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The use of distance education tools in teaching statistics

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Abstract

This article aims to assess the use of distance education tools in teaching statistics applied to administration. In order to reach this objective, a partially offline discipline was focused on. Digital instructional materials and some interactions via the Forum, chat, e-mail and polls were provided in this study. Most students accessed texts and tutorials available; however, the glossary was little used. Among the tools of communication, there was intense participation in forums and e-mail and low participation in chat. There was participation of the majority of students in the polls proposals. Generally, the use of distance education was successful in the discipline addressed, which shows that the use of technology in teaching statistics is viable and can turn more flexible the educational process.

Key-words: distance education; e-learning; teaching of statistics; online communication; digital content

1 Introduction

In the field of administration, there is a notorious difficulty on the part of students and faculty alike in the learning and teaching of Statistics. According to Nolan and Speed (1999), students find it difficult to apply the concepts of statistics acquired in class to their activities at work, as well as to actual problems, or even to the other disciplines in their courses. This stems from the fact that they are unable to correlate the use of statistics and the actual situations that are typical in their professional activities.

The development of technological environments, coupled with the advent of Internet, has fostered a considerable expansion in the field of education, and distance learning has become a natural trend among the academic institutions. According to Borba and Ayrosa

(2001), educators can no longer ignore the use of technology for their teaching activities, since the future generations of students will most certainly be computer literate already at the start of their educational process. Thus, traditional classroom instruction needs to be modernized and become more flexible (BORBA; AYROSA, 2001).

Yet, adapting to this teaching methodology is no simple matter, nor does it occur immediately, especially in the case of a discipline in the area of quantitative methods. Pan (2003) has pointed to the fact that computer technology has revolutionized the way statistics is taught, through the use of different media as the Internet and the World Wide Web. The strength in the use of technology lies in the students' involvement in their own learning process, which, in turn, also encourages them to study. Within this context, faculty members not only share the control of the teaching-learning process with the learners, but also pay close attention to each student's individual progress (PAN, 2003).

In this regard, the distance education tools (*EAD in Portuguese*) propose a change in the educational paradigm, by encouraging collaborative learning through online interaction between student/content, student/student and student/faculty (PINHEIRO, 2002). Such interaction is regarded as critical for the success of online courses, since it promotes discussion, reduces the feeling of isolation and distance and expands the contact between students and faculty.

In order to gain a better understanding of the teaching-learning process of statistics, a case study was developed to analyze the use of distance education tools for the teaching of statistics applied to administration courses. This analysis was based on a hybrid discipline of statistics, offered in the first semester of 2007 by School of Economics, Business and Accountancy in Ribeirão Preto, University of São Paulo, (FEA-RP/USP). The course made use of online contents, surveys and forum discussions, as well as chats.

2 Review of the literature

This section presents a review of the literature on distance education, e-learning and computer-mediated communication.

2.1 Characteristics of distance education

In accordance with Decree number 2494/98, distance education is a form of education that 'permits self-directed learning, mediated through didactic resources that are systematically organized, presented on different information support systems, used in isolation or in a combined form, and transmitted through several communication media' (BRASIL, 1998).

Contrary to common belief, distance education has been around for quite some time. The first such modality appeared in England in 1840 in the format of a course delivered through the mail. Since then, this resource has been used in other parts of the world, and other types of distance learning have emerged, as for example, education via radio, which has allowed nomad people to have access to education (VIGNERON, 2005).

With the advent of television, new distance learning tools have appeared, as for example: videocassettes, satellite TV, cable TV, video-conference, CD-ROM and Internet (VIGNERON, 2005).

According to Rodrigues (2004), five generations may be outlined as regards distance learning, and each one of them has, in turn, included the media used by the previous generation. As a rule, the communication tools set the limit between one generation and the next. Table 1 presents a description of the five generations in distance learning (RODRIGUES, 2004).

Generation	Date	Characteristics
1st	Until 1970	Courses by mail. Communication was established only through the use of printed materials, normally a study guide and exercises forwarded by mail.
2nd	1970	The first open universities appeared, with systematized design and implementation of distance education courses, using: printed materials; open TV and radio broadcasts; audio and video tapes, and student/tutor interaction by phone or at tutoring centers.
3rd	1990	Computers were used with multimedia workstations and conference networks.
4th	2000	The rise in computer processing capacity and in the speed of transmission lines facilitated content presentation and interaction. Access to data bases and electronic libraries.
5th	To the present	Use of wireless equipment and efficient transmission lines. Organization and reuse of contents.

Table 1. Generations of distance education
Source: Rodrigues (2004, p.54).

Pinheiro (2002) has stated that, in the case of distance learning, the relationship between faculty and students, as well as between the students themselves, is always mediated by some type of synchronous or asynchronous media, with different levels of interaction. Thus, it is important to define the media most usually found in distance education courses (Table 2).

Media	Characteristics
Print media	- This is a unidirectional medium that can be easily utilized anywhere, but its main drawback is the lack of interaction.
Video	- This is very valuable material to complement the print media. It is easy to handle, and it helps reduce the student's isolation as well as create empathy.
Teleconference	- Live transmission, via satellite, of lectures and presentations, in which the faculty member or speaker works in a TV studio, and the students receive the TV images on a specific channel at a predetermined time. Students may interact by telephone or via fax or e-mail.
Videoconference	- This is the medium closest to the traditional classroom because it allows real-time interaction and people may see and hear each other simultaneously. - Videoconferences can be held in rooms especially prepared for this purpose, or through the Internet, with the use of webcams with microphones and personal computers.
Computer	- This is one of the media that has added great potential to distance education, as all the other media can be reproduced on a computer, as for example, text, video, sound, images, etc.
Internet	- Using the Internet on the World Wide Web promotes easy access, reduces costs, allows course customization, reinforces faculty/student and student/student communication, makes corrections and updates fairly easy and facilitates giving feedback to the students.
Virtual reality	- It permits interaction with the virtual environment and its objects, as if they were real. This occurs by means of space/time simulations, which allow the student to interact in a 3D environment.
Audio	- Tapes and CDs are inexpensive, easy to reproduce, use and carry. - They are very useful for distribution during presentations and discussion panels; however, they do not offer a great deal of interaction or any visual elements.
Radio	- Radio is easy to use and, from an educational perspective, it may also fill in for an absent faculty member.

Table 2. Most important media in Distance Education
Source: The authors, based on Pinheiro (2002).

According to Nunes (1993), the main characteristics of distance education are as follows:

- Scattering of the student body, i.e. the physical distance between faculty and students; distance education opens up the possibility of attending to the needs of people in distant locations and to those who may have time constraints;

- The use of technical means of communication to bring together faculty and students and convey the educational content;

- Planned two-way communication between faculty and students, which encourages dialogue;

- Mainly adult students, which underscores their individual experience;

- Self-education courses: the teaching-learning process is no longer centered on the faculty but rather on the student. Content materials should emphasize the development of critical and analytical thinking;
- Previously prepared courses that combine different resources, as for example, texts for printing, magazines, books, radio, TV, films, computer materials, etc. Furthermore, the production of materials is centralized.
- The use of mass communication makes the course available to a large number of students in many different locations;
- Customized studies allow students to follow the course at their own pace and according to their individual characteristics;
- Rising use of information and communication technology;
- Courses developed by multi-disciplinary teams;
- Distance education demands a large initial investment in technology and in the development of high-quality materials;
- It tends to adopt flexible curricular structures, allowing it to adapt better to the possibilities and expectations of the individual students.

Distance education proposes a change in paradigm, by which traditional classroom education is substituted for a collaborative learning approach. This type of learning results from a continuous effort to create and maintain a relationship shared between the group members (PINHEIRO, 2002). This proposal of collaborative learning contributes towards the development of virtual learning communities. A characteristic that is common to these communities is the interaction that takes place by means of computer-mediated communication tools. With the use of these tools, opinions and ideas are shared and cohesive groups are also created. (PINHEIRO, 2002).

According to Rodrigues (2005), many distance education courses simply reproduce work methodologies from traditional classroom education environments, without including the interactive resources and the element of collaborative work. Thus, the following are some of the challenges that need to be overcome in distance education (MENEGHETTI NETO, 2004):

- lack of contact;
- the students adapting to this type of education;
- structured management of time and techniques;
- offering assistance to the learning community that is created;
- managing the messages (frequency, format and nature of the messages) as well as the students' participation.

There is a form of distance education, namely a hybrid strategy, i.e. classroom-based education and remote activities mediated by computers and Internet (RODRIGUES, 2005). In this case, the classroom-based education needs to be redeveloped, using new methods, activities and processes, as well as new conceptions and educational paradigms (BORGES, 2005).

2.2 E-learning

E-learning is a type of distance education that uses technology and the Internet for the teaching-learning process. In this modality, the teaching materials are delivered to the learners via computer networks (CARVALHO NETO; ZWICKER; CAMPANHOL, 2006), in order to generate knowledge and improve practical performance (ROSENBERG, 2001).

The use of information and communication technologies depends on the technological infrastructure available, on the person's ability to deal with technology, as well as on the proposed educational objectives (FILATRO; PICONEZ, 2004).

Rosenberg (2001) has presented some of the key criteria on which the concept of e-learning is based:

- transmitted through a network: i.e. instructions and information can be immediately updated, filed, distributed and shared;
- made available via computer: i.e. it uses Internet technology standards;
- focused on a broad learning perspective.

This author has also indicated some benefits of e-learning (ROSENBERG, 2001):

- cost reduction: less need of infrastructure;
- consistent messages: people receive the same content, presented in the same way;
- content is updated easily and quickly;
- overcomes space and time barriers;
- easy to use for people familiar with the Internet;
- universal in nature: takes advantage of the universal protocols and browsers on the Internet;
- builds communities that may share knowledge and insights once the course is over;
- scale: possibility to increase the number of students with little effort and low extra cost.

E-learning has been present since the fourth generation of distance education. However, the more flexible and intelligent models, with further communication resources, are already part of the fifth generation (CAVALHEIRO; IKEDA, 2005).

In order to participate in the on-line activities learners have to be aware of their role in the educational process. In more advanced contexts, learners also need to be held accountable for developing the discussions (LAAT; LALLY, 2004).

Using the Internet and other information and communication technologies in education modifies the role of the players involved in the process. The faculty member becomes the person who guides the learning process and is no longer responsible for delivering knowledge. The students become autonomous and responsible for the learning process, in as

much as they manage their time and decide on what to study, which, in turn, demands a more dynamic and active behavior (FREITAS; BERTRAND, 2006).

Some studies have pointed to interaction as a key factor in the teaching-learning process that uses e-learning (FREITAS; BERTRAND, 2006; GARRISON; CLEVELAND-INNES, 2005). This is because interaction may determine positive behavior on the part of the students as regards on-line classes, as well as increase their motivation to be successful in the activities (MABRITO, 2006). Bearing in mind the importance of interaction for the on-line teaching-learning process, section 2.3 will further analyze the characteristics of technology-mediated communication.

2.3 Technology-mediated communication

The information and communication technologies as well as the Internet hold a large potential to promote interaction in its deepest sense: ‘interaction seen as communication, for the purpose of influencing thought in a critical and reflective way´ (GARRISON; CLEVELAND-INNES, 2005, p. 134).

In their study, Beuchot and Bullen (2005) defined three very interesting categories of interaction:

- active interaction: messages posted are not related with previously sent messages;
- reactive interaction: refers implicitly or explicitly to a message posted before the reactive message;
- interactive interaction: messages are related; the posted messages take up on the previous messages.

The above mentioned authors have stated that reactive and interactive interactions are more desirable for computer-mediated communication. These two types of interaction may be

encouraged by increasing sociability and creating a social and emotional context that is pleasant for holding discussions (BEUCHOT; BULLEN, 2005).

Computer-mediated communication refers to the interaction that takes place between a person and a computer, or between two people with the use of a computer, i.e. it permits situations that do not occur face-to-face (RAMOS, 2005).

This type of interaction may occur in a synchronous or asynchronous way. Furthermore, these two forms of interaction may be used not only for communication purposes, but also for student follow-up. In the synchronous way, communication between the participants occurs simultaneously, i.e. students and faculty/tutors communicate in real time, which allows the group to be cohesive and keep its pace. On the other hand, asynchronous communication is more flexible, as the two parties do not need to participate at the same time. Thus, the students may set their work pace, and they also have time to research and reflect on the ideas they will present. Another important characteristic of asynchronous communication is related to its lower cost, as compared with the synchronous way. The former does not require sophisticated resources, as for example, state-of-the-art computers and broad band transmission (FREITAS; BERTRAND, 2006).

Table 3 summarizes the main characteristics of the synchronous and asynchronous ways of communication.

Modality	Characteristics
Asynchronous	- flexibility: access may occur anywhere, 24/7; - time to reflect: it allows the students to think about the ideas that are presented, check their notes, do research on new references and prepare their participation; - contextualization: since technology enables people to have access at home or at work, it is easy to integrate the ideas in the course with other practical situations; - low cost: materials based on text do not demand fast transmission lines or state-of-the-art computers.
Synchronous	- motivation: focus on the energy of the group; it encourages students to keep up with their colleagues; - real-time interaction: this develops cohesion within the group and the sense of belonging to a learning community; - feedback: immediate answers and orientation. It supports decision-making and encourages the group to seek consensus in its activities; - pace: it encourages students to keep their course activities up to date.

Table 3. Overall characteristics of technology-mediated communication
Source: Rodrigues (2004, p. 73).

The synchronous and asynchronous types of communication benefit the student/student and student/faculty interactions (MABRITO, 2006).

Both the synchronous and the asynchronous activities may be used to enrich the course, as, according to Vieira (2001), they aim at encouraging students to review the contents they found most difficult, or to go deeper into other interesting issues. Furthermore, Mabrito (2006) has indicated that, different as they may be, both the synchronous and asynchronous discussions are important and should be used during the course. It should be highlighted, however, that each one must be geared towards an appropriate purpose and designed for their intended educational goals.

The decision to use one type of communication or the other should take into account the characteristics of the course: available structure and resources, course design, characteristics of the target public. The latter should be highlighted since the specificities of the target public help define course design, as for example, the learning style and the technological resources that may be available to follow up an e-learning course.

The on-line communication activities (synchronous or asynchronous) represent an enormous challenge, not only for the course designers, but also for the tutors and faculty members that mediate them, as well as for the participating students themselves.

3 Methodology

This section discusses the definition of the research and the techniques used to collect and analyze the data.

3.1 Research definition

In order to reach the overall objective, defined as 'evaluating the use of distance education tools for the teaching of statistics applied to administration courses', a case study was devised, including two steps. The first one was descriptive and quantitative, and it consisted of an analysis of each one of the distance education tools implemented in the mentioned discipline. The second step, of an exploratory and qualitative nature, aimed at analyzing the opinion of the students enrolled in the course, as regards their experience in the proposed distance education activities.

According to Yin (2005, p.32), a case study is defined as 'an empirical investigation that analyzes a contemporary phenomenon within its actual context, when the boundaries between this phenomenon and the context are not clearly defined', and the researcher does not have control over the behavioral events, so that data collection and analysis have their own special characteristics.

In this approach, the researcher first seeks to understand the situation as a whole, and then, describe, comprehend and interpret the complexity of the case, through a deeper analysis (MARTINS, 2006). Case studies are used to reach a greater comprehension of complex social

phenomena and answer the how and why questions, while preserving the significant aspects of the actual occurrences (YIN, 2005).

According to Yin (2005), there are two types of case studies, i.e. the study of a single case and that of multiple cases. The single case study can be used when it represents 'the decisive case, when a well-formulated theory is being tested […], in order to determine whether the theoretical proposals are correct, or whether another set of explanations may be more relevant´ (YIN, 2005, p.62). It is also adequate when the single case represents a rare or extreme case, which is representative or typical, revealing or longitudinal, i.e. the same case is analyzed in two different moments in time (YIN, 2005).

The present work may be defined as a single-case study, as it analyzes the use of chats, during tutoring sessions to elucidate doubts, in a hybrid discipline of statistics applied to the administration course offered at FEA-RP/USP.

3.2 Data collection and analysis

The study was conducted in a statistics discipline of the undergraduate course in administration, offered during the first semester of 2007. The undergraduate courses offered at the mentioned institution follow the traditional classroom model. However, the discipline that is the subject of the present study was designed as a hybrid one, i.e. part of the course load was designed for online activities. The discipline was offered to 99 students enrolled in day and evening courses.

The use of each one of the distance education tools was analyzed using the students' login data, which was then analyzed by means of descriptive statistics. At the end of the statistics course, the students were organized into four focus groups aimed at revealing their opinion about the experience with distance education, as well as the strengths and weaknesses identified.

4 Results

This section presents the description of the discipline under study, the profile of the students enrolled, an analysis of the results of the use of distance education tools and the students' opinions expressed in the focus groups.

4.1 Description of the discipline

The discipline is named 'Statistics applied to administration I', and it was designed as a hybrid discipline, i.e. part of the course load was offered in a traditional classroom setting and another was planned for distance education activities. The discipline was offered during the first semester of 2007 as part of the FEA-RP/USP administration course, both as a day or evening session. It is a four-credit discipline, with two classes per week of one hour and forty minutes each. All the statistics disciplines are offered in the traditional classroom modality; however, during the first semester of 2007, 'Statistics I' became a hybrid discipline. Some of the traditional classes and activities were then offered in the distance education modality, by means of a virtual learning environment named LaViE.

Government Decree Number 4.059, issued in 2004 to regulate the Law for National Education Guidelines and Bases (*Lei de Diretrizes e Bases no. 9.394/96 – LDB in Portuguese*), states that the institutions of higher learning may include in their curricula both hybrid and distance education disciplines, provided that the distance education courses do not surpass 20% of the total course load (BRASIL, 2004). In the case of the mentioned discipline, 'Statistics I', the total load amounts to 30 classes. In accordance with the percentage established by the mentioned law, it would be possible to include up to six classes offered as distance learning. Thus, the on-line activities took up only the work load corresponding to six classes.

This discipline is made up of six content modules: hypothesis tests, significance tests for means, significance tests for proportions, variance analysis, correlation analysis and regression analysis. The following resources were chosen for use in the discipline: e-mails, forums, chats, digital texts, tutorials for the use of SPSS (Statistical Package for Social Sciences) and Excel, glossary of concepts in statistics and surveys. Only in the case of the forums were the students awarded grades from 0 to 10; for the other activities, they received participation grades, with a 0.5 weight towards the student's final grade point average.

E-mails were used as a permanent communication channel between faculty/students, tutor/students and student/student to clarify doubts and questions, but its use was not mandatory. The tutor was available every Tuesday for one-hour chats to elucidate doubts, and these chats were optional. Weekly surveys were also conducted, on a mandatory basis, so that the students would be obliged to log onto the portal at least once per week. Participation in the forum was also mandatory. This meant that the students had to read the practical examples (articles) in order to participate. Reading the theoretical texts, tutorials and glossary was not mandatory, albeit necessary, for them to be able to work on the required exercises and projects. The activity carried out in the shared environment was also obligatory, and it entailed evaluating the students' practical work. Each group had to assess another group's project, which implied having theoretical knowledge of the technique. Thus, the texts, tutorials and glossary also had to be consulted. Table 4 presents the way each one of the resources was utilized in the mentioned discipline.

Module	Activities carried out
Hypothesis test	Reading the text
	Using the glossary in case of conceptual doubts
Comparison involving means	Reading the text
	Using the glossary in case of conceptual doubts
	Using the tutorials to solve a case study
	Discussing the case study in the forum
Variance analysis	Reading the text
	Using the glossary in case of conceptual doubts
	Using the tutorials to develop Practical Project I
	Analyzing the article to be discussed in the forum
Comparison involving proportion	Reading the text
	Using the glossary in case of conceptual doubts
	Using the tutorials to solve the exercise
Correlation analysis	Reading the text
	Using the glossary in case of conceptual doubts
	Using the tutorial to develop Practical Project II
	Doing the exercise
	Posting the notes in the bulletin board
Regression analysis	Reading the text
	Using the glossary in case of conceptual doubts
	Using the tutorial to develop Project II
	Analyzing the article to be discussed in the forum

Table 4. Use of e-learning resources in the discipline

4.2 Student Profile

The study involved two groups totaling 99 students; 58% of them attending day classes and 42% enrolled in the evening session. The average age was 19.9 years and the students were predominantly male (66%). Most of them owned computers with Internet access from home, and they used mostly broad band connections. Thus, it may be concluded that, overall, these students had good quality access to the Internet, which is a relevant factor towards the success of an e-learning course. Internet is used mainly for e-mails, research, communication and leisure.

Most students had never participated in an on-line course (only 5.3% in the day session and 16.7% in the evening session). Nevertheless, they believed that distance education would add value to the discipline of statistics. As they had not before taken any on-line

courses, most students also did not master the tools of distance education. Table 5 presents a summary of the student profile characteristics.

Access Structure	**Result**
Computer	96% of the students have computers at home
Internet Access	95% of the students have Internet access at home
Connection type	74% of the students have broad band connections, and 21% use dial-up connections
Habits of Use	**Result**
Place of access	Access is most frequent from home, school and work.
Purpose	Internet is used for e-mailing, communication (Skype, MSN) researching and leisure.
Time of access	Most frequently used in the afternoon (students enrolled in evening session) and at night (students attending day session)
Frequency of use	63% - on a daily basis; 24% use the computer 4 to 6 times per week.
Experience with *e-learning*	**Result**
Participation in on-line courses	Only 16.4% of the students enrolled in the evening session and 5.3% of those attending day sessions had previously participated in on-line courses.
Aid for learning	80% believe that distance education can contribute towards their learning of statistics.
Favorable aspects	The students who had previously taken distance education courses mentioned the following favorable aspects: - Ease of access - Content availability - Innovative way of learning - Customized attention for the students - Dynamism - Interactive participation - Chance to expand knowledge
Unfavorable aspects	The students who had previously taken distance education courses mentioned the following unfavorable aspects: - Use of technologies is not adequate for the teaching of Statistics - Disliked digital content - Lack of knowledge about distance education - Lack of time to participate in interactive activities - Isolation in distance education
Knowledge about Distance Education tools	Internet: Mean = 4.0; Standard deviation = 0.7; Coefficient of variation = 17.5% Chat: Mean= 3.6, Standard deviation =1.0; Coefficient of Variation =27.8% Forum: Mean = 2.9; Standard deviation = 2.2; Coefficient of Variation = 41.4% E-mail: Mean = 4.4; Standard deviation =0.6; coefficient of variation =13.6%

Table 5. Summary of Student Profile

4.3 Analysis of the use of Distance Education tools

This section presents an analysis of the use of the distance education tools that were implemented in the discipline under study: e-mail, forum, chat, digital learning contents (texts, tutorials, glossary) and survey.

4.3.1 E-mail

E-mail was the communication tool most widely used by the students because of its practical and asynchronous nature, i.e. it is always available. The maximum time set for the tutors to respond to the e-mails was 24 hours, even on week-ends, and all the messages forwarded by the students received an answer.

Of all the messages, 83.8% were sent by the students, and they fall into the following categories: doubts about the course, problems of access, doubts about the content, system login, forwarding of files overdue. The tutor was responsible for 16.2% of the messages, dealing with: orientation for the activities, reminders of dates and deadlines, information about the course and feedback on the activities. Table 6 presents the statistical results of e-mail classification.

Classification	Day session		Evening session		Tutor	
Instructions	----------	-------	----------	-------	23 messages	26.7%
Reminders	----------	-------	----------	-------	16 messages	18.6%
Information about the course	----------	-------	----------	-------	33 messages	38.4%
Feedback	----------	-------	----------	-------	14 messages	16.3%
Doubts about the course	103 messages	52.3%	126 messages	48.1%	----------	-------
Problems of access	22 messages	11.2%	36 messages	13.7%	----------	-------
Doubts about the content	37 messages	18.8%	43 messages	16.5%	----------	-------
System login	22 messages	11.2%	47 messages	17.9%	----------	-------
Forwarding of files overdue	13 messages	6.5%	10 messages	3.8%	----------	------
Total messages	197 messages		262 messages		86 messages	
Participation index	3.3 messages /student		6 messages /student		----------	
% of students participating	80%		100%		----------	

Table 6. Classification of e-mails

The majority of students used this tool during the course (80% of those enrolled in the day session and 100% of the students attending the evening session). It should be highlighted that most of the messages forwarded by the tutor were classified as ‘information about the course’ and aimed at drawing the students’ attention to files overdue or checking their reasons for not logging onto the system.

Among the messages forwarded by the students, approximately 50% referred to doubts about the course, i.e. deadlines, availability of learning materials, notes and frequency of on-line activities.

As regards the messages about problems of access, most of them were related to the server being down, which prevented access to the site.

4.3.2 Forum

Three mandatory forums were held during the semester, with joint participation of the students in the day and evening sessions. The course management system stores the accesses

to the forum, but it does not differentiate accesses to post messages from accesses to read messages. Thus, it was not possible to verify the number of messages the students actually read, or the topic they accessed. The analyses consider the accesses to each forum, the percentage of students who participated by posting messages and the number of messages posted.

For each one of the forums, the students should complete the critical reading of an assigned article and analyze the way its authors had used the statistical tools. A tutor played the role of moderator in the forums, and the students had to present the strengths and weaknesses they had identified in the article and suggest improvements. This activity was mandatory, and each forum was open for discussions during ten days.

Overall, and considering the three forums as a whole, the students enrolled in the day session had a higher participation in these activities. The first forum also showed greater participation than the others. The reason for this might be the students' curiosity about the activity, bearing in mind that few students had previously participated in forums. Table 7 presents the percentages of accesses in each forum.

Access to forums	Day session		Evening session		Total
Forum 1	491 accesses	60.2%	324 accesses	39.8%	815 accesses
Forum 2	332 accesses	55.9%	262 accesses	44.1%	594 accesses
Forum 3	357 accesses	66%	184 accesses	34%	541 accesses
Total	1,180 accesses	60.5%	770 accesses	39.5%	1,180 accesses
Overall index of accesses	19.7 accesses /student		17.9 accesses /student		11.5 accesses /student

Table 7. Statistics of accesses in the forums

The number of posted messages was similar in all three forums, and most students participated in them, as is shown in Table 8.

Forum		Day session	Evening session	Total
1	Total number of messages	121	102	223
	Participation index	2 messages/student	2.4 messages/student	2.3 messages/student
	Percentage of participating students	70%	75%	73%
2	Total number of messages	129	96	225
	Participation index	2.2 messages/student	2.2 messages/student	2.2 messages/student
	Percentage of participating students	85%	86%	86%
3	Total number of messages	113	96	209
	Participation index	1.9 messages/student	2.2 messages/student	2.1 messages/student
	Percentage of participating students	92%	77%	86%

Table 8. Statistics of posted messages

4.3.3 Chat

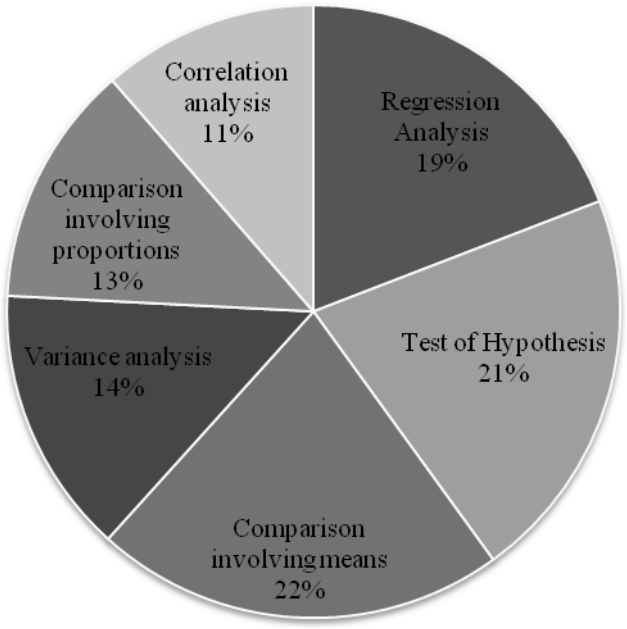
Weekly, optional, one-hour chats were also planned for the semester for the purpose of elucidating doubts on-line. Nineteen chats were planned and only 10 actually took place, i.e. students participated in them. It should be highlighted that the students participated in the chats on the week of the tests or when papers/exercises were due.

Overall, 31 students participated in the chats by forwarding messages; 15 of them (34% of the students) were enrolled in the evening session and 16 (27%) attended the day session. Thus, a small percentage of the students actually used this resource. The reason for the low figures was the synchronous nature of the activity, as well as the chat schedules. Although the students were consulted on the most convenient time for the chats, the schedules may have contributed to their low participation. The use of e-mails to elucidate the doubts may also have reduced the need to access the chat. Finally, the chats were held jointly for the

students in the day and evening sessions, and this may also have prevented some shy students from participating.

4.3.4 Texts

The mentioned discipline included six content modules: introduction to the tests of hypothesis, comparisons involving means, variance analysis, comparisons involving proportions, correlation analysis and regression analysis. The texts presented a summary of the theory behind each statistical tool, including: steps for its use, assumptions of the tool and examples of use. Graph 1 presents the overall percentage of access to the texts, in each module.



Graph 1. Proportion of access to the explanatory texts in each module of the discipline

As can be seen in Table 9, almost all the students accessed the explanatory texts. More students in the evening session accessed Modules 1 to 4, than did the students enrolled in the day session. In the case of Modules 5 and 6, the proportion of accesses was almost equal for both groups.

Access to the explanatory texts		Day session		Evening session	
Module 1 Test of Hypothesis	Percentage of students accessing the module	95%		100%	
	Access Index per student = number of accesses/number of enrolled students	5 accesses/student		7.3 accesses/student	
	Number of accesses to the module	299 accesses	19.2%	322 accesses	22.8%
Module 2 Comparison involving mean	Percentage of students accessing the module	95%		98%	
	Access Index per student	5.7 accesses/student		6.9 accesses/student	
	Number of accesses to the module	342 accesses	21.9%	302 accesses	21.4%
Module 3 Comparison involving proportion	Percentage of students accessing the module	85%		84%	
	Access Index per student	3.3 accesses/student		4.1 accesses/student	
	Number of accesses to the module	200 accesses	12.8%	180 accesses	12.7%
Module 4 Variance Analysis	Percentage of students accessing the module	78%		93%	
	Access Index per student	3.1 accesses/student		5.3 accesses/student	
	Number of accesses to the module	185 accesses	11.9%	235 accesses	16.6%
Module 5 Correlation Analysis	Percentage of students accessing the module	80%		82%	
	Access Index per student	3.5 accesses/student		3 accesses/student	
	Number of accesses to the module	207 accesses	13.3%	132 accesses	9.3%
Module 6 Regression Analysis	Percentage of students accessing the module	88%		91%	
	Access Index per student	5.5 accesses/student		5.5 accesses/student	
	Number of accesses to the module	328 accesses	21%	241 accesses	17.1%
Overall index of access to the texts		98% of the students		100% of the students	

Table 9. Statistics of access to each module in the course

4.3.5 Tutorials

Tutorials are texts that explain how to apply the statistical tools presented in the discipline, by means of software (SPSS – Statistical Package for Social Sciences - or Microsoft Excel). They also indicate how to analyze the results obtained. The data shows that the majority of students in both sessions accessed this material - 95% of the students in the day session and 98% of those in the evening session. The proportion of accesses per student also demonstrates that the students in the evening session logged onto this material more often than the other group. The reasons might be as follows: the students enrolled in the day session may have saved the tutorial files in their computers for access off-line; the students in the evening session may have accessed more the tutorials in video format, which can only be done through the site, with the corresponding increase in the number of accesses; or the evening students may actually have accessed this material more frequently. The access register does not supply data to reach any conclusions in this regard.

4.3.6 Glossary

The glossary is made up of a list of statistical concepts, relevant to the course, and their definitions. This resource was seldom used during the semester. Although the number of accesses was low, the students enrolled in the evening course used it more frequently, and a higher percentage of them searched the glossary. Table 10 presents the statistics of access.

Accesses to the glossary	Day session	Evening session
Total number of accesses	8 accesses	26 accesses
Overall index of access = number of accesses/number of enrolled students	0.1 access/student	0.6 access/student
Percentage of students who searched the glossary	7%	23%

Table 10. Statistics of the glossary search

4.3.7 Survey

Thirteen mandatory surveys and two optional ones were conducted during the semester. They included items regarding the students' opinion about the discipline, the virtual learning environment as well as their perception of the quality of the discipline.

The LaViE environment allows any user, regardless of whether he/she is enrolled in the disciplines or registered in the environment, to vote in the surveys. Users can vote as many times as they wish in the same survey. Furthermore, the system does not store the option chosen by the user, i.e. the student can vote several times in the same survey and chose different alternatives every time. Thus, the results of the survey could not be used as student feedback for the discipline, as was originally intended. This tool was utilized only to encourage the students to log onto the environment. Table 11 presents the statistics of the votes in the surveys. It should be noted that surveys 1 to 13 were mandatory, and surveys 14 and 15 were optional.

Votes in the surveys		Day session	Evening session
Survey 1	Participation index = number of students who voted/number of enrolled students	75% of the students	84% of the students
	Voting Index = total number of votes/number of enrolled students	1.3 votes/student	1.8 votes/student
Survey2	Participation index	75% of the students	89% of the students
	Voting index	1.1 votes/student	1.5 votes/student
Survey3	Participation index	75% of the students	95% of the students
	Voting index	1.1 votes/student	1.4 votes/student
Survey4	Participation index	70% of the students	73% of the students
	Voting index	1 vote/student	1 vote/student
Survey5	Participation index	87% of the students	82% of the students
	Voting index	1.6 votes/student	1.3 votes/student
Survey6	Participation index	92% of the students	86% of the students
	Voting index	1.8 votes/student	1.4 votes/student
Survey7	Participation index	80% of the students	77% of the students
	Voting index	1.1 votes/student	1 vote/student
Survey8	Participation index	92% of the students	80% of the students
	Voting index	1.1 votes/student	1 vote/student
Survey9	Participation index	93% of the students	77% of the students
	Voting index	1.1 votes/student	1 vote/student
Survey10	Participation index	88% of the students	77% of the students
	Voting index	1.2 votes/student	1 vote/student
Survey11	Participation index	75% of the students	73% of the students
	Voting index	0.9 votes/ student	1 vote/student
Survey12	Participation index	90% of the students	82% of the students
	Voting index	1.3 votes/student	1.3 votes/student
Survey13	Participation index	95% of the students	89% of the students
	Voting index	1.5 votes/student	1.3 votes/student
Survey14	Participation index	57% of the students	55% of the students
	Voting index	0.7 votes/student	0.7 votes/student
Survey15	Participation index	57% of the students	61% of the students
	Voting index	0.8 votes/student	1 vote/student
Total number of accesses		1043 accesses	773 accesses
Overall Participation Index = total number of votes/number of enrolled students		17.4 votes/student	17.6 votes/student

Table 11. Statistics of votes in the surveys

The students enrolled in the evening course had greater participation in the initial surveys, while those attending the day session participated more actively in the final required surveys. As a rule, both groups had lower participation in the optional surveys than in the

mandatory ones. Taking into consideration the overall participation index, both groups had approximately the same level of participation in the surveys.

4.4 Students' assessment of their experience in the discipline

From the students' point of view, e-mail played a very significant role during the course because the time to respond was short (maximum of 24 hours), which allowed them to elucidate their doubts very quickly. The dynamics of the use of this tool also afforded them greater contact with the faculty/tutor, which, in turn, gave them the certainty that they could get help any time.

A large number of messages were sent to request information about the course. According to the students it was more practical to send the tutor an e-mail asking for the information than to consult the summary of the discipline, which contains all the course information. Likewise, the reminder e-mails sent by the tutor were considered very useful to keep up to date with the activities of the discipline.

Overall, the students did not value the activities in the forum. The comparative grading system generated great anxiety because the students who posted more consistent messages would receive higher grades. The joint participation of the groups also generated a large number of messages, which discouraged their reading. Many students did post their messages but did not log onto the forum afterwards to check the comments from their colleagues and, thus, continue interacting. Furthermore, due to the large number of participants, it became difficult to have new comments for the forum, especially on the last days of the discussion, when a large number of ideas had already been addressed and analyzed. Thus, many students participated in the forum because it was required for their grade. Many of them did not read the whole article but only parts of it, so as to have an issue to discuss in the forum. This could

be avoided by requesting them to turn in a summary of the article that was discussed, or a summary of the forum discussions.

According to the students, forums are interesting only when people can actually get involved and participate in the discussions. This tool enables them to learn their colleagues' opinions, present theirs and clear any doubts they might have. To reach this level of involvement the students suggested having only one forum during the semester, since this activity demands time to reflect on it. Working with smaller groups might also reduce the repetitions and encourage more students to participate, as there would be fewer messages to read.

It was also suggested to have a summary of the forum presented during the regular class time, as an overall view of the discussion would raise people's interest in the activity.

Having to participate in the forum, together with the students from another group that they did not know personally, intimidated many students. They felt apprehensive about commenting on other colleagues' messages or responding to them. The instructions to participate in the forum were considered quite relevant because they highlighted the key items in the articles, which kept their debate focused on statistics.

Besides these educational forums, the students suggested having a permanent forum for doubts and suggestions on the course, which would reduce the need for e-mails.

Finally, the forum tool in the LaViE environment was described as impractical and difficult for browsing because all the messages are posted on the browser page, which discourages people from accessing.

Although few students actually participated in the chat, it was considered a very practical tool to elucidate doubts, especially the most urgent ones that could not wait for an answer by e-mail. The duration of the chats was described as limited, and it was suggested to have longer chat sessions on the days the papers were due, or on the days of the tests.

On the other hand, since this is a synchronous activity in which the messages appear in the order in which they were sent, it is difficult to follow up the discussion with many people interacting simultaneously. The MSN tool was suggested as an alternative that would allow students to clarify their doubts without a fixed schedule, in a synchronous and individual way, or even in small groups.

The texts were described as thorough, clear and objective, which reduced the need to take notes during the classroom sessions. The objectivity of the texts also enabled the students who were absent from these sessions to study and learn the content without difficulty. Many course participants studied just the contents published on the site, and they used books only for more thorough explanations. The texts were considered appropriate for the purpose of the discipline.

The tutorials were the most highly appreciated of all the course materials. They were described as highly explanatory and useful for the projects, which made the SPSS easy and even funny to use. Dividing the tutorials into chart creation and chart analysis also facilitated the learning process.

The tutorials were limited in that they presented only one example of application for each statistical tool; thus, the students found it difficult to apply the tools in other situations. Furthermore, the tutorials present an analysis for each chart, but they do not indicate how to draw an overall conclusion of the data, nor which charts are actually relevant for the analysis. Finally, the tutorials present only the functions that will be used to apply the statistical tools in this particular discipline, which is far less than the software has to offer.

During the focus groups, only two students declared having used the glossary, although they were instructed to do so in each module. These students considered the glossary useful for the slight conceptual doubts that came up as they studied the modules. Thus, the glossary does meet its intended function, despite the low level of participation.

The survey allows people to vote as often as they wish and on different alternatives. As the students were not informed that they had already voted in a specific survey, they felt insecure and found it difficult to manage their participation in this tool. Since they did not have this type of control, they would vote every time they logged onto the site. Although the survey addressed issues regarding their opinion about the course, the fact that they could vote several times distorted the results, which proved discouraging.

The students thought it was interesting to be able to express their opinion about the discipline, but the distorted results made it a useless task. The mandatory nature of this activity demands that they log onto the site, which may also encourage them to check the other resources, as for example, texts, tutorials, etc. However, this obligation also led some students to vote on any alternative, or even the most negative one, as a way to express their lack of interest.

5 Conclusions

The present article has analyzed the use of distance education tools for the teaching of statistics applied to administration, in a hybrid discipline. The LaViE virtual learning environment was used during the course, and different digital contents were offered to the students (texts, tutorials and glossary). Discussions were held via forums and chats and surveys were also conducted. Students received support via e-mail.

There was large-scale use of the texts and tutorials, although it was not a course requirement. The reason was that, both the tests and the required papers demanded studying the statistical techniques presented during the course, and this content was included in the mentioned materials. The purpose of the glossary was to clarify any conceptual doubts that the students might have had as they studied the theoretical materials. Few students used this

resource, although they were advised to do so in case of doubt. However, the students that did access the glossary rated as a useful tool, which means that the tool fulfills it intended role.

As regards the communication tools, e-mails were widely used to resolve administrative issues about the discipline, as for example, deadlines for papers, test schedules, etc. It was expected that e-mails would be used to solve doubts regarding course content, but this did not occur.

Chats were used as an optional resource to clarify doubts during the semester. Due to their synchronous nature, few students participated in the chats. Nevertheless, the students that did participate found this tool quite useful and efficient to elucidate their doubts. It should also be highlighted that the chat discussions were actually focused on resolving the doubts without digressing to other issues not related with the discipline. Thus, despite the low participation index, the chats also accomplished their goal.

The forum discussions were mandatory, and the majority of the students participated in them. However, of all the communication tools used in the course, the forum was the one the students appreciated the least. Not only was participation obligatory, but the grades were distributed comparatively among the students, i.e. the student who posted the largest number of messages and of the highest quality – including new, relevant issues consistent with the theory – would receive the highest grade. This generated great anxiety among the students, and the tool received a negative evaluation. Furthermore, the students in the day and evening sessions participated together in the forum, which generated a large number of messages and a certain reticence to interact with strangers.

Forum discussions also demand that the students reflect on the issues, prepare their participation in advance, read their peers' contributions and interact by posting new topics or responding to the active ones. This involves a great amount of time and effort, therefore, three forums in one semester was considered an excessive amount.

On the other hand, the students pointed out as one of the strengths of the forum that it afforded them a chance to express their ideas and arguments and get to know their colleagues' opinions, which also increased their knowledge. The forum encouraged them to use their critical reasoning, as they analyzed the practical application of the statistical techniques presented in the discipline, so it can be said that the forum achieved its goal.

The main purpose of the surveys was to learn the students' opinion about the discipline, in order to identify the problems during the semester and be able to solve them. A second objective was to encourage access to the virtual environment, since participation in the surveys was mandatory and they were conducted on a weekly basis. The items in the surveys covered questions about the appropriateness of the suggested work load, the planned activities, etc.

Given that the virtual environment allows anyone to vote in the surveys - students enrolled in the discipline or not - and more than one vote may be cast per survey, the results are not reliable to assess the students' opinion, and this fact generated discontent on their part. Yet, despite this limitation, the mandatory nature of this resource did encourage the students to log onto the virtual environment, as was intended.

Overall, the experience of using distance education technologies in the discipline under study was successful, which demonstrates the actual possibility of using these tools for the teaching of applied statistics. This could be made more flexible, as the students gain more freedom to manage their time and place of study, thus becoming more actively involved in their own educational process.

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