NSS
Neutrosophic Sets and Systems, Vol. 90, 2025
University of New Mexico

Single Valued Plithogenic Set for Aesthetic Education and Sustainable Development: Integrating Ecological Thinking into College Music Instruction

Huifang Li*

Department of Art, Lyuliang University, Lvliang, Shanxi, 033001, China

*Corresponding author, E-mail: huifang_0705@163.com

Abstract: Integrating ecological thought into aesthetic education has grown increasingly important considering the global sustainability issues. This study investigates how innovative curricula in music education at the collegiate level may be used to advance environmental awareness. Institutions can encourage more student involvement with sustainability concepts by including ecological narratives, indigenous customs, and sustainable behaviors into music instruction. Using a qualitative and evaluative framework, the study evaluates several instructional approaches according to standards including community involvement, cultural integration, and material sustainability.

Using Plithogenic set methodologies, six options from conventional models to community-based and digitally enhanced programs are assessed to see how well they foster environmentally conscious musicianship. We use the Single Valued Plithogenic Set (SVPS) to solve uncertainty information. The most promising programs for integrating music education with sustainability objectives are those that prioritize interdisciplinarity, indigenous knowledge, and active community engagement, according to the findings. This piece demonstrates how music education can be a significant factor in promoting environmental sustainability in higher education in addition to being a cultural and artistic undertaking.

Keywords: Single Valued Plithogenic Set; Aesthetic Education and Sustainability; Teaching; College Music Instruction.

1. Introduction

This subject should be treated in a vague and Plithogenic framework since the insights on infirmary providing efficiency are derived from the perspectives of College Music Instruction. As a collection of components or elements with a wide range of qualities, Smarandache [1] introduced the Plithogenic set as an extension of crisp, fuzzy, intuitionistic fuzzy, and

neutrosophic sets. According to certain specified criteria, an attribute value v has a corresponding (fuzzy, intuitionistic fuzzy, or neutrosophic) degree of appurtenance d(x, v) of the element x to the set P[2].

The categorization of replacements according to criteria is essential in decision-making processes, but it is challenging for evaluators to supply easy-to-understand language expressions to deal with the importance weights of assessing criteria and evaluating service rate. According to Smarandache [3], language expression demonstrated a useful method of presenting examples that were too complex or challenging to identify, since traditional quantification tools struggled to articulate them logically.

1.1 Literature Review

Without altering the paradigm of aesthetic music education, the world cannot overcome the present spiritual and ecological crises. Instead of being a consumer society's utilitarian commodity, music ought to be a significant factor in accomplishing the objectives of sustainable development. Therefore, a new paradigm of education that is ecologically conscious, aesthetically pleasing, and facilitates sustainable development at the urban, suburban, and rural levels should be highlighted, as well as music teacher education. In the framework of sustainable development culture, Guo et al. [4]looked at concerns related to aesthetic music instruction that is ecology focused. To create a new educational paradigm based on global experience, this study sought to validate an integrative framework for ecological rationality, aesthetic education, and musical ecology.

The goal of incorporating ecological consciousness into environmental art design programs is to develop artists who are both ecologically concerned and creatively engaged, addressing the need to integrate artistic practice with environmental sustainability. Fan [5] investigated how ecological concepts might improve students' artistic involvement with sustainability concerns. Targeting professors and students in environmental art design programs, the study uses a mixed-methods approach to gather both quantitative and qualitative data between January and March 2024. 63 instructors took part in interviews, and 562 valid responses were obtained from a survey given to 600 pupils. Non-Versioned Information, Versatile Outcomes (NVivo) and the Statistical Package for the Social Sciences (SPSS) were used to examine the data.

Even though music and ecology have historically been closely related, they seldom cross paths these days. Their capacity to promote social, cultural, and environmental values has been lost, along with excellent prospects for their integration in educational settings. By examining the historical ties between the two disciplines, thinking about the links between music and nature, and comprehending music as a component of the environment, Tojeiro-Pérez et al. [6] served as a meeting point between the sciences and music. A mixed-method analysis is presented that addresses the primary study dimensions: music teachers' perceptions of an interdisciplinary approach to the environmental issue and their knowledge and training in the environmental field.

Their analysis combines both quantitative and qualitative data from music teachers' surveys and interviews.

2. Methods and Definitions

This section shows the definitions of Single Valued Plithogenic Set (SVPS) and the proposed approach to rank the alternatives[7].

Two SVPS such as:

$$x = (x_1, x_2, x_3)\ and\ y = (y_1, y_2, y_3)$$

The intersection of SVPS can be defined as:

$$\left((x_{i1}, x_{i2}, x_{i3}), 1 \le i \le n\right) P\ \left((y_{i1}, y_{i2}, y_{i3}), 1 \le i \le n\right)$$

$$= \left(x_{i1} \wedge_F y_{i1}, 0.5 * (x_{i2} \wedge_F y_{i2}), 0.5 * (x_{i2} \vee_F y_{i2}), (x_{i3} \vee_F y_{i3})\right), 1 \le i \le n$$

The union of SVPS can be defined as:

$$\left((x_{i1}, x_{i2}, x_{i3}), 1 \le i \le n\right) \vee_P \left((y_{i1}, y_{i2}, y_{i3}), 1 \le i \le n\right)$$

$$= \left(x_{i1} \vee_P y_{i1}, 0.5 * (x_{i2} \vee_P y_{i2}), 0.5 * (x_{i2} \wedge_P y_{i2}), (x_{i3} \wedge_P y_{i3})\right), 1 \le i \le n$$

$$x_{i1} \wedge_F y_{i1} = [1 - c(v_D, v_1)].\, t_{norm}(v_D, v_1) + c(v_D, v_1).\, t_{conorm}(v_D, v_1)$$

$$x_{i1} \vee_P y_{i1} = [1 - c(v_D, v_1)].\, t_{conorm}(v_D, v_1) + c(v_D, v_1).\, t_{norm}(v_D, v_1)$$

$$t_{norm} = x \vee_F y = ay$$

$$t_{conorm} = x \vee_F y = a + y - xy$$

The complement of SVPS can be defined as:

$$\neg\left((x_{i1}, x_{i2}, x_{i3}), 1 \le i \le n\right) = \left((x_{i3}, x_{i2}, x_{i1}), 1 \le i \le n\right)$$

Example 1

Evaluator values:

- A: (0.10, 0.70, 0.80)
- B: (0.30, 0.40, 0.80)
- C: (0.25, 0.50, 0.70)

Step 1: A ∨ B:

- T = 0.10 + 0.30 - 0.10×0.30 = 0.37
- I = 0.70×0.40 + 0.70 + 0.40 - 0.70×0.40 = 0.55
- F = 0.80 × 0.80 = 0.64

- Result = (0.37, 0.55, 0.64)

Step 2: Result ∨ C:

- T = 0.37 + 0.25 - 0.37×0.25 = 0.5275
- I = 0.5*(0.55×0.50 + 0.55 + 0.50 - 0.55×0.50) = 0.3625
- F = 0.64 × 0.70 = 0.448
- Final Aggregated = (0.53, 0.3625, 0.45)

Example 2

Evaluator values:

- A: (0.20, 0.60, 0.70)
- B: (0.40, 0.50, 0.90)
- C: (0.30, 0.30, 0.80)

Step 1: A ∨ B = (0.52, 0.80, 0.63)

Step 2: Result ∨ C

- T = 0.52 + 0.30 - 0.52×0.30 = 0.664
- I = 0.5*(0.80×0.30 + 0.80 + 0.30 - 0.80×0.30) = 0.443
- F = 0.63 × 0.80 = 0.504
- Final Aggregated = (0.66, 0.443, 0.50)

Example 3

- A: (0.15, 0.45, 0.60)
- B: (0.25, 0.55, 0.70)
- C: (0.35, 0.65, 0.50)

Step 1: A ∨ B = (0.3625, 0.82, 0.42)

Step 2: Result ∨ C

- T = 0.3625 + 0.35 - 0.3625×0.35 = 0.605
- I = 0.5*(0.82×0.65 + 0.82 + 0.65 - 0.82×0.65) = 0.923
- F = 0.42 × 0.50 = 0.21
- Final Aggregated = (0.61, 0.4615, 0.21)

Example 4

- A: (0.50, 0.30, 0.20)
- B: (0.60, 0.20, 0.30)
- C: (0.70, 0.10, 0.40)

Step 1: A ∨ B = (0.80, 0.68, 0.06)

Step 2: Result ∨ C

- T = 0.80 + 0.70 - 0.80×0.70 = 0.94
- I = 0.5*(0.68×0.10 + 0.68 + 0.10 - 0.68×0.10) = 0.374
- F = 0.06 × 0.40 = 0.024
- Final Aggregated = (0.94, 0.374, 0.02)

Example 5

- A: (0.25, 0.50, 0.45)
- B: (0.55, 0.25, 0.40)
- C: (0.35, 0.45, 0.35)

Step 1: A ∨ B = (0.6875, 0.8125, 0.18)

Step 2: Result ∨ C

- T = 0.6875 + 0.35 - 0.6875×0.35 = 0.796
- I = 0.5*(0.8125×0.45 + 0.8125 + 0.45 - 0.8125×0.45) = 0.449
- F = 0.18 × 0.35 = 0.063
- Final Aggregated = (0.80, 0.449, 0.06)

Example 6

- A: (0.30, 0.60, 0.50)
- B: (0.40, 0.40, 0.60)
- C: (0.20, 0.50, 0.40)

Step 1: $A \vee B = (0.58, 0.84, 0.30)$

Step 2: Result ∨ C

- $T = 0.58 + 0.20 - 0.58 \times 0.20 = 0.664$

- I = 0.5*(0.84×0.50 + 0.84 + 0.50 - 0.84×0.50) = 0.46
- F = 0.30 × 0.40 = 0.12
- Final Aggregated = (0.66, 0.46, 0.12)

3. Results

The results of Aesthetic Education and Sustainability: Integrating Ecological Thinking into College Music Instruction are presented in this table by ranking the alternatives. We use eight criteria and six alternatives such as:

A. Integration of Environmental Themes in Music Curriculum
B. Student Awareness of Ecological and Cultural Interconnection
C. Use of Sustainable Materials and Instruments
D. Inclusion of Local or Indigenous Ecological Music Traditions
E. Interdisciplinary Collaboration with Environmental Studies
F. Promotion of Eco-Conscious Performance Practices
G. Engagement in Community-Based Eco-Music Projects
H. Assessment of Long-Term Behavioral Change Toward Sustainability in Music
a. Traditional Music Curriculum with Minor Environmental Add-ons
b. Eco centric Music Education Model with Interdisciplinary Integration
c. Digital Music Creation Program Using Recycled Sounds and Natural Recordings
d. Community-Based Eco-Performance and Awareness Program
e. Indigenous Knowledge-Focused Music Instruction with Ecological Storytelling
f. Blended Learning Model with Virtual Nature-Based Music Experiences

The steps of the proposed approach are organized as follows:

Step 1. Use the SVPS numbers to evaluate the criteria and alternatives.

Step 2. Use score function to obtain crisp values.

Step 3. Combine crisp values.

Step 4. Obtain average value of each alternative.

Four experts evaluate the criteria and alternatives using the SVPS as shown in Tables 1-4.

Table 1. The first SVPS.

	$SVPC_1$	$SVPC_2$	$SVPC_3$	$SVPC_4$	$SVPC_5$	$SVPC_6$	$SVPC_7$	$SVPC_8$
$SVPA_1$	(0.10, 0.75, 0.85)	(0.25, 0.60, 0.80)	(0.40, 0.70, 0.50)	(0.50, 0.40, 0.60)	(0.65, 0.30, 0.45)	(0.80, 0.10, 0.30)	(0.95, 0.05, 0.05)	(0.40, 0.70, 0.50)
$SVPA_2$	(0.10, 0.75, 0.85)	(0.95, 0.05, 0.05)	(0.80, 0.10, 0.30)	(0.65, 0.30, 0.45)	(0.50, 0.40, 0.60)	(0.40, 0.70, 0.50)	(0.10, 0.75, 0.85)	(0.50, 0.40, 0.60)
$SVPA_3$	(0.25, 0.60, 0.80)	(0.40, 0.70, 0.50)	(0.50, 0.40, 0.60)	(0.65, 0.30, 0.45)	(0.80, 0.10, 0.30)	(0.25, 0.60, 0.80)	(0.25, 0.60, 0.80)	(0.65, 0.30, 0.45)
$SVPA_4$	(0.50, 0.40, 0.60)	(0.40, 0.70, 0.50)	(0.25, 0.60, 0.80)	(0.10, 0.75, 0.85)	(0.95, 0.05, 0.05)	(0.10, 0.75, 0.85)	(0.40, 0.70, 0.50)	(0.80, 0.10, 0.30)

$SVPA_5$	(0.65, 0.30, 0.45)	(0.50, 0.40, 0.60)	(0.40, 0.70, 0.50)	(0.25, 0.60, 0.80)	(0.10, 0.75, 0.85)	(0.95, 0.05, 0.05)	(0.50, 0.40, 0.60)	(0.95, 0.05, 0.05)
$SVPA_6$	(0.65, 0.30, 0.45)	(0.65, 0.30, 0.45)	(0.50, 0.40, 0.60)	(0.65, 0.30, 0.45)	(0.95, 0.05, 0.05)	(0.80, 0.10, 0.30)	(0.65, 0.30, 0.45)	(0.80, 0.10, 0.30)

Table 2. The second SVPS.

	$SVPC_1$	$SVPC_2$	$SVPC_3$	$SVPC_4$	$SVPC_5$	$SVPC_6$	$SVPC_7$	$SVPC_8$
$SVPA_1$	(0.50, 0.40, 0.60)	(0.25, 0.60, 0.80)	(0.40, 0.70, 0.50)	(0.50, 0.40, 0.60)	(0.65, 0.30, 0.45)	(0.80, 0.10, 0.30)	(0.95, 0.05, 0.05)	(0.40, 0.70, 0.50)
$SVPA_2$	(0.40, 0.70, 0.50)	(0.95, 0.05, 0.05)	(0.80, 0.10, 0.30)	(0.50, 0.40, 0.60)	(0.50, 0.40, 0.60)	(0.40, 0.70, 0.50)	(0.50, 0.40, 0.60)	(0.50, 0.40, 0.60)
$SVPA_3$	(0.25, 0.60, 0.80)	(0.40, 0.70, 0.50)	(0.50, 0.40, 0.60)	(0.40, 0.70, 0.50)	(0.50, 0.40, 0.60)	(0.25, 0.60, 0.80)	(0.40, 0.70, 0.50)	(0.65, 0.30, 0.45)
$SVPA_4$	(0.10, 0.75, 0.85)	(0.40, 0.70, 0.50)	(0.25, 0.60, 0.80)	(0.25, 0.60, 0.80)	(0.40, 0.70, 0.50)	(0.10, 0.75, 0.85)	(0.25, 0.60, 0.80)	(0.80, 0.10, 0.30)
$SVPA_5$	(0.95, 0.05, 0.05)	(0.50, 0.40, 0.60)	(0.40, 0.70, 0.50)	(0.10, 0.75, 0.85)	(0.25, 0.60, 0.80)	(0.95, 0.05, 0.05)	(0.10, 0.75, 0.85)	(0.65, 0.30, 0.45)
$SVPA_6$	(0.50, 0.40, 0.60)	(0.50, 0.40, 0.60)	(0.50, 0.40, 0.60)	(0.95, 0.05, 0.05)	(0.10, 0.75, 0.85)	(0.50, 0.40, 0.60)	(0.95, 0.05, 0.05)	(0.80, 0.10, 0.30)

Table 3. The third SVPS.

	$SVPC_1$	$SVPC_2$	$SVPC_3$	$SVPC_4$	$SVPC_5$	$SVPC_6$	$SVPC_7$	$SVPC_8$
$SVPA_1$	(0.10, 0.75, 0.85)	(0.25, 0.60, 0.80)	(0.40, 0.70, 0.50)	(0.50, 0.40, 0.60)	(0.65, 0.30, 0.45)	(0.80, 0.10, 0.30)	(0.95, 0.05, 0.05)	(0.40, 0.70, 0.50)
$SVPA_2$	(0.95, 0.05, 0.05)	(0.95, 0.05, 0.05)	(0.80, 0.10, 0.30)	(0.65, 0.30, 0.45)	(0.50, 0.40, 0.60)	(0.40, 0.70, 0.50)	(0.10, 0.75, 0.85)	(0.50, 0.40, 0.60)
$SVPA_3$	(0.80, 0.10, 0.30)	(0.10, 0.75, 0.85)	(0.50, 0.40, 0.60)	(0.65, 0.30, 0.45)	(0.80, 0.10, 0.30)	(0.25, 0.60, 0.80)	(0.95, 0.05, 0.05)	(0.65, 0.30, 0.45)
$SVPA_4$	(0.65, 0.30, 0.45)	(0.95, 0.05, 0.05)	(0.10, 0.75, 0.85)	(0.10, 0.75, 0.85)	(0.10, 0.75, 0.85)	(0.10, 0.75, 0.85)	(0.80, 0.10, 0.30)	(0.80, 0.10, 0.30)
$SVPA_5$	(0.50, 0.40, 0.60)	(0.80, 0.10, 0.30)	(0.95, 0.05, 0.05)	(0.10, 0.75, 0.85)	(0.95, 0.05, 0.05)	(0.10, 0.75, 0.85)	(0.65, 0.30, 0.45)	(0.95, 0.05, 0.05)
$SVPA_6$	(0.40, 0.70, 0.50)	(0.65, 0.30, 0.45)	(0.80, 0.10, 0.30)	(0.95, 0.05, 0.05)	(0.80, 0.10, 0.30)	(0.95, 0.05, 0.05)	(0.50, 0.40, 0.60)	(0.80, 0.10, 0.30)

Table 4. The fourth SVPS.

	$SVPC_1$	$SVPC_2$	$SVPC_3$	$SVPC_4$	$SVPC_5$	$SVPC_6$	$SVPC_7$	$SVPC_8$
$SVPA_1$	(0.80, 0.10, 0.30)	(0.95, 0.05, 0.05)	(0.25, 0.60, 0.80)	(0.95, 0.05, 0.05)	(0.65, 0.30, 0.45)	(0.50, 0.40, 0.60)	(0.95, 0.05, 0.05)	(0.25, 0.60, 0.80)
$SVPA_2$	(0.95, 0.05, 0.05)	(0.10, 0.75, 0.85)	(0.10, 0.75, 0.85)	(0.10, 0.75, 0.85)	(0.50, 0.40, 0.60)	(0.40, 0.70, 0.50)	(0.10, 0.75, 0.85)	(0.95, 0.05, 0.05)
$SVPA_3$	(0.95, 0.05, 0.05)	(0.25, 0.60, 0.80)	(0.95, 0.05, 0.05)	(0.25, 0.60, 0.80)	(0.40, 0.70, 0.50)	(0.25, 0.60, 0.80)	(0.25, 0.60, 0.80)	(0.40, 0.70, 0.50)
$SVPA_4$	(0.25, 0.60, 0.80)	(0.25, 0.60, 0.80)	(0.25, 0.60, 0.80)	(0.65, 0.30, 0.45)	(0.40, 0.70, 0.50)	(0.25, 0.60, 0.80)	(0.65, 0.30, 0.45)	(0.65, 0.30, 0.45)
$SVPA_5$	(0.10, 0.75, 0.85)	(0.10, 0.75, 0.85)	(0.10, 0.75, 0.85)	(0.10, 0.75, 0.85)	(0.25, 0.60, 0.80)	(0.10, 0.75, 0.85)	(0.25, 0.60, 0.80)	(0.10, 0.75, 0.85)
$SVPA_6$	(0.95, 0.05, 0.05)	(0.95, 0.05, 0.05)	(0.95, 0.05, 0.05)	(0.25, 0.60, 0.80)	(0.10, 0.75, 0.85)	(0.95, 0.05, 0.05)	(0.10, 0.75, 0.85)	(0.25, 0.60, 0.80)

The score function is used to obtain crisp values as shown in Figures 1-4.

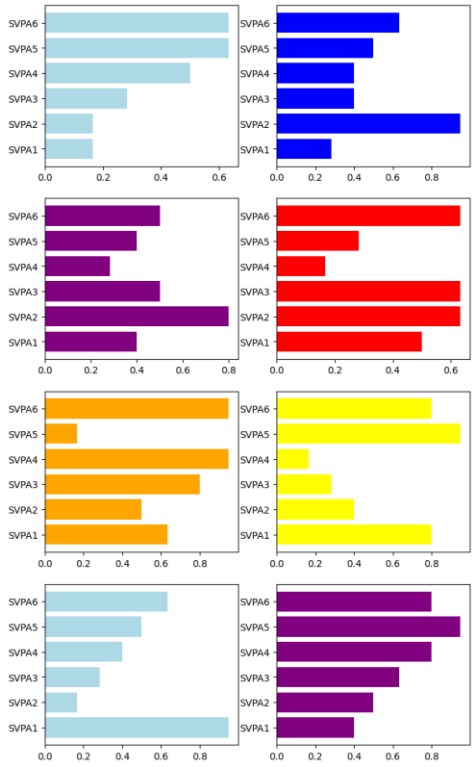

Figure 1. First crisp values.

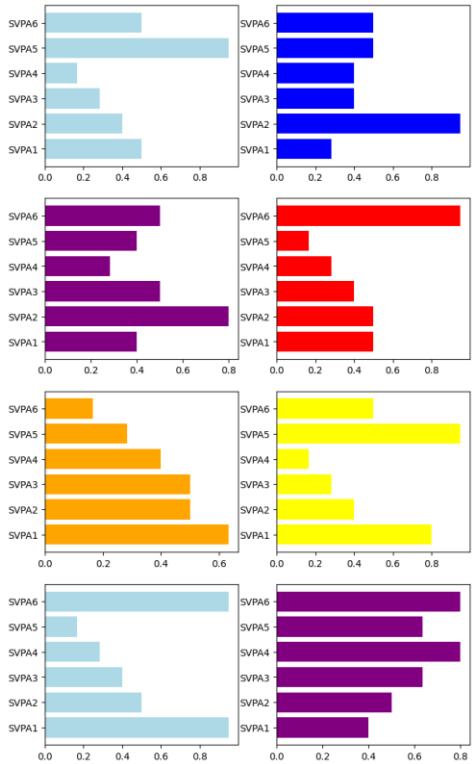

Figure 2. Second crisp values.

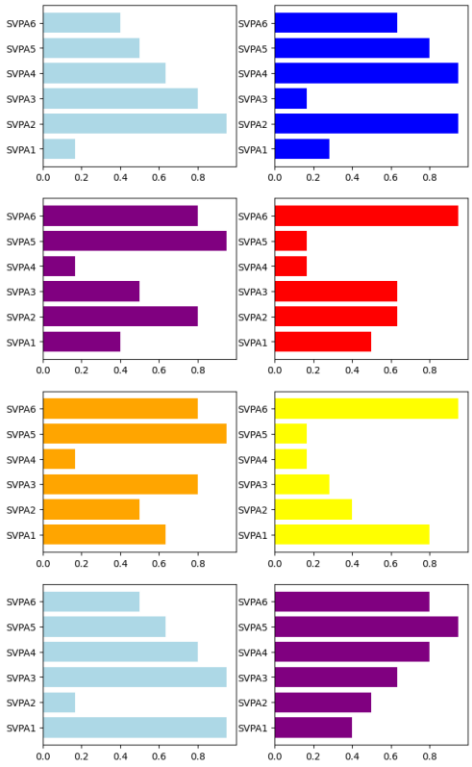

Figure 3. Third crisp values.

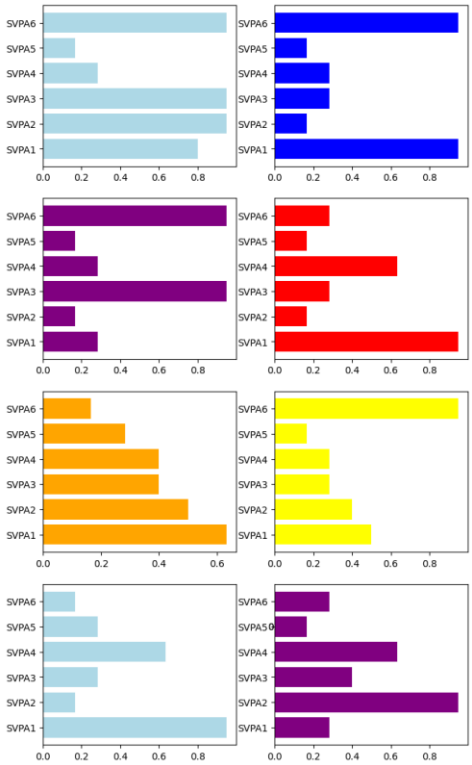

Figure 4. Fourth crisp values.

We combine the crisp values and apply the average method to obtain final score of each alternative. Then the alternatives are ranked as shown in Figure 5.

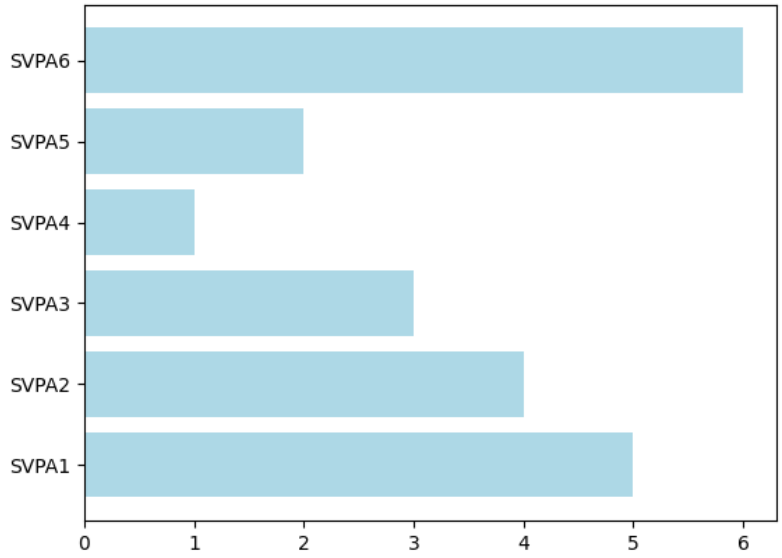

Figure 5. Ranks results.

4. Conclusions

One effective way to match musical practice with sustainability principles is through the incorporation of ecological thought into college music education. This study shows how music education may greatly improve students' ecological consciousness and civic duty when it integrates environmental themes, traditional ecological knowledge, and sustainable materials. The teaching methods that used multidisciplinary collaborations and involved students in community-based initiatives had the best quality indicators across several parameters. We used the Single Valued Plithogenic Set (SVPS) to solve uncertainty information. Eight criteria and six alternatives are used in this study. We show definitions and operations of SVPS.

These results highlight how crucial it is to broaden the scope of music instruction to promote sustainable attitudes and behaviors. Higher education institutions should acknowledge and support artistic disciplines like music as vital platforms for environmental education considering the world's growing ecological problems. Future research should evaluate scalability across various educational and cultural contexts and investigate long term effects on student behavior.

Acknowledgment

This work was supported by 2022 Philosophy and Social Science Research project of Shanxi Province "Research on the Application of Lvliang Red Music in the Great Ideological and Political Course" under project No.2022W158.

References

[1] F. Smarandache, "Plithogeny, plithogenic set, logic, probability, and statistics," *arXiv Prepr. arXiv1808.03948*, 2018.

[2] F. Smarandache, *Plithogenic set, an extension of crisp, fuzzy, intuitionistic fuzzy, and neutrosophic sets-revisited*. Infinite study, 2018.

[3] F. Smarandache, *Plithogeny, plithogenic set, logic, probability, and statistics*. Infinite Study, 2017.

[4] M. Guo, H. Su, and L. Yue, "Ecology-focused aesthetic music education as a foundation of the sustainable development culture," *Interdiscip. Sci. Rev.*, vol. 45, no. 4, pp. 564–580, 2020.

[5] H. Fan, "Integrating Ecological Consciousness Into Environmental Art Design Education: Impacts on Student Engagement, Sustainability Practices, and Critical Thinking," *Sustain. Dev.*, 2025.

[6] L. Tojeiro-Pérez and C. Gillanders, "(Re) connecting Music and Ecology: Teacher's Knowledge and Perceptions of an Interdisciplinary Approach for Environmental Education," *Sci. Educ.*, pp. 1–30, 2024.

[7] M. Abdel-Basset, M. El-Hoseny, A. Gamal, and F. Smarandache, "A novel model for evaluation Hospital medical care systems based on plithogenic sets," *Artif. Intell. Med.*, vol. 100, p. 101710, 2019.

Received: Jan 12, 2025. Accepted: July 26, 2025