Planning and Development of a virtual environment for

Statistics teaching-learning

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Introduction

Teaching Statistics in courses of applied social sciences, especially in Administration, is a great challenge for both teachers and students. According to Nolan and Speed (1999), students find it difficult to apply statistical concepts learned in the classroom to independent contexts (both to work and to real problems) or even to other disciplines at school. The reason for this difficulty is that they are unable to envision a connection between the use of Statistics and real typical situations in their professions. On the other hand, teachers of Statistics are usually trained mathematicians who end up teaching disciplines in courses that are not only mathematics-based, which is the case of applied social sciences, specifically Administration. Thus, it may be difficult for the teacher to correlate the concepts of Statistics to other fields of knowledge studied by their students. This makes the activity of teaching Statistics more difficult for the teacher who teaches it and for the student who is learning (GELMAN 2005).

The world is undergoing major and profound changes, and the ways of conducting teaching-learning have also changed. Pan (2003) states that computational technologies have rapidly changed the way Statistics is taught, through the use of a variety of media, the Internet, and the World Wide Web. The strong point of the use of technologies is the student's involvement in his own learning process. In this context, the teacher shares control over the teaching-learning process with the learner, but at the same time, pays careful attention to the progress of each individual student, which means the student received "individualized education" (PAN 2003).

The problem of teaching Statistics in courses of applied social sciences, the importance of statistics in the daily routine of the administrator, and the possibility of using educational technologies as facilitators of the teaching-learning process opened up an opportunity for developing a virtual environment for teaching Statistics, called the LaViE (Virtual Laboratory of Statistics Applied to Administration), to support the disciplines of Statistics in the Business Administration course of FEA-RP/USP. The LaViE project was

launched in 2003, beginning with the development of a construction methodology which proposes phases for the evolution of the project. Within this methodology, the target public of this environment was defined (undergraduate and post-graduate students of Business Administration of FEA-RP/USP), the structure of the Internet portal was developed, communication tools were created, and teaching materials were developed.

Planning and Development of the LaViE Project

The virtual environment was developed according to the following phases (Dutra, Noronha Viana, Miura, 2003):

Virtual pedagogy: divided into two phases: Analysis and logical Project. *Analysis phase*: this consisted of defining the objectives of the virtual environment, the target public, the contents and the design of the environment, as well as naming the environment LaViE (Virtual Statistics Environment). *Logical project phase*: this phase consisted of designing the learning structure and developing the contents for the environment.

Communication technology: divided into two phases: Physical Project and Utilization: The *Physical Project Phase* initially consisted of the development of the prototype, followed by the implementation of the environment as such. The *Utilization Phase* involves the development of a plan to guide the utilization of the environment, which includes the definition of the following elements: attendance meetings, programmed chats, tutorials, technical support, content support, rapid responses, and feedback of the activities realized.

Validation Process: also divided into two phases. The *Evaluation Phase* attempts to measure the teaching effectiveness (i.e., it attempts to ascertain how much of the evaluation effectively reflects the content studied) and the developed environment (through interviews with the users of the environment). The *Monitoring Phase* seeks to develop a monitoring procedure that allows for the identification of points where improvements and adaptations are required.

The LaViE is an open access portal containing the following didactic materials:

– *Glossary*: contains brief definitions of statistical concepts frequently found in Business Administration. The concepts were organized into *key concepts* and *specific concepts*. Each key concept is composed of a set of specific concepts. For example, clicking on the key concept of "dispersion measures" invokes the specific concepts involved, i.e., the respective dispersion measures of "variance", "standard deviation", etc. The purpose of this organization is to enable the student to interlink the concepts, as well as to facilitate his search for those concepts. The glossary contains a total of 24 key concepts subdivided in 213 specific concepts.

– *Explanatory texts*: these are materials that complement the text books on Statistics, which provide a summarized outline of the principal points of the statistical tool in question. All the texts follow the same standard: "name of the tool", "to study this module you need to know" (prerequisite contents for understanding the module and specification of the module where the student can find explanations about those contents), "in this module you will learn" (key points of the tool that will be covered in the text), "concepts to be studied", "studying hints" (recommendations the student can follow to facilitate his study), "problem situation" (describes a problem in Business Administration to which the tool in question can be applied to aid its solution), "understanding the tool" (theory), "the data's format required to apply the tool" (basic assumptions), and "steps for its utilization" (step-by-step use of the tool). A total of nine theoretical texts were developed. The texts were made available on Web pages, using links.

– *Tutorials*: these are brief explanations about how to use SPSS and/or Microsoft Excel software programs for application of the statistical tools. Two tutorial modes were developed: 1) *Text tutorials*: written explanations followed by copies of the software screens (SPSS or MS Excel), indicating which menus should be accessed to apply the tool. These texts were transformed into files in PDF format. 2) *Recorded tutorials*: these were developed using Microsoft Producer. They consist of audio explanations presented concomitantly to the presentation of the software screens, in an MS Power Point presentation. Both text and recorded tutorials were standardized as follows: "name of the tool", "problem situation" (presents a situation and the

respective database), "preparation of the data" (explanation of how to insert the data of the problem in the software flow sheets), "part 1 – generation of the tables" (explanation of the steps required to obtain the results), and "part 2 – analysis of the tables" (explanation of how to analyze the tables generated in the previous item). A total of 15 text tutorials were produced for the SPSS software, as well as 11 text tutorials for the MS Excel software, and 30 recorded tutorials.

– *Examples*: these refer to academic publications in the field of Business Administration that use some of the statistical tools selected for analyzing the data, and their purpose is to illustrate the various situations in which the statistical tools are utilized in the areas of Business Administration. The examples used were obtained through searches in databases of publications and are available for access in the laboratory, according to the areas of Administration: Human Resources, Marketing, Finance, Production and Logistics, Other areas. A total of 32 sample publications were obtained.

– *Exercises (Test your knowledge)*: these are exercises about each statistical tool, which should be solved in the environment itself. After solving the exercises, the student submits the solution and, in response, gets back the exercises he got right or wrong. A database with questions was developed for each statistical tool. These questions are divided into three levels, with increasing degrees of complexity.

– *Virtual lessons*: The use of films or animated cartoons can help the user understand certain topics, as if he were attending a classroom session, with the advantage that he can stop and go back to the topics he did not understand well, repeating this procedure as many times as necessary. Any doubts that crop up during the monitoring of the virtual lesson can be solve asynchronously (by email, talk with us, or forum) or synchronously (chat), the latter if has been previously scheduled. The following aspects were considered in the development of the virtual lessons: 1) Definition of content and objective; 2) Identification of the topics to be covered for the content to be understood; 3) Construction of an idea flowchart, identifying at which moment of the lesson each topic is covered; 4) Definition of the media or programs to be utilized in the development of the lesson (the use of the following programs was determined for the LaViE: : Microsoft Produce and/or PowerPoint); and 5) Production of the text for the spoken recordings (NORONHA VIANA, 2005).

All these materials were developed for the following statistical tools covered in the Business Administration course: significance tests, variance analysis, regression analysis, correlation, factor analysis, grouping analysis, and discriminant analysis. The plan is to develop these materials for other content topics. In addition to the materials, the environment presents communication tools (student/tutor, student/teacher, and student/student) such as forum, chat, and electronic mail, and resources such as survey, FAQ and links. Figure 1 depicts the main screen of the LaViE.
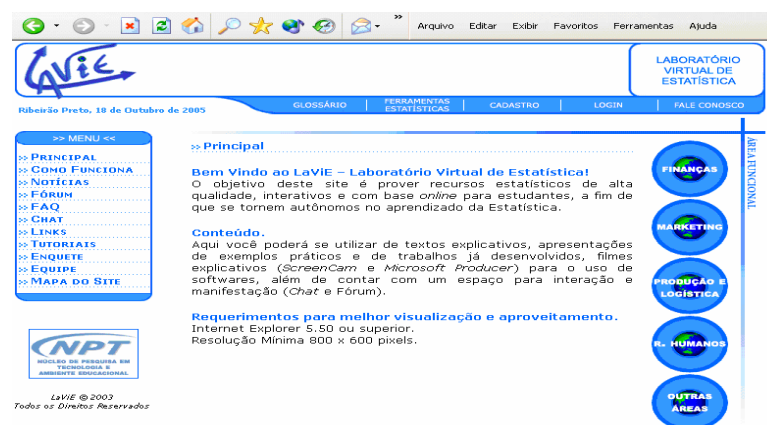

Figure 1 – Main screen of the Virtual Laboratory of Statistics Applied to Administration

Final Remarks

The environment was used experimentally in 2005 and 2006 (four disciplines of the Business Administration course). At that time, the environment was in its final phase of physical development so only some of the materials were completely available and the communication resources were utilized very little. However, it was possible to make a preliminary assessment, from the students/users perspective, about the strong and weak points in the experience with LaViE. This evaluation was done qualitatively through a focus group involving students of the Business Administration course who had used the environment as a support for the classroom attended discipline. This method was chosen because we wanted to know the students' points of view and opinions, which would not have been possible through other, more structured analysis methodologies.

Generally speaking, the students approved the use of the virtual environment as a support for the attended Statistics classes. They considered the available materials well designed and really useful for learning the subject, highlighting particularly the usefulness of the tutorials that teach them how to operate the software programs, because they were of great help in carrying out the activities proposed by the disciplines. It was noted that the preference for one or the other type of tutorial (text or recording) was closely related to the student's learning style, i.e., the students who stated a preference for reading preferred the text materials, while those who declared they preferred to learn by listening and watching showed greater interest in the recorded materials.

In addition, the possibility of accessing the classroom contents without time and space limitations was considered the most promising characteristic of the laboratory. This characteristic enables the student to study the contents whenever and wherever he wishes, i.e., he can access classroom contents he has missed, and can go back over points where doubts came up.

Note, also, that the communication tools (forum, chat and email) offer an additional option for discussion outside the classroom. Students can email their doubts to the teacher, or discuss them with each other in the forum or chat room. These resources enable them to overcome shyness and time constraints more easily than in physically attended environments, encouraging a collaborative atmosphere of knowledge construction insofar as students send each other extra materials, answer doubts, engage in critical discussions and help each other with regard to the discipline.

The use of LaViE has proved to be a form of rendering the traditional teaching-learning of Statistics for Business Administration more flexible. Moreover, by offering materials developed specifically for Business Administration, it has reduced the difficulty of students in associating Statistics to other disciplines of the course, and helped them find the real context in which Statistics is applied in the Business Administrator's career.

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