible methods. Culturally driven factors such as parental encouragement or even pressure in some cases would also play a role in shaping and influencing students' attitudes and aspirations. For instance, mathematics, in general, is regarded by the majority of the Iranian parents as a topic which will help their children with their future studies and profession. Hence, traditionally, in a society like Iran, school students would be encouraged to excel in learning mathematics and related topics by both parents and teachers. The Australian students, on the other hand, would have a wider exposure in terms of accepted topics. This is due to the fact that many other fields would also receive similar amount of respect. The findings however, appear to be very similar in terms of both groups of students' learning styles and methods preferences. It is interesting to note that both groups have indicated their preference for more visually oriented teaching materials in Statistics.

**Key words:** Statistics Education, Learning Style, Preference

## Introduction

Whether we choose to adopt the latest technology or maintain the traditional "chalk and talk" methods of teaching, we must bear in mind that we need to make teaching of statistics as interesting as possible for our students. There is no doubt that the misunderstood image of statistics as a dry subject should be re-built in the 21<sup>st</sup> century.

As suggested by Kettenring (1997) in a presentation entitled "Shaping Statistics for Success in the 21<sup>st</sup> Century" to the American Statistical Association back in 1997, image reconstruction of the field of statistics must be placed right at the top of the list.

The main purpose of this research project is to identify and use students' preferences for developing more effective and attractive teaching materials on statistics and related fields. Two groups of students from two different parts of the world were selected. The first group (133 students) was chosen from High Schools in the Darling Downs region of Queensland in Australia. The second group (17 students) was selected from a High School in Tehran, Iran. Both samples were chosen randomly from year-12 students. It should be noted that due to difficulties in data collection, the sample size for the second group is smaller than the first one.

The objectives of this paper are to compare and contrast the two groups in terms of:

- their learning style (modal) preferences; and
- their preferred method of learning.

For an introduction to modal preferences refer to Fleming (1995).

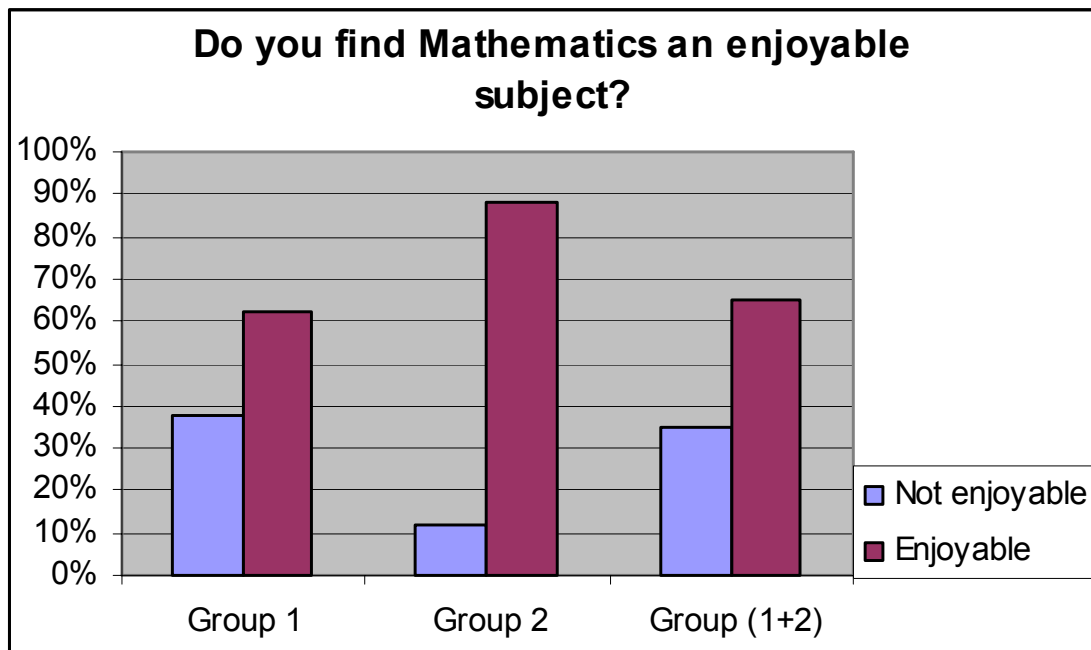
In order to achieve these objectives, a questionnaire was developed and used as the data collection instrument. The process of completing the questionnaires was administered and supervised by the Mathematics Coordinator and/or the Principal of the respective schools. This questionnaire contained questions on the following categories:

- students' background;
- students' learning preferences; and
- students' future goals and aspirations.

### **Analysis of Students' Perceptions and Characteristics**

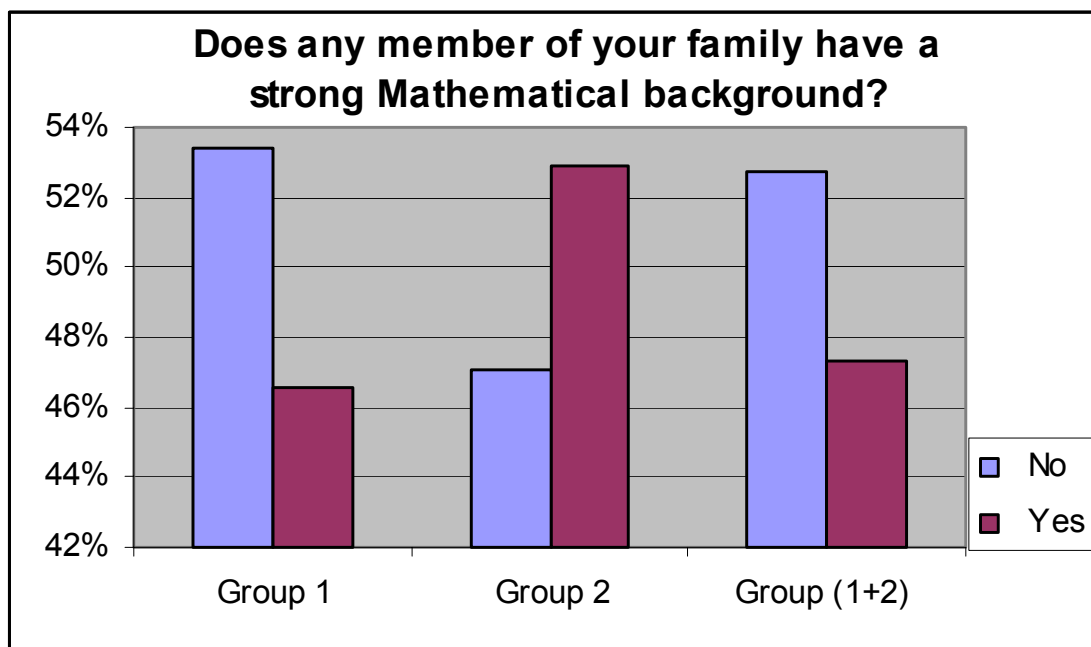
The following sections provide analysis and discussion on a number of key questions presented to the students:

**Enjoy learning Mathematics** - Over 65 percent of the total students regard mathematics as an enjoyable subject. Only around 35 percent of the total students claim that mathematics is not an enjoyable subject. See Figure 1 for details. Students from Tehran (88.2%) appear to enjoy learning mathematics more than their Australian (62.4%) counterparts. The Chi-Square test at 99.9 percent (P value of 0.001) confidence level shows that there is a significant difference between the two groups of students with regard to enjoying mathematics.



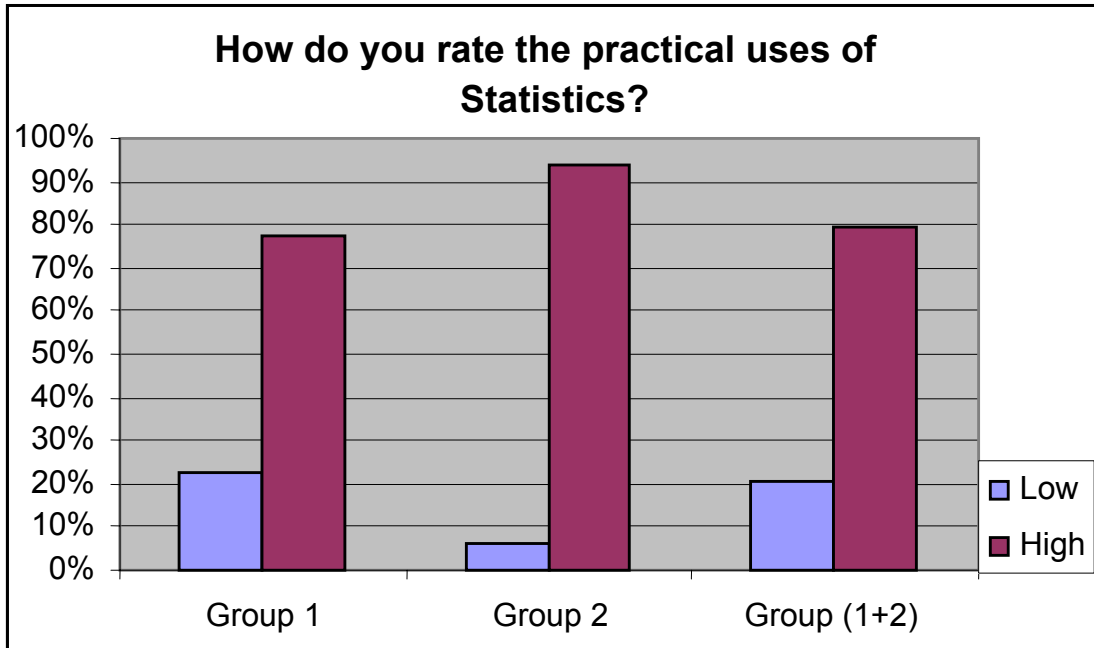
**Figure 1** – Comparison of two groups of students in terms of enjoying Mathematics

**Family background** - Around 48 percent of the total students have indicated that they have a member with a strong mathematical background in their families. See Figure 2. Although a larger proportion of the students from Tehran have someone with a mathematical knowledge and background, the Chi-square test is not significant even with 76 percent confidence level (reasonably large error margin of 0.242). This outcome suggests that there is no statistically significant difference between two groups of students in terms of mathematical background of their families.



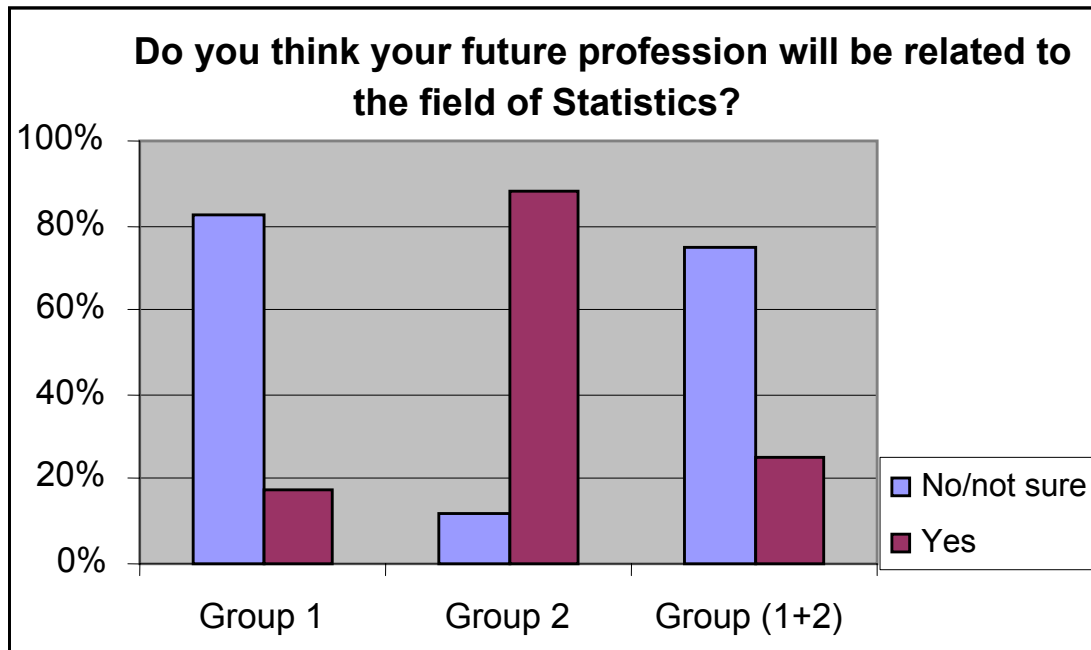
**Figure 2** – Comparison of two groups of students in terms of mathematical background of their family members

**Practical uses** - About 80 percent of the students (both groups) believe that the practical use of statistics is ‘high’. The percentage of students in this category is higher for the Tehran group (94.1%) than the Australian group (76.5%). The Chi-square test has shown that there is a significant difference between the two groups of students in terms of their perception of practical uses of statistics. Hence, most students from Tehran believe that the chances of having practical applications for Statistics for them are high (see figure 3). It should be noted that the test was significant at 98 percent confidence level (P value of 0.012).



**Figure 3** – Comparison of the perceptions of two groups of students with regard to practical uses of Statistics

**Future profession** - As Figure 4 shows, only 25 percent of the total students (both groups) believe that their future profession will be related to the field of statistics. However, the proportion (88.2%) of Iranian students who see some connection with and reliance on Statistics in their future is much higher than the proportion (17.3%) of the Australian students. Although, it is obvious by the figures and percentages, a Chi-Square test was also performed. This test has demonstrated that there is a significant difference between the two groups of students in terms of their perception of the future profession in statistics. The test was carried out at 99.99% confidence level with P value of 0.000 (much less than 0.05). This may be due to the fact that more future career alternatives are available for the Australian students.



**Figure 4** – Comparison of the perceptions of two groups of students with regard to their future profession

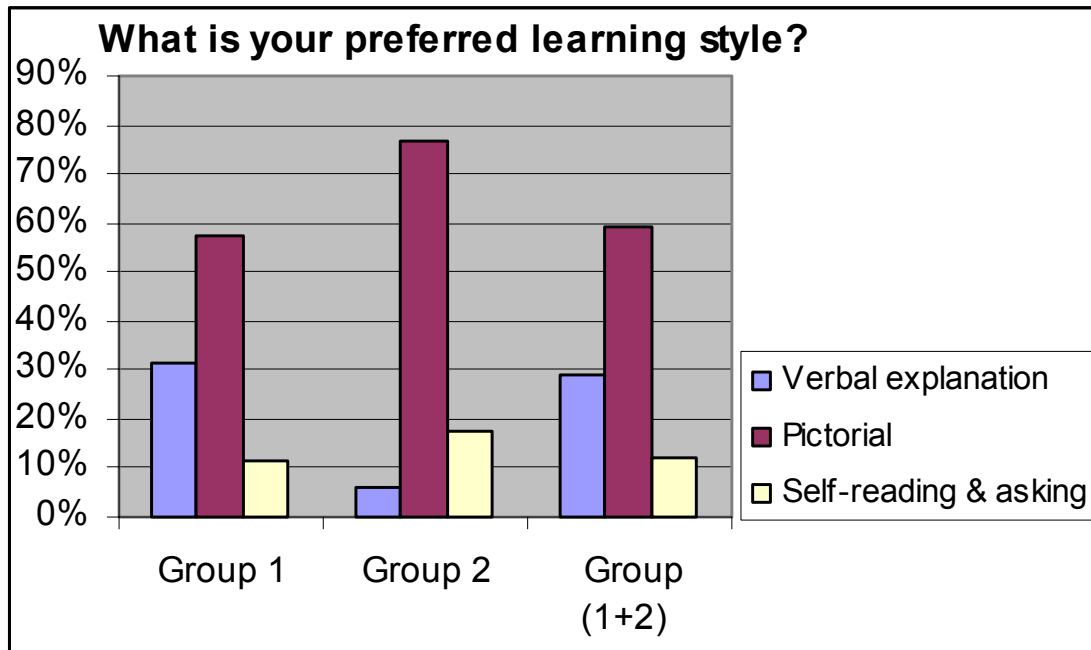
### Objectives

#### (1) Preferred learning style

It is notable that the learning style preferences of both groups of students are similar. Very low percentage (12 percent) of the total students prefers ‘self reading and then asking questions’ approach. Both groups prefer the learning style which uses graphs, pictures, images etc. In total, around 59 percent of students have a preference for visual learning (Table 1 and Figure 5). The proportion of students who prefer this style is higher in Iran (76.5%) is higher than that in Australia (57.1%). The Chi-Square test however, suggests that there is no significant difference in learning style preferences of two groups at 95 percent confidence level. This demonstrates that regardless of country or cultural background, students have a preference for visual features in learning. Similar conclusion was drawn by Nooriafshar et al. (2004).

**Table 1: Comparison of learning modal preferences of two groups of student**

		Group 1	Group 2	Group (1+2)
Learning modal preference	Verbal explanation	31.6%	5.9%	28.7%
	Using graphs, pictures, images	57.1%	76.5%	59.3%
	Self-reading and then asking	11.3%	17.6%	12.0%



**Figure 5** - Comparison of learning style preferences of two groups of students

## (2) Preferred learning method

Significant number (around 57 %) of the total students preferred practical examples before learning the concept, however, the proportion of students who preferred this learning method is higher in Iran (around 71%) than in Australia (around 55%). Only about 29 percent of the Iranian students and 45 percent of the Australian students prefer learning the concept first and then finding out about the application. (Table 2 and Figure 6). Although the preference for learning methods between the two groups of students seem slightly different the Chi-Square test shows that there is no statistically significant difference between them at 80 percent confidence level (P value is 0.219).

The test outcome demonstrates that the country and cultural differences do not play a significant role in students' preferences for learning methods. This finding has important implication in teaching practices. For instance, as a productive and effective teaching approach, we may consider presenting problems first for the brain storming purposes, and then solution for the concept development.

**Table 2: Comparison of preferred learning methods of two groups of student**

		Group 1	Group 2	Group (1+2)
Preferred learning method	Practical examples before learning the concept	54.9%	70.6%	56.7%
	First concept and then application	45.1%	29.4%	43.3%

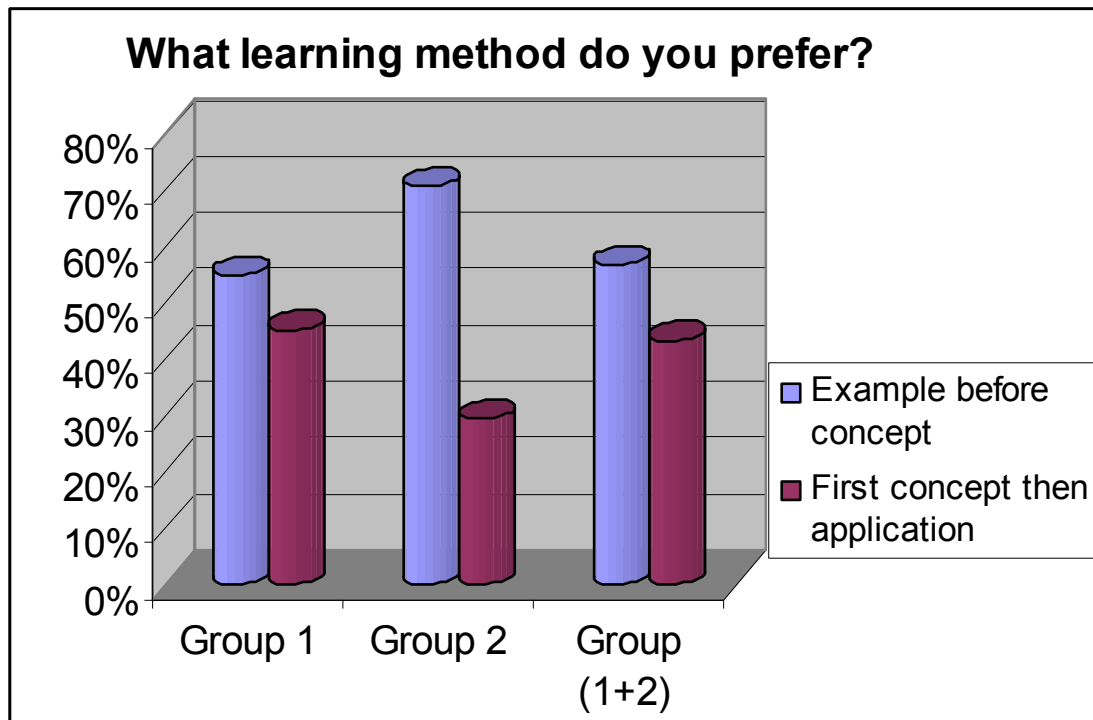


Figure 6- Comparison of preferred learning methods of two groups of students

### Conclusions

It is noteworthy to mention that the majority of the students from Tehran feel that they will have something to do with Statistics in the future. In contrast, most of the students from the Darling Downs (Australia) do not think that they will use Statistics in the future.

A close analysis of the statistics has revealed that in case of the students from Tehran, there is a close relationship between the *enjoyment of Mathematics* and several other factors such as *the family background and the perception of practical uses of Statistics and future profession*. Although this relationship is also significant in the case of the Australian students, it is not as strong as the Iranian Students. This may be due to several other factors like the country context, cultural background, students' attitude and availability of alternatives which are beyond the scope of this study. The findings have also demonstrated that most High School students have a preference for visual learning with regard to Statistics. This finding indicates that learning via multimedia, with interactive animations, appears to be an attractive approach. The use of memory handles and prompts such as analogies and anecdotes will make teaching and learning much more enjoyable for both the teacher and students. These prompts can help the learners to visualize both actual and virtual images of scenarios and situations and then link them with the content concepts. For a few examples, see Chanter (n.d.), Friedman; Halpern and Salb (1999); Nooriafshar (2001) and Nooriafshar et al. (2004).



Similarly, both groups of students prefer ‘problem’ first for brain storming and then ‘concept development’ for problem solving. This method makes students more creative, analytical and also helps them to maintain long lasting memory. The most important conclusion of this research is that regardless of the geographical location and cultural background, students’ preferences in terms of ‘learning method’ and ‘style’ are similar. This conclusion has significant implications for the course designers, teachers, and all stakeholders regardless of their status or location.

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