Neutrosophic Sets and Systems {Special Issue: Neutrosophic Advancements And Their Impact on Research in Latin America}, Vol. 62, 2023

University of New Mexico

Characterization of social skills and emotion management of students in a public Peruvian university based on Plithogenic Statistics and Indeterminate Likert Scale

Camayo-Lapa, Becquer Frauberth[1], Flores Ledesma Katia Ninozca[2] Landa-Guadalupe, Liz Evelyn [3], Quispe-Solano, Miguel Angel [4], De La Cruz Porta, Erika Amelia[5], López Bulnes Jorge Luis[6], Carlos Francisco Cabrera Carranza [7], and Agueda Saturnina Choque Mandamiento [8]

[1]Universidad Nacional del Centro del Perú, Huancayo, Perú. E-mail: bcamayo@uncp.edu.pe

[2] Universidad César Vallejo, Lima, Perú. E-mail: kfloresl1@ucvvirtual.edu.pe, kfloresl@unicartagena.edu.co

[3]Universidad Nacional del Centro del Perú, Huancayo, Perú. E-mail: 2014101478I@uncp.edu.pe

[4]Universidad Nacional del Centro del Perú, Huancayo, Perú. E-mail: mquispe@uncp.edu.pe

[5]Universidad Nacional del Centro del Perú, Huancayo, Perú. E-mail: edelacruz@uncp.edu.pe

[6] Universidad Nacional Mayor de San Marcos, Perú. E-mail: jlopezb@unmsm.edu.pe

[7] Universidad Nacional Mayor de San Marcos, Perú. E-mail: ccabrerac@unmsm.edu.pe

[8] Escuela de Educación Superior Pedagógica Pública Emilia Barcia Boniffatti, Lima, Perú. E-mail: achoque@eesppemiliabarcia.edu.pe

Abstract. This paper aims to investigate whether social skills are a factor related to emotion management since inadequate emotion management is causing mental illnesses in this century, such as stress and depression. The objective was to determine the relationship between social skills and emotional management in students at the National University of Central Peru. To estimate social skills, the scales proposed by the Technical Team of the Department of Mental Health Promotion and Prevention of Psychosocial Problems of Peru were applied to a random sample of 184 from a population of 352 students. The variable of adequate management of emotions was measured using an Indeterminate Likert Scale since we consider that emotion has multiple components and therefore it is more precise to measure it when all the components are taken into account at the same time. To process the collected data, plithogenic statistics were applied that allow the study of events of a multivariate nature in an indeterminate framework.

Keywords: Social skills, emotion management, refined neutrosophic sets, Indeterminate Likert Scale, plithogenic statistics, $\boldsymbol{\tau}$ test of Kendall.

1 Introduction

Globalization, which means the internationalization of social, economic, and cultural relations, is nothing more than the internationalization of capitalism where people from different parts of the world can interact, requiring greater work and emotional skills from people to be able to function professionally in a manner appropriate and assertive in this society. Likewise, companies in the world need professionals who have social skills and, most importantly, management of their emotions since these companies work in uncertainty and are in constant crisis.

It has been shown that there is a relationship between social skills and teaching performance in educational institutes at the university level. Social skills are also related to entrepreneurship and learning achievements. Emotional intelligence and social skills gain greater influence concerning behavioral changes in secondary school students.

The Ministry of Health, as an institutional policy, proposes training professionals and promoters of education for the development of their abilities and skills; for the prevention of risk behaviors in adolescents, and the early detection of inappropriate behavior in schools. If we do not study and intervene so that students have social skills and emotional control, school conflicts and mental illnesses of students will increase, thereby lowering their academic level and good professional training, which leads us to study the relationship that exists between abilities and emotion management in educational centers. To do this, we formulate the main objective as follows: Determine the relationship that exists between social skills and emotion management in students of the National University of Central Peru.

In the educational aspect, the research is carried out to benefit students, teachers, and families, to prevent serious consequences of mental health, with a multisector intervention in students in the control of their emotions about their abilities.

To carry out this study, 184 undergraduate students from the National University of Central Peru were investigated. It is known that emotions are not defined by a single component; e.g., there can be joy with a small component of sadness, anger, or dissatisfaction. Therefore, to more accurately reflect this human element, we resort to the Indeterminate Likert Scales ([1]), where students do not express only the degree of management of their emotions on a scale to choose a single value, but they have to precise the degrees for all types of emotion management, even though these emotion management can be contradictory to each other, including neutrality or indifference. This measurement scale is based on the refined neutrosophic sets, where each component of the neutrosophic sets, which are truthfulness (T), indeterminacy (I), and falseness (F), are refined into types of Ts, Is, or Fs, for more accurately specifying what people want to measure ([2-4]).

To process the data we use plithogenic statistics ([5]). Plithogenic sets represent the dynamics between variables of different nature ([6-9]). Especially plithogenic probabilities and statistics study events where multivariate phenomena exist that include indeterminacy ([8]). This is the case, where the degree of different management of emotions is measured, including both the degree of good management and bad management, in addition to neutrality and indifference. For statistical processing, Kendall's Tau Correlation Test is applied, which is adapted as a plithogenic statistics test ([10, 11]).

Let us remark that plithogeny theory was introduced by Prof. F. Smarandache and it has been applied in some real-life situations, mainly for Multicriteria Decision Making Problems ([12-15]).

The structure of this article is as follows, we continue with a preliminaries section that is dedicated to exposing the theories and concepts that are used throughout the paper, such as the Indeterminate Likert Scale, plithogenic theory, and plithogenic probabilities and statistics. The results section summarizes the results obtained from the applied calculations. The article has a last conclusions section.

2 Preliminaries

This section is dedicated to recalling the concepts that are used for the study we carried out, these are the Indeterminate Likert Scale and plithogenic statistics. Below we present the formal definitions:

2.1. Indeterminate Likert Scale

Definition 1 ([12, 16]): The *Single-Valued Neutrosophic Set* (SVNS) N over U is $A = \{< x;\ T_A(x), I_A(x), F_A(x) >: x \in U\}$, where $T_A: U \to [0,1]$, $I_A: U \to [0,1]$, and $F_A: U \to [0,1]$, $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$.

Definition 2 ([12, 16]): The *refined neutrosophic logic* is defined such that: a truth T is divided into several types of truths: $T_1, T_2, \dots, T_p$, I into various indeterminacies: $I_1, I_2, \dots, I_r$ and F into various falsities: $F_1, F_2, \dots, F_s$, where all $p, r, s \geq 1$ are integers, and $p + r + s = n$.

Definition 3 ([12, 16]) A *triple refined indeterminate neutrosophic set* (TRINS) A in X is characterized by positive $P_A(x)$, indeterminacy $I_A(x)$, negative $N_A(x)$, positive indeterminacy $I_{P_A}(x)$ and negative indeterminacy $I_{N_A}(x)$ membership functions. Each of them has a weight $w_m \in [0,1]$ associated with it. For each $x \in X$, there are $P_A(x), I_{P_A}(x), I_A(x), I_{N_A}(x), N_A(x) \in [0,1]$,
$w_P^m(P_A(x)), w_{I_P}^m(I_{P_A}(x)), w_I^m(I_A(x)), w_{I_N}^m(I_{N_A}(x)), w_N^m(N_A(x)) \in [0,1]$ and $0 \leq P_A(x) + I_{P_A}(x) + I_A(x) + I_{N_A}(x)(x) + N_A(x) \leq 5$. Therefore, a TRINS A can be represented by $A = \{\langle x;\ P_A(x), I_{P_A}(x), I_A(x), I_{N_A}(x), N_A(x)\rangle | x \in X\}$.

Let A and B be two TRINS in a finite universe of discourse, $X = \{x_1, x_2, \dots, x_n\}$, which are denoted by:
$A = \{\langle x;\ P_A(x), I_{P_A}(x), I_A(x), I_{N_A}(x), N_A(x)\rangle | x \in X\}$ and $B = \{\langle x;\ P_B(x), I_{P_B}(x), I_B(x), I_{N_B}(x), N_B(x)\rangle | x \in X\}$,

Where $P_A(x_i), I_{P_A}(x_i), I_A(x_i), I_{N_A}(x_i), N_A(x_i), P_B(x_i), I_{P_B}(x_i), I_B(x_i), I_{N_B}(x_i), N_B(x_i) \in [0,1]$, for every $x_i \in X$. Let w_i (i = 1,2,...,n) be the weight of an element x_i(i = 1,2,...,n), with $w_i \geq 0$ (i = 1,2,...,n) and $\sum_{i=1}^{n} w_i = 1$.

The generalized TRINS weighted distance is ([12]):

$$d_\lambda(A,B) = \left\{\frac{1}{5}\sum_{i=1}^{n} w_i \left[|P_A(x_i) - P_B(x_i)|^\lambda + \left|I_{P_A}(x_i) - I_{P_B}(x_i)\right|^\lambda + |I_A(x_i) - I_B(x_i)|^\lambda + \left|I_{N_A}(x_i) - I_{N_B}(x_i)\right|^\lambda + |N_A(x_i) - N_B(x_i)|^\lambda\right]\right\}^{1/\lambda} \quad (1)$$

Where $\lambda > 0$.

The Indeterminate Likert Scale is formed by the following five elements:
– Negative membership,
– Indeterminacy leaning towards negative membership,
– Indeterminate membership,
– Indeterminacy leaning towards positive membership,
– Positive membership.
These values substitute the classical Likert scale with values:
–Strongly disagree,
– Disagree,
–Neither agree or disagree,
– Agree,
–Strongly agree.

2.2. On Plithogenic Statistics

Regarding plithogenic sets, we have the following concepts ([5]):

Let U be a universe of discourse, and P a non-empty set of elements, $P \subseteq U$. let A be a non-empty set of *one -dimensional attributes* $A = \{\alpha_1, \alpha_2, \ldots, \alpha_m\}$, $m \geq 1$; and $\alpha \in A$ let be a given attribute whose spectrum of all possible values (or states) is the non-empty set S, where S can be a discrete finite set $S = \{s_1, s_2, \ldots, s_l\}$, $1 \leq l < \infty$, or infinitely countable set $S = \{s_1, s_2, \ldots, s_\infty\}$, or infinitely uncountable (continuous) set $S =]a, b[$, $a < b$ where] ... [is any open, semi-open, or closed interval of the set of real numbers or another general set.

Let V be a non-empty subset of S, where V is the range of all attribute values needed by experts for their application. Each element $x \in P$ is characterized by the values of all attributes in $V = \{v_1, v_2, \ldots, v_n\}$, for $n \geq 1$.

In the set of attribute values V, in general, there is a dominant attribute value, which is determined by experts in its application. The dominant attribute value means the most important attribute value that experts are interested in.

Each attribute value $v \in V$ has a corresponding *degree of appurtenance* $d(x, v)$ of element x, to the set P, for some given criteria.

The degree of appurtenance can be a *fuzzy degree of appurtenance*, an *intuitionistic degree of appurtenance*, or a *neutrosophic degree of appurtenance* to the plithogenic set.

Therefore, the *degree of appurtenance function is:*

$$\forall x \in P, d: P \times V \rightarrow P\ ([0,1]^z) \quad (2)$$

So $d(x, v)$ is a subset of $[0,1]^z$, where $\mathcal{P}([0,1]^z)$ is the power set of $[0,1]^z$, where z = 1 (fuzzy degree of appurtenance), z = 2 (for the intuitionistic degree of appurtenance), or z = 3 (for the neutrosophic degree of appurtenance).

Given the cardinal $|V| \geq 1$. Let be $c: V \times V \rightarrow [0,1]$ the *fuzzy attribute value contradiction degree function* between any two attribute values v_1 and v_2, denoted by $c(v_1, v_2)$, and satisfying the following axioms:

1. $c(v_1, v_1) = 0$, the degree of contradiction between the same attribute value is zero;
2. $c(v_1, v_2) = c(v_2, v_1)$, commutativity.

One can define a *fuzzy attribute value contradiction degree function* (c as before, which we can denoted by c_D to distinguish it from the next two), an *intuitionistic attribute value contradiction degree function* ($c_{ID}: V \times V \rightarrow [0,1]^2$), or more generally, a *neutrosophic attribute value contradiction degree function* ($c_N: V \times V \rightarrow [0,1]^3$) can be used increasing the complexity of the calculation, but also increasing the precision.

We mainly calculate the degree of contradiction between the values of uni-dimensional attributes. For multi-dimensional attribute values, we divide them into corresponding one-dimensional attribute values.

The *attribute value contradiction degree function* helps the plithogenic aggregation operators and the plithogenic inclusion relation (partial order) to obtain a more accurate result.

The attribute value contradiction degree function is designed in each field where a plithogenic set is used according to the application to be solved. If ignored, aggregations still work, but the result may lose precision.

Then (P, a, V, d, c) is called a *plithogenic set*, ([5]):

1. Where "P" is a set, "a" is an attribute (multidimensional in general), "V" is the range of the attribute values, "d" is the degree of appurtenance of the attribute value of each element x to the set P to some given criteria ($x \in P$), and "d" means "d_D" or "d_{ID}" or "d_N", when it is a fuzzy degree of appurtenance, an intuitionistic degree of appurtenance, or a neutrosophic degree of appurtenance respectively of an element x to the plithogenic set P;
2. "c" means either "c_D" or "c_{ID}" or "c_N", when it comes to the fuzzy degree of contradiction, intuitionistic degree of contradiction, or neutrosophic degree of contradiction between the attribute values respectively.

The functions $d(\cdot,\cdot)$ and $c(\cdot,\cdot)$ are defined according to the applications that the experts need to solve.

The notation below is used:

$x(d(x,V)), d(x,V) = \{d(x,v), \text{for all } v \in V\}, \forall x \in P$.

The attribute value contradiction degree function is calculated between each attribute value concerning the dominant attribute value (denoted by v_D) in particular, and with concerning attribute values as well.

The attribute value contradiction degree function c between the attribute values is used in the definition of plithogenic aggregation operators (intersection (AND), union (OR), implication (⟹), equivalence (⟺), inclusion relation (partial order), and other plithogenic aggregation operators that combine two or more degrees of attribute value acting on the t-norm and the t-conorm, ([5, 9]).

Most plithogenic aggregation operators are linear combinations of the fuzzy t-norm (denoted by $\wedge_D$), and the fuzzy t-conorm (denoted by $\vee_D$), but nonlinear combinations can also be constructed.

If the t-norm is applied on the dominant attribute value denoted by v_D, and the contradiction between v_D and v_2 is $c(v_D, v_2)$, then on the attribute value v_2 it is applied:

$$[1 - c(v_D, v_2)] \cdot t_{norm}(v_D, v_2) + c(v_D, v_2) \cdot t_{conorm}(v_D, v_2) \quad (3)$$

Or, by using symbols:

$$[1 - c(v_D, v_2)] \cdot (v_D \wedge_D v_2) + c(v_D, v_2) \cdot (v_D \vee_D v_2) \quad (4)$$

Similarly, if the t- conorm is applied on the dominant attribute value denoted by v_D, and the contradiction between v_D and v_2 is $c(v_D, v_2)$, then on the attribute value v_2 it is applied:

$$[1 - c(v_D, v_2)] \cdot t_{conorm}(v_D, v_2) + c(v_D, v_2) \cdot t_{norm}(v_D, v_2) \quad (5)$$

Or, by using symbols:

$$[1 - c(v_D, v_2)] \cdot (v_D \vee_D v_2) + c(v_D, v_2) \cdot (v_D \wedge_D v_2) \quad (6)$$

The *Plithogenic Intersection* is defined as:

$$(a_1, a_2, a_3) \wedge_P (b_1, b_2, b_3) = \left(a_1 \wedge_D b_1, \frac{1}{2}[(a_2 \wedge_D b_2) + (a_2 \vee_D b_2)], a_3 \vee_D b_3\right) \quad (7)$$

The *Plithogenic Union* is defined as:

$$(a_1, a_2, a_3) \vee_P (b_1, b_2, b_3) = \left(a_1 \vee_D b_1, \frac{1}{2}[(a_2 \wedge_D b_2) + (a_2 \vee_D b_2)], a_3 \wedge_D b_3\right) \quad (8)$$

In other words, for what applies to the appurtenance, the opposite applies to the non-appurtenance, while in indeterminacy the average between them applies.

Regarding the Plithogenic Statistics we have the following:

Plithogenic Statistics has as its aim to study the analysis and observation of events as in classical statistics. It is a generalization of the classical Multivariate Statistics, where multivariate results of neutrosophic or indeterminate variables are analyzed.

For example, according to the example in Smarandache ([7]) about Plithogenic Neutrosophic Probability (PNP), $PNP(Jenifer) = \{(0.5, 0.9, 0.2), (0.6, 0.7, 0.4), (0.8, 0.2, 0.1), (0.4, 0.3, 0.5)\}$ which consists of the neutrosophic probabilities that Jenifer will pass each of the 4 subjects corresponding to the semester. For example, to pass Differential Equations she has 50% of success rate, 20% of failure rate, and 90% of indeterminacy rate. That is why the neutrosophic probability of passing the semester is $(min\{0.5, 0.6, 0.8, 0.4\}, max\{0.9, 0.7, 0.2, 0.3\}, max\{0.2, 0.4, 0.1, 0.5\}) = (0.4, 0.9, 0.5)$.

Regarding Plithogenic Refined Probability (PRP), probabilities are generalized to the case where there is more than one value of truthfulness of probabilities, more than one value of indeterminacy, or more than one value of falsity. The illustrative example used by Smarandache is the following:

Suppose that for each subject Jenifer has to be evaluated in two tests, one oral and the other written. Then the set of probabilities is refined as: T_1(oral test), T_2(written test); I_1(oral test), I_2(written test); and F_1(oral test), F_2(written test).

So, $PRP(Jenifer) =$

$$\{((0.5, 0.6), (0.4, 0.7), (0.1, 0.2)), ((0.6, 0.8), (0.0, 0.7), (0.3, 0.4)), ((0.8, 0.8), (0.1, 0.2), (0.1, 0.0)), ((0.3, 0.7), (0.2, 0.3), (0.5, 0.4))\}$$

For example, $((0.5, 0.6), (0.4, 0.7), (0.1, 0.2))$ means that concerning the first subject, Jenifer has a 50% probability of passing the oral test and a 60% probability of passing the written test; 40% indeterminacy whether she will pass the oral test and 70% of indeterminacy whether she will pass the written test; while there is 10% of chance of not passing the oral exam and 20% of chance of not passing the written exam.

3 Results

The population is made up of 352 students from the careers of the National University of Central Peru. The sample is made up of 184 undergraduate students. The students were selected with simple random sampling. The sample size is representative of the size of the population with the parameters e = 0.05 and k = 0.95, according to Formula 9 ([17]).

$$n = \frac{k^2 Npq}{e^2(N-1)+k^2pq} \tag{9}$$

Where:
n is the sample size,
N is the population size,
k is a constant depending on the level of confidence,
e is the sampling error,
p: is the proportion of elements of the population satisfying the characteristic measured,
q: is 1-p. We use p = 0.5.

For the social skills variable, the psychometric technique adapted by the Specialized Institute of Mental Health of the Ministry of Health of Peru was used. Each studied student was classified according to their social skills and as a result of the psychometric tests on a measurement scale {Very High, High, High Average, Average, Low Average, Low, Very Low}, moreover, according to the results of the test, the specialists were asked to rank the respondents on their social skills, which is why if Y is the variable that indicates social skills, each of the students has an associated number from 1 to 184, where 1 means the student with the highest social skill and 184 is the worst.

On the other hand, the variable X is used to measure the ability to manage emotions; for this end, students were asked to self-evaluate according to the following visual scale shown in Figure 1:

Figure 1. Visual scale for measuring the degree of ability to manage emotions by students.

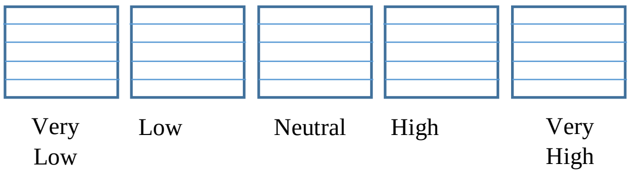

Figure 1 is a visual aid for students to evaluate themselves on how they perceive they manage their emotions. There were given examples so that they understood how to carry out this evaluation, such as the one shown in Figure 2.

Figure 2. Example of the use of the visual scale for measuring the degree of ability to manage emotions by students.

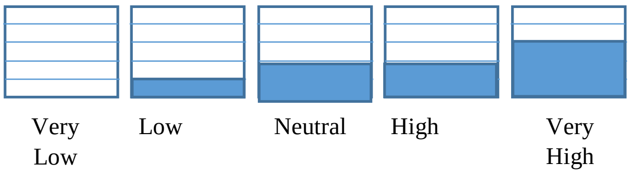

Figure 2 illustrates how to use the proposed scale, where the respondent assesses himself/herself managing emotions (from 0-5), 0 for “Very low”, 1 for “Low ”, 2 for “Neutral” and “High”, and 3 for “ Very High”. The meaning of this type of Likert scale is that the management of emotions changes over time and in this way greater fidelity is obtained to measure like this the behavior of each individual.

This scale of 0-5 for each component can be converted into a scale of 0-1, only by dividing each of these components by 5.

The next step is to define an ordering operator between the elements of this measurement scale. To do this, given $V = (v_1, v_2, v_3, v_4, v_5) \in [0,1]^5$ a vector that represents the evaluation of each student where v_1 represents the evaluation of “Very High”, v_2 that of “High” and so on, the following function is used:

$$\gamma(V) = 2v_1 + v_2 + 0.5v_3 - v_4 - 2v_5 \tag{10}$$

Thus, given V_1 and V_2 it is preferred V_1 over V_2 if and only if $\gamma(V_2) < \gamma(V_1)$ and is denoted by $V_2 \prec V_1$.

Thus, the conditions are given to order the elements of both X and Y. Below we present the details of the calculation for the τ Kendall test.

τ of Kendall is a nonparametric measure of association for ordinal variables that ignores ties [11-18-19-20]. The sign of the coefficient indicates the direction of the relationship and its absolute value indicates the strength. Higher values indicate that the relationship is closer. Generally, Kendall coefficients of 0.9 or greater are considered very good. It is used when studying the relationship between qualitative ordinal variables. The steps to follow are the following:

1. Order the observations in the variable X from 1 to n. Order the observations Y from 1 to n.
2. Arrange the list of n subjects so that the subjects' ranks in the variable X are in their natural order; this is 1, 2, 3,…, n.
3. Reorder the ranges Y in the order in which they occurred when the ranges X are in the natural order. Determine the values of S, the number of agreements in the order minus the number of disagreements in the order, for the observed orders in the ranges of Y.
4. If there are no ties between the observations X or Y, use Equation 11 to calculate the value of T.

$$T = \frac{2S}{n(n-1)} \tag{11}$$

If there are ties, use Equation 12.

$$T = \frac{2S}{\sqrt{n(n-1)-T_x}\sqrt{n(n-1)-T_y}} \tag{12}$$

Where $T_x = \sum t(t-1)$ is the number of tied observations in each group of ties in the variable X.

$T_y = \sum t(t-1)$ is the number of tied observations in each group of ties in the variable Y.

5. If the n subjects constitute a random sample from some population, the hypothesis that the variables are independent in that population can be tested, so calculate the value z associated with T using Equation 13.

$$z = \frac{T-\mu_T}{\sigma_T} = \frac{3T\sqrt{n(n-1)}}{\sqrt{2(2n+5)}} \tag{13}$$

Table 1 summarizes the results of the evaluations regarding students' social skills:

Table 1. Results obtained from the psychometric tests on the Social Skills variable on the ordinal qualitative scale.

	Frequency	Percentage (%)
Very high	22	12.0
High	35	19.0
High average	52	28.3
Average	36	19.6
Average low	35	19.0
Low	4	2.2
Total	184	100.0

Additionally, according to the results of the function γ of Equation 10, those who obtained scores greater than or equal to 2 were classified as "Very High", "High" are those who obtained scores greater than or equal to 1, "Average" group within those that fall from -1 to 1, "Low" between -2 and -1, and "Very Low" less than -2.

This is how Table 2 was obtained:

Table 2. Results obtained on the Emotion Management variable on the ordinal qualitative scale.

	Frequency	Percentage (%)
Very low	19	10.3
Low	62	33.7
Average	60	32.6
High	29	15.8
Very high	14	7.6
Total	184	100.0

As mentioned above, to apply the τ of Kendall test it is necessary to order the elements of the populations for the variables X and Y. The result of this test is shown in Table 3.

Table 3. Relationships between the social skills variable and the emotion management variable.

Proof statistics	Coefficient	p-value
Kendall Tau	0.315	<0.001
Cases valid	184	

The contrast of hypotheses with a significance level of 0.05 and applying the statistical test of Kendall's Tau by counting final values of different levels, leads to the conclusion that there is a direct significant relationship between social skills and emotion management in students due to having a p-value <0.001 for a low degree of correlation of 0.315. That is to say, the greater the social skills, the greater the management of emotions and vice versa.

It is also possible to predict the probability that each student has adequate management emotions using the following equations:

If $V = (v_1, v_2, v_3, v_4, v_5)$ is the vector that indicates the normalized values of the Indeterminate Likert Scale for the student M, then we have:

$$PNP(M) = (v_1+v_2 - v_1v_2, v_3, v_4+v_5 - v_4v_5) \tag{14}$$

That is, the plithogenic neutrosophic probability that M will manage his/her emotions correctly in the future is calculated with Equation 14. For example, from Figure 2 we have $E = (3,2,2,1,0)$, therefore $V = \left(\frac{3}{5}, \frac{2}{5}, \frac{2}{5}, \frac{1}{5}, 0\right)$, and then $PNP(M) = \left(1 - \frac{6}{25}, \frac{2}{5}, \frac{1}{5}\right) = \left(\frac{19}{25}, \frac{2}{5}, \frac{1}{5}\right)$. This information can be combined with others, for example, if it is known that the PNP probability of M will have assertive behavior is $\left(\frac{8}{25}, \frac{1}{5}, \frac{3}{25}\right)$, then the PNP probability of M having assertive behavior in the future and at the same time managing their emotions well is equal to $\left(\frac{8}{25}, \frac{2}{5}, \frac{1}{5}\right) = \left(min\left(\frac{19}{25}, \frac{8}{25}\right), max\left(\frac{2}{5}, \frac{1}{5}\right), max\left(\frac{1}{5}, \frac{3}{25}\right)\right)$.

Conclusion

The most recent neutrosophic theories were used in this paper to study if there is a significant correlation between the variables of emotion management and social skills in university students at a public university in Peru. To do this we use Kendall's tau test, however, we consider it is important to take into account the complexity of measuring emotions that is insufficient to capture through a single value or term. That is why an Indeterminate Likert Scale was used. The statistical test was also carried out with data expressed in plithogenic refined form, which constitutes an example of the use of classical statistical tests in problems where there is an indeterminacy of multivariate variables.

We conclude that there is a direct significant relationship between social skills and emotion management in students with a low degree of correlation. That is to say, the greater the social skills, the greater the management of emotions and vice versa. Therefore, it is recommended to introduce class exercises that contribute to improving social skills in students, such as solving practical exercises by forming work teams or promoting the creation of teams to bring collective solutions to extra-class homework to the classroom.

References

[1] Kandasamy, I., Kandasamy, W.V., Obbineni, J.M., and Smarandache, F. (2020) Indeterminate Likert scale: feedback based on neutrosophy, its distance measures and clustering algorithm. Soft Computing, 24, 7459-7468.
[2] Deli, I. (2016). Refined neutrosophic sets and refined neutrosophic soft sets: theory and applications. In Handbook of Research on Generalized and Hybrid Set Structures and Applications for Soft Computing (pp. 321-343). IGI Global.
[3] WB, V., Kandasamy, I., Smarandache, F., Devvrat, V., and Ghildiyal, S. (2020). Study of imaginative play in children using single-valued refined neutrosophic sets. Symmetry, 12(3), 402.
[4] Pimienta Concepción, I., Mayorga Aldaz, E., Gabriel Flores, L., González Caballero, E. (2020). Neutrosophic Scale to Measure Psychopathic Personalities Based on Triple Refined Indeterminate Neutrosophic Sets. Neutrosophic Sets and Systems, 37, 61–71.
[5] Smarandache, F. (2017) Plithogeny, plithogenic set, logic, probability, and statistics. Infinite Study.
[6] Smarandache, F. (2021). Plithogenic Probability & Statistics are generalizations of MultiVariate Probability & Statistics. Neutrosophic Sets and Systems, 43, 280-289.

[7] Smarandache, F. (2022). Plithogeny, plithogenic set, logic, probability and statistics: a short review. Journal of Computational and Cognitive Engineering, 1(2), 47-50.
[8] Smarandache, F. (2022). Neutrosophic Statistics is an extension of Interval Statistics, while Plithogenic Statistics is the most general form of statistics (second version) (Vol. 2). Infinite Study.
[9] Smarandache, F. (2023). Introduction and advances to neutrosophic probability and statistics and plithogenic probability and statistics and their applications in bioinformatics and other fields (review chapter). In Cognitive Intelligence with Neutrosophic Statistics in Bioinformatics (pp. 1-23). Academic Press.
[10] Gillard, J. (2020) A First Course in Statistical Inference, Springer Nature.
[11] Siegel, S. and Castellán, N.J. (1995) Nonparametric statistics: Applied to behavioral sciences. Mexico City: Editorial Trillas.
[12] Abdel-Basset, M., El- Hoseny, M., Gamal, A. and Smarandache, F. (2019). A novel model for evaluation Hospital medical care systems based on plithogenic sets. Artificial intelligence in medicine, 100, 101710.
[13] Gomathy, S., Nagarajan, D., Broumi, S., Lathamaheswari, M. (2020) Plithogenic sets and their application in decision making. Neutrosophic Sets and Systems, 38, 453-469.
[14] Grida, M., Rehab M., Abdelnaser H. Z. (2020) A Novel Plithogenic MCDM Framework for Evaluating the Performance of IoT Based Supply Chain. Neutrosophic Sets and Systems, 33, 323-340.
[15] Batista Hernandez, N., Gonzalez Caballero, E., Valencia Cruzaty, L. E., Ortega Chavez, W., Padilla Huarac, C.F. y Chijchiapaza Chamorro, S. L. (2021). A new method to assess entrepreneurship competence in university students using based on plithogenic numbers and SWOT analysis. International Journal of Fuzzy Logic and Intelligent Systems, 21(3), 280-292.
[16] Leonor, M.M., Easud, G.S. and Fernando, P.P. (2022). Indeterminate Likert Scale in Social Sciences Research. International Journal of Neutrosophic Science (IJNS), 19 (1), 289-297.
[17] Wu, C., Thompson, M. E (2020) Sampling Theory and Practice, Switzerland AG: Springer Nature.
[18] Binti Rosli , S. N. I., & Bin Zulkifly , M. I. E. ¨A Neutrosophic Approach for B-Spline Curve by Using Interpolation Method¨. Neutrosophic Systems With Applications, vol 9, pp 29–40, 2023. https://doi.org/10.61356/j.nswa.2023.43
[19] Maissam Jdid, & Smarandache, F. ¨Graphical Method for Solving Neutrosophical Nonlinear Programming Models¨. Neutrosophic Systems With Applications, vol 9, pp 41–47, 2023. https://doi.org/10.61356/j.nswa.2023.67
[20] Naeem Saleem, Umar Ishtiaq, Khaleel Ahmad, Salvatore Sessa, & Ferdinando Di Martino. ¨Fixed Point Results in Neutrosophic Rectangular Extended b-Metric Spaces¨. Neutrosophic Systems With Applications, vol 9, pp 48–80, 2023. https://doi.org/10.61356/j.nswa.2023.63

Received: October 17, 2023. **Accepted:** December 15, 2023