Elaboration of an Interactive Electronic Book of Descriptive Measures

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Abstract

These are the advantages of technology: multimedia presentation, interaction, personalization, etc. Within this context an interactive digital book of the characteristics of the information was realized. In a data set, the following characteristics are usually of paramount importance: 1. the center, 2. the variation, 3. the distribution, 4. the atypical values and 5. The characteristics of the data that change over time. It is important to understand the standard deviation values using tools such as the general rule of rank.

Because technology allows us to get many of these statistics automatically, it is not so important to memorize formulas or perform complex arithmetic calculations by hand on the other hand, so that the students can concentrate on understanding and interpreting the values that are obtained from them.

The interactive digital book of measures of central tendency contemplates that each chapter indicates prerequisites, learning objectives, written development of the subject, videos with explanation, interactive exercises, widget (html 5. Interactive galleries, interactive images, etc.) review questions.

The interactive digital book will provide students with full-screen experience with galleries, videos, interactive diagrams, 3D objects, and math expressions and more; these books give life to the content in ways that a printed page can not do. Students will no longer be limited to static images that illustrate traditional texts, but can now immerse themselves in an image with interactive subtitles, rotate a 3D object or make an answer come to life in a chapter review. You can flip through a book with a single finger on the screen. They can also highlight text, take notes, look up content and find definitions in a glossary very easily. In addition, they can take them wherever they go, which will allow students not only to learn between the walls of the classroom, but also in the virtual space that make up these books.

Introduction

Statistics help transform numbers into useful information for decision makers. It allows you to know the risks associated with making a business decision. And it also helps to understand and reduce variation in the decision-making process. Descriptive statistics include methods that help gather, summarize, present, and analyze data. Within the descriptive statistics are the measures of central tendency, which are developed in the electronic book elaborated.

Within the characteristics of the information we have the measures of central tendency, variability, position and form. Central trend measures indicate the extent to which data values are grouped around a typical or central value. Most data sets have a distinctive tendency to cluster around a central value. When people talk about an average value, about the intermediate value or about the most frequent value, they refer from informal to informal to average, median and fashion, three measures of central tendency.

The variability is the amount of dispersion or spread of the values from a central value. A simple measure of variation is the range, the difference between the largest and the smallest value. However, in statistics, it is more common to use standard deviation and variance. This statistic measures the average dispersion around the mean, that is, the way the larger values fluctuate above it and the way the smaller ones fluctuate below it.

The form is the pattern of the distribution of values, from the lowest to the highest. A distribution is symmetric or skewed. In a symmetric distribution the values that are below the mean are distributed in exactly the same way as the values that are above this. Thus the high and low values are neutralized. In a biased distribution, the values do not distribute symmetrically around the mean. This skewed produces an imbalance between high and low values.

This interactive e-book was designed to help capture the sense of measures of central tendency, variability, position and form, this is how and when to apply statistical techniques in situations in which decisions are to be made, and most importantly how interpret the results obtained. Since it was not written for professional statisticians, our text is adapted to the knowledge and needs of college students who may accept the fact that statistics can be of considerable utility to their professional performance.

With the content of the book the student will be guided throughout the learning process through reminders of what he should already know, through a gallery widget, interactive

images or images in html, as well as examples that can be identified and processes developed step by step or with a video using specialized software in statistics.

Development

The contents of the interactive book are as follows: Introduction video, Chapter 1 Introduction, Chapter 2 Measures of central tendency, Chapter 3 Measures of Variability, Chapter 4 Measures of position, Chapter 5 Other descriptive measures, Chapter 6 Form, Chapter 7 Activities 1, Chapter 8 Activities 2, Chapter 9 Activities 3 and Chapter 10 Internet Resources. Figure 1 shows the contents of the book.

http://matematicas.cuautitlan2.unam.mx/aulamovil/contenido2.pdf

Figure 1. E-book content

The videos are gaining more attention every day by the teachers as a tool of contents and information, within this context the digital book was made a video of introduction of the characteristics of the information, in which it is described the measures of trend, variability and form. In addition to the calculation, application and interpretation of each of the measures and the use of the software to obtain it. Figure 2 shows the introduction video.

http://matematicas.cuautitlan2.unam.mx/aulamovil/md.mp4
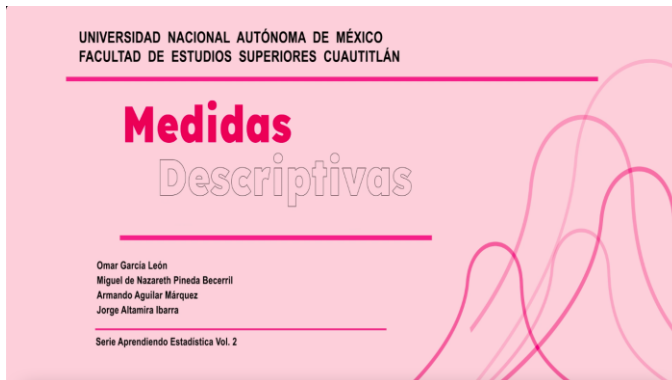
Figure 2. Introduction video

In each chapter the theoretical part was developed in the form of questions and answers, in order to make the students easier to understand each of the topics. Widgets were added to support the content of the book. The "widgets" tool consists of small applications that allow you to integrate interactive content into the digital book. The widgets that are used in this book are the following: gallery, multimedia, review, interactive image, HTML, scrollbar and popup. Figure 3 shows the form of questions and answers on the topic of measures of central tendency.
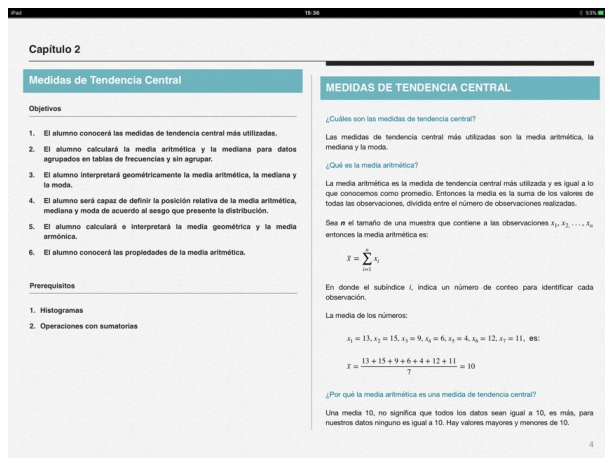

Figure 3. Development of the topic of measures of central tendency.

In the image gallery instead of seeing a single image on the page, the student can walk through an entire collection with his finger, including the notes in the photo. The galleries that were used can be seen using thumbnails or photo by photo. In the subject of measures of variability, a gallery of images was performed, in which the percentage of observations for different intervals in the normal distribution is shown, this is shown in figure 4.
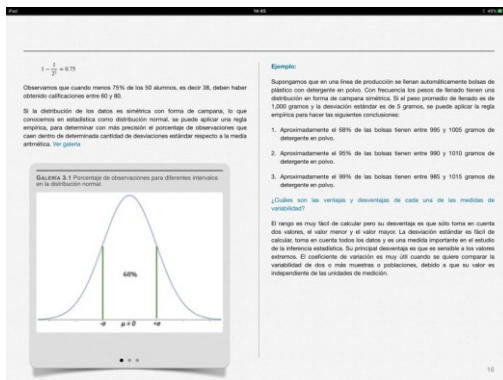
Figure 4. Image gallery in the subject of measures of variability.

Images say a lot more when they are interactive. And with the zoom capabilities and labels, any information can have a better description of the image, since you can point out important parts of an image and get a better understanding of the subjects. For the item of measurements of position was realized an interactive image of a box graph in which the characteristics of this graph are shown, which is seen in figure 5.
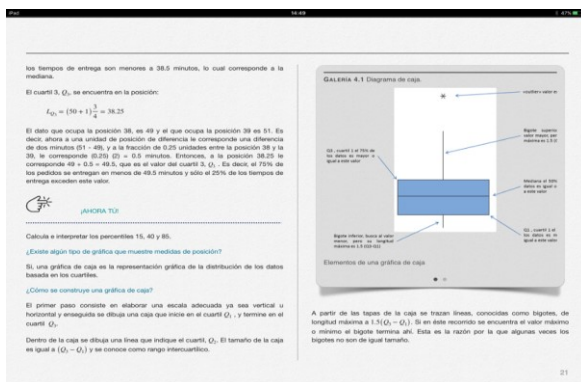

Figure 5. Interactive image of the box graph.

Audiovisual content gives life to any topic anywhere on the page. It is no longer just about seeing and reading: it is now possible to interact with text and images. Videos can be automatically reproduced, or as many times as the student wants, in order to better understand a topic or to see how a practical exercise with the use of software is solved. In chapter 5 a video was produced on an example of bias and kurtosis, as shown in Figure 6.

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http://matematicas.cuautitlan2.unam.mx/aulamovil/vVideo06.mp4
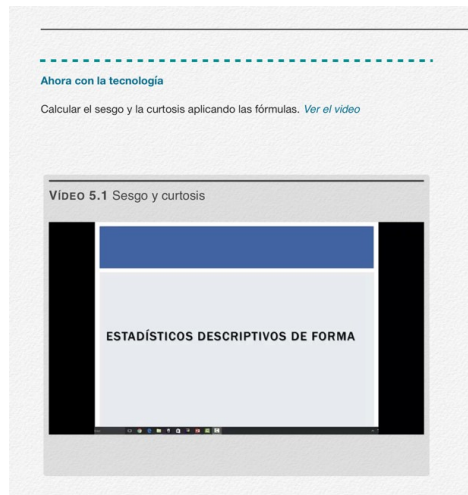
Figure 6. Video of bias and kurtosis.

iBooks Author has a number of tools that allow us to make a highly interactive eBook in a very easy way, but the most powerful and flexible tool of all is the HTML Widget, with which we can basically add any animation / interaction you can imagine. In most of the chapters the HTML widget was used, since with this tool you can make all kinds of animations, interactions, web pages, banners, GIFs, etc. In this book they are used to explain better the theoretical part or in the resolution of an exercise. Figure 7 shows an html widget which was made in order to explain the variance and standard deviation of two samples.

https://matematicas.cuautitlan2.unam.mx/aulamovil/galo24/galo24
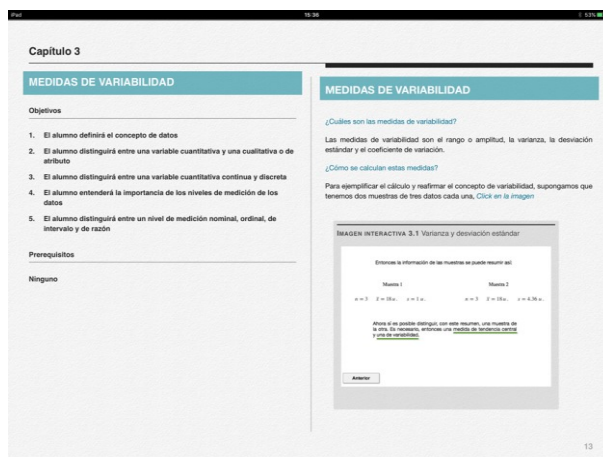
Figure 7. HTML variance of variance and standard deviation

To evaluate their knowledge, readers can do review activities: answer a multiple selection questionnaire, choose the correct photo, name a picture or a mix of all. In Chapter 8, concerning activities 2, 12 questions were asked to review the topics of measures of central tendency, variability, position and form. In Figure 8 we can see the review questions.

https://matematicas.cuautitlan2.unam.mx/aulamovil/Repaso3/Repaso3.html
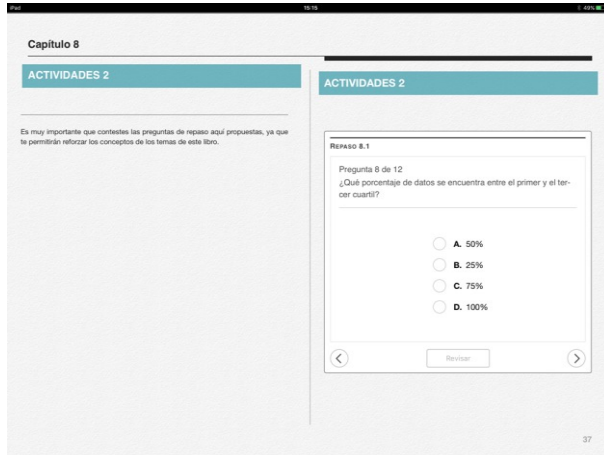
Figure 8. Review questions.

In chapter 7 of activities a video was realized in which all the measures seen in the previous chapters are obtained making use of a statistical software. The contents of chapter 9 are proposed exercises, with the purpose of putting into practice the knowledge acquired in the subjects seen. Chapter 10 proposes that the student make use of the available resources in internet. Since each exercise has access to a web page with data file in which it is proposed to obtain different measures.

Results

The resources of the multimedia book of the subjects measured of central tendency and variability were used, in a pilot group (group A), the results of the examination corresponding to the subjects of measures of central tendency: mean, median, and mode, which were compared with another group that did not use it (group B). In addition, the groups that were compared were groups of the same professor and in the same degree. Figure 9 shows us the results of the examination of the topic of measures of central tendency of both groups.
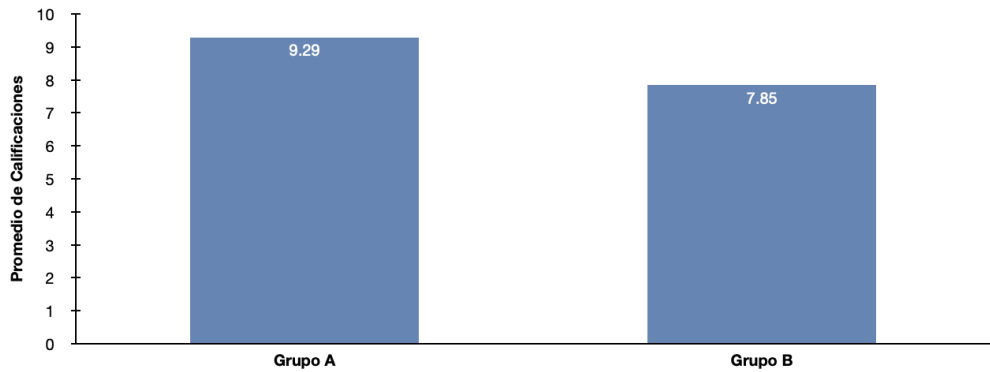
Figure 9. Average ratings of the topic of measures of central tendency.

The grades of group A correspond to the students who used the resources of the multimedia book as a complement to what was learned in the classroom, these students were provided in .pdf format so that they could use it from any electronic device (PC, Laptop, tablets, iPad, etc.) and that they had free access. Figure 10 shows the results of the exam corresponding to the theme of dispersion measures: variance, standard deviation and coefficient of variation.
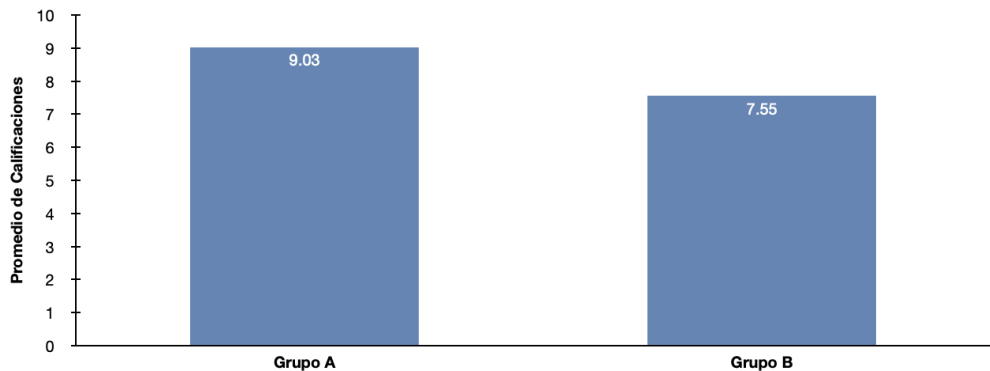

Figure 10. Average ratings of the variability measures topic.

It is important to mention that in the exams that were carried out for each group, apart from the exercises to be solved, they were also asked questions about concepts and interpretation of the results obtained.

Conclusions

The technology that has been integrated into the educational process is changing teaching paradigms. We can see this even in low-income schools. The changes are in general, good. Thanks to technology books are also changing the way of teaching. We consider that the student, when making use of the developed electronic book, will have a better way of learning when considering the book as a complementary material for the subjects of the normal course.

It is also considered that in making use of the electronic book the student can focus on the interpretation of the results and the understanding of the topics, rather than memorizing formulas; since with the use of software the results are obtained in a faster way and the student should focus on the interpretation of these with a critical thinking that helps decision making.

Acknowledgments

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