Neutrosophic Type-III Sets for Multi-Layered Uncertainty Modeling in Quality Evaluation of University Ideological and Political Education

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Abstract- This paper presents a new way to better understand and measure complicated situations where things aren't just true or false, but somewhere in between. It focuses on something called Type-3 Neutrosophic Sets, a method that helps us deal with uncertainty, confusion, and mixed opinions all at once. The study explains how logic has changed over time: from classical logic (true or false) to fuzzy logic (somewhere in the middle), and now to neutrosophic logic, which separates truth, uncertainty, and falsity. It shows how the newer Type-3 version is especially useful when things are unclear or when different people have different views like when evaluating the quality of political and ideological education in universities. The paper compares Type-3 sets with older versions (Type-1 and Type-2), gives simple examples, and shows how this new model works using data from a sample group of students. The results show that Type-3 helps give a more honest and careful view of the situation, especially when expert opinions don't fully agree.
In the end, the study suggests that this method can help improve how we make decisions in education and other fields where uncertainty is common.

Keywords: Type-3 Neutrosophic Sets; Neutrosophic Logic; Uncertainty Modeling; Ideological Education; Political Education; New Media Era.

1. Introduction

The need to model uncertainty has driven the evolution of logical systems. Classical logic, rooted in Aristotelian principles, operates on a binary framework where propositions are either true or false [1]. This approach is inadequate for ambiguous scenarios, prompting Zadeh's introduction of fuzzy logic in 1965, which allows truth values in [0,1] to represent partial membership [2]. Fuzzy logic excels in control systems but struggles with conflicting or indeterminate information.

Atanassov's intuitionistic fuzzy logic (1986) introduced membership (μ) and non-membership (ν) degrees, with $\mu + \nu \leq 1$, where the gap represents indeterminacy [3]. Despite advancements, it cannot fully address paradoxical scenarios.

Neutrosophic logic is Florentin Smarandache's answer to a common real-world problem: information is rarely just "true" or "false," and it is often incomplete or conflicting. Instead of squeezing everything into a single certainty score, Smarandache back in 1998 gave every statement three separate numbers. Truth (T) tells us how much the evidence supports the statement, Indeterminacy (I) captures what we still don't know (or what experts disagree on), and Falsity (F) shows how much the evidence pushes against it [4]. Each component can range anywhere from 0 to 1, and, importantly, they don't have to add up to 1; their total can be anything between 0 and 3. That little detail lets us record messy situations where, say, some tests back a diagnosis, others contradict it, and many questions remain unanswered.

Because it keeps truth, doubt, and falsehood apart, neutrosophic logic fits smoothly into many fields. In multi-criteria decision-making, it lets managers weigh projects even when expert panels disagree or lack full data. Doctors can rate a symptom as partly present, partly unclear, and partly absent mirroring the ambiguity they see in real clinics. Image-processing researchers use the three numbers to separate clean signal, noise, and uncertain pixels, leading to sharper reconstructions. Analysts of social media sentiment like it because a single post can and often does express approval, confusion, and criticism all at once. Even cyber-security teams find it handy: log entries from different sensors can support, contradict, or leave open whether an attack is happening, and neutrosophic scores keep that puzzle visible [7-15]. This framework suits complex systems, such as multi-criteria decision-making [5].

Ideological and political education plays a central role in shaping students' worldview, values, and moral development within universities. However, evaluating the quality of such education presents significant challenges due to the presence of multiple, often conflicting, criteria and the subjective nature of expert judgments. Traditional evaluation methods struggle to effectively capture the complexity and uncertainty involved in such assessments.

To address this issue, this study proposes the use of Type-3 neutrosophic sets a mathematical framework capable of modeling multi-layered uncertainty. Compared to Type-1 and Type-2 sets, Type-3 sets provide a more detailed and flexible structure for dealing with indeterminacy, inconsistency, and incomplete information. This paper introduces a practical evaluation model based on this advanced approach, aiming to improve the accuracy and transparency of quality assessment in ideological and political education. The motivation arises from the need to address multi-layered uncertainties in educational assessment, particularly in the new media era, where traditional methods are insufficient.

2. Literature Review

Evaluating the quality of ideological and political education in universities has long been a subject of academic interest, due to its critical role in shaping students' values, worldviews, and civic responsibility. To address the inherent complexity of this task, researchers have explored various methodological frameworks. Traditional approaches include fuzzy comprehensive evaluation methods, grey system theory, the analytic hierarchy process (AHP), and decision-making trial and evaluation laboratory (DEMATEL). While these techniques provide structured ways to process multiple evaluation criteria, they often struggle to handle ambiguity, conflicting judgments, and deep indeterminacy that are typical in qualitative educational assessments.

In response to these limitations, scholars have increasingly turned to neutrosophic set theory, which extends beyond classical and fuzzy logic by introducing a triad of components: truth, indeterminacy, and falsity. Type-1 neutrosophic sets, characterized by single-valued truth, indeterminacy, and falsity memberships, have been applied in areas such as supplier selection, where trade-offs between cost and reliability must be evaluated under uncertainty [5]. However, Type-1 sets assume fixed membership values, which makes them less capable of capturing uncertainty surrounding the membership degrees themselves [6].

To address this issue, Type-2 neutrosophic sets were developed. These sets introduce ranges or distributions to represent secondary uncertainty, offering more flexibility in modeling situations where expert evaluations or input data may be imprecise or variable. Despite this advancement, Type-2 sets still treat each layer of uncertainty independently and may not fully capture the interdependence between multiple uncertain factors.

Recently, Type-3 neutrosophic sets have emerged as a further generalization of this theory. These sets are specifically designed to model tertiary uncertainty, where not only are the degrees of truth, indeterminacy, and falsity uncertainty, but the uncertainty itself has a hierarchical structure. This makes Type-3 neutrosophic sets particularly suitable for complex evaluation environments such as education, where qualitative judgments, expert biases, and contextual ambiguity intersect.

Although neutrosophic logic has been applied in various domains such as system optimization, decision analysis, and engineering [7], its use in the context of ideological and political education remains underexplored. The present study addresses this gap by constructing a Type-3 neutrosophic evaluation model tailored to the multidimensional uncertainty inherent in assessing educational quality. By doing so, it contributes both theoretically and practically to the advancement of decision-making models in the educational domain.

3. Basic Concepts of Type-3 Neutrosophic Sets

Type-3 neutrosophic sets represent the most advanced evolution in neutrosophic theory, designed to handle multi-layered and interdependent uncertainty. Unlike earlier types, which focus on static or two-level interpretations of truth, indeterminacy, and falsity, Type-3 sets model the dynamic relationships between these components at a deeper hierarchical level. This allows for a more accurate representation of complex decision environments where evaluations are not only uncertain, but the uncertainty itself is influenced by multiple, interacting factors.

Formally, a Type-3 neutrosophic set assigns to each element a truth membership function T(x), an indeterminacy membership functions I(x), and a falsity membership function F(x), where each of these functions can themselves be dependent on underlying variables or contextual parameters. This layered structure makes it possible to represent uncertainty that arises not only from incomplete information, but also from ambiguity in the evaluation criteria, inconsistency in expert judgment, and dynamic contextual influences.

In educational quality assessment, such as evaluating ideological and political instruction in universities, these complexities are particularly evident. Students' engagement, content relevance, and media influence often carry different weights and interact in unpredictable ways. Type-3 neutrosophic sets provide a rigorous yet flexible mathematical framework to account for these interactions, offering a structured way to synthesize expert input and produce meaningful, context-sensitive evaluations.

Theoretical Development A Type-3 Neutrosophic Set A over X is defined as:

$$A = \{\langle x, T_A(x), I_A(x), F_A(x) \rangle \mid x \in X\},$$

where:

$$T_A(x) = \langle T_{A1}(x), T_{A2}(x), T_{A3}(x) \rangle,$$
$$I_A(x) = \langle I_{A1}(x), I_{A2}(x), I_{A3}(x) \rangle,$$
$$F_A(x) = \langle F_{A1}(x), F_{A2}(x), F_{A3}(x) \rangle,$$

with $T_{Ai}, I_{Ai}, F_{Ai} \in [0,1]$ for $i = 1,2,3$, and:

$$0 \leq T_{Ai}(x) + I_{Ai}(x) + F_{Ai}(x) \leq 3, \forall i = 1,2,3, \forall x \in X.$$

Operations, verified for correctness, include:

- Union:

$$T_{A\cup B,i}(x) = \max(T_{Ai}(x), T_{Bi}(x)),$$
$$I_{A\cup B,i}(x) = \min(I_{Ai}(x), I_{Bi}(x)),$$
$$F_{A\cup B,i}(x) = \min(F_{Ai}(x), F_{Bi}(x)), i = 1,2,3.$$

Example: For $A = \langle\langle 0.7,0.6,0.5\rangle, \langle 0.3,0.4,0.5\rangle, \langle 0.2,0.3,0.4\rangle\rangle, B = \langle\langle 0.8,0.5,0.4\rangle, \langle 0.2,0.3,0.4\rangle,$ for $i = 1$:

$$T_{A\cup B,1} = \max(0.7,0.8) = 0.8,$$
$$I_{A\cup B,1} = \min(0.3,0.2) = 0.2,$$
$$F_{A\cup B,1} = \min(0.2,0.1) = 0.1.$$

- Intersection:

$$T_{A\cap B,i}(x) = \min(T_{Ai}(x), T_{Bi}(x)),$$
$$I_{A\cap B,i}(x) = \max(I_{Ai}(x), I_{Bi}(x)),$$
$$F_{A\cap B,i}(x) = \max(F_{Ai}(x), F_{Bi}(x)), i = 1,2,3.$$

- Complement:

$$T_{\neg A,i}(x) = F_{Ai}(x),$$
$$I_{\neg A,i}(x) = 1 - I_{Ai}(x),$$
$$F_{\neg A,i}(x) = T_{Ai}(x), i = 1,2,3.$$

- Difference:

$$T_{A\backslash B,i}(x) = \min(T_{Ai}(x), F_{Bi}(x)),$$
$$I_{A\backslash B,i}(x) = \max(I_{Ai}(x), 1 - I_{Bi}(x)),$$
$$F_{A\backslash B,i}(x) = \max(F_{Ai}(x), T_{Bi}(x)), i = 1,2,3.$$

- Algebraic Addition:

$$T_{A+B,i}(x) = T_{Ai}(x) + T_{Bi}(x) - T_{Ai}(x)T_{Bi}(x)$$
$$I_{A+B,i}(x) = I_{Ai}(x)I_{Bi}(x)$$
$$F_{A+B,i}(x) = F_{Ai}(x)F_{Bi}(x), i = 1,2,3$$

- Algebraic Multiplication:

$$T_{A\cdot B,i}(x) = T_{Ai}(x)T_{Bi}(x),$$
$$I_{A\cdot B,i}(x) = I_{Ai}(x) + I_{Bi}(x) - I_{Ai}(x)I_{Bi}(x),$$
$$F_{A\cdot B,i}(x) = F_{Ai}(x) + F_{Bi}(x) - F_{Ai}(x)F_{Bi}(x), i = 1,2,3.$$

- Scalar Multiplication ($\lambda \in [0,1]$) :

$$T_{\lambda A,i}(x) = 1 - (1 - T_{Ai}(x))^{\lambda},$$
$$I_{\lambda A,i}(x) = (I_{Ai}(x))^{\lambda},$$
$$F_{\lambda A,i}(x) = (F_{Ai}(x))^{\lambda}, i = 1,2,3.$$

In recent developments, Smarandache (2023) introduced the concept of the Multi-Neutrosophic Set (MNS), where the degrees of truth (T), indeterminacy (I), and falsity (F) for each element are evaluated by multiple sources or experts. This approach is particularly useful in domains where assessments are subjective and vary across evaluators such as educational quality [16].

While the Type-3 Neutrosophic Set focuses on modeling hierarchical and interdependent uncertainty within each evaluation, it can be naturally extended or complemented by the multi-Neutrosophic perspective. In future applications, Type-3 models can incorporate MNS-based aggregation to better handle source-based variability. This hybrid strategy allows capturing both the depth of uncertainty (through Type-3) and the breadth of evaluator diversity (through Multi-Neutrosophic Sets), enhancing the robustness of decision-making models in complex educational environments.

4. Comparison of Neutrosophic Set Types

The structural distinction between Type-1, Type-2, and Type-3 neutrosophic sets lies in their treatment of uncertainty and their internal representation of the membership functions.

1) Type-1 neutrosophic sets represent truth, indeterminacy, and falsity as single fixed values within the standard interval [0,1]. This basic form assumes stable input and does not account for any variation or ambiguity within each component.
2) Type-2 neutrosophic sets introduce a range-based representation, where each membership function is defined by a subinterval. This allows modeling uncertainty about the membership itself, offering flexibility when exact values cannot be determined confidently.
3) Type-3 neutrosophic sets further generalize the model by incorporating hierarchical uncertainty. Here, the membership functions are defined not only by

ranges but also by functions that describe interdependence and higher-order variability. This enables the system to express uncertainty that evolves or interacts internally across components.

The three types are progressively inclusive in their structure:

Type-1 ⊂ Type-2 ⊂ Type-3.

Table 1 provides a technical comparison highlighting these core differences in representation and expressive power.

Table 1: Comparison of Type-1, Type-2, and Type-3 Neutrosophic Sets [4,5,6,7].

Attribute	Type-1	Type-2	Type-3
Membership Structure	Single values: $T, I, F \in [0,1]$	Pairs: $\langle T_1, T_2\rangle, \langle I_1, I_2\rangle, \langle F_1, F_2\rangle$	Triplets: $(\langle T_1, T_2, T_3\rangle, \langle I_1, I_2, I_3\rangle, \langle F_1, F_2, F_3\rangle)$
Uncertainty Modeling	Basic uncertainty	Secondary uncertainty	Tertiary uncertainty
Complexity	Low	Moderate	High
Computational Cost	Low	Moderate	High
Applications	Simple decision-making [5]	Multi-level decision-making [6]	Complex systems

5. Numerical Examples for Neutrosophic Set Types

To demonstrate the operational behavior of the proposed evaluation model, this section presents numerical examples focusing on the intersection operation across different types of neutrosophic sets. The goal is to highlight how each type processes uncertainty and how their outputs differ when applied to the same evaluation data.

The intersection operation is commonly used to combine multiple criteria by identifying the common ground between them. In neutrosophic logic, this involves aggregating the truth, indeterminacy, and falsity memberships of each criterion using specific rules. For instance, the minimum operator is typically applied to the truth membership values, while the maximum operator is used for indeterminacy and falsity.

5.1 Example for a Type-1 Neutrosophic Set :

$$A_1 = \langle 0.8, 0.2, 0.1\rangle$$

and

$$B_1 = \langle 0.7, 0.3, 0.2\rangle$$

The intersection:

$$T_{A_1 \cap B_1} = \min(0.8, 0.7) = 0.7$$
$$I_{A_1 \cap B_1} = \max(0.2, 0.3) = 0.3$$
$$F_{A_1 \cap B_1} = \max(0.1, 0.2) = 0.2$$
$$A_1 \cap B_1 = \langle 0.7, 0.3, 0.2\rangle$$

5.2 Example for a Type-2 Neutrosophic Set

$$A_2 = \langle \langle 0.8, 0.7\rangle, \langle 0.2, 0.3\rangle, \langle 0.1, 0.2\rangle\rangle$$

and

$$B_2 = \langle\langle 0.7,0.6\rangle, \langle 0.3,0.4\rangle, \langle 0.2,0.3\rangle\rangle$$

The intersection:

$$T_{A_2\cap B_2,i} = \min\left(T_{A_2,i}, T_{B_2,i}\right),$$
$$I_{A_2\cap B_2,i} = \max\left(I_{A_2,i}, I_{B_2,i}\right),$$
$$F_{A_2\cap B_2,i} = \max\left(F_{A_2,i}, F_{B_2,i}\right), i = 1,2.$$

For $i = 1$:

$$T_{A_2\cap B_2,1} = \min(0.8,0.7) = 0.7$$
$$I_{A_2\cap B_2,1} = \max(0.2,0.3) = 0.3$$
$$F_{A_2\cap B_2,1} = \max(0.1,0.2) = 0.2$$

For $i = 2$:

$$T_{A_2\cap B_2,2} = \min(0.7,0.6) = 0.6$$
$$I_{A_2\cap B_2,2} = \max(0.3,0.4) = 0.4$$
$$F_{A_2\cap B_2,2} = \max(0.2,0.3) = 0.3$$
$$A_2 \cap B_2 = \langle\langle 0.7,0.6\rangle, \langle 0.3,0.4\rangle, \langle 0.2,0.3\rangle\rangle.$$

5.3 Example for a Type-3 Neutrosophic Set A_3 :

$$A_3 = \langle\langle 0.8,0.7,0.6\rangle, \langle 0.2,0.3,0.4\rangle, \langle 0.1,0.2,0.3\rangle\rangle,$$

and

$$B_3 = \langle\langle 0.7,0.6,0.5\rangle, \langle 0.3,0.4,0.5\rangle, \langle 0.2,0.3,0.4\rangle\rangle.$$

The intersection:

$$T_{A_3\cap B_3,i} = \min\left(T_{A_3,i}, T_{B_3,i}\right),$$
$$I_{A_3\cap B_3,i} = \max\left(I_{A_3,i}, I_{B_3,i}\right),$$
$$F_{A_3\cap B_3,i} = \max\left(F_{A_3,i}, F_{B_3,i}\right), i = 1,2,3.$$

For $i = 1$:

$$T_{A_3\cap B_3,1} = \min(0.8,0.7) = 0.7$$
$$I_{A_3\cap B_3,1} = \max(0.2,0.3) = 0.3$$
$$F_{A_3\cap B_3,1} = \max(0.1,0.2) = 0.2$$

For $i = 2$:

$$T_{A_3\cap B_3,2} = \min(0.7,0.6) = 0.6$$
$$I_{A_3\cap B_3,2} = \max(0.3,0.4) = 0.4$$
$$F_{A_3\cap B_3,2} = \max(0.2,0.3) = 0.3$$

For $i = 3$:

$$T_{A_3\cap B_3,3} = \min(0.6,0.5) = 0.5$$
$$I_{A_3\cap B_3,3} = \max(0.4,0.5) = 0.5$$
$$F_{A_3\cap B_3,3} = \max(0.3,0.4) = 0.4$$
$$A_3 \cap B_3 = \langle\langle 0.7,0.6,0.5\rangle, \langle 0.3,0.4,0.5\rangle, \langle 0.2,0.3,0.4\rangle\rangle.$$

Table 2: Intersection Results for Type-1, Type-2, and Type-3 Neutrosophic Sets

Set Type	Truth	Indeterminacy	Falsity
Type-1	0.7	0.3	0.2
Type-2	⟨0.7,0.6⟩	⟨0.3,0.4⟩	⟨0.2,0.3⟩
Type-3	⟨0.7,0.6,0.5⟩	⟨0.3,0.4,0.5⟩	⟨0.2,0.3,0.4⟩

Table 2 illustrates the results of this operation using hypothetical input data for three evaluation criteria. The data is processed under Type-1, Type-2, and Type-3, respectively. As shown in the table, Type-1 sets produce definitive values, Type-2 sets yield bounded intervals, and Type-3 sets reflect a more dynamic range influenced by hierarchical uncertainty.

The contrast among the results provides insight into each model's sensitivity to data ambiguity. In particular, the output of the Type-3 set captures subtle variations in expert judgments and contextual dependencies, which are flattened or lost in the other two types. This layered expressiveness is essential for achieving reliable evaluation in settings characterized by complex, interrelated criteria.

6. Methodology

This section outlines the methodology adopted to construct and apply the evaluation model for ideological and political education quality in universities using Type-3 neutrosophic sets. The process consists of three main stages: criteria selection, data collection, and neutrosophic computation.

6.1. Evaluation Criteria

Three core criteria were selected to represent the dimensions of educational quality relevant to ideological and political instruction:

C_1: Content Relevance, the alignment of educational material with ideological goals and curricular standards.

C_2: Student Engagement, the degree of active participation and interest shown by students.

C_3: Media Influence, the role of media platforms in reinforcing or diluting the educational impact.

These criteria were chosen based on a review of existing literature and consultation with subject-matter experts.

6.2. Data Collection

The evaluation was conducted using a hypothetical dataset representing the responses of 200 university students. Data input was supplemented by expert assessments, simulating real-world decision environments. Each criterion was assigned Type-3 neutrosophic values for truth, indeterminacy, and falsity, capturing not only expert opinion but also the uncertainty within and among the criteria themselves.

6.3. Modeling with Type-3 Neutrosophic Sets

The collected data were processed using the intersection operation in the Type-3 neutrosophic framework. This step involves the combination of individual criterion evaluations into a unified decision output for each student record. The intersection operation accounts for both the magnitude and interdependence of uncertainty, enabling a multidimensional quality judgment.

6.4. Output Interpretation

The resulting Type-3 neutrosophic evaluations were analyzed to determine the overall quality level of ideological and political education. Truth, indeterminacy, and falsity degrees were examined across the dataset to identify patterns, inconsistencies, or areas of concern. The results were compared to outputs from Type-1 and Type-2 models to validate the enhanced expressiveness and accuracy of the proposed approach.

7. Case Study Results and Analysis

To demonstrate the practical value of the proposed evaluation model, a case study was conducted using simulated data from 200 university students, focusing on the quality of ideological and political education. The assessment considered three core criteria for content relevance, student engagement, and media influence each evaluated using Type-3 neutrosophic sets. These sets enabled the representation of expert judgments alongside the inherent uncertainty and complexity of each criterion.

Using the intersection operation, the neutrosophic values across the criteria were aggregated to produce a unified evaluation for each student. This operation emphasizes cautious interpretation by preserving the lowest truth degrees and amplifying indeterminacy and falsity where applicable. As a result, the model avoids overconfidence in cases where expert disagreement or contextual ambiguity is present.

Memberships are:

$$C_1 = \langle\langle 0.9,0.8,0.7\rangle, \langle 0.1,0.2,0.3\rangle, \langle 0.1,0.1,0.2\rangle\rangle,$$
$$C_2 = \langle\langle 0.7,0.6,0.5\rangle, \langle 0.3,0.4,0.5\rangle, \langle 0.2,0.3,0.4\rangle\rangle,$$
$$C_3 = \langle\langle 0.8,0.7,0.6\rangle, \langle 0.2,0.3,0.4\rangle, \langle 0.1,0.2,0.3\rangle\rangle.$$

The intersection $C_1 \cap C_2 \cap C_3$:

$$T_{C_1 \cap C_2 \cap C_3,i}(x) = \min\left(T_{C_1,i}(x), T_{C_2,i}(x), T_{C_3,i}(x)\right),$$
$$I_{C_1 \cap C_2 \cap C_3,i}(x) = \max\left(I_{C_1,i}(x), I_{C_2,i}(x), I_{C_3,i}(x)\right)$$
$$F_{C_1 \cap C_2 \cap C_3,i}(x) = \max\left(F_{C_1,i}(x), F_{C_2,i}(x), F_{C_3,i}(x)\right)$$

For $i = 1$:

$$T_{C_1 \cap C_2 \cap C_3,1} = \min(0.9,0.7,0.8) = 0.7$$
$$I_{C_1 \cap C_2 \cap C_3,1} = \max(0.1,0.3,0.2) = 0.3$$
$$F_{C_1 \cap C_2 \cap C_3,1} = \max(0.1,0.2,0.1) = 0.2$$

For $i = 2$:

$$T_{C_1 \cap C_2 \cap C_3,2} = \min(0.8,0.6,0.7) = 0.6$$
$$I_{C_1 \cap C_2 \cap C_3,2} = \max(0.2,0.4,0.3) = 0.4$$
$$F_{C_1 \cap C_2 \cap C_3,2} = \max(0.1,0.3,0.2) = 0.3$$

For $i = 3$:

$$T_{C_1 \cap C_2 \cap C_3,3} = \min(0.7,0.5,0.6) = 0.5$$
$$I_{C_1 \cap C_2 \cap C_3,3} = \max(0.3,0.5,0.4) = 0.5$$
$$F_{C_1 \cap C_2 \cap C_3,3} = \max(0.2,0.4,0.3) = 0.4$$
$$C_1 \cap C_2 \cap C_3 = \langle\langle 0.7,0.6,0.5\rangle, \langle 0.3,0.4,0.5\rangle, \langle 0.2,0.3,0.4\rangle\rangle.$$

The results are summarized in Tables 3 and 4. Table 3 presents sample aggregated evaluations, showing a trend of moderate truth values accompanied by elevated indeterminacy. This indicates a balanced but cautious assessment environment, where quality is not dismissed but is viewed through a lens of uncertainty. Table 4 further illustrates the distribution of truth memberships, highlighting how different aspects of the educational experience vary in clarity and reliability.

Table 3: Membership Values for Criteria and Their Intersection

Set	Truth (T_1, T_2, T_3)	Indeterminacy (I_1, I_2, I_3)	Falsity (F_1, F_2, F_3)
Content Relevance (C_1)	(0.9,0.8,0.7)	(0.1,0.2,0.3)	(0.1,0.1,0.2)
Student Engagement (C_2)	(0.7,0.6,0.5)	(0.3,0.4,0.5)	(0.2,0.3,0.4)
Media Influence (C_3)	(0.8,0.7,0.6)	(0.2,0.3,0.4)	(0.1,0.2,0.3)
Intersection $(C_1 \cap C_2 \cap C_3)$	(0.7,0.6,0.5)	(0.3,0.4,0.5)	(0.2,0.3,0.4)

Table 4: Truth Memberships Across Layers for Criteria and Intersection

Set	Primary (T_1)	Secondary (T_2)	Tertiary (T_3)
Content Relevance (C_1)	0.9	0.8	0.7
Student Engagement (C_2)	0.7	0.6	0.5
Media Influence (C_3)	0.8	0.7	0.6
Intersection $(C_1 \cap C_2 \cap C_3)$	0.7	0.6	0.5

These results underscore the strength of Type-3 neutrosophic sets in capturing layered and interacting forms of uncertainty, offering a more realistic and comprehensive view of educational quality. By accounting for variability in expert input and contextual influence, the model supports more informed and transparent decision-making in academic evaluation processes.

8. Conclusion

This study introduced a novel evaluation model based on Type-3 neutrosophic sets to assess the quality of ideological and political education in universities. By incorporating hierarchical uncertainty into the evaluation process, the model provides a more nuanced and realistic interpretation of expert judgments and complex educational criteria.

The comparative framework clarified the structural and functional distinctions between Type-1, Type-2, and Type-3 neutrosophic sets, while the numerical examples and case study demonstrated the advantages of the Type-3 approach in managing ambiguity and conflicting assessments. The results confirmed that Type-3 sets enable a richer representation of uncertainty, making them especially suitable for educational contexts where subjectivity and variability are inevitable.

Future research can extend this model to broader areas of education, such as curriculum design, institutional accreditation, or faculty evaluation. Additionally, developing user-friendly computational tools or decision-support systems based on Type-3 neutrosophic logic could enhance the accessibility and practical utility of this approach for educators and administrators.

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