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Neutrosophic Linguistic Scale for the Assessment of Knowledge of Natural and Traditional Medicine in Dental Students

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Abstract. It is more and more frequent to carry out research in the field of natural and traditional Chinese medicine in dental treatments and for this reason, it is necessary to identify the knowledge of university students in this matter while in connection with neutrosophic philosophy. Based on these arguments, this paper aims to apply a linguistic neutrosophic scale for the assessment of knowledge of natural and traditional medicine in dental university students. During the study, theoretical, empirical, and mathematical-statistical methods were used. When applying these methods, the knowledge of the students on this subject was identified. The results obtained show the need to deepen other investigations that link Neutrosophy, natural and traditional medicine, and dentistry.

Keywords: neutrosophic linguistic scale, neutrosophic sample, natural medicine, dentistry.

1 Introduction

Medicine is the product of man's activity, his social development, and originates when his instinct to preserve life and relieve pain drives him to influence nature. Throughout history, man has raised the problem of the balance between health and disease [1].

Natural and Traditional Medicine (NTM), conceived as the unique heritage of the Eastern Hemisphere, over time has expanded its use to other territories of the planet, where it has reached great significance [1].

The NTM includes 10 modalities: herbal medicine, apitherapy, traditional Chinese medicine, and all its variants, homeopathy, floral therapy, medical hydrology, traditional exercises: taiji, tiangong, ozone therapy, heliothalassotherapy, and nutritional guidance, so that the methods and procedures that encompass its use enrich its actions on man and that, over time, it occupies an important place in the patient's therapy [2], [3].

The NTM is also known by the international scientific community as energetic, alternative, naturalistic, or complementary. It is part of the heritage of universal culture, that is, of concepts and practices that have been inherited from generation to generation. It has contributed since ancient times to the treatment of various diseases and ailments [1].

The clinical-therapeutic model of natural and traditional medicine has its own theoretical and philosophical foundations, supported by scientific knowledge and medical science, whose approach to the health-disease process is based on principles such as similarity, the individuality of the patient and the use of minimum drug dose [4].

Among the trends in NTM, its growing incorporation into professional practice stands out, not as an alternative method motivated by economic reasons or to solve shortage problems, but as a true scientific discipline that needs to be studied, perfected, and permanently develop its skills due to its proven ethical and scientific advantages [3].

As shown by the theoretical references, research on NTM has been addressed by the international scientific community from various approaches and perspectives. However, in these cases, the use of neutrosophic techniques for the evaluation of the results has been insufficient.

The NTM has several applications in different medical specialties where dentistry is increasingly acquiring greater connotation. The use of herbalism has already been demonstrated in various treatments for gum diseases and as a means of coagulation once jaw extractions have been carried out, just to mention two examples. That is why every day it is used more and more is included in the arsenal of dentists to indicate to their patients.

That is why this medical specialty is increasingly included in the different curricula for the training of dental professionals at different universities in Latin America. On these arguments, the need to carry out research on the knowledge of university students on this subject is demanded. [19], [20], [22]

Based on the arguments presented above, this research has the objective of applying a linguistic neutrosophic scale for the assessment of knowledge of natural and traditional medicine in dental students from the Autonomous Regional University of the Andes in Ecuador.

2 Methodology

2.1 Study subjects

A neutrosophic sample is a chosen subset of a population, a subset that contains some indeterminacy: either with respect to several of its individuals (which may not belong to the population under study or may only partially belong to it) or with respect to the subset as a whole. While classical samples provide accurate information, neutrosophic samples provide vague or incomplete information, as researchers have suggested [5], [6], [7], [21], [23].

Following the aforementioned, the following aspects are established:

q = proportion of the reference population that does not present the subject under study ($1 - p$).

The desired confidence level (Z). Indicates the degree of confidence that the true value of the parameter in the population will be found in the calculated sample. The absolute precision (d).

With a confidence level of 95 to 99%, then $z = [1.895, 1.96]$, $d = [0.05, 0.1]$ and $p = [0.3, 0.33]$, $N = 30$. On the results obtained before, the sample has 10 and 29 subjects.

That is why a total of 25 students of the Dentistry course of the Autonomous Regional University of the Andes (UNIANDES) are selected for the study. The sample was randomly chosen, particularly through the raffle procedure, where all the dental students had the same selection possibilities. [24]

2.2 Classical methods and techniques used

For the investigation, a group of methods and techniques of a theoretical, empirical, and mathematical statistical nature were taken into account. Which will be explained below, in correspondence with the type to which it corresponds.

Theoretical methods

Analytical-synthetic: it allowed to carry out a study about the theoretical and methodological foundations that support the neutrosophic linguistic scale to identify the knowledge about natural and traditional medicine in dental students. It was used for the and specification of the processed information. It was helpful in interpreting the data obtained in this study.

Inductive-deductive: it made it possible to make a deep analysis of the bibliographic sources consulted and from them to make inferences and generalizations that were useful for the justification and foundation and interpretation of the data obtained, from which new logical conclusions are deduced.

Empirical methods

A *neutrosophic survey* will be used to identify the knowledge about natural and traditional medicine in dental students from the Autonomous Regional University of the Andes in Ecuador.

Statistical-mathematical methods

Descriptive statistics are used, within it the percentage calculation, which allows identifying the level of knowledge of the students who are part of the study sample.

2.3 Neutrosophic method

The flow of activities followed during the investigation is presented from a neutrosophic approach. Which has been structured in the ten fundamental methodological steps described below:

- Step 1.** Selection of the study sample
- Step 2.** Selection of methods and instruments
- Step 3.** Preparation of personnel involved in the investigation
- Step 4.** Selection of the implementation schedule
- Step 5.** Preparation of the implementation plan
- Step 6.** Implementation of methods and techniques
- Step 7.** Data collection
- Step 8.** Tabulation of the data

Step 9. Analysis and interpretation of the results

Step 10. Writing the final report

For the investigation, the so-called "Likert scales" are used. These are psychometric instruments where the respondent must indicate his agreement or disagreement on a statement or item, which is done through an ordered and one-dimensional scale. These instruments are usually recognized among the most used for measurement in Social and medical sciences, particularly in this case medical education [5], [8], [9].

In agreement with several authors knowledgeable about Neutrosophy [8], [9], these scales are used to represent inconsistent, imprecise and uncertain information from the real world, the membership of indeterminacy is represented independently, along with the membership of truth and falsity in the set of Neutrosophy as explained by Smarandache, [10] generalizing the concept of various sets such as the classical set, the fuzzy set and the paradoxical set, $TA(x)$, $IA(x)$ and $FA(x)$ are functions of membership that can be real standard or nonstandard subsets.

In this way, it was not possible to apply it to real-world problems in science and engineering. Authors like [11], [12], [13], [14], proposed a single value neutrosophic set (SVNS), to overcome this. [25, 26, 27]

Let X be a universe of discourse, an SVNS A over X has the following form:

$$A = \{(x, u_a(x), r_a(x), v_a(x)): x \in X\}d$$

Where

$$u_a(x): X \rightarrow [0,1], r_a(x): X \rightarrow [0,1] \text{ and } v_a(x): X \rightarrow [0,1]$$

With

$$0 \leq u_a(x), r_a(x), v_a(x) \leq 1, \quad \forall x \in X$$

The intervals $u_a(x)$, $r_a(x)$ and $v_a(x)$ denote the true, indeterminate, and false memberships of x in A , respectively. In correspondence with the application of the aforementioned, the results are shown in Table 1.

Linguistic term	SVN numbers
Excellent (E)	(1,0,1)
Very good (VG)	(0.71,0.34,0.29)
Good (G)	(0.50,0.49,0.49)
Regular (R)	(0.40,0.75,0.85)
Bad (B)	(0,1,1)

Table 1. Linguistic terms of the Likert scale applied in the research.

Let $A = (T, I, F)$ be a single-valued neutrosophic number, a score function S related to a single-valued neutrosophic value, based on the degree of truth membership, the degree of indeterminacy membership and the degree of falsehood membership is defined by: [15], [16], [18]

3 Results

This section shows the results of the three questions of the neutrosophic survey. The number of students who expressed indeterminacy in the response to each of the survey questions are also presented. The results obtained are explained below.

Question 1	Excellent	Very good	Good	Regular	Bad
How do you assess your	4 (16%)	3 (12%)	3 (12%)	6 (24%)	9 (36%)

knowledge
about Natural
and Traditional
Medicine?

Table 2. Results of question 1 of the student survey

When analyzing the results of question 1 of the survey, the terms with the highest values were the least indicated by the students. This shows that E was only marked by 4, for 16%, while VG was only marked by 3, for 12%, that of G coincided with the previous value. While most of the students are located in the values of R, 6 for 24% and B, 9 for 36%. Which denotes that most of the students of this research have a poor knowledge about natural and traditional medicine in dentistry.

Question 2	Excellent	Very good	Good	Regular	Wrong
How do you evaluate the use of natural and traditional medicine in dentistry?	9(36%)	7(28%)	3(12%)	3(12%)	3(12%)

Table 3. Results of question 2 of the student survey

Table 3 reflect the results of question 2 of the survey, where the majority of the students 9 of them for 36% selected the scale with the highest score, that is, E, while the other term most indicated by the students was VG with 7 for 28%. On the other hand, G was selected by 3, for 12%, equal to this value were the remaining terms (R and B), respectively.

Question 2	Excellent	Very good	Good	Regular	Wrong
How do you value natural and traditional medicine treatments in dentistry?	12 (48%)	8 (32%)	3(12%)	1(4%)	1(4%)

Table 4. Results of question 3 of the student survey

Table 4 shows the results of question 3 of the survey to university dental students. Where, the majority, 12 for 48%, determined that the treatments with natural and traditional medicine were E, on the other hand, 8 for 32% stated that it was VG. While, 3 for 12% said it was G, while only 1 for 4% selected R and the same amount selected B.

These results show that university students, despite having little knowledge about natural and traditional medicine, do value its use in different dental treatments very positively. Which denotes that actions must be carried out in order to enhance and knowledge of these in this subject. [17]

The survey applied to the students had a subsection that referred to arguing why they selected one of the two options. However, there was a group of students in each of the questions and linguistic terms that left that section blank and marked one of the options, this gave rise to the indeterminacy of why they marked that option.

Table 5 shows a summary of each of the students who showed indeterminacy in their arguments. Where in question 1 there were 8, distributed as shown in Table 5. On the other hand, in question 2 there were 9, while in question 3 there were only 5. This denotes the importance of Neutrosophy in the explanation of the results obtained in this studio.

Linguistic terms	Question 1	Question 2	Question 3
Excellent	1	-	1
Very good	-	-	1
Good	-	5	-
Regular	4	2	2
Bad	3	2	1
Total	8	9	5

Table 5. Number of students who showed indeterminacy as to why they selected one of the two options for each question according to the linguistic terms.

Conclusion

In accordance with the results of the study of the bibliographic sources, it was identified that there are few investigations that use a neutrosophic approach in the evaluation of the use of natural and traditional medicine in dentistry.

The results obtained in the research are valid because they are obtained with the use of scientific methods and show that university students have little knowledge about natural and traditional medicine. However, they recognize the importance that this has for an adequate treatment.

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