YOUTH AND ADULTS STUDENTS INTERPRETING BAR AND LINE GRAPHS

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The objective of this study was to investigate the influence of schooling on the performance of Youth and Adults (EJA) students in solving activities of construction and interpretation of bar and line charts. The participants were 30 students divided into three groups: 10 students in the early years of elementary school, 10 students in the final years of elementary school and 10 high school students. The results indicated no significant differences in the performance presented by participants according to the segments of education to which they belonged. There were significant differences in performance on the basis of the activities of interpretation of the bar charts, but not between the bar and line charts.

INTRODUCTION

The objective of this study was to investigate the performance of Youth and Adults students in activities of interpretation of bar and line charts, in particular, to investigate how education influences the performance of young people and adults in interpreting charts. Thus, the participants in this study were 30 students, three groups of 10 students each. Each group consisted of students enrolled in the final series of each segment of Youth and Adults education (Elementary and Middle). In order to study the specific aspects of the area of mathematics education related to students and young adults, it is necessary to understand some important points about the type of education that is proposed for these particular groups.

To this end, we look in the literature for authors who have dedicated themselves to the analysis of specific situations faced by those who tardily initiate or resume the process of learning at school (Oliveira, 1999; Fonseca, 2005; Gadotti & Romão, 2006). Some of these studies also served as a theoretical base for legal reference documents that guided the curriculum for Youth and Adults at the national level (Brazil) and the research carried out on the mathematical knowledge that these students bring to the classroom (Silva, 2006; Gomes, 2007; Carraher, Carraher & Schliemann, 1988), as well as research on the topic of information processing (Monteiro & Selva, 2001; Monteiro, 2006; Selva, 2003; Guimarães, 2002; Guimarães, Gitirana & Roazzi, 2001; Ainley, 2000; Pagan et al., 2008; Langrall, Nisbet & Mooney, 2006, among others).

Data Processing, the focus of this study, it is important to note that the national curriculum standards in Brazil (1997) have already incorporated the teaching of statistical concepts. This has been done by constructing blocks of known mathematical processing with the purpose of making the students develop procedures to collect, organize, communicate and interpret data using tables, charts and representations that frequently appear in their day-to-day activities.

THEORETICAL CONSIDERATIONS

The credibility that quantitative information has in contemporary society is undeniable. Lopes (2004) asserts that there is a broad consensus around the idea of literacy statistics, i.e., she claims that any individual has the capacity to understand and interpret *statistical arguments in newspaper articles, news and information of different nature* (p. 187). According to Lopes (2004) the acquisition of skills related to statistical literacy *requires the development of statistical thinking which allows one to be able to use ideas and statistics to assign a statistical significance* (p. 188) Therefore, the subjects have to be able to interpret reality from a set of data or its representation. Specifically, we are interested in analyzing the performance of students in relation to chart representations. Therefore, we emphasize the importance of mastering this language of statistical thinking.

To understand some particular factors pertaining to the activity of interpretation of charts, we use the definition of understanding charts drafted by Curcio (1989). Following him there are three different levels on this understanding, these levels are independent of the type of chart that is

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being used and are classified as *reading data, reading between the data and reading beyond the data* (p. 5 and 6).

We also use the Theory of Conceptual Fields, developed by Gerard Vergnaud, contributing to the understanding of mathematical knowledge and their interrelationships. Vergnaud (1986) brings the idea of the Conceptual Fields *as a set of situations whose mastery requires a variety of concepts, procedures and symbolic representations in close connection* (p. 84). In what concerns the role of symbolic representation, Vergnaud (ibid) considers the existence of mediation among the symbols of representation, that is, signifiers, and the real-world objects, i.e., the meanings.

METHOD

All students were asked to perform three activities of individual interpretation of charts, previously developed, with two bar charts and one line chart. Bar charts were: a bar chart with categories, the subject matter of this chart was the amount of calories burned in 1 hour when performing some physical activity, called the chart of "calories", and a bar chart of time series, representing the amount of medals won by Brazil from the Olympics in 1964 to 2004, called the chart of "medals". The line chart had as subject matter the amount of spectators who attended the Brazilian cinemas, called the chart of "cinema". Each activity of interpretation had specific questions, comparison, combination and equalization.

ANALYSIS

Considering the three charts that were interpreted, the statistical analysis of results were managed in the Statistical Package for Social Science - SPSS - through a analysis of variance, and as an independent group (school), intra-subjects factor, type of chart and the dependent variable, the performance obtained. The results indicated no effects of instruction (group). There was a significant difference in student performance according to the charts, ($F = 3.601$, $p < 0.05$). Table 1 below shows the percentage indices of correct answers given by students in each chart.

Table 1. Percentage of general arrangement of the groups by chart

Groups	Charts			
	Chart "calories"	Chart "medals"	Chart "cinema"	Total per group
Early years	46	82	60	62.6
Final Years	66	66	72	68
School	70	84	86	80
Total per chart	60.6	77.3	72.6	

Analyzing differences in performance between groups of students

Non-parametric methods managed in SPSS indicated no significant difference between students enrolled in the final series adult education for the three different areas of education investigated in this study (initial years of elementary school, the final years of elementary and high school). However, analyzing the percentage index of the results, we observed an improvement of the participants according to the series (more education - better performance).

We must stress that this is a good result considering the specificities of the investigated type of education and the public that it is intended. Often the operation of adult education does not meet the needs of young people, over 14 years of age, and adults with little or no schooling There are no teaching materials and working hours, in most cases, are not sufficient.

Analyzing the three charts proposed

Through the Wilcox on test of managed in SPPS, we only observed significant differences in performance between the bar chart with categories ("calories") and bar chart with time series ("medals"). Looking at Table 1, we note that the chart "medals" had the highest percentage of accuracy in relation to other charts, followed by the performance in the line chart ("cinema").

However, there was no significant difference in performance between a bar chart of time series and line chart and between the bar chart with categories and the line chart.

A hypothesis that can explain why the chart "medals" was significantly easier than the chart "calories" is based on the type of variable of these charts. The variables were of different nature and may have generated some effect on the reading and interpretation of data. The variable in the chart "medals" was quantitative and referred to a series, while in the chart "calories" the figures were represented by nominal variables. The results seem to indicate that the bar chart representing quantitative variables was more easily understood when compared to the bar chart representing nominal variables. We can conclude that the difficulties encountered by participants were not necessarily related to the type of representation used, but probably related to the items included in those representations, the nature of the variables.

Another hypothesis that can help to explain the results concerns the knowledge of participants in face of information that was being treated in the charts and the possible impact that these actions have created in the responses along the activity of interpretation. There may have been some difficulties for students according to their prior knowledge that interfered in the interpretation of the charts, as observed in the results of the interpretation of the chart "calories", in which many students concerned with the loss of calories answered the questions on the basis of information beyond the data presented in the chart.

CONCLUSION

Comparing the performance presented by groups of students at different levels of education in the interpretation of charts, we found that differences were significant only according to the type of chart worked Therefore, we emphasize the importance of work done in the classroom focusing not only on the teaching of some inherent characteristics of each type of representation, but, above all, focusing on planning education systematized in terms of certain aspects or elements contained in these representations as variables. Teachers should also take into account the possible emergence of various forms of interaction between the readers and the data (based on reader's prior knowledge) and promote discussions about the information covered.

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