



Neutrosophic study of Bullying due to Parental Sexual Identity

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Abstract. The path of making themselves visible as gay, lesbian or trans mothers or fathers is just one of the possibilities. Generally, this community has chosen to keep this situation private and not express it, as a way of avoiding possible problems with their children, such as bullying in the schools. More frequently, it occurs in cases of reconstituted families, of previous heterosexual unions, where this position becomes much simpler and more comfortable since they can present themselves to the institution as separated parents, of whom heterosexuality is presumed. In addition, the sexual orientation of the guardians is not investigated before the minors enter school. Given this uncertainty, it was decided to carry out this study to define the factors that trigger bullying due to the identity of the parents, their interrelation as a neutrosophic group, and their modeling with neutrosophic statistics. It was concluded that the state must reform existing policies for the benefit of the children of trans people.

Keywords: sexual orientation, bullying, neutrosophy, neutrosophic statistics, sexual identity.

1 Introduction

The sexual orientation of the parents is not an indicator that serves to evaluate the educational role of fathers and mothers. Parents and children of homoparental families must appropriate resilient elements that allow them to grow, in the face of any potentially negative social manifestation towards them. Many studies have shown that there are no differences in psychological, social, intellectual, personal, and effective development between children raised in these families and those from heteroparental homes. However, homoparental families are constantly challenged to demonstrate their parental aptitude.

Homoparental families, just like heteroparental ones, are capable of educating and raising their sons and daughters satisfactorily. The parental educational principles must be unalterable, given the sexual condition of the sons and daughters. Love, respect, trust, and good values are what make a family an optimal home to raise children [1].

There are social, family, personal, school, and economic causes that drive the appearance of bullying. Within the social causes, it is worth noting the value that people give to their peers according to the social or economic hierarchy that a subject or family occupies in society since under social terms the strongest abuse the weakest [2].

Schools and institutes are fundamental pieces in socialization during childhood and adolescence, as well as in performative and identity-building processes. Society is increasingly plural and this fact is also evident in the plurality of affective-sexual and gender diversity that is present in all areas of life and, therefore, also in the classroom. Even so, it is important to be aware that in educational spaces there is a problem that students suffer: bullying.

School bullying is an asymmetric relationship of power in the educational context, through aggressive or discriminatory behavior that is maintained over time. The students who are usually the object of discrimination belong to minority communities, groups stigmatized by society, or people with individual characteristics, in this case lesbian, gay, bisexual, trans, and intersex parents, for whom they are perceived as undesirable or negative.

The increase in the incidence of bullying justifies the growing need for reliable instruments for its evaluation. Bullying is an existing reality in school practices. School harassment or bullying in schools and colleges is one of the causes that influence student performance. The various types of bullying are based on aggressive and hurtful behavior [3].

School bullying produces countless consequences in various important aspects of the victims' lives, such as decreased school performance, change in habitual behavior, aggressive, disruptive, and criminal behavior, phobias, anxiety, suicide, inhibition, and withdrawal. This means that the effects of bullying can cause serious problems in

adolescents on emotional, physical, psychological, and social levels. They feel unhappy, insecure and even try to attack others who in turn consider them inferior, going from being a victim to a victimizer [4].

The present work aims to define the triggering factors of bullying due to the identity of the parents. As a specific objective, to determine the causes that affect the analyzed variable and, finally, to project potential solutions to protect school bullying victims.

2 Materials and Methods

2.1 PESTEL Method

The PESTEL analysis (Political, Economic, Social, Technological, Ecological, and Legal) is an analysis of preconditions with the main function of identifying the environment within which an organization or project operates and providing data and information to enable the organization to make predictions about new situations and circumstances. Its application consists of identifying and analyzing the environment to subsequently act strategically on it, analyzing the factors associated with the political class that influence the future activity of the organization, current, and future economic issues that influence the execution of the strategy, the sociocultural factors that help to identify the trends of today's society, the influence of new technologies and the change that may arise in the future, the possible changes referred to ecology and the changes in legal regulations related to the study (Figure. 1), that may affect it positively or negatively [5].

All aspects of this technique are crucial because, in addition to helping to understand the market, they represent the backbone of strategic management. This section includes elements such as the policies developed in the country, the levels of poverty in the environment, the inequality indices, economic development, access to resources for its inhabitants, as well as how all of this affects the activity of the company [6].

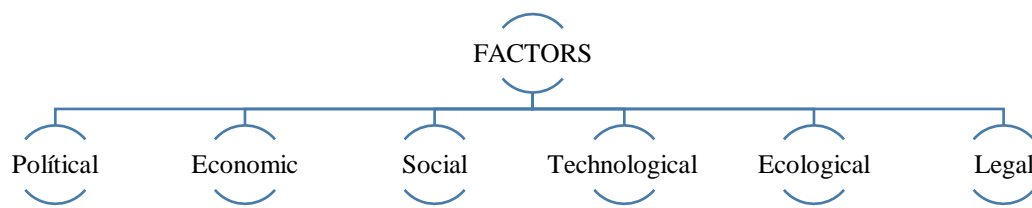


Figure 1: Dimensions of the PESTEL method.

2.2 Neutrosophic Statistics

Neutrosophic statistics is an extension of classical statistics in which neat numerical values are replaced by values in the form of intervals. This substitution can be applied to parameters, not just to random variables. The sample size can also be considered indeterminate or inexact. In this theory, the data can be ambiguous, vague, inaccurate, incomplete, or indeterminate.

Neutrosophic Statistics was founded by Prof. Florentin Smarandache who developed it in 2014 introducing Neutrosophic Descriptive Statistics (NDS). Later, Prof. Muhammad Aslam, from King Abdulaziz University, Saudi Arabia, founded Neutrosophic Inferential Statistics (NIS), Applied Neutrosophic Statistics (ANS), and Neutrosophic Statistical Quality Control (NSQC) in 2018. [24]

Neutrosophic logic, designed by Florentin Smarandache in 1995, is an addition to, or advancement of, fuzzy logic, intuitionistic logic, paraconsistent logic, and tri-valued logic that use imprecise value. In neutrosophic logic, the entire logical variable (x) is defined by the ordered triplet denoted by $x = (t, i, f)$, (t) the degree of truth, (f) the degree of falsehood, and (i) be the degree of indeterminacy.

The Indeterminate (I) is classified as contradiction and uncertainty and obtains an addition of Belnap's four-valued logic. Also, (I) is contradictory, not true, and not known and gets the five value logic [7]. In a refined general neutrosophic logic, (T) can be divided into subcomponents (T_1, T_2, \dots, T_p) and (I) into (I_1, I_2, \dots, I_r) and (F) into (F_1, F_2, \dots, F_s) where $[p + r + s = n \geq 1]$. Furthermore: $T, I,$ and/or F (or any of their subcomponents $T_j, I_k,$ and/or F_l) can be countable or uncountable infinite sets. As an example: a statement can be between $[0.4, 0.6]$ true, $\{0.1\}$ or between $(0.15, 0.25)$ indeterminate and 0.4 or 0.6 false.

Neutrosophic probabilities and statistics are a generalization of classical and imprecise probabilities and statistics. The Neutrosophic Probability of event E is the probability that event E occurs, the probability that event E does not occur, and the probability of indeterminacy (not knowing whether event E occurs or not). In classical probability $n_{sup} \leq 1$, while in neutrosophic probability $n_{sup} \leq 3+$.

The function that models the neutrosophic probability of a random variable x is called the neutrosophic distribution: $NP(x) = (T(x), I(x), F(x))$, where $T(x)$ represents the probability that the value x occurs, $F(x)$ represents

the probability that the value x does not occur, and $I(x)$ represents the indeterminate or unknown probability of the value x .

Neutrosophic Statistics is the analysis of neutrosophic events and deals with neutrosophic numbers, neutrosophic probability distribution, neutrosophic estimation, neutrosophic regression, etc. It refers to a set of data, which is formed totally or partially by data with some degree of indeterminacy and the methods to analyze them [9].

While Classical Statistics deals with determined data and determined inference methods, Neutrosophic Statistics deals with indeterminate data, that is, data that has some degree of indeterminacy (unclear, vague, partially unknown, contradictory, incomplete, etc.), and indeterminate inference methods that also contain degrees of indeterminacy (for example, instead of arguments and crisp values for probability distributions, graphs, diagrams, algorithms, functions, etc. can have inaccurate or ambiguous arguments and values) [25, 26, 27, 28]

Neutrosophic Statistics is also a generalization of Interval Statistics because while Interval Statistics is based on Interval Analysis, Neutrosophic Statistics is based on Set Analysis (understanding by such all types of sets, not just intervals) [10], [21]. If all the data and methods of inference are determined, then Neutrosophic Statistics coincides with Classical Statistics.

In the real world, there are more indeterminate than determined data, thus more neutrosophic than classical statistical procedures are needed [11,12, 19, 22, 23].

Neutrosophic statistical methods allow neutrosophic data (data that may be ambiguous, vague, imprecise, incomplete, or even unknown) to be interpreted and organized to reveal underlying patterns. Finally, the Neutrosophic Logic [13], the Neutrosophic Sets, and the Neutrosophic Probabilities and Statistics have a wide application in various research fields and constitute a new reference for study in full development.

Neutrosophic Descriptive Statistics comprises all the techniques for summarizing and describing the characteristics of neutrosophic numerical data [14, 20]. Neutrosophic Numbers are numbers of the form $N = a + bI$ where a and b are real or complex numbers, while "I" is the indeterminacy part of the neutrosophic number.

The study of neutrosophic statistics refers to a neutrosophic random variable where X_l and $X_u I_N$ represent the lower and correspondingly higher level that the studied variable can reach, in an indeterminate interval $[I_l, I_u]$. Following the neutrosophic mean of the variable by formulating:

$$X_N = X_l + X_u I_N; I_N \in [I_l, I_u] \tag{1}$$

$$\text{Where } \bar{x}_a = \frac{1}{n_N} \sum_{i=1}^{n_N} X_{il}, \quad \bar{x}_b = \frac{1}{n_N} \sum_{i=1}^{n_N} X_{iu}, \quad n_N \in [n_l, n_u], \tag{2}$$

is a neutrosophic random sample. However, for the calculation of neutral squares (NNS) it can be calculated as follows

$$\sum_{i=1}^n N(X_i - \bar{X}_{iN})^2 = \sum_{i=1}^n N \left[\begin{array}{l} \min \left((a_i + b_i I_L)(\bar{a} + \bar{b} I_L), (a_i + b_i I_L)(\bar{a} + \bar{b} I_U) \right) \\ (a_i + b_i I_U)(\bar{a} + \bar{b} I_L), (a_i + b_i I_U)(\bar{a} + \bar{b} I_U) \\ \max \left((a_i + b_i I_L)(\bar{a} + \bar{b} I_L), (a_i + b_i I_L)(\bar{a} + \bar{b} I_U) \right) \\ (a_i + b_i I_U)(\bar{a} + \bar{b} I_L), (a_i + b_i I_U)(\bar{a} + \bar{b} I_U) \end{array} \right], I \in [I_L, I_U] \tag{3}$$

Where $a_i = X_l b_i = X_u$. The variance of the neutrosophic sample can be calculated by:

$$S_N^2 = \frac{\sum_{i=1}^{n_N} (X_i - \bar{X}_{iN})^2}{n_N}; S_N^2 \in [S_L^2, S_U^2] \tag{4}$$

The neutrosophic coefficient (NCV) measures the consistency of the variable. The lower the value of the NCV, the more consistent the performance of the factor is than that of the other factors. The NCV can be calculated as follows [15], [16], [17], [18].

$$CV_N = \frac{\sqrt{S_N^2}}{\bar{x}_N} \times 100; CV_N \in [CV_L, CV_U] \tag{5}$$

3 Results

From the case study, the PESTEL method is applied to determine the negative factors of bullying.

Dimension	Factor	Possible solutions
Politics	Policy setting	<ul style="list-style-type: none"> • Establish a correct application of the regulations by the public officers of the entities, to guarantee that the principle of the right to equality is complied with. • Distribute school materials that address these topics. • Activate the participation of universities and thus facilitate the teaching and guidance work. • Work with the officers responsible for the various entities of the public administration so that they take the constitutional precepts seriously and therefore the constitutional norms materialize. • Comply with the provisions of the Constitution in Article 26 and be an effective guarantee of equality and social inclusion and an essential condition for good living. • Develop policies so that the different study centers provide a safe environment for the comprehensive development and well-being of trans people.
Economic	Improve economic factors.	<ul style="list-style-type: none"> • Assign a budget to school entities for psychological treatment derived from bullying. • Promote the study and innovation of research.
Social	Perception of equality rights.	<ul style="list-style-type: none"> • Give greater participation to the different agents of the educational community to have a role focused on the solution of the conflictive situation. • Prioritize the existence of professionals trained in psychology who can intervene in the detection, reduction, and eradication of peer violence. • Modify the socio-cultural patterns of behavior in society to eradicate the structural homophobia that it suffers. • Provide emotional support to students who experience bullying.
Technological	Electronic development.	<ul style="list-style-type: none"> • Support trans families with specialized services that help them face the challenges they face at a social and legal level. • Promote programs through social networks and outreach media that are aimed at eradicating bullying.
Legal	Rights of those involved.	<ul style="list-style-type: none"> • Guarantee through the courts that people from the LGBTI community who have been discriminated against are given effective protection. • Implement training programs so that those who dispense justice receive sufficient information on the human rights of the LGBTI population. • Reform the Organic Law of the Ombudsman's Office, so that it is not only an observer of due process but also has the power to sanction according to the case that arises.

Table 1: Diagnosis of variables and matrix of interrelation between dimensions, factors, and possible solutions to improve and integrate the principle of equality.

4 Development of the Neurosophic Statistical Method

For the neurosophic statistical modeling, the experts select five factors (Dimensions of the PESTEL) that prevail in the neurosophic groups, that exist in bullying, and that affects the LGBTI community (Table 2). The results are presented to the group of experts to evaluate and define the main trends in bullying and its consequences.

Variable analyzed: bullying For a sample of $n=60$, for each factor (f)

For the development of the statistical study, the neurosophic frequencies of the factors are analyzed to relate to the occurrence of bullying. It should be noted that the ecological factor did not apply to the variable analyzed.

Days	Neurosophic frequencies				
	P	E	S	T	L
1	[5; 6]	[0 ; 1]	[2; 2]	[1; 6]	[1 ; 2]
2	[4 ; 6]	[4 ; 6]	[2 ; 5]	[2 ; 3]	[0 ; 6]
3	[1 ; 3]	[3; 5]	[2; 4]	[0 ; 3]	[1 ; 1]
4	[0 ; 2]	[4 ; 4]	[0 ; 4]	[2; 5]	[0 ; 2]
5	[1 ; 2]	[1 ; 1]	[2 ; 4]	[2; 6]	[1 ; 3]
6	[2 ; 3]	[3 ; 4]	[3 ; 5]	[0 ; 2]	[1 ; 3]
7	[0 ; 0]	[4 ; 4]	[3 ; 7]	[0 ; 4]	[0 ; 2]
8	[2 ; 2]	[2 ; 2]	[3 ; 3]	[0 ; 5]	[1 ; 1]

Days	Neutrosophic frequencies				
	P	E	S	T	L
9	[2 ; 3]	[4 ; 5]	[0 ; 0]	[1 ; 4]	[0 ; 0]
10	[4 ; 5]	[3 ; 6]	[3 ; 6]	[0 ; 0]	[0 ; 6]
11	[4 ; 5]	[1 ; 1]	[0 ; 2]	[0 ; 1]	[0 ; 2]
12	[3 ; 4]	[2 ; 5]	[1 ; 2]	[2 ; 2]	[0 ; 2]
13	[1 ; 2]	[0 ; 2]	[3 ; 7]	[1 ; 4]	[0 ; 5]
14	[1 ; 3]	[3 ; 4]	[1 ; 2]	[0 ; 5]	[0 ; 4]
15	[5 ; 7]	[1 ; 2]	[0 ; 1]	[0 ; 0]	[1 ; 6]
16	[4 ; 6]	[1 ; 4]	[0 ; 1]	[0 ; 3]	[1 ; 2]
17	[4 ; 4]	[1 ; 2]	[1 ; 2]	[2 ; 4]	[1 ; 7]
18	[4 ; 6]	[4 ; 4]	[0 ; 1]	[1 ; 4]	[1 ; 2]
19	[0 ; 0]	[2 ; 2]	[3 ; 3]	[2 ; 2]	[1 ; 1]
20	[5 ; 7]	[1 ; 4]	[3 ; 6]	[2 ; 7]	[0 ; 6]
0-60	[143 ; 205]	[122 ; 202]	[105 ; 237]	[62 ; 219]	[26 ; 192]

Table 2: Neutrosophic frequencies of each factor. Source: own elaboration.

Table 2 studies the factors that promote bullying for 60 days, with an occurrence level of [0; 7] for each factor per day, with a total indeterminacy level of $f_1 = 62, f_2 = 80, f_3 = 132, f_4 = 157, f_5 = 166$, with a level of representativeness of [30.24%; 86.46%], on the days that 7 occurrences per factor are recorded, with a higher incidence of 60% in the political. Because of the existing indeterminacy, the use of classical statistics is not possible, so the use of neutrosophic statistics is necessary for its greater understanding.

In the modeling, it is observed that the political factor is one of the causes that most affect the origin of bullying (Table 3). To understand which factor implies a representative mean $\bar{x}_f \in [\bar{x}_{L_f}; \bar{x}_{U_f}]$, the values of the neutrosophic means and the variation of the variable are calculated for the study of the uncertainties in the final result, with the incorporation of the values of the neutrosophic standard deviation for each factor $S_{N_f} \in [S_{L_f}; S_{U_f}]$. To determine which factor requires more attention in the process of preventing possible acts of harassment in student centers through the values provided by the $CV_{N_f} \in [CV_{L_f}; CV_{U_f}]$.

Factors	\bar{x}_N	S_N	CV_N
Political	[2,383 ; 3,417]	[1,849 ; 3,149]	[0.776 ; 0.922]
Economic	[2033 ; 3,367]	[1,202 ; 2,573]	[0.591 ; 0.764]
Social	[1.75 ; 3.95]	[0.877 ; 2.68]	[0.501 ; 0.678]
Technological	[1,033 ; 3.65]	[0.428 ; 2,642]	[0.414 ; 0.724]
Legal	[0.433 ; 3.2]	[0.127 ; 2,622]	[0.293 ; 0.819]

Table 3: Neutrosophic statistics of the causes of bullying. Source: own elaboration.

Each factor in the neutrosophic set has a strong interrelation with indeterminate elements among its own elements, so that representatively in this group, the economic factor has a greater incidence or repercussion, with a higher level of indeterminacy of occurrence.

While for the political factor it is on average the one that most affects the origin of bullying on a neutrosophic scale [0;1]. In affirmation, the value of $CV_{N_{f_1}}$ this factor is lower compared to the rest. This means that the political factor is more coherent and precise than the other factors.

To determine the associated referent indeterminacy measure for $\bar{x} \in [\bar{x}_L; \bar{x}_U]$, $S_N \in [S_L; S_U]$ and $CV_N \in [CV_L; CV_U]$ to the form of neutrosophic numbers (Table 4). In the results obtained, it is observed that the values CV_N range from 0.293 to 0.776 with the measure of indeterminacy from 15.8% to 64.2%, which generates a relevant cause to be mitigated by having a lower level of indeterminacy, such as its influence on the other factors.

Factors	\bar{x}_N	S_N	CV_N
P	2,383 + 3,417 I; I \in [0; 30.3]	1,849 + 3,149 I; I \in [0; 41.3]	0.776 + 0.922 I; I \in [0; 15.8]
E	2,033 + 3,367 I; I \in [0; 39.6]	1,202 + 2,573 I; I \in [0; 53.3]	0.591 + 0.764 I; I \in [0; 22.6]
S	1.75 + 3.95 I; I \in [0; 55.7]	0.877 + 2.68 I; I \in [0; 7.3]	0.501 + 0.678 I; I \in [0; 26.1]
T	1.033 + 3.65 I; I \in [0; 71.7]	0.428 + 2.642 I; I \in [0; 83.8]	0.414 + 0.724 I; I \in [0; 42.8]
L	0.433 + 3.2I; I \in [0; 86.5]	0.127 + 2.622 I; I \in [0; 95.2]	0.293 + 0.819 I; I \in [0; 64.2]

Table 4: Neutrosophic forms with the measure of indeterminacy. Source: own elaboration

7 Preliminary Solutions

From the result obtained and the interrelation of the political factor with the rest, the following is suggested:

- ✓ Ensure that the authorities and institutions comply with the constitutional regulations whose foundations guarantee citizens equality, freedom, and the right to a dignified life and not to be discriminated against for any reason. Take all appropriate measures to prevent, investigate and punish manifestations of violence, intolerance, and discrimination that violate the human rights of the LGBTI community and their families.
- ✓ Establish the necessary judicial and administrative mechanisms to ensure that any person who is a victim of violence and discrimination has effective access to redress, compensation for the damage caused, or other fair, prompt, and effective means of compensation.
- ✓ Promote knowledge and observance of the human rights of the LGBTI population in society. This must be done at the level of colleges and schools, through sex education that emphasizes how diverse and complex human sexuality is.
- ✓ Modify the sociocultural patterns of behavior of society to eradicate the structural homophobia that it suffers. This will also be achieved with rights education that counteracts and eliminates entrenched prejudices, customs, and all kinds of practices that base their premise on the inferiority, unworthiness, or abnormality of people belonging to the LGBTI community.
- ✓ Facilitate processes of social participation with trans families with parents both in existing spaces for family care, as well as by creating specific meeting spaces between equals. Such participation makes these families visible and makes it easier for their positive parenting experiences to become known, within the trans community itself and in society as a whole.
- ✓ Define a set of actions that make the existence of transphobia visible, as a specific form of violence and discrimination, as well as define its peculiar characteristics, when it refers to a family context that requires specific preventive actions. The public powers have a very important role that enables social changes and actions to prevent violence, act against it, and generate a collective conscience that makes its mere existence impossible.

Conclusion

Education systems must play a role in improving the quality of the educational environment by preventing stigma, discrimination, and bullying, measures that would help reduce school dropouts by children of trans people. Taking into account the right to education, it is equally important to ensure that programs and curricula are gender sensitive and include a diversity of identities and the negative outcomes of intolerance and sexism, as well as homophobia and transphobia.

After the analysis of the factors from an essay perspective fused with the PESTEL technique, it can be said that the indeterminacy is incorporated into the modeling of the causal relationships between the analyzed factors, where neutrosophic science is an active part and a person who takes decisions. The neutrosophic analysis of the data determined the causes that, in the form of a chain reaction, affect the victims and their families, by determining the causes that originate bullying due to the sexual identity of their parents with the use of neutrosophic statistics. Due to the degree of indeterminacy existing in the analyzed variable, the result shows a lower value of CV to the political dimension as a key factor and trigger of school bullying.

Affective-sexual diversity must be incorporated transversally throughout the different educational cycles, subjects, and materials of formal education. An educational strategy that is attentive to affective-sexual diversity is necessary to attend to the reality of young people and train teachers and provide them with the necessary knowledge

and tools. As well as adequate protection against all forms of social exclusion and violence, including bullying and harassment within the school environment.

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