

# Perception of professors who teach statistics in higher education in Brazil towards statistical teaching

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## ABSTRACT

This study aims to identify the perception of three hundred and thirty-four teachers who teach statistical content in undergraduate courses in Brazil according to their area of action, considering the following aspects: how statistical knowledge is acquired, how the statistical content is worked in the classroom, and as techniques of memorization are linked to the process of teaching Statistics. Depending on the field of study they teach (Humanities, Exact and Natural Sciences, and Health Sciences) or the type of institution for which they work (Public or Private), they define statistics as a research tool for organizing and analyzing data for decision making and using real problems. They still argue that statistical knowledge is acquired by associating theory with practice with the support of technological tools.

**Keywords:** Teaching Statistics. Perceptions of statistics. Professors. High education.

## Percepção de professores que ensinam estatística no ensino superior no Brasil sobre o ensino de estatística

## RESUMO

O objetivo deste estudo é identificar a percepção de trezentos e trinta e quatro professores que ensinam conteúdos estatísticos em cursos de Graduação no Brasil segundo sua área de atuação, considerando os seguintes aspectos: como o conhecimento estatístico é adquirido, como os conteúdos estatísticos são trabalhados em sala de aula e como técnicas de memorização estão ligadas ao processo de ensino de Estatística. Estes professores, dependendo do campo de estudo que ensinam (Humanidades, Ciências Exatas e Naturais, e Ciências da Saúde) ou no tipo de instituição para a qual trabalham (Público ou Privado), definem a estatística como ferramenta de pesquisa para organizar e analisar dados para tomada de decisão e usando problemas reais. Ainda argumentam que o conhecimento estatístico é adquirido associando a teoria à prática com o apoio de ferramentas tecnológicas.

**Palavras-chave:** Ensino de Estatística. Percepção de estatística. Professores. Ensino Superior.

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## INTRODUCTION

Many students derive no pleasure from taking statistics courses, and often ask themselves why they must learn the concepts of means and standard deviations, probability, hypothesis testing, correlations, and so on. Sadly, many of these students do not really understand the concepts, and this causes them to quit their courses, or to pass them without a proper understanding of the main ideas.

Such difficulties, according to Mendes and Brumatti (2003), may be exacerbated by, or even the result of factors associated with the teachers of statistics: (1) the professor's misconceptions about statistical methods, believing they are limited to data collection without any criteria, followed by a presentation with graphical representations; (2) flaws in the teachers' professional training, which causes them to teach statistical concepts with the same approach that was used to teach them; (3) unfamiliarity with pedagogical strategies when their course requires development; (4) insufficient or inadequate knowledge of statistical content.

From the same perspective, Ho (2000) and Ho, Watkins and Kelly (2001) encourage all teachers to examine, confront and challenge their conceptions, arguing that this is a necessary first step to better teaching practice.

According to Hogg (1992), difficulties in teaching and learning statistics have received considerable attention from teachers and professionals after a series of calls to change in statistics education that were made by the American Statistical Association (2007) and the Mathematical Association of America (2004), which are: (1) to emphasize statistical thinking, (2) to use more data and concepts, and less theory and a contextual formula, (3) to nurture active learning.

Hartmann (2001) suggests that, according to recent changes recommended in statistics education, emphasis should be given not only to data procedures and formulas (production, visualization, analysis and presentation) and to statistical concepts (in particular, variability and statistical thinking), but also to the development of active learning in environments that utilize technological tools and other appropriate measures to motivate and facilitate learning.

Statistics teachers carry out many activities that involve mathematical reasoning and thinking, such as "figuring out what students know; choosing and managing representations of mathematical ideas; appraising, selecting and modifying textbooks; deciding among alternative courses of action" (Ball, Lubienski & Mewborn, 2001, p.453).

Consequently, teachers' statistical knowledge plays a significant role in the quality of their teaching of statistics, since their instructional decisions in the statistics classroom are dependent on this knowledge (Batanero & Díaz, 2010).

For most statistics students, who are taking 'service' courses in other disciplines, this knowledge then enables them to read, interpret and produce statistics, both as a citizen who consumes such information, and as a professional who reapplies these skills in the exercise of their profession (Cazorla, 2002; Novaes, 2004).

Gordon, Petocz and Reid (2007) report on the results of a series of e-mail interviews with statistics educators around the world, focusing on their views of the nature of teaching statistics as a ‘service’ subject. What do they think are the important aspects of statistics to focus on in such servicing teaching? What do they think are the characteristics of good teachers? And how do they go about developing themselves as statistics teachers? They analyze their responses to these and other questions using a phenomenographic approach to identify an outcome space for their conceptions of teaching service statistics. They examine the centralities and tensions that emerged from their responses and discuss the implications, insights on agency and reflective practice. The study contributes to a research framework for understanding the nature of pedagogical awareness in contexts beyond the setting for this study and aims to stimulate discussion about teaching service courses.

Garfield and Ben-Zvi (2008) discuss how two different types of professional development projects for school teachers are based on the same framework and are used to prepare knowledgeable and effective teachers of statistics. The first example involved a graduate course for masters’ students in elementary mathematics education at the University of Haifa, Israel. The second example is a graduate course for in-service secondary mathematics teachers, at the University of Minnesota, USA. Both these courses provide a learning environment for developing a deep and meaningful understanding of statistics and helping students develop their ability to think and reason statistically, a “Statistical Reasoning Learning Environment” (SRLE).

Hay (2010) reports on teachers’ perceptions about how to develop students’ statistical literacy effectively. The interview data used in the analysis were collected from high school teachers located in 7 different schools across one Australian state as part of a three-year longitudinal study investigating students’ development of statistical literacy. The resulting map supports the notion that students’ engagement with statistical programs and statistical literacy activities are enhanced when there is a focus on the student’s active participation: doing; using; understanding; and discussing.

Martins, Nascimento and Estrada (2012) report on their investigation of Portuguese elementary school teachers’ attitudes towards statistics, carried out by surveying a group of almost 500 teachers during in-service training. The survey asked for the extent of agreement with statements about statistics (such as “statistics can manipulate the truth”) on a five-point scale, and also requested written clarification of responses to some of these questions. Although the study was carried out at an earlier level of education, there are some similarities with the current study, particularly in the aim of understanding the views about statistics and statistics teaching from a large sample of teachers from a country, an approach that has not often been attempted at the level of tertiary education.

## **METHODOLOGY**

The aim of this study was to investigate the perception of teachers of undergraduate statistics courses in Brazil about aspects of their pedagogical work, and more philosophically, their views about how statistical knowledge is acquired, and the role that

memorization plays in statistics education. The approach taken was to send surveys to all higher education institutions in Brazil that offer courses with statistical content.

The study can be classified as a cross-sectional, observational study (carried out at a specific time), utilizing both quantitative (presentation of frequencies and descriptive statistics) and qualitative (analysis of the content of answers) aspects. Barros and Souza (1986) and Bervian and Cervo (1983) explain that research is descriptive when the researcher observes, records, analyzes and correlates facts or phenomena (variables) without manipulating them; that is, the researcher seeks to discover how often a phenomenon occurs, its nature, characteristics, causes, relationships and connections with other phenomena.

The survey instrument which was the basis for the data collection consisted of questions about socio-demographic and educational aspects, and four open-ended questions: (1) What does 'statistics' mean to you?; (2) How does a person get knowledge in statistics?; (3) How do you work on statistical topics with your students?; (4) What do you think about the use of memorization as a tool in teaching and learning statistics?

The first question investigated how statistics professors in various areas of knowledge define the discipline. The second question asked how they believe that statistical knowledge is acquired, aiming to identify their perceptions of the use of statistics. The third question asked how these professors work with statistical content in their classrooms. The final question sought their opinion on the role of memorization in statistics education.

Participants were obtained using the following procedure:

- 1) Identification from the Ministry of Education's Register of Institutions and Courses for Higher Education, of INEP (National Institute for Educational Studies, <http://emec.mec.gov.br/>) of the websites of all Brazilian institutions that offered courses which included subjects with statistical content;

- 2) A search for the e-mail addresses of the selected courses, and sending messages requesting teachers' participation in the research;

- 3) Contact with the course coordinators who sent the message directly to their professors, or directly from the researcher to the professors if an e-mail list was found on the website.

Participants were categorized according to two main variables. First, the broad field in which they teach their statistics lessons (Natural Sciences, Humanities, and Health Sciences). Secondly, the type of higher education institution in which these professors teach their classes (private, public or both).

The information obtained from responses to the open-ended questions was analyzed using content analysis. The method of content analysis, for Bardin (2009), is a set of techniques for analyzing communication that uses systematic and objective procedures to describe the content of the messages. Bardin proposes a three-phase approach: (1) Pre-analysis – organizing the material to be analyzed in order to make it operational,

systematizing initial ideas; (2) Exploration of the material – defining categories and identifying reporting units and the context units in documents; (3) Treatment of results, inference and interpretation – summarizing the main information from the analysis, culminating in inferential interpretations; this is the moment for intuition, reflective and critical analysis.

Teachers' responses to the open-ended survey questions were identified by subject number, transcribed, and read in order to get an overall impression of the message and ideas contained in the text. For each question, categories were identified. Each response was examined individually and classified in one of the defined categories. The results were presented in a series of tables, shown in the following section.

## RESULTS

### Socio-demographic and discipline results

A total of 334 responses were received from Brazilian professors who taught statistics in the Natural Sciences (118, 35%), Humanities (140, 42%), or Health Sciences (76, 23%), in public institutions (105, 31%), private institutions (195, 58%) or both (public and private) institutions (34, 10%). There are no published statistics in Brazil that give information about the number of undergraduate courses that include statistics, nor of the number of teachers involved in teaching them. Hence, it is not possible to determine the proportion of such teachers who participated in this study.

To avoid a problem of access to the research subjects and to ensure the randomness of the selection process, we opted for random sampling and the web-based collection instrument. The randomness of the process is defended in Murteira (1990) in what the author calls a process of natural selection.

Sampling at random or without norm is the sampling in which the researcher, to simplify the process, tries to be random without, however, properly performing the draw using some reliable random device (Costa Neto, 1977).

The results of random sampling are, in general, equivalent to those of a probabilistic sampling if the population is homogeneous and if there is no possibility of the researcher being unconsciously influenced by some characteristic of the elements of the population (Gonçalves, 2009).

Table 1 shows the distribution of gender and age in the sample, according to the area of knowledge (Natural Sciences, Humanities and Health Sciences) in which professors of statistics provided most of their classes in higher education institutions. It is apparent that the majority of the professors are male. The Health Sciences sector has the highest proportion of female professors (39%) while the Humanities has the lowest (23%). There is a tendency for the gender distribution in areas of knowledge to be uneven due to the socialization process: women are encouraged to care and protection-related areas, such as education and health, and men, in turn, to the areas of technology and finance.

Table 1. *Distribution of professors, according socio-demographic variables and area of knowledge in which they teach*

	Natural sciences	Humanities	Health sciences
	n (%)	n (%)	n (%)
Gender			
Female	42 (36)	32 (23)	30 (39)
Male	76 (64)	108 (77)	46 (61)
Age (years)			
up to 32	14 (12)	27 (19)	12 (16)
33 – 42	42 (35)	49 (36)	36 (47)
43 – 52	35 (30)	40 (29)	16 (21)
53 – 62	21 (18)	18 (13)	11 (14)
63 and over	6 (5)	6 (4)	1 (1)
average $\pm$ sd	44.1 $\pm$ 10.0	42.1 $\pm$ 10.0	41.7 $\pm$ 9.5

In the same table, we can observe that the average age of the professors is above 41 years, with the oldest group in the Natural Sciences. Since the usual age for completing qualifications is 24, this implies that they have spent more than 17 years since graduating. The Humanities has the largest proportion of younger professors, with 19% of them being under 33 years.

The undergraduate courses in Brazil, associated with higher education, are traditionally linked to large fields of knowledge such as Mathematics, Statistics, Engineering, Education, etc., being distributed in the following academic degrees: (1) Bachelor: those courses which provide professional training in various knowledge fields; (2) Licentiate: entitles the holder to be a teacher in different areas of knowledge, especially in basic education; (3) Technology: allows the holder to be a CT Technologist, i.e., hand-intensive technical and scientific specializes in various areas of knowledge, covering specific market demands.

The graduate courses are divided into two parts: (1) *sensu lato*: courses are more targeted to the professional performance and updating of undergraduates in higher education; (2) *sensu stricto*: courses are aimed at scientific and academic training and also linked to the research. Exist in the masters and doctoral (PhD) levels.

Research shows, Table 2, that 93 (ninety-three) professors, among the 306 who reported their academic training, had their education (Bachelor or Licentiate) in Statistics, i.e., 30.4%. Other 87 (eighty-seven) professor's undergraduate in Mathematics, 28.4%, which usually offers only one discipline of statistics throughout its training, and it is noted in the survey of the said course in the curricula of higher education institutions higher in Brazil. The training of these professionals is completed in graduate courses, which requires specific, focused statistical knowledge in areas routed, i.e., conditions that give content to researchers to conduct statistical analysis of their own work.

Table 2. *Distribution of professors according to their area of training*

Discipline	Licentiate	Bachelor	Postgraduate <i>sensu lato</i>	Masters	PhD	Post-doc
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Statistics	7 (7)	86 (42)	20 (18)	60 (24)	25 (20)	2 (25)
Mathematics	64 (63)	23 (11)	19 (17)	21 (8)	2 (2)	-
Agriculture	1 (1)	25 (12)	5 (5)	24 (10)	21 (16)	1 (13)
Applied Social	4 (4)	23 (11)	17 (15)	33 (13)	10 (8)	-
Engineering	3 (3)	22 (11)	3 (3)	19 (8)	7 (6)	1 (13)
Exact & Earth Sciences	9 (9)	11 (5)	12 (11)	23 (9)	12 (9)	1 (13)
Biological Sciences	7 (7)	6 (3)	1 (1)	6 (2)	3 (2)	1 (13)
Health Sciences	4 (4)	5 (3)	1 (1)	25 (10)	21 (16)	-
Education	2 (2)	1 (1)	32 (29)	27 (11)	9 (7)	2 (25)
Production Engineering	1 (1)	1 (1)	2 (2)	15 (6)	17 (13)	-
Humanities	-	1 (1)	-	-	1 (1)	--
Total	102	204	112	253	128	8

Areas shown in Table 2, presents proposal division of the Universidade Federal de Minas Gerais (UFMG) in Brazil. According to Table 2, for the professor who attended the Postgraduate *Sensu Lato* or ‘*broad sense*’—a specialization after an undergraduate degree, the largest number of these had their Postgraduate *sensu lato* in Education (28.6 %). As for post-graduate studies, we observed the following distribution: Master’s degree in Statistics (23.7 %); PhD in Statistics (19.5 %) and Postdoctoral Fellow in Statistics (25.0%) and Education (25.0 %).

In addition, teachers in higher education do not have a unique identity, which is not surprising if the observed diversity and multiplicity of Brazilian higher education. And within these institutions, the teacher can assume different roles: teaching, research, extension; but the common activity is teaching (Pimenta and Anastasiou, 2002).

Furthermore, the teacher, in doing its postgraduate training, usually constructs a technical and scientific expertise in some aspect of their field of knowledge, but walks with prejudice towards a broader, comprehensive and integrated view of society. Even spaces to discuss the university, their roles and relationships are privileged in the curriculum, as if science could be taken out of power relations governing the institutional and structural. Accordingly, and as almost all of his professional time, he becomes a skilled and knowledgeable widespread ignorant, as stated by Santos (1994).

The well-known and very successful UK statistician David Hand (2013) stated that: “You can’t go wrong with a career in statistics. Most statisticians start out with a degree in mathematics but some of the best I’ve known started off as biochemists or economists, or in some other area, and then retrained as statisticians. Since they have an understanding of a particular problem domain, they can have an advantage in analyzing data in that area.”

Table 3 shows the distribution of professors participating in the research according to the region of Brazil and the general area of knowledge in which they teach statistics. Overall, 59% of the sample teaches in the Southeast and South regions of Brazil, areas that have a greater number of higher education institutions, and hence more courses that contain statistics in the curriculum.

Table 3. *Distribution of professors according to the region of Brazil and the area of knowledge in which they teach*

Region	Natural sciences n (%)	Humanities n (%)	Health sciences n (%)	Overall n (%)
Midwest	12 (10)	23 (16)	12 (16)	47 (14)
North	7 (6)	15 (11)	5 (7)	27 (8)
Northeast	23 (19)	25 (18)	15 (20)	63 (19)
South	35 (30)	38 (27)	19(24)	92 (28)
Southeast	41 (35)	39 (28)	25 (33)	105 (31)
Total	118	140	76	334

## Defining statistics

Figure 1 shows the categorizations of professors' definitions of statistics, separated according to the areas of knowledge in which they teach. According to Vasques (2007), the main aim of statistics is to organize and guide data collection, allowing for decision making. Everyone is faced with statistical messages every day, both through the means of communication and through educational materials.

We consider it important to emphasize that this question, 44 (13.17%) professors have not exposed your opinion regarding the consideration raised.

The largest group of professors in Natural Sciences views statistics as a method for organizing and analyzing data (31%); others see it as a tool to assist in decision making (21%), or an instrument to help understand real problems (17%). Thus, there is evidence that statistical methods are most important for this group of professors, and the results lend themselves to decision making; but for these results to be effective, the situations encountered should be related to everyday situations.

For professors in the Humanities and Health Sciences, statistics is a tool to assist in decision making (36% and 28%), and it is used as a method for the organization and analysis of data (20% and 25%). For this group of professors, the main concern is to facilitate the decision-making process, by appropriate organization and analysis of the data; again, for these results to be effective, they prefer to have contact with the actual context of the data.

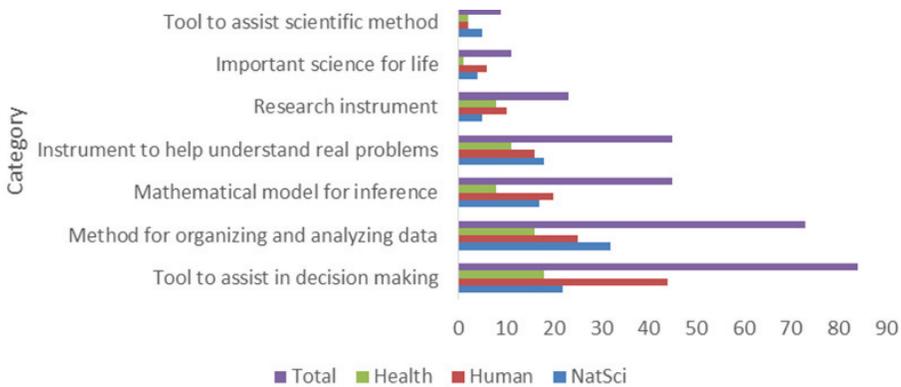


Figure 1. How professors define statistics, according to the area of knowledge in which they teach

According to the website of the Escola Nacional de Ciências Estatísticas (National School of Statistical Sciences, ENCE), statistics is a set of techniques and methods of research that involves planning the experiment to be performed, the collection of data, inference, processing, analysis, and dissemination of information. The development and improvement of statistical techniques for obtaining and analyzing information enable control and proper study of phenomena, facts, events or occurrences in different areas of knowledge. ENCE was the first institution of higher education offering a statistics course in Brazil. It is connected to the Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics, IBGE), the leading provider of Brazilian data and information, addressing the needs of different segments of civil society, as well as organs of federal, state and local government.

Figure 2 shows professors' definition of statistics according to the type of institution for which they work.

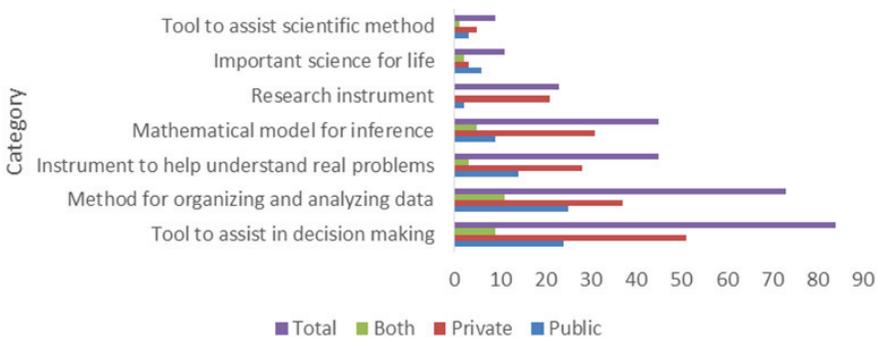


Figure 2. How professors define statistics, according to the type of institution for which they work

Most professors at all types of institutions of higher education claim that statistics is a method for organizing and analyzing data or a tool to assist in decision making; these are the most important aspects of statistics for this group. Teachers in private institutions are more likely to see statistics as a research instrument (18%) than those in public institutions (11%), and there is an even larger discrepancy between those who view statistics as an instrument to understand real problems – 12% in private and only 2% in public institutions. Those professors who teach their classes in both public and private institutions follow the distribution of opinions shown by professors in public institutions.

## Obtaining statistical knowledge

Figure 3 shows the distribution of the categorization of questions about how the professors of the various knowledge areas (Health Sciences, Natural Sciences, and Humanities) believe that statistical knowledge is obtained.

We consider it important to emphasize that this question, 48 (13.37%) professors have not exposed your opinion regarding the consideration raised.

It is noteworthy that 37% of the professors who teach Statistics in the Humanities, 37% of professors in Health Sciences and 35% in Natural Sciences, consider that Statistical knowledge is acquired by linking theory to practice, using various statistical activities and technology.

It is considered that this is one of the best procedures for statistical training because it associates theoretical elements with practical activities, it is the science that works with the processing of data in various areas of knowledge and results from the decisions can be taken. We also believe that the use of technological tools helps in linking theory and practice in teaching Statistics.

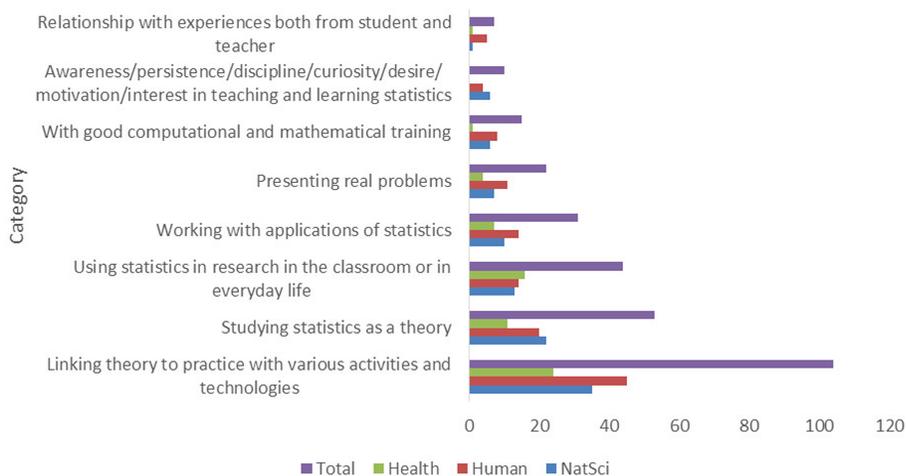


Figure 3. How professors believe that statistical knowledge is obtained, according to their area of expertise

We agree with Marasinghe, Duckworth and Shin (2004) to say that new technologies are tools to provide professors with the ability to present and illustrate statistical concepts, as they allow for concept exploration and encourage active learning.

According Road (2002), teachers need to use statistical analysis and therefore the decision making from the data analyzed in the teaching and learning of Statistics, selecting and using appropriate tools useful knowledge. However, despite the statistical be considered an important part of basic cultural baggage citizen of our society (Gil Perez and Guzman, 1993), there are shortcomings in the proper preparation of teachers who are in charge of teaching this subject (Barros, 2003).

Another aspect highlighted is the percentage of professors who believe that statistical knowledge is obtained only by studying its theory, i.e., 22% of the professors who teach Statistics in Natural Sciences, 17% of professors in Health Sciences and 16% of the professor of the Humanities.

Figure 4 shows the distribution of the categorization of professors' perception regarding obtaining e statistical knowledge according to the institution they work for (Public, Private or Both).

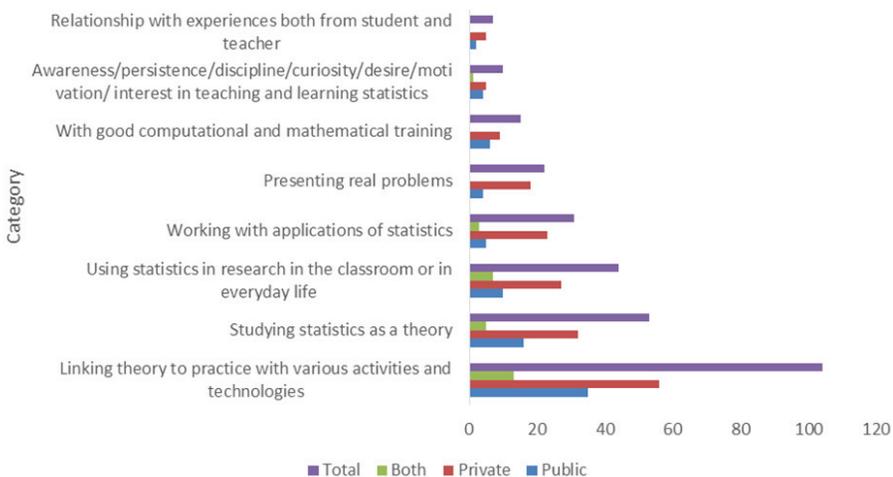


Figure 4. How professors, according to their workplace, believe that statistical knowledge is obtained

It is noteworthy that 43% of the professors who teach Statistics courses in public and 32% in private institutions consider Statistics knowledge is acquired by linking theory to practice, using various statistical activities and technology. Another important aspect is that 12% of professors in public institutions and 15% in private institutions use Statistics research in their classrooms, considering everyday situations. It is worth noting that all groups of professors (public – 20%; private – 18%; and both – 17%) believe that statistical knowledge is obtained only by studying its theory. Interesting to note that there

are similar percentages in public and private professors when considering the way, they believe statistical knowledge is acquired.

Professors who teach Statistics in both types of institution, mainly considering the acquisition of statistical knowledge should link theory to practice, using various statistical activities and technology, 45%. Unlike the other two groups, the second choice (24%) was “using Statistics in research in the classroom or in everyday life”.

### Pedagogical approach to teaching statistics

Figure 5 shows the distribution of the categorization of questions about how professors teach Statistics according to their knowledge (Health Sciences, Natural Sciences, and Humanities).



Figure 5. How professors teach their Statistics lessons, according to their area of expertise

When professors are required to describe how they work statistical content with their students, 61% of Natural Sciences professors and about half of the Humanities and Health Sciences professors said they work linking theory to practice with various resources and activities. It should also be noted that approximately one-fifth of all groups prioritizes theoretical and expository resources and diverse activities.

We consider it important to emphasize that in this question, 42 (12.57%) professors have not exposed their opinion regarding the consideration raised.

It is also important to note that most professors in Humanities prioritize their classes in research activities and the presentation of everyday situations (29.2%) if compared to professors of Health Sciences (22.2%) and professors of Natural Sciences (19.0%).

Students learn statistics best when they are engaged in active learning. They learn by doing as opposed to being passive recipients of information (Christophe and Marek, 2002; Sedlmeier, 2000).

Figure 6 presents the distribution of the categorization of classroom practices of Statistics education considering the professors' workplace.

It is noteworthy that 57.1% of Statistics professors in public and 49.4% of private institutions teach associating statistical theory using different activities. It is also worth noting that 19.0% of Statistics professors in public and 17.0% of private institutions prioritized theoretical and expository resources and diverse activities. Curious that here too there was no difference in percentage between public and private professors when it comes to how these believe statistical knowledge is acquired.



Figure 6. How professors work statistical content in the classroom, according to their workplace

Also, consider that 70.0% of professors that who teach Statistics in both types of institution (public and private), link theory to practice with many resources and activities.

## The role of memorization in statistics education

Figure 7 shows the distribution of the categorization of questions about the professors' position on the memorization process in Statistics education, according to their areas, Health Sciences, Natural Sciences, and Humanities.

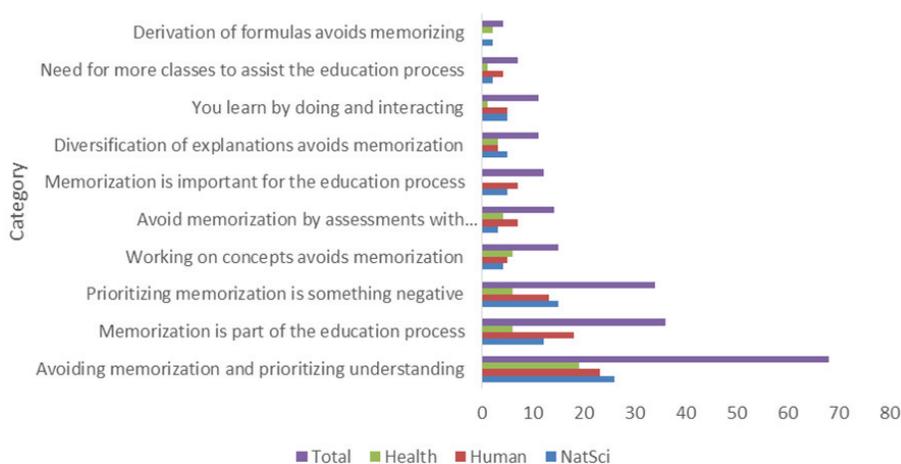


Figure 7. How professors regard memorization in statistics education, by area of expertise

We consider it important to emphasize that this question, 122 (36.53%) professors have not exposed your opinion regarding the consideration raised. Maybe because it was the last question of the instrument and that doubts have emerged as to the position in relation to this discussion.

Health Sciences professors are the ones that most prevents memorization in teaching Statistics, considering that it is possible to teach it prioritizing the understanding of statistical content (40%); 33% of Natural Sciences professors position themselves in the same way and so does 27% of Humanities professors.

Following the same line of reasoning, 19% of Natural Sciences professors, 15% of Humanities professors, and 12% of Health Sciences professors believe that prioritizing memorization is negative.

Considering the favorable aspects of memorization in Statistics education, 27% of Humanities professors agree with it, while 33% of Natural and 40% of Health Sciences professors are consistent with this practice.

Rote memorization is a particularly ineffective and inefficient way of learning statistics. Students lacking confidence in their ability to understand the abstract nature of statistics often attempt to learn through rote memorization (Broens and Imbos, 2005)

Figure 8 shows the distribution of the categorization of teacher opinion about memorization in Statistics education, according to their workplace.

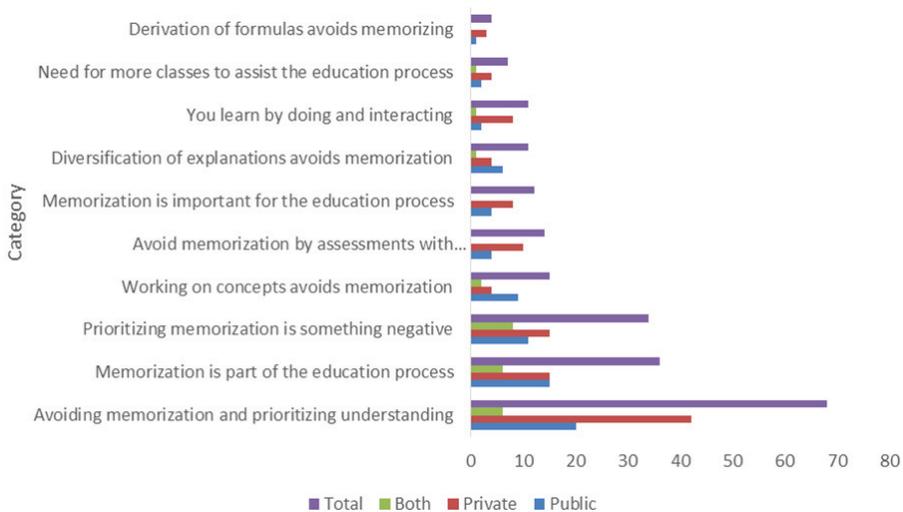


Figure 8. How professors regard memorization in Statistics education, according to the institution they teach at.

Professors of private institutions of higher education are the group that most avoids memorization in teaching Statistics, considering that it is possible to teach prioritizing the understanding of statistical content (37%). Following the same line of reasoning, another 13% of this same group of professors, believe either that prioritizing memorization is negative, or that working statistical concepts avoids memorization.

By observing how professors of public institutions of higher education are positioned facing the same question, 27% avoid memorization in teaching Statistics and yet 15% of this same group of professors, either believes prioritizing memorization is negative, or that working statistical concepts avoids memorization.

It was also observed that 20% of professors in public institutions of higher education consider memorization favorable to Statistics education, while among the professors of private institutions of higher education this percentage decreases to 13%.

In this regard, professors who teach in both types of institution, consider that prioritizing the memorization of statistical content is negative for the teaching and learning process represent 32%.

Coll (2000) says that, opposed to learning subjects based on memorization of content, meaningful learning refers to the way a student assigns meaning to that new content, and how this material relates itself to prior knowledge and can contribute to the personal and professional growth of the student.

## CONCLUSION

Statistics as a science is in a period of remarkable expansion because of the increasing importance that the analysis and interpretation of data assume both individually and on a social level.

Therefore, the need for increasingly competent citizens in this area of expertise arises from the rapid development that straddles Statistics as a science, because of its usefulness for research and for the most diverse areas of application.

About teaching strategies adopted by the professor, the more statistical tools are used, it is believed that it internalizes the use of practical activities is positive in the teaching and learning of Statistics.

It is perceived that professors believe that using teaching activities in teaching statistics it is necessary to put into practice. One of the key actions of teaching that content is working in terms of their relevance, feasibility, usefulness and meaning. Thus, learning contents would relate to the practice and daily life of students and enables them to assign meaning to what is taught.

Professors believe that only memorization and worked isolated will have no educational effect; only when it is interconnected and contextualized can it bring great benefits. What happens today is that professors end up not using these forgotten practices because they thought they went out of fashion – thus, it is the error in Education. Professors need to take advantage of anything they can to broaden the educational paths in the best possible way.

Moreover, since the professors who participated in this study had a poor training in statistics, it also reveals interest to examine the extent to which wider training on this topic during the initial and continuing training modifies the teaching practices Statistics.

A recommendation binds the interest in ascertaining whether these teachers tend to vary the procedures and methods of teaching in the following school years, checking if changes occur either at the level of their conceptions, both in terms of hands.

In addition, the existence of students' difficulties in statistical situations points to the need to reflect on future directions to be given to practices of teaching and learning statistics. In this sense, it is important that future investigations actively involve teachers in finding strategies to help students to overcome their difficulties.

Furthermore, an important study to evaluate the extent of how much the attitude of teachers who teach statistics in relation to Statistics interferes with the teaching-learning process.

Another important issue is to identify the following characteristics of teachers who teach statistics:

Characteristics of the professors (teacher training; teaching full time; teaching disciplines of Statistics; number of disciplines in undergraduate Statistics attended; number of disciplines in Statistics attended post-Graduation);

Characteristics of the educational technology (software used in their classes; uses of scientific calculator in their classes; used spreadsheet in their classes; uses the Internet to search for data in their classes; software used in the classroom);

Characteristics of Educational Practice (teach assembly database; teaches various ways of calculating the sample; teaches how his former teachers; way corrects their assessments; reinforcement of the importance of statistics for the profession; rescue of fundamental concepts; textbook used).

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