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A new method for measuring the effectiveness of teacher evaluation instruments in improving pedagogical performance in higher education based on the neutrosophic 2-tuple linguistic model and offset logic

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Abstract. Assessment in a teaching-learning process allows teachers to determine to what degree students are assimilating the content and are meeting the objectives of the study program. That is why when there are fine-tuned assessment instruments, it is assumed that there is better pedagogical performance. This is a consequence of the fact that the accuracy of the tests allows better adjustment of the classroom methods carried out by the teacher. In this article, we propose a technique that allows determining the degree of effectiveness of assessment instruments on school results and their relationship with pedagogical performance. We focus specifically on higher education in Ecuador, although the method may be valid in another context. For the design of the method, we took into account that the teacher or the specialist who evaluates is better understood with the help of a linguistic measurement scale. In addition, experience shows that in each evaluation there is indeterminacy and uncertainty. That is why the proposed method is based on the neutrosophic 2-tuple linguistic model. This is a model of Computing with Words, where they are evaluated with a natural language scale and the indeterminacy of the evaluation is also taken into account. On the other hand, offsets allow obtaining logical results between these words when logical operations are performed between their indices that are outside the classic truth values in [0, 1].

Keywords: Educational Quality, Higher Education, pedagogical evaluation, pedagogical performance, Computing with Words (CWW), neutrosophic 2-tuple linguistic model, offsets, offset logic.

1 Introduction

The quality of education in Ecuador faces constant challenges, one of the most relevant being the improvement of the pedagogical performance of teachers in higher education institutions. In this context, teacher evaluation emerges as a key tool to identify strengths and areas for improvement in pedagogical practices. However, questions remain about the real effectiveness of the evaluation instruments applied in the Ecuadorian educational system and their impact on teacher performance and student learning outcomes.

The central problem lies in the influence of the design, implementation, and feedback of teacher evaluation instruments on the improvement of pedagogical performance. In Ecuador, traditional instruments tend to focus on standardized criteria that often do not consider the contextual and cultural characteristics of educational institutions. This creates a disconnect between evaluation and teacher improvement strategies. In addition, teachers' perception of evaluation is generally negative, considering it a punitive mechanism rather than a formative tool, which limits its effectiveness in promoting significant changes in pedagogical practice.

The analysis of this problem focuses on three main variables: the assessment instruments used, the pedagogical performance of teachers, and the feedback generated from the assessment process. Studies carried out in the country indicate that current instruments are not always aligned with a formative approach, which limits their capacity to promote the continuous professional development of teachers. Likewise, the lack of training on the use and interpretation of assessment results affects the implementation of improvement strategies.

Teacher evaluation should become a formative process that allows for the identification of specific teacher needs and the design of personalized professional development plans. In addition, it is crucial to incorporate the participation of key actors, such as students and teaching colleagues, to ensure a comprehensive view of pedagogical performance. Implementing more participatory and competency-based approaches could significantly contribute to improving teaching-learning processes.

This article proposes a method for evaluating the effectiveness of the learning process in any higher education institution, especially in Ecuador. The method is based on the tools that emerged from Neutrosophy. This is the branch of philosophy that deals with the study of the neutral, the inconsistent, the paradoxical, the contradictory, etc., [1].

Particularly, we will use the neutrosophic 2-tuple linguistic model [2-9]. This extends the 2-tuple linguistic model, which is a technique of Computing with Words (CWW), where the concept of symbolic translation is used when results are aggregated in the form of linguistic evaluations. In this way, evaluations are obtained in the form of words which is the natural manner in which humans understand each other daily, without losing precision. The neutrosophic 2-tuple linguistic model incorporates a triad of linguistic values into each of the possible evaluations, which adds even more accuracy. This is because the evaluations are indeterminate and uncertain, and neutrosophy takes this into account, rather than avoiding it.

On the other hand, because the neutrosophic 2-tuple model performs aggregations based on values outside of the interval [0, 1], we use offsets to perform logical operations such as implication, which indicates causal relationships between concepts, and bi-implication to signify logical equivalences [10-15].

One of the most recent theories of F. Smarandache is the offset, where the truth values go outside the range [0, 1]. This is used to indicate over-compliance when the truth value is greater than 1 and defaults with debt for truth values less than 0. In the method, we use these offsets to obtain a framework consistent with the values of the indices associated with the evaluations carried out with the linguistic 2-tuple model.

This paper is divided into the following sections, a Materials and Methods section where the main results of neutrosophic 2-tuple linguistic models and offsets are presented. This is followed by a section called The Method section, where the method we designed is explained and an illustrative example is provided. The last section is dedicated to the conclusions.

2 Materials and Methods

In this section, we present the main concepts and theories that we will use in the article to create the proposed method. We start with the neutrosophic 2-tuple linguistic models and we continue with the offsets.

2.1 Neutrosophic 2-tuple linguistic model

Definition 1([1, 2, 16]). Let $S = \{s_0, s_1, \dots, s_g\}$ be a set of linguistic terms and $\beta \epsilon [0, g]$ a value that represents the result of a symbolic operation, then the linguistic 2-tuple that expresses the information equivalent to β is obtained using the following function:

$$\Delta: [0, g] \rightarrow S \times [-0.5, 0.5)$$

$$\Delta(\beta) = (s_i, \alpha) \qquad (1)$$

Where s_i is such that $i = \text{round}(\beta)$ and $\alpha = \beta - i, \alpha \in [-0.5, 0.5)$ and "round" is the usual rounding operator, s_i is the index label closest to β and α is the value of the symbolic translation.

It should be noted that $\Delta^{-1}: \langle S \rangle \rightarrow [0, g]$ is defined as $\Delta^{-1}(s_i, \alpha) = i + \alpha$. Thus, a linguistic 2-tuple $\langle S \rangle$ is identified with its numerical value in $[0, g]$.

Suppose that $S = \{s_0, \dots, s_g\}$ is a *2-Tuple Linguistic Set* (2TLS) with odd cardinality g+1. It is defined for $(s_T, a), (s_I, b), (s_F, c) \in L$ and a, b, c ∈[0, g], where $(s_T, a), (s_I, b), (s_F, c) \in L$ independently express the degree of truthfulness, indeterminacy, and falsehood by 2TLS. *2-Tuple Linguistic Neutrosophic Number* (2TLNN) is defined as follows:

$$l_j = \left\{(s_{T_j}, a), (s_{I_j}, b), (s_{F_j}, c)\right\} \quad (2)$$

Where $0 \le \Delta^{-1}(s_{T_j}, a) \le g$, $0 \le \Delta^{-1}(s_{I_j}, b) \le g$, $0 \le \Delta^{-1}(s_{F_j}, c) \le g$, and $0 \le \Delta^{-1}\left(s_{T_j}, a\right) + \Delta^{-1}\left(s_{I_j}, b\right) + \Delta^{-1}(s_{F_j}, c) \le 3g$.

The scoring and accuracy functions allow us to rank 2TLNN.

Let $l_1 = \left\{(s_{T_1}, a), (s_{I_1}, b), (s_{F_1}, c)\right\}$ be a 2TLNN in L, the scoring and accuracy functions in l_1 are defined as follows, respectively:

$$\mathcal{S}(l_1)=\Delta\left\{\frac{2g+\Delta^{-1}(s_{T_1},a)-\Delta^{-1}(s_{I_1},b)-\Delta^{-1}(s_{F_1},c)}{3}\right\},\ \Delta^{-1}(\mathcal{S}(l_1)) \in [0, g] \quad (3)$$

$$H(l_1)=\Delta\left\{\frac{g+\Delta^{-1}(s_{T_1},a)-\Delta^{-1}(s_{F_1},c)}{2}\right\},\ \Delta^{-1}(H(l_1)) \in [0, g] \quad (4)$$

2.2 Brief notion of offsets

Definition 2 ([1, 17]). Let X be a space of points (objects), with a generic element in X denoted by x. A *Neutrosophic Set* A in X is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$ and a falsity-membership function $F_A(x)$. $T_A(x)$, $I_A(x)$ and $F_A(x)$ are real standard or nonstandard subsets of $]^-0, 1^+[$. There is no restriction on the sum of $T_A(x)$, $I_A(x)$ and $F_A(x)$, thus, $^-0 \le \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \le \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \le 3^+$.

Definition 3 ([1, 17]). Let X be a space of points (objects), with a generic element in X denoted by x. A *Single-Valued Neutrosophic Set* A in X is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$ and a falsity-membership function $F_A(x)$. $T_A(x)$, $I_A(x)$ and $F_A(x)$ are elements of [0, 1]. There is no restriction on the sum of $T_A(x)$, $I_A(x)$ and $F_A(x)$, thus, $0 \le T_A(x) + I_A(x) + F_A(x) \le 3$.

Definition 4 ([10, 17]). Let X be a universe of discourse and the neutrosophic set $A_1 \subset X$. Let $T(x)$, $I(x)$, $F(x)$ be the functions that describe the degree of membership, indeterminate membership, and non-membership respectively, of a generic element $x \in X$, concerning the neutrosophic set A_1:

T, I, F: $X \to [0, \Omega]$, where $\Omega > 1$ is called *overlimit*, $T(x), I(x), F(x) \in [0, \Omega]$. A *Single-Valued Neutrosophic Overset* A_1 is defined as: $A_1 = \{(x, \langle T(x), I(x), F(x)\rangle), x \in X\}$, such that there exists at least one element in A_1 that has at least one neutrosophic component that is bigger than 1, and no element has neutrosophic components that are smaller than 0.

Definition 5 ([10, 17]). Let X be a universe of discourse and the neutrosophic set $A_2 \subset X$. Let $T(x)$, $I(x)$, $F(x)$ be the functions that describe the degree of membership, indeterminate membership, and non-membership respectively, of a generic element $x \in X$, concerning the neutrosophic set A_2:

T, I, F: $X \to [\Psi, 1]$, where $\Psi < 0$ is called *underlimit*, $T(x), I(x), F(x) \in [\Psi, 1]$. A *Single-Valued Neutrosophic Underset* A_2 is defined as: $A_2 = \{(x, \langle T(x), I(x), F(x)\rangle), x \in X\}$, such that there exists at least one element in A_2 that has at least one neutrosophic component that is smaller than 0, and no element has neutrosophic components that are bigger than 1.

Definition 6 ([10, 17]). Let X be a universe of discourse and the neutrosophic set $A_3 \subset X$. Let $T(x)$, $I(x)$, $F(x)$ be the functions that describe the degree of membership, indeterminate membership, and non-membership respectively, of a generic element $x \in X$, concerning the neutrosophic set A_3:

T, I, F: $X \to [\Psi, \Omega]$, where $\Psi < 0 < 1 < \Omega$, Ψ is called *underlimit*, while Ω is called *overlimit*, $T(x), I(x), F(x) \in [\Psi, \Omega]$. A *Single-Valued Neutrosophic Offset* A_3 is defined as: $A_3 = \{(x, \langle T(x), I(x), F(x)\rangle), x \in X\}$, such that there exists at least one element in A_3 that has at least one neutrosophic component that is bigger than 1, and at least another neutrosophic component that is smaller than 0.

Let X be a universe of discourse, $A = \{(x, \langle T_A(x), I_A(x), F_A(x)\rangle), x \in X\}$ and $B = \{(x, \langle T_B(x), I_B(x), F_B(x)\rangle), x \in X\}$ be two single-valued neutrosophic oversets/undersets/offsets.

T_A, I_A, F_A, T_B, I_B, F_B: $X \to [\Psi, \Omega]$, where◎◎≤0<1≤Ω, Ψ is called *underlimit*, while Ω is called *overlimit*, $T_A(x)$, $I_A(x)$, $F_A(x)$, $T_B(x)$, $I_B(x)$, $F_B(x) \in [\Psi, \Omega]$. Let us remark that the three cases are comprised, viz., overset when Ψ=0 and Ω>1, underset when Ψ<0 and Ω=1, and offset when Ψ<0 and Ω>1.

Then the main operators are defined as follows:

$A \cup B = \{(x, \langle \max(T_A(x), T_B(x)), \min(I_A(x), I_B(x)), \min(F_A(x), F_B(x))\rangle), x \in X\}$ is the union.

$A \cap B = \{(x, \langle \min(T_A(x), T_B(x)), \max(I_A(x), I_B(x)), \max(F_A(x), F_B(x))\rangle), x \in X\}$ is the intersection,

$C(A) = \{(x, \langle F_A(x), \Psi + \Omega - I_A(x), T_A(x)\rangle), x \in X\}$ is the neutrosophic complement of the neutrosophic set.

One *offnegation* can be defined as in Equation 5.

$$\underset{O}{\neg}\langle T, I, F\rangle = \langle F, \Psi_I + \Omega_I - I, T\rangle \quad (5)$$

Definition 7 ([10, 17]). Let c be a neutrosophic component (T_O, I_O or F_O). c: $M_O \to [\Psi, \Omega]$, where Ψ≤0 and Ω≥1. The neutrosophic component *N- offnorm* $N_O^n: [\Psi, \Omega]^2 \to [\Psi, \Omega]$ satisfies the following conditions for any elements x, y and z∈M_O:

i. $N_O^n(c(x), \Psi) = \Psi$, $N_O^n(c(x), \Omega) = c(x)$ (Overbounding Conditions),

ii. $N_O^n(c(x), c(y)) = N_O^n(c(y), c(x))$ (Commutativity),

iii. If $c(x) \le c(y)$ then $N_O^n(c(x), c(z)) \le N_O^n(c(y), c(z))$ (Monotonicity),

iv. $N_O^n(N_O^n(c(x), c(y)), c(z)) = N_O^n(c(x), N_O^n(c(y), c(z)))$ (Associativity).

To simplify the notation sometimes we use $\langle T_1, I_1, F_1\rangle \underset{O}{\wedge} \langle T_2, I_2, F_2\rangle = \langle T_1 \underset{O}{\wedge} T_2,\ I_1 \underset{O}{\vee} I_2, F_1 \underset{O}{\vee} F_2\rangle$ instead of $N_O^n(\cdot,\cdot)$.

Proposition 1 ([17]). Let $N_O^n(\cdot,\cdot)$ be a neutrosophic component N-offnorm, then, for any elements x, y∈M_O we have $N_O^n(c(x), c(y)) \le \min(c(x), c(y))$.

Definition 8 ([10, 17]). Let c be a neutrosophic component (T_O, I_O or F_O). c: $M_O \to [\Psi, \Omega]$, where Ψ≤0 and Ω≥1. The neutrosophic component *N-offconorm* $N_O^{co}: [\Psi, \Omega]^2 \to [\Psi, \Omega]$ satisfies the following conditions for any elements x, y and z∈M_O:

i. $N_O^{co}(c(x), \Omega) = \Omega$, $N_O^{co}(c(x), \Psi) = c(x)$ (Overbounding Conditions),

ii. $N_O^{co}(c(x), c(y)) = N_O^{co}(c(y), c(x))$ (Commutativity),

iii. If $c(x) \le c(y)$ then $N_O^{co}(c(x), c(z)) \le N_O^{co}(c(y), c(z))$ (Monotonicity),

iv. $N_O^{co}(N_O^{co}(c(x), c(y)), c(z)) = N_O^{co}(c(x), N_O^{co}(c(y), c(z)))$ (Associativity).

To simplify the notation sometimes we use $\langle T_1, I_1, F_1\rangle \underset{O}{\vee} \langle T_2, I_2, F_2\rangle = \langle T_1 \underset{O}{\vee} T_2,\ I_1 \underset{O}{\wedge} I_2, F_1 \underset{O}{\wedge} F_2\rangle$ instead of $N_O^{co}(\cdot,\cdot)$.

Proposition 2 ([17]). Let $N_O^{co}(\cdot,\cdot)$ be a neutrosophic component N-offconorm, then, for any elements x, y∈M_O we have $N_O^{co}(c(x), c(y)) \ge \max(c(x), c(y))$.

Here we use the notion of lattice, based on the poset denoted by $\leq_O$, where, $\langle T_1, I_1, F_1\rangle \leq_O \langle T_2, I_2, F_2\rangle$ if and only if $T_2 \geq T_1$, $I_2 \leq I_1$ and $F_2 \leq F_1$, where the infimum and the supremum of the set are $\langle \Psi, \Omega, \Omega\rangle$ and $\langle \Omega, \Psi, \Psi\rangle$, respectively, [17].

3. The Method

This section presents the elements that form part of the proposed method. It is based on the opinion of a group of specialists $E = \{e_1, e_2, \cdots, e_n\}$, who give their beliefs on the following aspects:

A1: The assessment instruments used are adequate,
A2: The pedagogical performance of teachers is adequate,
A3: There is adequate training on the use and interpretation of assessment results,
A4: The feedback generated from the evaluation process is adequate,
A5: The approach to assessment is formative,
A6: Specific needs of teachers are identified and personalized professional development plans are designed,
A7: There is a participatory approach, based on competencies,
A8: The proactive contribution of the actors who are part of the process, such as students and teaching colleagues, is guaranteed,
A9: The pedagogical performance in the institution is adequate.

The steps to follow are given below:

1. Each expert in E is asked to evaluate each of the nine aspects $A = \{A_1, A_2, \cdots, A_9\}$. The logical treatment for this research addresses teacher evaluation considering a triadic component: perceived effectiveness (truth), contextual limitations (falsehood) and uncertainty in the results (indeterminacy).

The proposed linguistic scale is as follows, see Table 1:

Table 1. Linguistic meaning of each element of the S scale ([16]).

Scale element	Linguistic Meaning
s_{-5}	Extremely Low
s_{-4}	Very Low
s_{-3}	Low
s_{-2}	Somewhat Low
s_{-1}	Lower than High
s_0	As Low as High
s_1	Higher than Low
s_2	Somewhat High
s_3	High
s_4	Very High
s_5	Extremely High

The expert must evaluate each of the above aspects on a linguistic scale individually such that $S = \{s_{-5}, s_{-4}, s_{-3}, s_{-2}, s_{-1}, s_0, s_1, s_2, s_3, s_4, s_5\}$ according to Table 1.

Another scale of the expert's opinion about the importance of the criteria is included, which is shown in Table 2 with the scale $W = \{\omega_{-5}, \omega_{-4}, \omega_{-3}, \omega_{-2}, \omega_{-1}, \omega_0, \omega_1, \omega_2, \omega_3, \omega_4, \omega_5\}$.

Table 2. Linguistic meaning of each element of the W scale ([16]).

Scale element	Linguistic Meaning
ω_{-5}	Extremely Insignificant
ω_{-4}	Very Insignificant
ω_{-3}	Insignificant
ω_{-2}	Somewhat Insignificant
ω_{-1}	More Insignificant than Important

Scale element	Linguistic Meaning
ω_0	As Insignificant as Important
ω_1	More Important than Insignificant
ω_2	Somewhat Important
ω_3	Important
ω_4	Very Important
ω_5	Extremely Important

In summary, each respondent $e_i(i = 1,2,\dots,n)$ is asked to give his/her opinion on each of the aspects A_j (j = 1, 2,.., 9) as a triad of linguistic values on the scale shown in Table 1 such that $v_{ij} = \left(s_{kT_{ij}}, s_{kI_{ij}}, s_{kF_{ij}}\right)$ $(kT_{ij}, kI_{ij}, kF_{ij} \in \{-5,-4,\dots,0,\dots,4,5\})$ means that the ith respondent thinks that the higher education institution satisfies the jth criterion according to the linguistic meaning whose scale element is $s_{kT_{ij}}$ concerning satisfaction (perceived effectiveness), $s_{kI_{ij}}$ concerning indeterminacy (uncertainty in results) and $s_{kF_{ij}}$ concerning dissatisfaction (contextual constraints).

Similarly, each respondent gives his/her opinion on the weight or importance $\omega_{ij} = \left(\omega_{kT_{ij}}, \omega_{kI_{ij}}, \omega_{kF_{ij}}\right)$ of each of the aspects to be evaluated, as well as a triad for truth, indeterminacy and falsehood.

2. From now on, calculations are performed with the triad of indices corresponding to the linguistic values using:

$indv_{ij} = \left(\Delta^{-1}\left(s_{kT_{ij}}, 0\right), \Delta^{-1}\left(s_{kI_{ij}}, 0\right), \Delta^{-1}\left(s_{kF_{ij}}, 0\right)\right)$ and $ind\omega_{ij} = \left(\Delta^{-1}\left(\omega_{kT_{ij}}, 0\right), \Delta^{-1}\left(\omega_{kI_{ij}}, 0\right), \Delta^{-1}\left(\omega_{kF_{ij}}, 0\right)\right)$

Then, a measure of central tendency is calculated for all respondents for each attribute, as follows:

$$\overline{indv_j} = \left(median_i \left\{\Delta^{-1}\left(s_{kT_{ij}}, 0\right)\right\}, median_i\left\{\Delta^{-1}\left(s_{kI_{ij}}, 0\right)\right\}, median_i\left\{\Delta^{-1}\left(s_{kF_{ij}}, 0\right)\right\}\right) \quad (6)$$

$$\overline{ind\omega_j} = \left(\mathrm{median}_i \left\{\Delta^{-1}\left(\omega_{kT_{ij}}, 0\right)\right\}, median_i\left\{\Delta^{-1}\left(\omega_{kI_{ij}}, 0\right)\right\}, median_i\left\{\Delta^{-1}\left(\omega_{kF_{ij}}, 0\right)\right\}\right) \quad (7)$$

3. Using the results of (6) and (7) we calculate:

$\mathrm{P}_1 = \mathrm{N}_{\mathrm{O}}^{\mathrm{n}}\left(\overline{ind\omega_1}, \overline{indv_1}, \overline{ind\omega_2}, \overline{indv_2}, \dots, \overline{ind\omega_8}, \overline{indv_8}\right)$ which is the neutrosophic offnorm of opinions and their weights on the first eight attributes.

On the other hand, $\mathrm{P}_2 = \mathrm{N}_{\mathrm{O}}^{\mathrm{n}}\left(\overline{ind\omega_9}, \overline{indv_9}\right)$.

4. The final result given in Equation 8 is calculated:

$$\mathrm{G} := \mathrm{P}_1 \Leftrightarrow_o \mathrm{P}_2 \quad (8)$$

Where $\Leftrightarrow_o$ is the neutrosophic off-bi-implication defined as:

$$(\boldsymbol{x} \Leftrightarrow_o \boldsymbol{y}) \coloneqq \mathrm{N}_{\mathrm{O}}^{\mathrm{n}}(\boldsymbol{x} \Rightarrow_o \boldsymbol{y}, \boldsymbol{y} \Rightarrow_o \boldsymbol{x}) \quad (9)$$

Where:

$$(\boldsymbol{x} \Rightarrow_o \boldsymbol{y}) \coloneqq \mathrm{N}_{\mathrm{O}}^{\mathrm{co}}\left(\urcorner_{\mathrm{O}}\boldsymbol{x}, \boldsymbol{y}\right) \quad (10)$$

Let us illustrate the proposed method with an example.

Example 1: Suppose that a group of three specialists denoted by $E = \{e_1, e_2, e_3\}$ evaluate each of the attributes of the Higher Education institution U as indicated in Table 3.

Table 3. Results of the experts' evaluation of U on each of the 9 aspects to be measured.

Attribute/Expert	e1	e2	e3
A1	(s_5, s_{-5}, s_{-5})	(s_2, s_0, s_{-2})	(s_3, s_{-4}, s_{-5})
A2	(s_4, s_{-5}, s_{-2})	(s_3, s_1, s_{-1})	(s_4, s_{-2}, s_{-1})
A3	(s_5, s_{-5}, s_0)	(s_4, s_{-1}, s_1)	(s_4, s_{-5}, s_{-5})
A4	(s_4, s_{-3}, s_{-1})	(s_2, s_{-1}, s_1)	(s_2, s_2, s_0)
A5	(s_4, s_{-4}, s_{-4})	(s_1, s_2, s_{-1})	(s_5, s_{-5}, s_{-1})
A6	(s_5, s_{-1}, s_0)	(s_3, s_{-5}, s_{-5})	(s_4, s_{-3}, s_{-3})
A7	(s_4, s_{-5}, s_{-5})	(s_2, s_{-1}, s_{-4})	(s_4, s_{-1}, s_{-4})
A8	(s_2, s_0, s_{-3})	(s_3, s_{-5}, s_0)	(s_3, s_{-1}, s_{-5})
A9	(s_5, s_{-5}, s_{-5})	(s_2, s_{-1}, s_{-5})	(s_4, s_{-5}, s_{-1})

Table 4 contains the experts' results on the measures of the importance of each attribute:

Table 4. Results of the evaluation of the weights of each of the 9 aspects to be measured in U according to the experts.

Attribute/Expert	e1	e2	e3
A1	$(\omega_5, \omega_{-5}, \omega_{-5})$	$(\omega_4, \omega_{-4}, \omega_{-4})$	$(\omega_3, \omega_{-4}, \omega_{-5})$
A2	$(\omega_5, \omega_{-5}, \omega_{-5})$	$(\omega_4, \omega_{-4}, \omega_{-4})$	$(\omega_3, \omega_{-4}, \omega_{-5})$
A3	$(\omega_5, \omega_{-5}, \omega_{-5})$	$(\omega_4, \omega_{-4}, \omega_{-4})$	$(\omega_3, \omega_{-4}, \omega_{-5})$
A4	$(\omega_5, \omega_{-5}, \omega_{-5})$	$(\omega_4, \omega_{-4}, \omega_{-4})$	$(\omega_3, \omega_{-4}, \omega_{-5})$
A5	$(\omega_5, \omega_{-5}, \omega_{-5})$	$(\omega_4, \omega_{-4}, \omega_{-4})$	$(\omega_3, \omega_{-4}, \omega_{-5})$
A6	$(\omega_5, \omega_{-5}, \omega_{-5})$	$(\omega_4, \omega_{-4}, \omega_{-4})$	$(\omega_3, \omega_{-4}, \omega_{-5})$
A7	$(\omega_5, \omega_{-5}, \omega_{-5})$	$(\omega_4, \omega_{-4}, \omega_{-4})$	$(\omega_3, \omega_{-4}, \omega_{-5})$
A8	$(\omega_5, \omega_{-5}, \omega_{-5})$	$(\omega_4, \omega_{-4}, \omega_{-4})$	$(\omega_3, \omega_{-4}, \omega_{-5})$
A9	$(\omega_5, \omega_{-5}, \omega_{-5})$	$(\omega_4, \omega_{-4}, \omega_{-4})$	$(\omega_3, \omega_{-4}, \omega_{-5})$

The results of Equations 6 and 7 appear in Table 5.

Table 5. Results of the aggregation of weights and evaluations for all experts for each attribute.

Attribute/Results	Weight	Assessment
A1	$(\omega_4, \omega_{-4}, \omega_{-4})$	(s_3, s_{-4}, s_{-5})

Attribute/Results	Weight	Assessment
A2	$(\omega_4, \omega_{-4}, \omega_{-4})$	(s_4, s_{-2}, s_{-1})
A3	$(\omega_4, \omega_{-4}, \omega_{-4})$	(s_4, s_{-5}, s_0)
A4	$(\omega_4, \omega_{-4}, \omega_{-4})$	(s_2, s_{-1}, s_0)
A5	$(\omega_4, \omega_{-4}, \omega_{-4})$	(s_4, s_{-4}, s_{-1})
A6	$(\omega_4, \omega_{-4}, \omega_{-4})$	(s_4, s_{-3}, s_{-3})
A7	$(\omega_4, \omega_{-4}, \omega_{-4})$	(s_4, s_{-1}, s_{-4})
A8	$(\omega_4, \omega_{-4}, \omega_{-4})$	(s_3, s_{-1}, s_{-3})
A9	$(\omega_4, \omega_{-4}, \omega_{-4})$	(s_4, s_{-5}, s_{-5})

Then, we have $\mathrm{P}_1 = (s_2, s_{-1}, s_0)$ and $\mathrm{P}_2 = (s_4, s_{-4}, s_{-4})$ therefore, $\neg_0\mathrm{P}_1 = (s_0, s_1, s_2)$ and $\neg_0\mathrm{P}_2 = (s_{-4}, s_4, s_4)$, so $\mathrm{G} = (s_2, s_{-1}, s_0)$. From here we infer that the correlation between the effectiveness of the evaluation instruments and the pedagogical performance is "Somewhat High" with indeterminacy "Lower than High" and falseness "As Low as High".

4. Conclusion

In this paper, we introduced a method that allows evaluating the correlation between the effectiveness of the evaluation in Higher Education in any Ecuadorian institution, compared to the pedagogical performance. It is a method that allows specialists to carry out an accurate evaluation because it takes into account the indeterminacies. In addition, the measurement scales are linguistic; therefore it is very easy for evaluators and decision makers to carry out the evaluation. From the theoretical point of view, it is a hybridization between two neutrosophic techniques, the neutrosophic 2-tuple linguistic model and offset logic. The usefulness of the method is shown with a hypothetical example.

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