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Educational strategy to favor attitudes towards statistics in engineering students

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ABSTRACT

The increase in the need of teaching and learning of statistics leads to new research in this area. An exploratory study is presented, during the 2018-2019 school year, to analyze the attitudes towards the statistics, that students of the civil engineering career have at the University of Camagüey, Cuba. Based on experiences validated by the experts Estrada (2002, 2007) and Auzmendi (1992), the application of an educational strategy with three stages is proposed. It is based, applied and evaluated in the characterization of the second-year students of Civil Engineering and the diagnosis of their attitudes towards Statistics. The results show, that the implementation of this methodology, allowed to increase the positive attitude towards statistics and encourage better learning of the teaching process.

Keywords: Attitudes; Statistics; Educational strategy

1 INTRODUCTION

Learning statistics has doubtless become indispensable in everyday life to analyze and interpret a wide variety of information in various contexts and fields of study. Within the investigation in Statistical Education there are several concerns, as indicated in numerous works oriented to the analysis of the understanding of stochastic concepts, to the training of professors in statistics or to their curricular inclusion. As a complement, in recent times, studies related to the attitudes towards statistics of both the student population (Blanco, 2008; Gal, Ginsburg 1994), as well as the teaching staff (Estrada, 2002; 2007) have become important.

Students of different engineering majors at the University of Camaguey have varied positions regarding the study of Statistics and its applications in future professional practice, but it has not been formally confirmed that the attitudes of

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those who learn about this discipline are positive or negative. The authors made an initial diagnosis in Civil Engineering and were given the task of conducting a two-part investigation. In the first of these, they developed an educational strategy to pedagogically influence attitudes towards Statistics and in the second part they present an exploratory study, during the 2018-2019 school year at the University of Camagüey to contribute to the solution of the problem, with the aim to analyze the attitudes towards statistics that students from different engineering careers of the University of Camagüey have, taken from works already validated by experts, Estrada (2002, 2007), Auzmendi (1992), Gil (1999) and Carmona (2004), theoretical references to the Attitudes towards Statistics scale.

1.1 Conceptual framework and background

The attitude construct originates in the field of social psychology and derives in multiple definitions, which point to the durable organization of motivational, perceptual and cognitive processes regarding some aspect of the individual's world (PADUA, 1979). It is a psychological construct in which beliefs and emotions are combined and which predispose an individual to respond to other people, objects and institutions in a positive or negative way; it refers to the tendency to evaluate an object or construct in positive or negative terms. The authors assume as a concept of Educational Strategy the projection of a system of actions in the short, medium and long term that allows the transformation of the modes of action of schoolchildren to achieve in a specific time the objectives committed to the training, development and improvement of its moral and intellectual faculties (CASTILLO & PALACIOS, 2005).

The traits that characterize the strategies as a scientific result are the following:

• Conception with a systemic approach in which coordination relations predominate, although relations of subordination and dependence are still present.

• A structuring based on phases or stages related to orientation, execution and control actions, regardless of the different nomenclature used for their denomination.

• The fact of responding to a contradiction between the current and the desired state of a specific object located in space and time, which is resolved by the programmed use of certain resources and means.

• A dialectical character that is given by the search for the qualitative change that will occur in the object (real state to desired state), for the constant adjustments and readjustments that its actions can undergo and for the articulation between the objectives (goals pursued), among other.

• The adoption of a specific typology that is conditioned by the element that becomes the object of transformation. This last category is essential for the purpose of selecting which variant to use within the existing taxonomy.

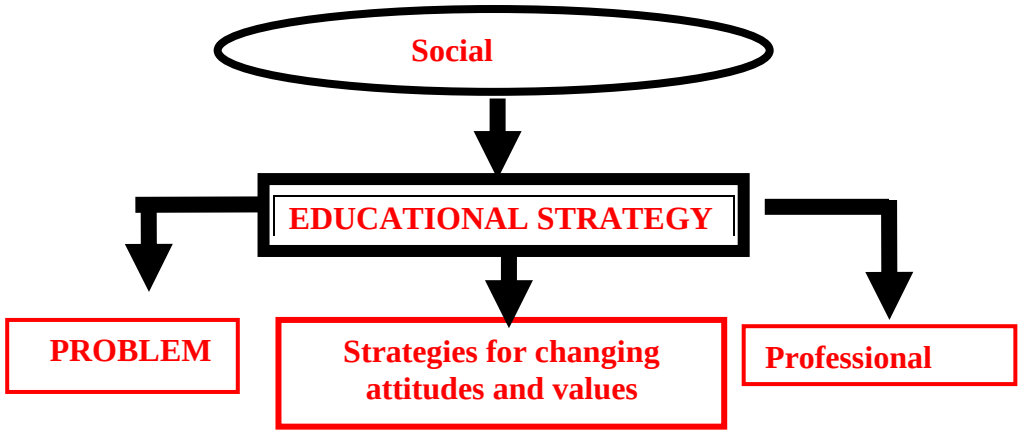
• Its unrepeatability, the strategies are casuistic and valid in their entirety only at a specific time and context, so their universe of application is smaller than that of other scientific results. This does not contradict the fact that one or more of its actions can be repeated in another context.

• Its character of eminently practical contribution due to its persistent degrees of tangibility and usefulness. This does not deny the existence of theoretical contributions within its conformation. The unit of instruction, education, and teaching is based on the conception of personality assumed that is seen as a system that integrates the motivational functions - affective and cognitive - instrumental.

For the elaboration of the strategy, assessments and classifications of previous works were taken into account in which actions are distinguished to achieve personal attitudes using the word as a nuclear element of social creativity, exemplified with modalities of teamwork: the group as a unit that works in an articulated and cohesive manner, round table, panel, debate, symposium, seminar, whirlwind of ideas, case studies. They advise to take into account: Number of people who make up the group and attach importance to methodological flexibility: necessary due to the

unpredictability that accompanies the dynamics of a group. The authors consider placing more emphasis on the evaluation of the emotional affective dimension by being more associated with personal and professional motivations especially that students see statistics and understand the usefulness of the subject in their professional profile. So finally, the main author of this work has summarized his own educational strategy in the following diagram:

Educational Strategy for the study of attitudes.



Source: authors

Educational Strategy
Strategy to favor the affective dimension in the attitude towards Statistics. Actions to increase interest and social relations: visits to companies, visits to specialists or the object of learning. Social affective components: Solve real situations in a given topic, contextualized in the specialty. Recognize the applications of Mathematics in various fields and use it to understand and solve problems in which they are motivated.
Educational Strategy
Behavioral Dimension: Actions to raise self-esteem and effort. Work in forums, seminar workshops, collective and individual work at the same time. Do not limit yourself to the exam Students solve problems with the use of abstracts and interactive platforms to evaluate learning.

Source: Own elaboration

2. OBJECTIVE

Analyze the attitudes towards the statistics that students of the civil engineering career have at the University of Camagüey, Cuba.

3. METHODOLOGY

Consists of three main moments: diagnosis, intervention with the educational strategy and determination of indicators and assessment scales proposed to validate the educational strategy in the emotional, cognitive and behavioral fields. In this first article the authors refer only to the elaboration of the educational strategy and some results are shown to show the fulfillment of the research objective.

Sample: It is composed of 22 Cuban students between 20 and 25 years of age, from the first semester of the second year of the electrical engineering major at the Ignacio Agramonte University, Camagüey Cuba, who are studying the Statistics and Probability course. The sample represents 50% of the population divided by sex is: 63.64% of men and 36.36% of women. Regarding the form of access to their university studies, the vast majority conducted an entrance exam to university studies.

4. RESULTS AND DISCUSSION

Description of attitudes towards statistics with global levels. The 86% of the students surveyed affirm that they have previously studied subjects related to statistics throughout their previous academic career. In table 1, the mean and standard deviation obtained by the sample in each of the items of the attitude to statistics questionnaire are shown. The scale contains 25 items consisting of a statement and 5 possible answers: strongly disagree (1 point), disagree (2 points), indifferent (3 points), agree (4 points) and strongly agree (5 points). Since not all items are written in the same direction, they have been coded so that a higher score is associated with a more positive attitude and vice versa. The items that express a favorable attitude are: 2, 4, 5, 7, 8, 10, 12, 13, 16, 17, 18, 20, 22 and 24.

Table 1 (fragment with items that showed positive attitude))

Item	Average	Deviation S
2. Statistics helps to understand today's world	4.14	.79
4. It is essential in the basic formation of the future citizen	3.91	.8
5. I use statistics to solve everyday problems	3.68	.89
7. I have fun in the classes that explain statistics	3.27	.71

8. Statistical problems are easy for me	2,64	1.0
10. Statistics helps to understand the complexity of certain issues	3.82	.81
12. I find the world of statistics interesting	3.41	0.99
14. I use little statistics outside of school	2.86	1.08
16 I am passionate about statistics because it helps to see problems objectively	3.27	.91
17 Statistics are easy	2.64	1.27
20 I like to make problems when I use statistics	3.18	.76
22 I often explain to my fellow statistical problems that they have not understood	2.82	1.02
24 Statistics help to make more documented decisions	4.05	.69

Source: authors

To analyze the total score in attitudes of each student with respect to Statistics, the sum of the scores of the 25 items must be observed. In this way, this Likert-type scale values between 25 and 125 points, that is, from a totally negative score to a very positive one, therefore, the higher this score is, the more favorable the attitude will be. A score of 75 refers to an indifferent or neutral attitude and all higher scores will be more favorable when the value obtained in the measurement scale is higher. The score ranges from 25 to 125 points per student, none has a totally negative or totally positive attitude towards Statistics. Of these, 22 respond favorable responses favorable attitude towards Statistics 64%, which was higher than estimated before the intervention of researchers with the proposed educational strategy.

5. CONCLUSIONS

• The theoretical and empirical analyzes developed have allowed the diagnosis of the status of the problem investigated. The applied instruments allowed to detect irregularities in the components of the scales of measurement of the attitudes and to measure the dimensions and indicators proposed, in the students who receive the Probabilities and Statistics course of the Civil Engineering major in Camagüey.

• The proposed educational strategy is designed in two stages of Identification of needs, of Implementation, Control, and evaluation, as established.

• To solve this problem an educational strategy was applied which is designed for this purpose, which meets the theoretical-methodological requirements for this type of scientific result.

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