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Didactic Strategy for the contextualization of the statistical content in the Tourism and Civil Engineering careers

Estrategia didáctica para la contextualización del contenido estadístico en las carreras de Licenciatura en Turismo e Ingeniería civil

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ABSTRACT

The Statistical discipline is included in the curriculum of several careers, among which Tourism and Civil Engineering are, among others. Achieving that the students prepare themselves in the application of this subject in manifest situations in the profile of each career is the purpose of its study, for which it is necessary to contextualize its content to the profession. The objective of this paper is to present a didactic strategy for the contextualization of statistical content in in Tourism and Civil Engineering careers. The conception of this strategy is supported theoretically in the epistemological analysis about how to conceive the statistical training in the university careers so that it contributes to the preparation to solve exercises of different levels of difficulty, contextualized to the profession, as well as in a study of the contexts that contribute to professional situations related to the solution of statistical exercises in the in Tourism and Civil Engineering careers. The result is the elaboration of a didactic strategy oriented to the contextualization of the content of Statistics to the profile of the careers in which it is studied and some examples of exercises contextualized to the aforementioned careers. As conclusions of the work, it is obtained that the application of the Didactic Strategy proposed contributed to increase the cognitive independence of the students in the solution of contextualized exercises to the profession.

Keywords: university careers; didactic strategy; contextualization of statistical content.

RESUMEN

La disciplina Estadística se incluye en el currículo de varias carreras, entre las que se encuentran las de Turismo e Ingeniería civil. Lograr que los estudiantes se preparen en la aplicación de esta materia en situaciones manifiestas en el perfil de cada carrera es el propósito de su estudio, para lo cual se hace necesario contextualizar su contenido a la profesión. El presente trabajo tiene como objetivo presentar una estrategia didáctica para la contextualización del contenido estadístico en las carreras de Licenciatura en Turismo

e Ingeniería civil. La concepción de esta estrategia se sustenta teóricamente en el análisis epistemológico acerca de cómo concebir la formación estadística en las carreras universitarias de modo que contribuya a la preparación para solucionar ejercicios de diferentes niveles de dificultad, contextualizados a la profesión, así como en un estudio de los contextos que aportan situaciones profesionales afines a la solución de ejercicios estadísticos en las carreras de Licenciatura en Turismo e Ingeniería civil. Se obtiene como resultado la elaboración de una estrategia didáctica orientada a la contextualización del contenido estadístico al perfil de las carreras en las que se estudia y algunos ejemplos de ejercicios contextualizados a las carreras antes mencionadas. Como conclusiones del trabajo se obtiene que la aplicación de la estrategia didáctica propuesta contribuye a elevar la independencia cognoscitiva de los estudiantes en la solución de ejercicios contextualizados a la profesión.

Palabras clave: carreras universitarias; estrategia didáctica; contextualización del contenido estadístico.

INTRODUCTION

Nowadays, statistics have become an effective tool to accurately describe the values of economic, political, social, psychological, biological or physical data, and it serves as a way to relate, analyze and interpret such data within the framework of a real problem whose interpretation involves making a timely decision (Batanero Bernabeu, 2004)

For this reason, it is included in the curriculum of several careers, among which are the careers of Tourism and Civil Engineering. It is necessary then to ensure that students prepare themselves in the application of this subject in manifest situations in the profile of the profession, for which it is necessary to contextualize its content to the professional profile. One of the ways to achieve this is the orientation of independent work aimed in this regard.

Numerous works of authors also address the issue of the teaching of statistics, such as: (Godino & Llenares, 2002) and (Fardales Macías, 2013) (Biehler, 1990) and in this sense they have obtained remarkable results in relation to development of a statistical culture, as well as some important conceptualizations about the need for students to solve professional problems.

They have approached university statistical training, within the framework of the medical profile (Fardales Macías, 2013), (Ledesma Santos, Rodríguez Corvea, & Lazo Rodríguez, 2016), (Ríos Obregón & Fardales Macías, 2018) and (Pérez Olivares Idania & Lahera Role, 2018) in the training of university teachers (Martín Pérez, 2016), in university education in general and in the humanistic profile (Numa Rodríguez, Sanchez Numa, Manzano Palermo, & Rodríguez Moya, 2017), (Guerrero Mantilla, 2016) and (Bouza Herrera, 2004), however, the essential qualities and methodological orientation that a training process that contributes to the resolution of problems related to the profession are not always revealed.

Solving exercises and solving contextualized statistical problems to the profiles of the careers in which it is taught requires the development of skills in the integration of the statistical contents of a subject of the subject, or several. For this

reason, it is advisable to confront students with the systematic solution of contextualized integrative exercises.

Although it has been revealed by these authors the need to develop a process of statistical training oriented to the solution of integrative exercises contextualized to the profession, it has not yet been achieved that students are able to apply statistical content within the framework of a problem that It is presented in the professional field, independently.

There are still deficiencies in the development of strategies that take into account the need to ensure that students not only integrate the contents within the framework of Statistics, but that beyond this achieve high levels of integration that lead to analysis and the modeling of problems that manifest in the professional profile.

This paper **aims to** present a didactic strategy for the contextualization of statistical content in the Bachelor of Tourism and Civil Engineering degrees.

MATERIALS AND METHODS

To carry out the work, the method of analysis and synthesis was applied, when assessing the characteristics of the contents studied in the subjects of Statistics Applied to Tourism and Probability and Statistics for the Civil Engineering Degree, in relation to the possible contribution of these contents to solve problems related to the profession.

Extraclass tasks aimed at solving problems of the profession were reviewed by reviewing documents. This made it possible to verify that the students of

these careers, although they dominate the statistical contents, have insufficient cognitive independence in the application of these in the identification, interpretation and modeling of real problems given in the field of action of the career. The inadequacies revealed in the diagnostic results allow us to identify the research problem.

Within the framework of the search for the solution to the problem, a study of scientific results related to the subject is carried out, which allows a conceptualization about the process of statistical training oriented to the solution of integrative exercises contextualized to the profession and contextualization. of statistical content in university careers. Addressing these issues based on the ideas and proposals referred to in the reviewed works and the considerations of the authors of this, it was possible to outline the methodological conceptions that support the main results of the work, which were formed taking into account the systemic structural method.

The results were applied in the careers of Tourism, and Civil Engineering during the 2016-2017 and 2017-2018 courses, through independent work aimed at solving contextualized exercises to the profession of various levels of complexity. It was proved by reviewing final tasks aimed at solving problems in the profession, that students achieved better results in solving statistical professional problems.

RESULTS

Didactic strategy aimed at contextualizing the content of statistics to the profession

I. Design

a. Develop a system of statistical exercises contextualized to the university career with different levels of complexity. The gradation of the levels is determined by the lesser or greater information offered to the subject in the context of the exercise and, consequently, the degree to which he has to inquire, infer or create, either within the framework of the statistical content or in the professional field

Level 1: Exercise with text in which a group of data is reflected and the statistical method to be applied is indicated. The student should only use the methods studied reproductively.

Level 2: Exercise with text in which a group of data is reflected and a problem situation is indicated, but the student has to identify the statistical method to be applied. In this sense it is framed at the productive level.

Level 3: Problem in which a demand for solution is indicated, the data, only the variables to be measured and the scale to be applied are not disclosed. The student has to inquire based on obtaining the data, as well as identifying the methods that are required to apply to obtain the solution. In this sense it is framed on the creative level.

Level 4: Problem in which a demand for solution is indicated and the student has to model the problem, that is, identify the variables, investigate the information in the form of data and decide the methods

to be applied. It is also framed on a creative level, but of a higher order.

b) Plan, in addition to conferences and practical classes, seminars, workshops and consultations.

c) To plan the independent work according to the system of exercises elaborated so that the exercises of levels 1 and 2, those of level 3 and 4 in Seminars, and those of level 5 in a related extraclass task are solved in the practical classes with the Labor Practice.

d) To guide independent work through guides that guide them on how to proceed to solve the exercises depending on the type of activity in which the exercises will be carried out.

II. Dynamic

a. In the conferences show, through examples, the procedures to follow to solve the different exercises of levels 1 and 2.

b. Ask questions to illustrate to the students, through solved examples, how to solve the exercises of levels 3 and 4.

c. Hold workshops to discuss how to solve the level 5 exercises.

III. Evaluation

a. Evaluate in the practical classes and partial tests the exercises of levels 1 and 2.

b. Evaluate the level 3 and 4 exercises in the seminars.

c. Evaluate in a final job those of level 5.

The system of procedures was applied in the 2015-2016, 2017-2018 courses, and led to improved student results in the cognitive independence demonstrated in the development of practical activities as well as in the completion of the final task, which is also reflected in the quality of the final works defended.

Exercises and contextualized problems (integrators)

The conception of these exercises takes into account the levels defined in the strategy developed. Exercises are considered those corresponding to levels one and two and problems corresponding to levels three and four.

Its essential quality is expressed in the fact that for its elaboration they have to apply in an integrated way contents of two or more subjects of the subject such as: Descriptive Statistics, Probabilities, Sampling and Estimation; and test of parametric and non-parametric hypothesis.

The elaboration of these requires the determination of the nuclei of possible knowledge to be applied in an integrated way, as well as the determination of the way in which the exercise or problem is written, so that the student requires the search for information to find the solution routes to a lesser or greater extent, as well as a lesser or greater degree of deduction or creativity, as the case may be. Since those that correspond to the first two levels use reasoning and deduction and those of the latter, in addition, must resort to creativity.

Example of contextualized exercises and integrative problems, to the degree programs in Tourism and Civil Engineering

Exercise 1: Level 1

The following data describe the behavior of children attending the mini club of the Memories Caribe Hotel in a month.

15	8	5	17	14	7	10	9	7	8
5	6	6	8	5	6	11	5	12	16
17	14	5	15	7	5	18	6	10	5

a. Classify the data according to the scale and the possible values to be achieved.

b. Build the frequency distribution of 5 classes.

c. Graph the absolute and relative frequencies.

d. Calculate the mode, the mean and the median. What do these values mean?

e. Calculate the standard deviation and the coefficient of variation.

f. Interpret the given dispersion measures.

g. Determine a confidence interval for the mean with a significance level of 0.05.

h. Determine a confidence interval for the variance with a significance level of 0.01.

i. Check if the data follows a Poisson distribution.

j. Apply a hypothesis test to verify if the mean is significantly greater than 9.

Exercise 2: Level 1

The following data represent the amount of tiles used in the construction of plateaus in 32 houses of the contingent "El Vaquerito".

53	57	60	65	71	75	82	67
95	93	85	81	75	86	94	60
65	71	75	82	85	97	87	70
75	82	86	94	97	62	67	80

a. Build a frequency distribution for grouped data.

b. Calculate and interpret the measures of central tendency and dispersion that you consider appropriate and interpret their values.

c. Check if the data fits more to a normal distribution or a binomial.

d. If a house is selected at random, find the probability that less than 70 tiles will be used in this (considering a normal distribution).

e. Determine among which values the population variance is at a significance level of 0.05%.

f. Verify by means of a parametric hypothesis test if the population mean is less than 80, with a significance level of 0.05%.

Exercise 3: Level 2

The following data represent the amount of bags of cement that are used daily in the construction of a workplace, measured in 16 days.

4	5	12	10	12	8	4	5
5	5	4	10	12	5	5	6

a. Perform a descriptive analysis of the data using the contents studied in the topic Descriptive Statistics.

b. Estimate between which values the mean and population variance vary.

c. What is the probability that when choosing a place at random, between 8 and 13 bags of cement are used in its repair?

d. Can we say that the data follow a binomial distribution?

e. It can be stated at a level of 0.05 that the average population is at least greater than 5.

Exercise 4: Level 2

The data presented below constitute the number of Argentine clients that stayed at the Tryp Cayo Coco Hotel during the 30 days of April of this year.

10	9	13	15	12
12	14	8	11	8
15	10	6	10	7
8	7	11	8	9
13	15	12	7	13
11	8	7	11	10

a. Perform a descriptive analysis of the data.

b. Estimate between which values the mean, variance and proportion of days in which there were more than 11 clients vary.

c. Assuming that the data follow a normal distribution, with the estimated parameters, say how likely it is that by

randomly choosing one day, between 10 and 12 clients are hosted?

d. Can we say that the data follow a binomial distribution?

e. Can it be affirmed at a level of 0.05 that the population average is at least greater than 10?

Exercise 5: Level 3

In the Colonial Cayo Coco Hotel an exploratory study of the behavior of the services provided is carried out. For this, it is measured: in a group of 15 customers, randomly selected, A: nationality, B: the level of satisfaction expressed regarding the services provided in the Creole Restaurant and C: the number of customers who receive the services of this restaurant for 15 days

a. Determine a scale for variables A and B.

b. Collect the information in the form of data in a center related to your profession or work with supposed data.

c. For each of the variables, perform a descriptive analysis of the corresponding data.

d. Perform an inferential analysis for variable C.

e. Perform an inferential analysis to decide whether there is a dependency relationship between variables A and B.

Exercise 6: Level 3

The quality specialist of a materials company expresses that the composition of floor tiles must conform to the following distribution: 62% clay, 25% feldspar and 13% silica; and its director states that the average daily production of tiles is greater than 300 and that the percentage of days in which more than 500 tiles are manufactured is greater than 0, 85. The variable number of tiles produced in 30 days is measured and amount of tiles produced in 30 days.

a. Collect information in the form of data from exploration in a company or work with assumed data.

b. Check with a hypothesis test (in a sample of 500 grams) if the composition of the tiles manufactured in the company complies with the quality standard.

c. Apply a hypothesis test to verify the raised regarding the production of tiles.

d. Apply a hypothesis test to verify what was raised regarding the production of tiles.

Exercise 7: Level 4

In the Creole restaurant "Calalú" of the Memories Flamenco hotel, in Ciego de Ávila, we want to study how the services of the three different work shifts affect the level of customer satisfaction and the prices of the products are offered, in the demand of these by customers. To solve this problem, select the variables, define the scales based on a random sample of 30 days and 30 clients, obtain supposed data, which correspond to the reality observed in the tourist facilities visited by you during the Labor Practice. With these data, apply the Inferential Statistics methods that you consider appropriate and interpret their results.

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DISCUSSION

Didactic strategy

The didactic strategy proposed is theoretically based on the epistemological analysis of how to conceive statistical training in university careers so that it contributes to the preparation to solve exercises of different levels of difficulty, contextualized to the profession.

The statistical training process aimed at solving exercises and solving integrative problems contextualized to the profession

In Cuba, the Ministry of Higher Education pays special attention to the constant improvement of the entire educational system, with special emphasis on the need to develop a training process in relation to the historical, social and cultural, particular and universal context; for students to appropriate solid and enduring knowledge, from the development of a thoughtful and critical scientific thinking, through the integration of theory and practice. This preparation must be manifested in an efficient professional performance in the resolution of problems and exercises contextualized to the profession, through the integration of knowledge, skills and professional values, in a scientific search process developed with cognitive independence (Numa Rodríguez, Sanchez Numa, Manzano Palermo, & Rodríguez Moya, 2017).

The exercises contextualized to the profession related to the analysis and interpretation of data, are manifested in the professional field of numerous careers, because in all areas of knowledge situations arise that require the search for information related to a given object, the organization, processing and analysis of this information obtained in the form of data, using the methods of statistical content.

The graduates of the different careers, require the performance of actions that demand the knowledge of statistical methods and their use in the classification, description, analysis, presentation and interpretation of the information obtained, through methods and techniques of their area of work, which will help them in making timely decisions (Fardales Macías, 2013).

The above reflects the need to deepen the conceptualization about how to methodologically conceive the process of statistical training, oriented to the solution of real exercises that are manifested in the mode of professional performance, as theoretical support for the proposal of didactic alternatives that contribute to overcome these limitations and consequently develop a process aimed at enabling the student, while receiving the content of the subject, appropriate methods of the profession for the solution of exercises that manifest in the professional field (Numa Rodríguez, Diéguez Batista, Rodríguez Moya, & Martín Pérez, 2012).

When addressing the methodological conception of this process, it is necessary to emphasize the development of a didactic procedure that leads to students, in addition to appropriating the statistical content, also appropriating the thought processes required to solve exercises related to their profile, which demands a treatment of statistical contents consistent with a logic in line with the search for information, developed in the context of the development of exercises contextualized to the profession (Numa Rodríguez, Diéguez Batista, & Martín Pérez, 2014) .

The interpretative logic that demands to face the search for the solution of a problem that is presented in the professional field, implies the establishment of the necessary link between the analysis of the professional problem, carried out in the labor context, and the corresponding statistical analysis to solve it, what demands to orient the treatment of the statistical contents for the solution of real professional exercises not modeled, like methodological paradigm. While systematizing the appropriation of this logic requires systematically confronting the understanding and application of thought processes, professional and statistical procedures, which are involved in such analyzes (Numa Rodríguez, Sánchez Numa, Manzano Palermo, & Hall Aguilar, 2016)

On the other hand, in order to achieve this purpose it is necessary to systematize skills in the sense of applying in an integrated way the contents included in the same subject or in different subjects of the subject. Because, the problems that arise in professional practice require the application of a thought that is not only interpretive, but also integrative; Starting from the fact that, although for their study the Statistical Methods are divided into different topics, in the reality of social economic practice these are applied in an integrated way.

Conception of exercises and contextualized problems (integrators)

The elaboration of the contextualized integrative exercises to the profile of the Bachelor's degrees in Tourism and Civil Engineering is necessary because in the textbooks that are available, in most of the subjects contemplated in the Statistics subject for the careers before mentioned,

the application of statistical methods to the tourism sector is not contextualized and very few contextualized to civil engineering. It can be said that there are even less integrative exercises of the different subjects of the subject.

These insufficiencies in the material basis of study make planning, orientation and control of independent work difficult, in the appropriation of the contents at a level that allows them to be applied in the resolution of problems given in the field of professional action, does not contribute to a treatment of the contents contextualized to the profession and consequently, does not contribute to the recognition by the students of the applicability of the subject in the profile of their careers, as well as their importance in the performance in the field of professional action.

This little recognition of the need for the study of Statistics as part of their professional training, is motivated in part by the ignorance of the types of problems that can be solved in their profile, applying statistical methods, as well as the development of capacities to the statistical design required for the modeling and resolution of professional problems, which limits the development of future performances as managers of the processes developed in the profile related to each career. This is reflected in the level of independence and quality of the defense of the final integrative task. (Biehler, 1990) (Guerrero Mantilla, 2016).

The examples proposed in the work serve to illustrate the way of conceiving exercises and integrative problems contextualized to the profession with different levels of complexity.

The process of statistical training, oriented to the solution of real problems that are manifested in the professional field, is

conceived as a didactic procedure based on the integration of contextualized statistical contents to the career profile. This conception encourages the student, while receiving the content of the subject, appropriate methods of the profession to solve problems of the professional profile

The didactic strategy proposed helps to increase the cognitive independence of the students in the resolution of manifest problems in the professional field.

The integrative exercises shown contribute to the development of skills in solving problems that arise in the profession through the integrated application of statistical content.

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