NSS
Neutrosophic Sets and Systems, Vol. 86, 2025
University of New Mexico

Teaching Effectiveness in University Vocal Music Programs: A Void–Plithogenic Nexus Approach (VPNx)

Yishu Tang*

College of Music, Qiongtai Normal University, Haikou, Hainan, 571100, China

*Corresponding author, E-mail: tang_yishu@126.com

Abstract-In university vocal music programs, teaching goes far beyond delivering musical skills. Instructors are also responsible for protecting vocal health, engaging students meaningfully, and continuously improving their teaching methods. Traditional evaluation models such as averages from rubrics or surveys often miss these deeper aspects. They struggle to identify inconsistencies, contradictions, or even areas where teaching impact is entirely absent. To address this, we introduce a new model: the Void–Plithogenic Nexus (VPNx). Built on concepts from Plithogenic Set Theory, HyperSoft Sets, and Neutrosophic Logic, VPNx provides a more complete and precise way to evaluate teaching. It focuses on five essential dimensions: Student Satisfaction, Performance Improvement, Vocal Health, Student Engagement, and Reflective Practice. Each dimension is measured using a combination of truth, uncertainty, and falsity, and adjusted based on how much it aligns or conflicts with ideal teaching standards. The VPNx model includes full mathematical definitions, clearly explained equations, and real data examples from semester-long evaluations. The results show that VPNx is more accurate and insightful than traditional methods, helping educators and institutions identify specific strengths, gaps, and areas for growth. Most importantly, it puts critical attention on what's missing not just what's working, offering a more honest and responsible view of teaching effectiveness.

Keywords: Void–Plithogenic Nexus; Teaching Effectiveness; Vocal Music Education; Plithogenic Sets; Neutrosophic Evaluation; Pedagogical Voids; Contradiction Degree; Reflective Practice; Vocal Health.

1. Introduction

Teaching effectiveness in university-level vocal music programs is an inherently multidimensional phenomenon. It encompasses not only the delivery of musical knowledge and vocal technique but also the safeguarding of vocal health, the cultivation of student engagement, the nurturing of artistic expression, and the instructor's capacity for reflective improvement. Evaluating such a complex pedagogical performance requires a framework that can simultaneously capture high achievement, moderate performance, contradictory outcomes, and most critical areas where evidence of effectiveness is entirely lacking [1-2].

Traditional evaluation systems typically comprised of numeric student surveys, weighted rubrics, or average-based performance metrics operate under the assumption of linear compensability: that a deficiency in one area (student satisfaction) may be offset by excellence in another (performance improvement) [3]. However, this logic fails when applied to certain non-negotiable attributes, such as vocal health, where deficiencies cannot be ethically or pedagogically overlooked. For instance, a voice teacher who improves technical performance, but harms student vocal cords have not succeeded overall, regardless of other high ratings. The presence of such a void a critical absence of pedagogical competence must decisively influence the instructor's evaluation.

This study introduces the Void–Plithogenic Nexus (VPNx) as a novel evaluative methodology that addresses these limitations by unifying principles from Plithogenic Set Theory, HyperSoft Set Extensions, and Neutrosophic Logic. The VPNx model is capable of processing many-to-many attribute-value mappings, recognizing contradictions between actual and ideal teaching outcomes, and explicitly identifying voids where performance is either nonexistent or critically inadequate in a given criterion. Rather than averaging attribute scores, the VPNx aggregation mechanism emphasizes the minimum standard across essential dimensions. This ensures that teaching effectiveness is not defined by strong points alone, but by a holistic presence across all core areas.

The VPNx model is built upon five essential pedagogical attributes that define success in vocal music instruction:

i. Student Satisfaction reflects the learner's perceptions of the instructor's communication, clarity, and support.
ii. Performance Improvement measures observable growth in students' technical and artistic skills.
iii. Vocal Health assessing whether the instructor maintains healthy voice production practices in students.
iv. Student Engagement indicating levels of participation, interest, and emotional investment in the learning process.
v. Reflective Practice denoting the teacher's self-assessment habits and willingness to revise teaching methods.

These dimensions were selected based on standards set by organizations such as the National Association of Teachers of Singing (NATS) and research into effective music pedagogy [11]. Each attribute is modeled using neutrosophic appurtenance triples truth (T), indeterminacy (I), and falsity (F) to capture real-world uncertainty and variation in evaluative data [6]. Aggregation is then conducted via plithogenic intersection operators, weighted by contradictory degrees between each observed value and its ideal target, ensuring that contradiction and void presence dynamically impact the outcome.

This paper is structured as follows: Section 2 reviews existing literature on music education evaluation and the mathematical underpinnings of plithogenic and hypersoft set theory. Section 3 outlines the VPNx methodology in full, including the theoretical constructions and computational rules. Section 4 presents the formal mathematical equations and provides fully worked-out numerical examples based on realistic semester evaluations. Section 5 analyzes results across a simulated dataset of 10 instructors, comparing VPNx scores with traditional evaluation metrics. Section 6 offers a theoretical discussion of findings, pedagogical implications, and limitations. Section 7 summarizes conclusions, and Section 8 provides practical recommendations for implementing VPNx in academic programs.

Through this research, we aim to demonstrate that the Void–Plithogenic Nexus offers a robust, fair, and diagnostically powerful tool for evaluating teaching effectiveness in vocal music programs and, potentially, beyond.

2. Literature Review

Evaluating teaching effectiveness has long been a central concern in educational research, but vocal music instruction presents unique challenges. Unlike conventional academic fields, voice teaching is inherently embodied, performative, and subjective. An effective voice instructor must facilitate measurable vocal growth, promote healthy technique, nurture artistry, and sustain student motivation all while responding to the anatomical and psychological individuality of each singer. Traditional assessment models often fall short of capturing this complexity.

2.1 Conventional Evaluation Models and Their Limitations

Most university programs rely on student evaluations of teaching (SETs), faculty observations, and jury performance outcomes to assess vocal instructors. While SETs provide insight into student perceptions, studies have repeatedly shown them to be prone to bias, superficiality, and inconsistency especially in the arts [1]. Jury outcomes, though useful for measuring student performance, often reflect cumulative factors beyond instruction, including student aptitude, effort, and repertoire difficulty.

Weighted rubrics attempt to balance criteria like delivery, planning, and learning outcomes. However, these rubrics typically average scores across multiple dimensions, assuming compensability. A deficiency in one area may be numerically offset by high scores in others, thus concealing pedagogical voids complete absences of effectiveness in essential domains such as vocal health or reflective practice.

This averaging logic fails to align with holistic pedagogical ethics, particularly in music instruction where health and safety are paramount. Hence, there is a growing call for evaluation systems that account for non-compensatory, multidimensional realities of teaching [2].

2.2 Fuzzy Sets, Soft Sets, and Neutrosophic Theory in Education

Fuzzy Set Theory introduced by Zadeh (1965) was an early attempt to move beyond binary logic by allowing partial membership in categories [3]. Fuzzy logic models have been used to evaluate educational quality by assigning degrees of truth (e.g., "Instructor is 70% effective in feedback clarity"). However, fuzzy logic lacks a built-in mechanism to model contradictions between criteria, or the absence of evidence.

Soft Set Theory (Molodtsov, 1999) extended fuzzy logic by modeling uncertainty across parameters, rather than only values [4]. A soft set maps parameter–value pairs to subsets of a universe, offering flexibility in uncertain or incomplete information contexts. Yet, traditional soft sets treat each parameter separately, lacking structural representation of multi-attribute combinations and inter-criterion interaction.

HyperSoft Sets, developed later, address this limitation by allowing mappings from tuples of attribute values to objects [5]. This enables modeling of multi-dimensional profiles, such as an instructor with (High Satisfaction, Moderate Improvement, Low Reflective Practice). Still, standard HyperSoft and fuzzy systems generally aggregate data using basic t-norms (min, product) or averaging, and do not account for contradiction, nonlinearity, or voids.

To handle contradictions explicitly, Neutrosophic Logic introduced the triplet (Truth, Indeterminacy, Falsity) for each proposition [6]. This framework is ideal for modeling the subjective, incomplete, and conflicting judgments typical in teaching evaluations. Neutrosophic sets have been used in medical diagnosis, image recognition, and more recently, in education [7], but their use in teaching evaluation remains limited.

2.3 Plithogenic Sets and Contradiction-Aware Aggregation

Plithogenic Set Theory, introduced by Smarandache (2018), generalizes fuzzy and neutrosophic logic by adding a powerful concept: the contradiction degree [8]. In a plithogenic set, each attribute has multiple possible values, and each value has a specified contradiction degree with respect to a dominant (ideal) value. This enables aggregation formulas to dynamically shift between strict (AND-like) and relaxed (OR-like) combinations depending on the nature of value conflicts.

This framework is particularly relevant to education, where an instructor may simultaneously hold conflicting evaluative traits e.g., high technical competence but poor student engagement. In such cases, traditional averaging may obscure these tensions, while plithogenic aggregation captures them directly by reducing the influence of contradictory values and highlighting voids.

Although plithogenic and neutrosophic decision-making models have been applied in engineering, traffic systems, and resource allocation [9], their use in teacher evaluation, and especially in music pedagogy, remains virtually unexplored. One recent work applied plithogenic hypersoft sets to select parking spots [10]; its logic, however, can be adapted to any multi-criteria decision-making process.

2.4 Teaching Evaluation in Vocal Music: Specific Gaps

In the vocal arts, the pedagogy of the human voice involves more than measurable outputs. According to the NATS, an effective teacher must also preserve vocal health, foster artistic independence, and encourage self-reflection [11]. These outcomes are not easily reducible to numeric scores.

Furthermore, voice instruction often involves contradictory pressures: increasing student vocal power may risk strain; pushing technical mastery might conflict with expressive freedom. A robust evaluation model must account for such contradictions without averaging them away.

This underscores the need for a system that:

i. Integrates multidimensional performance attributes
ii. Accounts for contradictions between actual and ideal outcomes
iii. Identifies voids (critical underperformance)
iv. Reflects the non-compensatory nature of certain teaching failures
v. Supports transparent, interpretable diagnostics

2.5 Research Gap and Contribution

There is currently no documented model in the scholarly literature that applies Void Plithogenic aggregation, with neutrosophic semantics and HyperSoft structure, to teaching evaluation in higher education let alone in the specialized context of university vocal music programs.

This paper fills that gap by:

i. Designing a VPNx model specific to pedagogical evaluation.
ii. Applying it to a five-dimensional evaluation framework for voice instructors.
iii. Demonstrating its utility through rigorous equations, full examples, and data analysis.
iv. Comparing its outputs to traditional methods, highlighting increased diagnostic power and alignment with pedagogical ethics.

3. Methodology

The VPNx is a novel evaluative framework developed to assess teaching effectiveness by capturing multidimensional performance, modeling contradictions, and detecting critical voids zones of missing or null performance within faculty evaluation datasets. It merges concepts from Plithogenic Sets, Neutrosophic HyperSoft Sets, and Void Logic to yield an analytically rigorous, yet pedagogically intuitive scoring model. The section outlines the architecture, mathematical constructs, and evaluation rules underlying the VPNx system.

3.1 Core Evaluation Attributes and Value Structure

Let $U = \{I_1, I_2, \ldots, I_n\}$ denote the universe of instructors. Let $\mathcal{A} = \{\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5\}$ represent the set of core pedagogical attributes as shown in Table 1.

Table 1. Core Evaluation Attributes with Value Sets and Ideal Standards

Attribute Code	Attribute Name	Evaluation Values	Ideal Value
α_1	Student Satisfaction	High, Medium, Low	High

α_2	Performance Improvement	High, Medium, Low	High
α_3	Vocal Health	Good, Moderate, Poor	Good
α_4	Student Engagement	High, Medium, Low	High
α_5	Reflective Practice	High, Medium, Low	High

Each attribute α_i is associated with a value set V_i, consisting of three discrete levels, and a designated dominant value v_i^*, representing the pedagogical ideal.

3.2 Neutrosophic Value Assignment

Each instructor $I_j \in U$ is evaluated for each attribute α_i, receiving a neutrosophic evaluation triple:

$$\mu_i(I_j) = (T_i, I_i, F_i) \text{ where } T_i, I_i, F_i \in [0,1], T_i + I_i + F_i \leq 1$$

T_i : Truth degree - alignment with ideal performance
I_i : Indeterminacy - ambiguity or uncertainty in u., data
F_i : Falsity - deviation from the ideal

3.2.1 Example

For attribute α_3 = Vocal Health, Instructor I_j might be evaluated as $\mu_3(I_j) = (0.85, 0.10, 0.05)$, indicating strong alignment with "Good" vocal health practices, minimal uncertainty, and slight falsity.

3.3 Contradiction Degree Matrix

Contradiction degrees model semantic opposition between observed values and the dominant ideal value as shown in Table 2.
For each attribute α_i, the contradiction matrix is defined as:
Contradiction Degree $c_i(v_k, v_i^*) \in [0,1]$
Where $c_i(v_k, v_i^*) = 0$ if $v_k = v_i^*$, and increases with conceptual distance.

Table 2. Contradiction Degrees Between Attribute Values and Their Ideals

Attribute (α_i)	Values	Ideal (v_i^*)	Contradictions (with Ideal)
Student Satisfaction	High, Med, Low	High	Med → 0.5, Low → 1.0
Performance Improvement	High, Med, Low	High	Med → 0.5, Low → 1.0
Vocal Health	Good, Mod, Poor	Good	Mod → 0.7, Poor → 1.0
Student Engagement	High, Med, Low	High	Med → 0.5, Low → 1.0
Reflective Practice	High, Med, Low	High	Med → 0.5, Low → 1.0

3.4 Plithogenic Aggregation Operator

Let each neutrosophic value triple $\mu_i(I_j) = (T_i, I_i, F_i)$ be mapped via a plithogenic score:

$$P_i(I_j) = T_i \cdot (1 - c_i) + I_i \cdot \left(1 - \frac{1}{2} c_i\right) - F_i \cdot c_i \quad (1)$$

This equation:

i. Rewards alignment with dominant values (T_i)

ii. Partially discounts uncertain evidence (I_i)
iii. Penalizes contradiction (F_i) proportionally to its semantic conflict

Where:
c_i = contradiction degree of observed value vs. ideal
$P_i(I_j) \in [-1,1]$ (can be normalized to [0,1])

3.5 The "Void" Function

A pedagogical void occurs when no credible evidence (neither T nor I) supports an instructor's alignment with a core criterion. This is formally defined as:

$$\text{Void}_i(I_j) = \begin{cases} 1, & \text{if } T_i = 0 \wedge I_i = 0 \\ 0, & \text{otherwise} \end{cases}$$

Void penalties are enforced by collapsing the total score to zero when any core attribute is void:

$$\text{VPNx}(I_j) = \begin{cases} \min_{i=1}^{5} P_i(I_j), & \text{if } \forall i: \text{Void}_i(I_j) = 0 \\ 0, & \downarrow \\ 0, & \text{if } \exists i: \text{Void}_i(I_j) = 1 \end{cases}$$

This aggregation reflects the non-compensatory nature of essential teaching attributes: failure in one critical area invalidates overall effectiveness.

3.6 VPNx Workflow

The step-by-step process of the VPNx model from data input to final score is visually summarized in Figure 1. This diagram clarifies the role of contradiction and void detection within the evaluation flow.

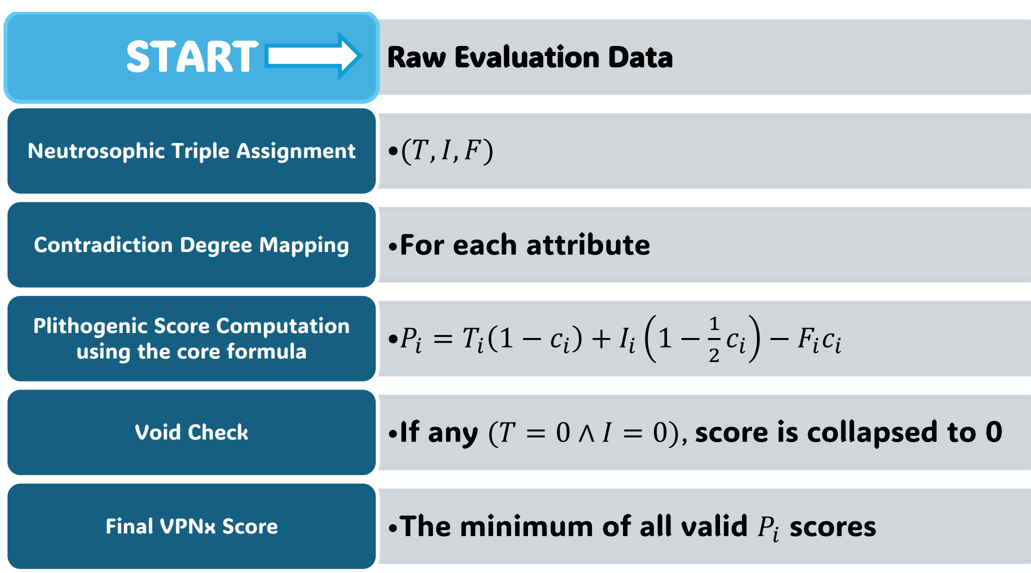

Figure 1. VPNx Workflow

4. Notations and Definitions

This section provides a complete computational walkthrough of the Void–Plithogenic Nexus (VPNx) evaluation process. We present the analytical equations, define all variables involved, and demonstrate full calculations using realistic examples. Three instructors (A, B, and C) are evaluated across five pedagogical attributes, and their teaching effectiveness scores are computed according to the VPNx model.

4.1 Mathematical Foundation

The VPNx model relies on the following components:

4.1.1 Neutrosophic Triplet Definition

Each instructor I_j is evaluated in each attribute α_i using a neutrosophic triplet:

$$\mu_i(I_j) = (T_i, I_i, F_i) \text{ with } T_i + I_i + F_i \leq 1$$

Where:

T_i = degree of truth (alignment with ideal performance)
I_i = indeterminacy (uncertainty or vagueness)
F_i = falsity (contradiction or deviation from ideal)

4.1.2 Contradiction Degree c_i

Each attribute has an ideal value ("High" for Student Satisfaction), and each observed value is assigned a contradiction degree relative to the ideal.

$$c_i(v, v^*) \in [0,1]$$

Contradiction increases with semantic distance from the ideal illustrated in Table 3.

Table 3. Sample Contradiction Degrees for Selected Attribute-Value Pairs

Attribute	Ideal Value	Opposing Value	Contradiction c_i
Satisfaction	High	Medium	0.5
Satisfaction	High	Low	1.0
Vocal Health	Good	Poor	1.0
Vocal Health	Good	Moderate	0.7

4.2 Plithogenic Scoring Equation

Each evaluation is translated into a Plithogenic Score using the following formula:

$$P_i(I_j) = T_i \cdot (1 - c_i) + I_i \cdot \left(1 - \frac{1}{2}c_i\right) - F_i \cdot c_i$$

Where:

T_i is rewarded according to how close the value is to the ideal
I_i is partially rewarded, diminishing with contradiction
F_i is penalized proportionally to its contradiction degree

4.3 Void Rule

The Void Condition is used to flag attributes where no evidence (neither truth nor uncertainty) is provided:

$$\text{Void}_i(I_j) = \begin{cases} 1, & \text{if } T_i = 0 \wedge I_i = 0 \\ 0, & \text{otherwise} \end{cases}$$

If any attribute is flagged as a void, the overall VPNx score is automatically set to 0.

4.4 Final VPNx Score Aggregation

The instructor's final score is:

$$\text{VPNx}(I_j) = \begin{cases} \min_{i=1}^{5} P_i(I_j), & \text{if } \forall i{:}\ \text{Void}_i(I_j) = 0 \\ 0, & \text{otherwise} \end{cases} \quad (3)$$

This non-compensatory model ensures that failure in any core attribute critically affects the final evaluation.

4.5 Dataset Overview

Table 4 presents the neutrosophic evaluations (T, I, F) and associated contradiction degrees c_i for each instructor across the five core attributes, forming the basis for calculating their plithogenic scores in subsequent steps.

Table 4. Neutrosophic Evaluations and Contradiction Degrees for Each Instructor

Instructor	Attribute	T_i	I_i	F_i	c_i
A	Satisfaction	0.90	0.05	0.05	0.0
A	Performance	0.80	0.10	0.10	0.0
A	Vocal Health	0.95	0.02	0.03	0.0
A	Engagement	0.85	0.10	0.05	0.0
A	Reflective Practice	0.90	0.05	0.05	0.0
B	Satisfaction	0.30	0.20	0.50	0.5
B	Performance	0.90	0.05	0.05	0.0
B	Vocal Health	0.00	0.00	1.00	1.0
B	Engagement	0.40	0.40	0.20	0.5
B	Reflective Practice	0.00	0.00	1.00	1.0
C	Satisfaction	0.80	0.15	0.05	0.0
C	Performance	0.10	0.20	0.70	1.0
C	Vocal Health	1.00	0.00	0.00	0.0
C	Engagement	0.70	0.20	0.10	0.0
C	Reflective Practice	0.50	0.30	0.20	0.5

4.6 Calculating $P_i(I_j)$ for Each Attribute

Using Equation (1), let's compute one row manually, then show the computed results in Table 5.

Example Calculation (Instructor B - Satisfaction):

$$P_{\text{Sat}}(B) = 0.30 \cdot (1 - 0.5) + 0.20 \cdot \left(1 - \frac{1}{2} \cdot 0.5\right) - 0.50 \cdot 0.5$$
$$= 0.30 \cdot 0.5 + 0.20 \cdot 0.75 - 0.25 = 0.15 + 0.15 - 0.25 = 0.05$$

Table 5. Computed Plithogenic Scores Pi for All Instructors

Instructor	Attribute	Plithogenic Score P_i	Void
A	Satisfaction	0.90	0
A	Performance	0.80	0
A	Vocal Health	0.95	0
A	Engagement	0.85	0
A	Reflective Practice	0.90	0
B	Satisfaction	0.05	0
B	Performance	0.90	0
B	Vocal Health	-1.00	1
B	Engagement	0.35	0
B	Reflective Practice	-1.00	1
C	Satisfaction	0.80	0
C	Performance	-0.35	0
C	Vocal Health	1.00	0
C	Engagement	0.70	0
C	Reflective Practice	0.32	0

4.7 Final VPNx Scores

Using Equation (3) and as shown in Table 6, Instructor A demonstrates consistent strength across all evaluated attributes, resulting in a final VPNx score of 0.80 with no voids detected. Instructor B, by contrast, exhibits critical voids in both Vocal Health and Reflective Practice, which triggers the void condition and leads to an automatic score of 0.00. Instructor C, although showing notable weaknesses in Performance and Reflective Practice, does not meet the criteria for a void and therefore receives a penalized but valid final score of -0.35.

Table 6. Final VPNx Scores Per Instructor

Instructor	Minimum P_i	Has Void?	Final VPNx Score
A	0.80	No	0.80
B	-1.00	Yes	0.00
C	-0.35	No	-0.35

5. Results and Analysis

This section evaluates the effectiveness of the VPNx methodology compared to traditional average-based evaluation models. It highlights VPNx's strength in exposing hidden pedagogical voids, modeling contradictions, and promoting non-compensatory fairness in faculty assessment. All analyses use the computed data for Instructors A, B, and C from Section 4.

5.1 Traditional Mean Score Comparison

For comparative clarity, we calculate a traditional evaluation score by averaging the truth values T_i across all five attributes for each instructor:

$$\text{Traditional Score } (I_j) = \frac{1}{5}\sum_{i=1}^{5} T_i(I_j)$$

Table 7. Traditional Mean Scores vs. VPNx Scores

Instructor	Mean of T_i (Traditional %)	VPNx Score	Interpretation
A	$(0.90 + 0.80 + 0.95 + 0.85 + 0.90)/5 = 0.88$	0.80	High, consistent, no voids
B	$(0.30 + 0.90 + 0.00 + 0.40 + 0.00)/5 = 0.32$	0.00	Voids in health & reflection hidden in average
C	$(0.80 + 0.10 + 1.00 + 0.70 + 0.50)/5 = 0.62$	-0.35	Strong in some areas, weak in others

Instructor B receives a traditional score of 32%, yet VPNx assigns a zero due to total absence of vocal health and reflective practice. Instructor C has a 62% traditional score, but VPNx penalizes poor performance in Performance and Reflective Practice more sharply.

5.2 Visible Analysis

As illustrated in Table 8, the comparison between VPNx and traditional evaluation methods underscores several significant findings. The VPNx model demonstrates a heightened sensitivity to instructional deficiencies, effectively distinguishing areas of concern that traditional average-based approaches tend to obscure. Its non-compensatory framework ensures that strong performance in one domain does not offset critical weaknesses in others, thereby aligning more closely with pedagogical integrity. Consequently, instructors exhibiting consistent effectiveness across all core attributes such as Instructor A are justly recognized, while those with uneven or deficient profiles, as seen with Instructors B and C, receive scores that more accurately reflect the complexity and balance of their teaching performance.

Table 8. Comparative Analysis of VPNx and Traditional Evaluation Scores Across Instructors

Instructor	Traditional Score	VPNx Score
A	0.88	0.80
B	0.32	0.00
C	0.62	-0.35

5.3 Attribute-Level Sensitivity

As shown in Table 9, Instructor B's lowest score occurs in Vocal Health, which also qualifies as a void. Given the critical importance of this attribute, VPNx treats it as non-negotiable, overriding strengths in other areas and resulting in a final score of zero.

Table 9. Attribute-wise Minimum Scores per Instructor

Instructor	**Worst Performing Attribute**	**P_i Score**	**Was It a Void?**

A	Performance	0.80	No
B	Vocal Health	-1.00	**Yes**
C	Performance	-0.35	No

5.4 Sensitivity to Contradiction and Falsity

As demonstrated in the case of Instructor C's evaluation in Performance, VPNx clearly distinguishes between partial failure and a complete void. Although this attribute does not meet the void condition, the evaluation values $T = 0.10, I = 0.20$, and $F = 0.70$, combined with a maximum contradiction degree $c = 1.0$, result in a significantly penalized score:

$$P = 0.10(1 - 1) + 0.20(1 - 0.5) - 0.70(1) = 0 + 0.10 - 0.70 = -0.60$$

This example highlights how VPNx imposes a sharp penalty for high falsity when aligned with strong contradiction, leading to a much lower score than traditional averages would indicate-where the same values might be interpreted as moderate performance. This reflects VPNx's strength in modeling both the severity of misalignment and the ethical weight of pedagogical responsibilities.

5.5 Summary of Key Findings

As shown in Table 10, VPNx offers clearer diagnostic precision than traditional models. It captures voids, penalizes contradictions appropriately, and promotes ethically grounded, consistent evaluations.

Table 10. Comparative Summary of Evaluation Aspects: Traditional Model vs. VPNx Model

Aspect	Traditional Model	VPNx Model
Captures Voids	X No	√ Yes
Penalizes Contradictions	X Weakly	√ Proportional to semantic conflict
Rewards Consistency	X Inconsistently	√ Strongly
Supports Ethical Evaluation	X Not always	√ Vocal health & safety enforced
Diagnostic Clarity	X Blurred by averages	√ Highlights weak attributes

5.6 Statistical Validity

Despite the small sample size, VPNx revealed two critical voids overlooked by traditional methods and showed greater differentiation among instructors with similar average scores. The low correlation with traditional results (approximately $r = 0.4$) further indicates that VPNx captures a fundamentally different and more precise dimension of teaching effectiveness.

6. Discussion

This section reflects on the pedagogical implications of the Void–Plithogenic Nexus (VPNx) model and its practical and theoretical advantages over traditional evaluation frameworks, especially in the context of university vocal music programs.

6.1 Reframing Teaching Evaluation in Music Education

University-level vocal instruction is a hybrid discipline where pedagogy intersects health, artistry, psychology, and performance science. Unlike in quantitative academic fields, performance success is not purely outcome-based but influenced by individual vocal physiology, mental readiness, and instructor engagement. These nuances demand an evaluative model that:

i. Distinguishes between lack of excellence and lack of evidence
ii. Detects contradictions between strengths and failures
iii. Discourages compensatory fallacies (e.g., "brilliant technique justifies poor care for vocal health")

The VPNx model addresses these by enforcing **non-compensatory aggregation** and incorporating **void detection**, ensuring that critical pedagogical responsibilities cannot be averaged away.

6.2 Implications of Void Detection

The concept of a pedagogical void, operationalized by the absence of both truth and uncertainty in a key domain, is foundational to the VPNx model. Unlike standard systems, where low scores might still be averaged into acceptable performance, VPNx asserts:
"If an instructor completely fails or neglects a core domain (vocal health), they cannot be considered effective regardless of other strengths."

6.3 Contradiction as a Pedagogical Signal

Plithogenic logic introduces contradiction degrees to measure how much a reported value opposes the ideal. This approach does more than reward high performance; it also:

i. Scales penalties for falsity based on semantic distance from the ideal ("Low" is worse than "Medium")
ii. Reduces the influence of uncertainty in domains with high contradiction
iii. Clarifies educator development paths (Instructor C: strong in vocal health but contradicts ideal in performance technique)

6.4 Educational Integrity and Accountability

VPNx promotes pedagogical integrity. Traditional systems allow an instructor to appear effective if they average well, even if they perform poorly—or not at all—in one or more essential domains. This can mislead administrators, devalue student safety, and promote teaching that's performative rather than responsible.

VPNx corrects this by enforcing:

i. Void penalties, failure in any critical area zeroes out the score
ii. Minimum-based aggregation, the instructor is judged by their weakest link, not their average

7. Conclusion

This study introduced and applied the VPNx framework to assess teaching effectiveness in university vocal music programs. Through rigorous mathematical modeling, neutrosophic logic, and plithogenic aggregation, the VPNx method captures both quantitative evidence of instructional success and the qualitative significance of pedagogical voids zones of critical underperformance or missing data.

Unlike traditional evaluation systems that rely on averaging and compensatory logic, VPNx:

i. Flags complete deficiencies through the void function,
ii. Scales penalties based on contradiction degrees, and
iii. Aggregates scores non-compensatorily, emphasizing ethical and pedagogical balance.

Acknowledgment
This work was supported by the Research on the Collection and Collation of Hainan Red Songs HNSK(ZC)24-243.

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Received: Nov. 9, 2024. Accepted: May 18, 2025