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Neutrosophic Fuzzification Mathematical Modelling: Based on Survey Responses

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Abstract

Fuzzy is capable of converting human ideas into numbers. As a result, the fundamental purpose of this research is to employ a unique formula to convert the human views gathered in the survey into Neutrosophic values. A unique method for turning the crisp replies from the survey's questions to Neutrosophic Fuzzy numbers. A unique MATLAB method of converting Crispy information into Neutrosophic Fuzzy information was also created. To calculate rank of EE Beneficiaries, the Neutrosophic Fuzzy Weighted Arithmetic Operator Score (NWAAOS) is employed. It also contradicts the Pythagorean Fuzzy Weighted Arithmetic Average Operator Score method. The method for analyzing and prioritizing EE beneficiaries According to the study's findings, the late boomers will benefit the most. The NWAAOS rank will be the same as the PWAAOS rank. However, the Score values differ between NWAAOS and PWAAOS. This paper provides a novel approach for evaluating investigate questionnaire responses against a Neutrosophic fuzzy setting. An innovative MATLAB approach to generating Neutrosophic fuzzy numbers using data gathered and the NWAAOS Ranking. This one-of-a-kind method of translating investigate responses to Neutrosophic fuzzy kind will be applied to any sort of questionnaire.

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Article type: Research article

1.Introduction:

Multiple criterion decision-making (MCDM) problems can be used to solve single-valued neutrosophic sets. As a geometric explanation for the Neutrosophic Set, F. Smarandache (2004) offered the Neutrosophic Cube. Other contrasts may be made between the set of neutrosophic and the intuitionistic fuzzy collection. The single-value neutrosophic set (SVNS) was proposed by Wang, H., Smarandache, et al. as a sort of neutrosophic set. The notions of inclusiveness, complement one another, association, and intersecting have been established for single value neutrosophic sets. Several characteristics of set-theoretic operators have been documented. By extending the order preference by similarity to ideal solution approach to a single valued neutrosophic environment, Biswas, P et al. proposed a novel strategy for multi-attribute team decision - forming challenges. Grades for each attribute are viewed as a neutrosophic set that represents the selection maker's assessment according to the details supplied. Pamucar et al. present a unique fuzzy-neutrosophic-based method for resilient supplier selection. The primary contributions of this research work are the creation, execution, and examination of a multi-attribute assessment technique for fuzzy neutrosophic evaluations.

This assessment approach employs a unique pairwise comparison with trapezoidal neutrosophic language variables to estimate the relevant strengths of supplier characteristics.Khalaf O.I et al. provide an innovative and smart virtual health service based on contemporary technology such as the Web of things and Neutrosophic fuzzy structures to ensure precise assessment of data while using less time and energy. Alzahrani et al. advocated that the optimal site for women's institutions be chosen based on social and national requirements. A novel de-neutrosophication approach has been developed and implemented. Comparisons were made between the two approaches, NTOPSIS and NCOPRAS. Ye, J., Du, S., and Yong, R. developed a multi-criteria choice-making system built on the trigonometric averages of weights and geometric integrators of single-valued neutrosophic confidence quantities. To start, a neutrosophic confidence set is offered to increase confidence values. The scoring and reliability algorithms are used to rate single-valued neutrosophic. Bui, Q, and colleagues create information measures that consider similarity, including entropy and cross-entropy, among Neutrosophic sets. In addition, with an example, we provide an innovative and efficient method for making multi-criteria decisions utilizing these data measures.

Meng, Q., et al. suggested an EDAS method decision-making process based on an average solution concept specified in a Neutrosophic set scenario. The influence on the excessive ideal scenario and the selection maker's passion upon the results was lessened, and the program's capabilities of EDAS got expanded. According to J Peng et al. (2014), an innovative surpassing technique for multi-criteria selection-making concerns is developed in a setting with a neutrosophic environment. Focusing on the surpassing connections of SNNs, a ranking technique for resolving MCDM difficulties is given. A. E. Torkayesh et al. provided a systematic way to evaluating alternative waste treatment solutions while taking into account several sustainability criteria. It examines multi-criteria decision making and life cycle assessment methodologies for determining the long-term viability of systems for handling waste Various neutrosophic number-based aggregation techniques are proposed by E. Zheng et al. to assist with several characteristic group selection challenges. The NNGHWA operator is implemented to suggest a selection making strategy for several characteristic groups. R. Şahin proposed a multiple characteristic making choices approach when dealing with an instance issue in which the option characteristics have varying levels of relevance and take the form of conventional neutrosophic numbers.

Kavitha M. and Hepzibah RI. (2023) offer a novel approach for assessing asking for information against a Pythagorean fuzzy backdrop. PFWSM rating and an unusual MATLAB technique to computing Pythagorean numbers that are fuzzy using results of surveys. A literature search on the translation of survey questionnaire replies into fuzzy, in addition to MATLAB code on a fuzzy background, was conducted. Only a few academics have looked at the conversion of survey response data into fuzzy data. Specifically, the translation of survey data via the Neutrosophic fuzzy hunger approach. To meet this research need, a novel technique for converting questionnaire data to Neutrosophic combined with MATLAB was designed. To bridge this gap, it was determined to discover a new approach to frame the Neutrosophic fuzzy number using survey respondents' opinions. MATLAB code was written to facilitate the conversion of Neutrosophic Fuzzification. In this study, the approach was graded using Neutrosophic fuzzy WAAOS. In this work, results were additionally contrasted using Hepzibah RI, Kavitha M. (2023). WAAOS with Pythagorean fuzzy. To deal with imprecise information and unresolved language, neutrosophic theory of fuzzy sets became frequently used throughout real-world selection-making scenarios. The key objective of this endeavor

is to convert findings from surveys into Neutrosophic notation. This study will aid in determining the problem and providing a solution.

Future survey questions designed to elicit respondents' sentiments might benefit from fuzzy centering analysis over a wide range of categories. The distinctive approach for transforming questionnaire replies to Neutrosophic uncertain kind is able to use with every kind of questionnaire.

2. Preliminaries:

2.1. Neutrosophic Set:

Neutrosophic is defined as follows by Wang, H., Smarandache, et al., (2010).
Assume $\mathfrak{S} = \{\varkappa_1, \varkappa_2, \varkappa_3, \ldots\ldots \varkappa_n\}$ is a finite set. In X, a Neutrosophic Set (NS) is a structure

$$\grave{\mathrm{N}} = \{\langle \varkappa, \mathbf{T}_{\grave{\mathrm{N}}}(\varkappa), \boldsymbol{I}_{\grave{\mathrm{N}}}(\varkappa), \boldsymbol{F}_{\grave{\mathrm{N}}}(\varkappa)\rangle / \varkappa \in \mathfrak{S}\} \quad \textbf{(1)}$$

that has the property $0 \leq \mathrm{T}_{\grave{\mathrm{N}}}(\varkappa) + \mathrm{I}_{\grave{\mathrm{N}}}(\varkappa) + \mathrm{F}_{\grave{\mathrm{N}}}(\varkappa) \leq 3$, for all $\varkappa \in \mathfrak{S}$. These three functions are the function of truth-membership $\mathrm{T}_{\grave{\mathrm{N}}}: \mathfrak{S} \rightarrow [0,1]$, function of indeterminacy-membership $\mathrm{I}_{\grave{\mathrm{N}}}: \mathfrak{S} \rightarrow [0,1]$, and as well as the function of falsity-membership $\mathrm{F}_{\grave{\mathrm{N}}}: \mathfrak{S} \rightarrow [0,1]$.

2.2 Operations of NS:

Take into account that P and Q are separate NS, as indicated by Peng, J. J et al., (2014). Then

$$\mathbf{P} \oplus \mathbf{Q} = \{\langle \mathbf{x}, \mathbf{T}_{\grave{\mathrm{N}}_\mathbf{P}} + \mathbf{T}_{\grave{\mathrm{N}}_\mathbf{Q}} - \mathbf{T}_{\grave{\mathrm{N}}_\mathbf{P}} * \mathbf{T}_{\grave{\mathrm{N}}_\mathbf{Q}}, \mathbf{I}_{\grave{\mathrm{N}}_\mathbf{p}} * \mathbf{I}_{\grave{\mathrm{N}}_\mathbf{p}}, \mathbf{F}_{\grave{\mathrm{N}}_\mathbf{P}} * \mathbf{F}_{\grave{\mathrm{N}}_\mathbf{Q}}\rangle / \mathbf{x} \in \mathbf{X}\} \quad \textbf{(2)}$$

$$\mathbf{P} \otimes \mathbf{Q} = \{\langle \mathbf{x}, \mathbf{T}_{\grave{\mathrm{N}}_\mathbf{P}} * \mathbf{T}_{\grave{\mathrm{N}}_\mathbf{Q}}, \mathbf{I}_{\grave{\mathrm{N}}_\mathbf{P}} + \mathbf{I}_{\grave{\mathrm{N}}_\mathbf{Q}} - \mathbf{I}_{\grave{\mathrm{N}}_\mathbf{P}} * \mathbf{I}_{\grave{\mathrm{N}}_\mathbf{Q}}, \mathbf{F}_{\grave{\mathrm{N}}_\mathbf{P}} + \mathbf{F}_{\grave{\mathrm{N}}_\mathbf{Q}} - \mathbf{F}_{\grave{\mathrm{N}}_\mathbf{P}} * \mathbf{F}_{\grave{\mathrm{N}}_\mathbf{Q}}\rangle / \mathbf{x} \in \mathbf{X}\} \quad \textbf{(3)}$$

The notation "$\mathbf{T}_{\grave{\mathrm{N}}}, \boldsymbol{I}_{\grave{\mathrm{N}}}, \boldsymbol{F}_{\grave{\mathrm{N}}}$" is used for single-valued neutrosophic elements rather than "$\langle \boldsymbol{x}, \mathbf{T}_{\grave{\mathrm{N}}}(\boldsymbol{x}), \boldsymbol{I}_{\grave{\mathrm{N}}}(\boldsymbol{x}), \boldsymbol{F}_{\grave{\mathrm{N}}}(\boldsymbol{x})\rangle$ " for simplicity.

2.3 Operator for Neutrosophic Weighted Arithmetic Average (NWAAO):

Weighted arithmetic average operator (WAAO) for SVNSs is defined as follows by Şahin, R. (2014),

$$\mathbf{NWAAO} = \sum_{p=1}^{n} \mathbf{W_p} * \grave{\mathrm{N}}_{\mathbf{p}} = \left(1 - \prod_{p=1}^{n} \left(1 - \mathbf{T}_{\grave{\mathrm{N}}_{\mathbf{p}}}\right)^{W_p}, \prod_{p=1}^{n} \left(\mathbf{I}_{\grave{\mathrm{N}}_{\mathbf{p}}}\right)^{W_p}, \prod_{p=1}^{n} \left(\mathbf{F}_{\grave{\mathrm{N}}_{\mathbf{p}}}\right)^{W_p}\right) \quad \textbf{(4)}$$

where W_p denotes the weight vector of SVNSs and satisfies the conditions such that $W_p \in [0,1]$ and $\sum_{p=1}^{n} W_p = 1$.

2.4 Neutrosophic Score Function:

According to [21], Neturosophic Score function determined as,

$$\mathbf{S}\left(\mathbf{T}_{\grave{\mathrm{N}}}, \boldsymbol{I}_{\grave{\mathrm{N}}}, \boldsymbol{F}_{\grave{\mathrm{N}}}\right) = \frac{(2 + \mathbf{T}_{\grave{\mathrm{N}}} - \boldsymbol{I}_{\grave{\mathrm{N}}} - \boldsymbol{F}_{\grave{\mathrm{N}}})}{3}, \qquad \text{Where S: } \grave{\mathrm{N}} \rightarrow [0, 1] \qquad \textbf{(5)}$$

That is the average of the neutrosophic components $\mathbf{T}_{\grave{\mathrm{N}}}$, $\boldsymbol{I}_{\grave{\mathrm{N}}}$ and $\boldsymbol{F}_{\grave{\mathrm{N}}}$ positivity.

3. Methodology:

3.1 Proposed Framework:

The proposed project will establish a brand-new approach for estimating the Neutrosophic fuzzy number using data from surveys. To rank, the NWAAO method was employed. In the MATLAB code, new calculations for Neutrosophic fuzzy numbers and NWAAO are defined. Figure 1 depicts the steps of the proposed framework.

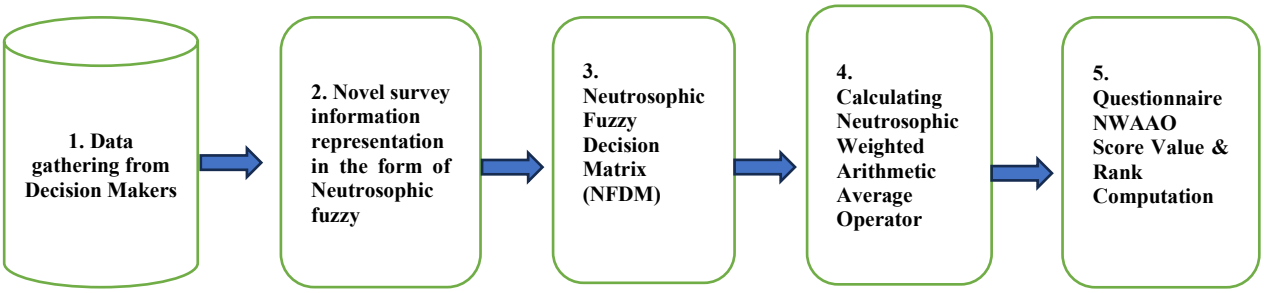

Figure:1 Framework Flow Chart Proposal

3.2 Proposed Algorithm:

The survey data are represented into NFSs using innovative methods in this study, which is coded in MATLAB. The aforesaid approach was verified by NWAAOS and contrasted with PWAAOS. The actions this paper took are as follows:

Step :1 Data gathering from Decision Makers

This section proposes a novel approach for generating Neutrosophic Fuzzy numbers using survey data. The **Ennum Ezhuthum (EE)** Mission will commence in classes 1 to 3 in all government schools in Tamil Nadu in the academic year 2022-23, with the goal of closing the learning gap by 2025.The mission theme is that by the age of eight, all Tamil Nadu students would be able to read with comprehension and do basic arithmetic utilising a level-based method.

Based on the findings, a questionnaire was developed for teachers to rank the beneficiaries of **EE**. It was built with 5 questions. 1 to 3 standard teachers in the Krishnagiri district were asked to respond to the questionnaires. Two categories of decision makers provided a combined 163 replies. The two groups of respondents are $\check{D} = \{\check{D}_1, \check{D}_2\}$. The respondent can choose any option from the ordinal list. $\tilde{O} = \{\tilde{o}_1, \tilde{o}_2, \tilde{o}_3, \tilde{o}_4, \tilde{o}_5\}$ indicated as $\tilde{o}_1$ = Very Satisfied, $\tilde{o}_2$ = Satisfied, $\tilde{o}_3$ = Neutral, $\tilde{o}_4$ = Unsatisfied, $\tilde{o}_5$ = Very unsatisfied.

Step :2 NFN - Novel survey information representation in the form of Neutrosophic fuzzy

Step:2 (a) Neutrosophic Fuzzification

This stage presents a novel technique of configuring NFNs based on survey data answers. The questionnaire respondents' for Beneficiary $\left(Q_i\right)$ views for the decision maker $(\check{D}_j)$ are
conveyed by

$$\hat{N}_{ij}\left(\mathbf{T}_{\hat{N}_{ij}}, \mathbf{I}_{\hat{N}_{ij}}, \mathbf{F}_{\hat{N}_{ij}}\right) = \left(\frac{\mathbf{V}_{\hat{N}_{ij}}+\mathbf{S}_{\hat{N}_{ij}}}{\hat{H}_{\hat{N}_{ij}}}, \frac{\mathbf{U}_{\hat{N}_{ij}}}{\hat{H}_{\hat{N}_{ij}}}, \frac{\mathbf{R}_{\hat{N}_{ij}}+\mathbf{W}_{\hat{N}_{ij}}}{\hat{H}_{\hat{N}_{ij}}}\right) \quad (6)$$

where $\hat{H}_{\hat{N}_{ij}} = \mathbf{V}_{\hat{N}_{ij}} + \mathbf{S}_{\hat{N}_{ij}} + \mathbf{U}_{\hat{N}_{ij}} + \mathbf{R}_{\hat{N}_{ij}} + \mathbf{W}_{\hat{N}_{ij}}$ $0 \leq \mathbf{T}_{\hat{N}_{ij}} + \mathbf{I}_{\hat{N}_{ij}} + \mathbf{F}_{\hat{N}_{ij}} \leq 3$

Here, $\mathbf{T}_{\hat{N}_{ij}}$ is the function of truth-membership, $\mathbf{I}_{\hat{N}_{ij}}$ is function of ignorance membership and $\mathbf{F}_{\hat{N}_{ij}}$ is the function of false membership.

$\mathbf{V}_{\hat{N}_{ij}}$ - the amount of participants who rated the decision maker of j-th as Very Satisfied on the i-th questionnaire.

$\mathbf{S}_{\grave{\mathrm{N}}_{ij}}$ - the amount of participants who rated the decision maker of j-th as Satisfied on the i-th questionnaire

$\boldsymbol{U}_{\grave{\mathrm{N}}_{ij}}$ - the amount of participants who rated the decision maker of j-th as Neutral on the i-th questionnaire

$\mathbf{R}_{\grave{\mathrm{N}}_{ij}}$ - the amount of participants who rated the decision maker of j-th as Unsatisfied on the i-th questionnaire

$\mathbf{W}_{\grave{\mathrm{N}}_{ij}}$- the amount of participants who rated the decision maker as of j-th Very Unsatisfied on the i-th questionnaire

Step 2 (b) Numerical Example:

For example, second questions from decision maker 1, a novel configuration of Neutrosophic fuzzy is defined using survey data responses. Apply the responses in (6), we get,

$\grave{\mathrm{N}}_{21}\left(\mathbf{T}_{\grave{\mathrm{N}}_{21}}, \mathbf{I}_{\grave{\mathrm{N}}_{21}}, \mathbf{F}_{\grave{\mathrm{N}}_{21}}\right)$ = (0.8740, 0.1181, 0.0079).

Step 2 (c) Verification:

Utilizing the NFs value $\grave{\mathrm{N}}_{21}\left(\mathbf{T}_{\grave{\mathrm{N}}_{21}}, \mathbf{I}_{\grave{\mathrm{N}}_{21}}, \mathbf{F}_{\grave{\mathrm{N}}_{21}}\right)$ = (0.8740, 0.1181, 0.0079), in accordance with (6), validate the aforementioned condition.

Condition: $0 \leq \mathbf{T}_{\grave{\mathrm{N}}_{ij}} + \mathbf{I}_{\grave{\mathrm{N}}_{ij}} + \mathbf{F}_{\grave{\mathrm{N}}_{ij}} \leq 3$

$0 \leq \mathbf{T}_{\grave{\mathrm{N}}_{21}} + \mathbf{I}_{\grave{\mathrm{N}}_{21}} + \mathbf{F}_{\grave{\mathrm{N}}_{21}} = 1.0000 \leq 3$

It meets condition.

Step :3 Neutrosophic Fuzzy Decision Matrix (NFDM)

The data respondent was transformed into a Neutrosophic Fuzzy Decision Matrix (NFDM). There are five questions and two decision makers. It was decided as follows:

$$R = \begin{array}{c} \\ Q_1 \\ Q_2 \\ \vdots \end{array} \begin{array}{c} \check{\mathrm{D}}_1 \qquad\qquad \check{\mathrm{D}}_2 \\ \begin{pmatrix} \left(\mathbf{T}_{\grave{\mathrm{N}}_{11}}, \mathbf{I}_{\grave{\mathrm{N}}_{11}}, \mathbf{F}_{\grave{\mathrm{N}}_{11}}\right) & \left(\mathbf{T}_{\grave{\mathrm{N}}_{12}}, \mathbf{I}_{\grave{\mathrm{N}}_{12}}, \mathbf{F}_{\grave{\mathrm{N}}_{12}}\right) \\ \left(\mathbf{T}_{\grave{\mathrm{N}}_{21}}, \mathbf{I}_{\grave{\mathrm{N}}_{21}}, \mathbf{F}_{\grave{\mathrm{N}}_{21}}\right) & \left(\mathbf{T}_{\grave{\mathrm{N}}_{22}}, \mathbf{I}_{\grave{\mathrm{N}}_{22}}, \mathbf{F}_{\grave{\mathrm{N}}_{22}}\right) \\ \vdots & \ddots \end{pmatrix} \end{array}$$

$$Q_{\S} \quad \left(T_{\dot{N}_{51}}, I_{\dot{N}_{51}}, F_{\dot{N}_{51}}\right) \quad \left(T_{\dot{N}_{52}}, I_{\dot{N}_{52}}, F_{\dot{N}_{52}}\right) \tag{7}$$

The Neutrosophic fuzzy decision matrix was produced after converting a crisp response to Neutrosophic fuzzy. Table 1 demonstrates this.

Step :4 Calculating Neutrosophic Weighted Arithmetic Average Operator

Because the survey questions had the same importance in the evaluation, we believed that the choice makers' weights were identical. In this study, w_1=0.5 and $w_2 = 0.5$. NWAAO is calculated using (4), and Table 1 displays the NWAAO consolidation result.

Step :5 Questionnaire NWAAO Score Value & Rank Computation

The average operator score value was obtained using (5) Neutrosophic Weighted Arithmetic and is shown in table 1 below.

Table: 1 Displays the NWAAO Score & Rank

S.No.	Beneficiary	Survey questionnaire response rate (DM1)					Survey questionnaire response rate (DM2)					Neutrosophic Fuzzy Decision Matrix DM1 (PFDM)			Neutrosophic Fuzzy Decision Matrix DM2 (PFDM)			NWAAO			NWAAO Score	NWAAOS Rank
		$V_{\dot{N}_{11}}$	$S_{\dot{N}_{11}}$	$U_{\dot{N}_{11}}$	$R_{\dot{N}_{11}}$	$W_{\dot{N}_{11}}$	$V_{\dot{N}_{12}}$	$S_{\dot{N}_{12}}$	$U_{\dot{N}_{12}}$	$R_{\dot{N}_{12}}$	$W_{\dot{N}_{12}}$	$T_{\dot{N}_{11}}$	$I_{\dot{N}_{11}}$	$F_{\dot{N}_{11}}$	$T_{\dot{N}_{12}}$	$I_{\dot{N}_{12}}$	$F_{\dot{N}_{12}}$	$T_{\dot{N}}(x)$	$I_{\dot{N}}(x)$	$F_{\dot{N}}(x)$	S	R
1	CWSN Students	35	57	28	7	0	18	10	7	1	0	0.7244	0.2205	0.0551	0.7778	0.1944	0.0278	0.0036	0.9105	0.4014	0.2306	5
2	Late Bloomers	57	54	15	1	0	17	18	1	0	0	0.8740	0.1181	0.0079	0.9722	0.0278	0.0000	0.4784	0.5103	0.0887	0.6264	1
3	Fast Bloomers	87	28	9	3	0	23	10	2	1	0	0.9055	0.0709	0.0236	0.9167	0.0556	0.0278	0.4039	0.5019	0.3204	0.5272	2
4	Minority Language Students	37	70	16	4	0	16	15	5	0	0	0.8425	0.1260	0.0315	0.8611	0.1389	0.0000	0.2305	0.7276	0.1775	0.4418	3
5	Dropout Students	33	53	32	5	4	18	13	3	1	1	0.6772	0.2520	0.0709	0.8611	0.0833	0.0556	0.0591	0.7906	0.5019	0.2555	4

Table 1 displays the NWAAO score and rank for EE Beneficiaries. Every recipient has a score between 0.2 and 0.7. It represents a score-based ranking as $Q_2 > Q_3 > Q_4 >$

$Q_5 > Q_1$. Late Bloomer pupils received first level benefit from EE based on rank and score value.

4. Results and Discussion

4.1 New MATLAB Code for Netrosophic Fuzzification

The fresh code for MATLAB was created from scratch for expressing survey data as Neutrosophic fuzzy numbers and to check the specifications of the Neutrosophic fuzzy number. The code and outcome is displayed below.

```
%clearance
clc;
clear all;
close all;

%Enter information from survey responses for Q2_DM1
V21=input('enter V21=');
S21=input('enter S21=');
U21=input('enter U21=');
R21=input('enter R21=');
W21=input('enter W21=');

%New Representation of survey data in the form of Neutrosophic fuzzy values (DM1)
T21=((V21+S21)/(V21+S21+U21+R21+W21));
I21=((U21)/(V21+S21+U21+R21+W21));
F21=((R21+W21)/(V21+S21+U21+R21+W21));
NF_21=[T21,I21,F21];

%New Representation of survey data in the form of Neutrosophic fuzzy values(DM1)
disp('Output')
disp('.....')
disp('Neutrosophic fuzzy number from survey data frequency for DM1')
NF_21=[T21,I21,F21]

%Verification condition 1 DM1:
condition1 = T21+I21+F21;
if condition1<=3
```

```
disp('Condition1: T21+I21+F21<=3 Satisfied. So, NF_21 is Neutrosophic fuzzy number.')
else
disp('Condition1: T21+I21+F21>3 Fails')
end
```

OUTPUT

```
enter V21=
57
enter S21=
54
enter U21=
15
enter R21=
1
enter W21=
0

Output
......
Neutrosophic fuzzy number from survey data frequency for DM1

NF_21 =

   0.8740    0.1181    0.0079

Condition1: T21+I21+F21<=3 Satisfied. So, NF_21 is Neutrosophic fuzzy number.
```

4.2 NWAAO based on the score and rank:

This is also an important aspect of students' successful learning techniques. Figure 2 and Table 1 demonstrate that late bloomers benefited the most from EE. Many late bloomers prefer to learn via EE. Fast bloomers benefited in second place. Minority Language pupils were awarded third place. Dropout students were the fourth beneficiaries. CWSN students are the sixth recipient. According to the data, this conclusion implies that all types of pupils benefited from EE. Every learning strategy was created with a child's whole growth in mind.

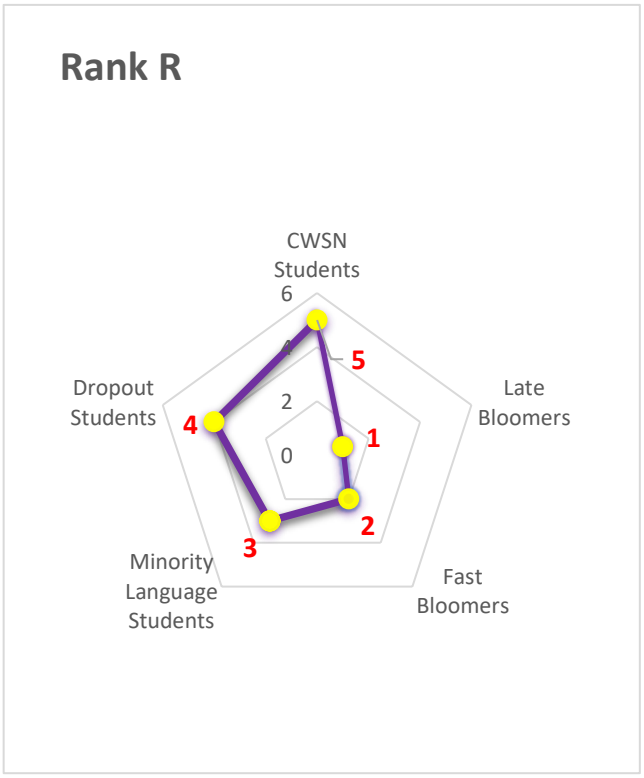

Figure:2 NWAAO based on the score and rank

4.3 Score comparison between NWAAOS and PWAAOS using graphs

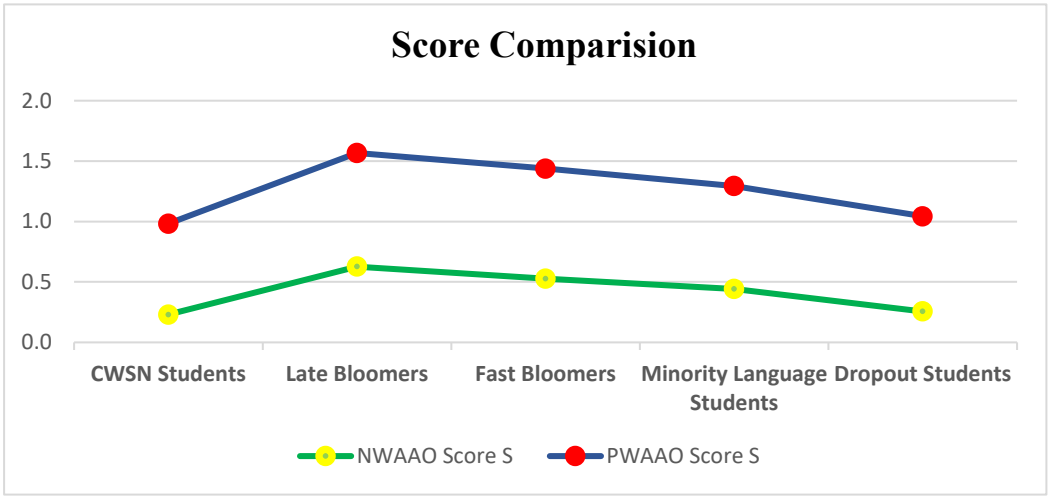

Figure: 3 Score comparison NWAAOS and PWAAOS

PWAAO score values are calculated by Kavitha (4) in Pythagorean Fuzzy background. In the graph, the score value is compared to NWAAOS and PWAAOS. The NWAAOS and

PWAAOS score values for each Beneficiary are clearly distinct. It demonstrates that the rank specified in NWAAOS and PWAAOS will be the same in all comparisons to the score rank. Figure 3 depicts the rank as follows:

NWAAOS Score Rank is $Q_2 > Q_3 > Q_4 > Q_5 > Q_1$.

PWAAOS Score Rank is $Q_2 > Q_3 > Q_4 > Q_5 > Q_1$.

5. Conclusion:

The article covers Neutrosophic fuzzification, or how to use a novel formula to transform survey data into Neutrosophic fuzzy. New MATLAB code is also used to validate it. We introduced the Neutrosophic Weighted Arithmetic Average Operator Score (NWAAOS) approach for evaluating EE Beneficiaries using survey information in this study. For starters, the proposed technique does not require raw data and accounts for ambiguity in respondents' viewpoints. This enables the phenomenon to be assessed using aggregated secondary data by converting these data into Neutrosophic fuzzy values. The proposed approach for translating aggregate secondary data into Neutrosophic fuzzy values does not contradict the assumptions regarding the measurement level of ordinal scales, as well as the allowed relationships and value transformations.

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