Research on the Classification and Application of Physical Education Teaching Mode by Neutrosophic Analytic Hierarchy Process

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Abstract

The goal of this paper is to classify and application of Physical Education (PE). PE growth rapidly these days due to rapid development in information technology. This rapid turn over the sports, training and physical education. So, this paper identifies the application of PE by using the Multi-Criteria Decision Making (MCDM) concept. This problem contains many criteria and sub-criteria. This paper proposed the Analytic Hierarchy Process (AHP) to determine the weights of criteria and sub-criteria. The AHP method was used under a neutrosophic environment to deal with uncertainty in this problem. An example is provided to show the outcomes of the proposed method.

Keywords: AHP; Neutrosophic; Physical education.

1. Introduction

Innovation in information technology in recent years give a growth development. This development affects all science and sports like PE. The PE indicates the training and teaching. There are many applications in PE, like virtual reality. The application of PE helps many of board in a society like enhance the teaching and training. Virtual reality help students to get more gain in PE, like give them more information and skills in sports. This paper identifies the application of PE and rates them. There are many articles in PE[1]–[4], [4]–[10].

DOI: https://doi.org/10.54216/IJNS.230305
Received: August 17, 2023 Revised: November 26, 2023 Accepted: January 27, 2024

This problem contains many criteria and sub-criteria. So, the MCDM is used for dealing with these criteria. The MCDM has many methods in decision making. This paper introduces the AHP method for Assessment the application of PE. The AHP was used for calculating the weights of criteria. This paper used four main criteria and fourteen sub-criteria. The AHP method is an MCDM method. The AHP build the matrix between criteria by opinions of experts. The AHP method is integrated under the neutrosophic sets[11]–[16].

The neutrosophic set is a tool to deal with incomplete and vague information. The neutrosophic sets deal with the problem in decision making. It is better than fuzzy due to fuzzy not considering the indeterminacy value in the calculations. This paper uses the Single-Valued neutrosophic sets (SVNS). It consists of three values truth, indeterminacy and falsity values. We use the Single-Valued neutrosophic numbers for assessment of the criteria and sub-criteria by decision-makers and experts[17]–[20].

This paper's main contribution introduces the neutrosophic with the AHP method for application and classification of PE teaching mode for the first time.

The rest of this paper present: Section 2 presents the Neutrosophic AHP method. Section 3 present the example and results for this paper. Section 4 presents conclusions for this paper.

2. Related work

The assessment of a teacher's teaching ability is vital for the advancement of instructors, the choosing of courses by students, and the status of educational institutions. Mixing the TOPSIS with the single-valued neutrosophic set was the method that Wu and Fang[21] used in their research to develop a multilevel assessment framework for the teaching quality in higher education (SVNS). The teaching performance as well as the learning results of the students were included into an indicator system that was developed.

Using a novel set theory known as the neutrosophic set, Salama et al. [22]describe a suggested Social Learning Management System that incorporates social activities in e-Learning. Moreover, they use this system to evaluate data collected from social networks generated by learning activities.

Yilmaz et al.[23] conducted research to determine the factors that influence the viability of distance education (DE) in higher education institutions. Additionally, the researchers wanted to comprehend the differences in viewpoints held by a number of internal stakeholders regarding DE. To do so, they used a methodology that combined the AHP and the Copeland group decision-making technique.

Mamites et al. [24]conducted an analysis of the components that affect teaching quality in order to discover the causal linkages between these factors and, ultimately, to pinpoint those ones that are most important. The neutrosophic decision-making trial and evaluation laboratory, or DEMATEL, approach is used to simulate these characteristics in the context of public universities. The method utilises 10 criteria that were acquired following an exhaustive assessment of the relevant literature.

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The MCDM problem is one that is usually considered while discussing the assessment of the quality of physical education instruction in colleges and universities. Taxonomy Approach to Solving the MAGDM Under SVNSs: Yang and Liu's Design Yang and Liu's [25]taxonomy technique for solving the MAGDM under SVNSs.

In recent years, there has been a meteoric rise in the number of higher education institutions that are using various applications of learning management systems to better assist their students' academic pursuits. A significant number of studies in the field of learning management system assessment are carried out with comprehensive knowledge, despite the fact that the actual environment contains elements of uncertainty. Traditional techniques of assessment could not be useful since the systems being evaluated were defined by development organisations using uncertainty terminology such as vagueness, imprecision, ambiguity, and inconsistency. Neutrosophic logic was proposed by Radwan et al. [26]as a superior alternative to fuzzy logic for simulating human thought. This is due to the fact that, in contrast to fuzzy logic, neutrosophic logic is able to manage indeterminacy of information, which indicates the proportion of unknown parameters. Nortey et al. [27]introduced a unique Neutrosophic-Principal Component Analysis and Two-way Neutrosophic ANOVA for the purpose of analysing the factors that contribute to the Performance Gap between students attending private and public schools in the Basic Education Certificate Test.

This inquiry is predicated on the need of carrying out a neutrosophic analysis of the educational orientation of the diabetic patient, which demonstrates its influence on quality of life. This assumption serves as the investigation's foundation. The data were analysed by Ronelsys and colleagues [28]using a technique called Neutrosophic Statistics. This technique brings statistical approaches into the interval-valued domain. With the use of neutrosophic statistical analysis and the use of plithogenic sets, Fernando et al. [29]conducted an investigation into the factors that influence the growth of educational opportunities. The individuals' prior knowledge is used in the process of understanding in order to infer the meaning of a particular object; this process is essential for the development of the pupils' capabilities and talents. The level of understanding that students in higher education should have is determined using neutrosophy and, more specifically, a model that is based on neutrosophic sets. These models make use of the findings that are gained via the usage of linguistic concepts. Jesús and his colleagues [30]investigated the level of comprehension shown by students in higher education.

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2. Physical Education Classification Using Neutrosophic Sets

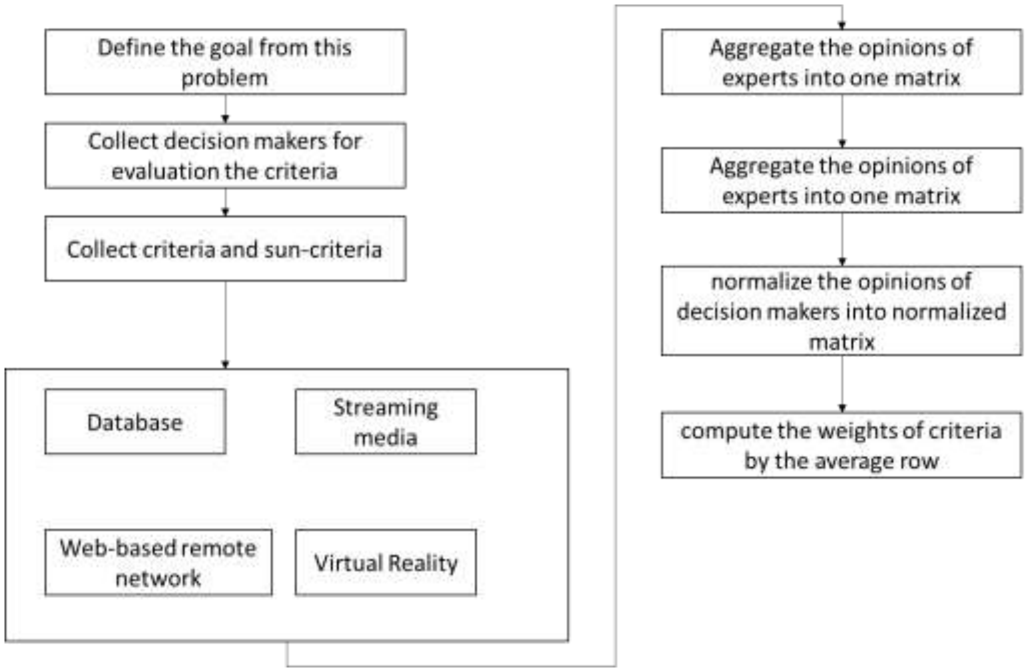

Figure 1: The Neutrosophic AHP and criteria of education.

The AHP, which was first suggested by Saaty, is a well-known approach to dealing with complex problems. This method works by first breaking complex problems down into smaller smaller subproblems and then combining the solutions to these smaller subproblems into a single solution to the larger problem. Making sure that the judgements are consistent is given a significant amount of weight in this methodology, which is centered around establishing comparisons between different pairs of experts.

Neutrosophic operations have been carried out at each stage of the neutrosophic AHP technique, and the concept is able to generate neutrosophic weights. These are all aspects of the neutrosophic computations that are performed throughout all phases of the idea. Following the construction of the pairwise comparison matrix, subsequent pairwise comparison matrix are built with respect to the data that is readily available. These pairwise comparison matrix multiplication are built using a neutrosophic scale that is comprised of linguistic terms and the neutrosophic numbers that correlate to them.

The AHP is used to the decision-making process that has a hierarchical structure, as shown in Fig 1. This allows the weights of the criteria to be determined.

In this section proposed the AHP method under the neutrosophic environment. The following steps of the AHP method:

Step 1: Define the goal from this problem

Step 2: Collect decision makers for evaluation the criteria then collect criteria and sun-criteria

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$$A_k = \begin{pmatrix} 1 & \cdots & a_{1nk} \\ \vdots & \ddots & \vdots \\ \frac{1}{a_{1nk}} & \cdots & 1 \end{pmatrix}$$

Step 3: Aggregate the opinions of experts into one matrix

$$A = \begin{pmatrix} 1 & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ \frac{1}{a_{1n}} & \cdots & 1 \end{pmatrix}$$

Step 4: normalize the opinions of decision makers into normalized matrix

$$S_i = \frac{a_i}{\sum_{i=1}^{n} a_i}$$

Step 5: compute the weights of criteria by the average row.

$$W_i = \frac{S_i}{\sum_{i=1}^{n} S_i}$$

Where $i = 1,2,3 \ldots . n$

3. An Example and outcomes

This section proposed the outcomes of the proposed method. First, the goal of this paper computes the weights of criteria and show the importance of criteria in the application of PE. Three decision-makers evaluated the decision-makers. Then collect four and fourteen criteria: DB: Database, DB1: Engine, DB2: Powerful management system, DB3: SQL requirements. SM: Streaming media: SM1: User player, SM2: File storage, SM3: Server, SM4: Encoding and decoding. WB: Web-based remote network, WB1: Teaching sources, WB2: effectively activities, WB3: Enhance efficiency. VR: Virtual Reality, VR1: Improve quality, VR2: gain skills and knowledge, VR3: gain immersive feeling, VR4: Gain experience. The opinions of decision-makers are in Table 1-3. Then combined in Table 4. Then normalize it in Table 5. Then compute weights in Table 6. Fig 2. Present the criteria's weights. The VR is the highest weight and importance, and SM is the lowest weight and importance.

Table 1: The opinion of the first decision makers.

	DB	SM	WB	VR
DB	0.5	0.8167	0.9	0.8167
SM	1.22444	0.5	0.383	0.283
WB	1.111111	2.610966	0.5	0.9
VR	1.22444	3.533569	1.111111	0.5

Table 2. The opinion of the second decision makers.

	DB	SM	WB	VR
DB	0.5	0.8167	0.383	0.9
SM	1.22444	0.5	0.283	0.283
WB	2.610966	3.533569	0.5	0.8167
VR	1.111111	3.533569	1.22444	0.5

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Table 3: The opinion of the second decision makers.

	DB	SM	WB	VR
DB	0.5	0.9	0.8167	0.9
SM	1.111111	0.5	0.9	0.283
WB	1.22444	1.111111	0.5	0.383
VR	1.111111	3.533569	2.610966	0.5

Table 4. The combined opinion of the decision makers.

	DB	SM	WB	VR
DB	0.5	0.844467	0.6999	0.872233
SM	1.186664	0.5	0.522	0.283
WB	1.648839	2.418549	0.5	0.6999
VR	1.148887	3.533569	1.648839	0.5

Table 5: The normalized opinion of the decision makers.

	DB	SM	WB	VR
DB	0.111498	0.115735	0.20764	0.370354
SM	0.264621	0.068525	0.154862	0.120163
WB	0.367684	0.331463	0.148335	0.297181
VR	0.256197	0.484277	0.489162	0.212302

Table 6: The Criteria's weights.

	Weights
DM	0.201307
SM	0.152043
WB	0.286166
VR	0.360485

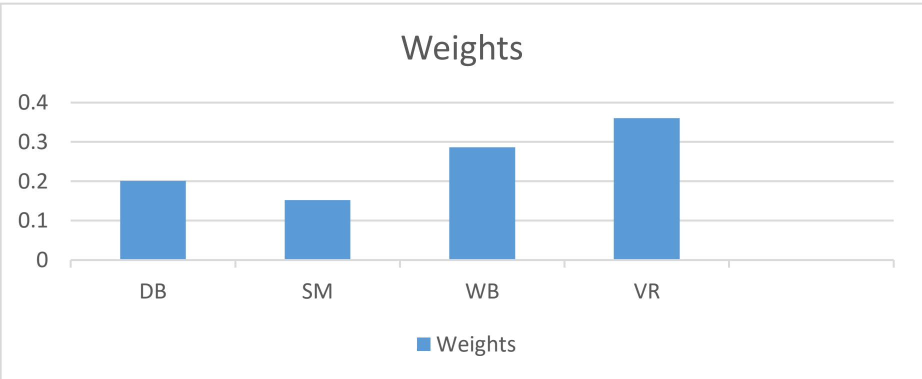

Figure 2: The criteria's weights

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Then compute the weights of DM. The opinions of decision-makers are in Table 7-9. Then combined in Table 10. Then normalize it in Table 11. Then compute weights in Table 12. Fig 3. Present the criteria's weights of DB. The DB3 retirements are the highest weights and importance, and DB1 is the lowest weight and importance.

Table 7: The opinion of the first decision makers.

	DB_1	DB_2	DB_3
DB_1	0.5	0.9	0.283
DB_2	1.111111	0.5	0.8167
DB_3	3.533569	1.22444	0.5

Table 8: The opinion of the second decision makers.

	DB_1	DB_2	DB_3
DB_1	0.5	0.8167	0.9
DB_2	1.22444	0.5	0.283
DB_3	1.111111	3.533569	0.5

Table 9: The opinion of the second decision makers.

	DB_1	DB_2	DB_3
DB_1	0.5	0.383	0.8167
DB_2	2.610966	0.5	0.9
DB_3	1.22444	1.111111	0.5

Table 10: The combined opinion of the decision makers.

	DB_1	DB_2	DB_3
DB_1	0.5	0.6999	0.666567
DB_2	1.648839	0.5	0.666567
DB_3	1.956373	1.956373	0.5

Table 11: The normalized opinion of the decision makers.

	DB_1	DB_2	DB_3
DB_1	0.121796	0.221749	0.363621
DB_2	0.401645	0.158415	0.363621
DB_3	0.476558	0.619836	0.272757

Table 12: The Criteria's weights of DB.

	Weights
DM_1	0.235722
DM_2	0.307894
DM_3	0.456384

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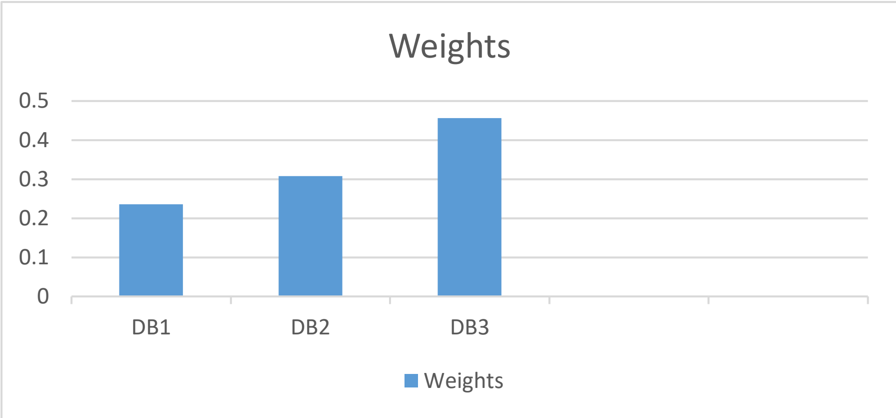

Figure 3: The criteria's weights of DB.

Then compute the weights of SM. The opinions of decision-makers are in Table 13-15. Then combined in Table 16. Then normalize it in Table 17. Then compute weights in Table 18. Fig 4. Present the criteria's weights of SM. The SM4 is the highest weight and importance, and SM1 is the lowest weight and importance.

Table 13: The opinion of the first decision makers.

	SM_1	SM_2	SM_3	SM_4
SM_1	0.5	0.9	0.8167	0.383
SM_2	1.111111	0.5	0.283	0.8167
SM_3	1.22444	3.533569	0.5	0.9
SM_4	2.610966	1.22444	1.111111	0.5

Table 14: The opinion of the second decision makers.

	SM_1	SM_2	SM_3	SM_4
SM_1	0.5	0.8167	0.9	0.283
SM_2	1.22444	0.5	0.383	0.9
SM_3	1.111111	2.610966	0.5	0.8167
SM_4	3.533569	1.111111	1.22444	0.5

Table 15: The opinion of the second decision makers.

	SM_1	SM_2	SM_3	SM_4
SM_1	0.5	0.383	0.283	0.8167
SM_2	2.610966	0.5	0.9	0.9
SM_3	3.533569	1.111111	0.5	0.283
SM_4	1.22444	1.111111	3.533569	0.5

Table 16: The combined opinion of the decision makers.

	SM_1	SM_2	SM_3	SM_4
SM_1	0.5	0.6999	0.666567	0.494233

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SM_2	1.648839	0.5	0.522	0.872233
SM_3	1.956373	2.418549	0.5	0.666567
SM_4	2.456325	1.148887	1.956373	0.5

Table 17: The normalized opinion of the decision makers.

	SM_1	SM_2	SM_3	SM_4
SM_1	0.076202	0.146812	0.182875	0.195115
SM_2	0.251289	0.10488	0.143212	0.344343
SM_3	0.298158	0.507317	0.137176	0.26315
SM_4	0.374352	0.240991	0.536737	0.197392

Table 18: The Criteria's weights.

	Weights
SM_1	0.150251
SM_2	0.210931
SM_3	0.30145
SM_4	0.337368

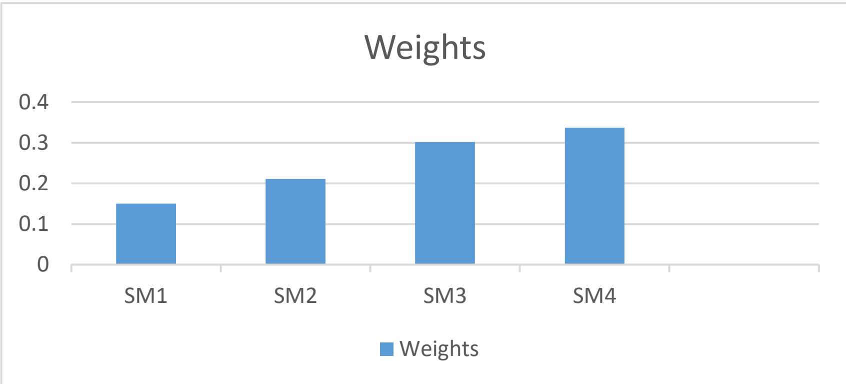

Figure 4: The criteria's weights of SM

Then The WB3 is the highest weight and importance, and WB1 is the lowest weight and importance. Then The VR3 is the highest weight and importance, and the VR1 is the lowest weight and importance. Fig 5. Present the criteria's weights of WB. Fig 6. Present the criteria's weights of VR.

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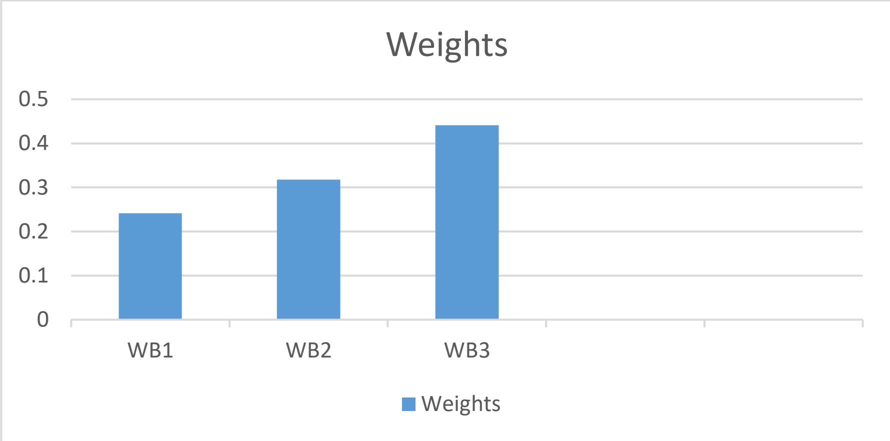

Figure 5: The criteria's weights of DM

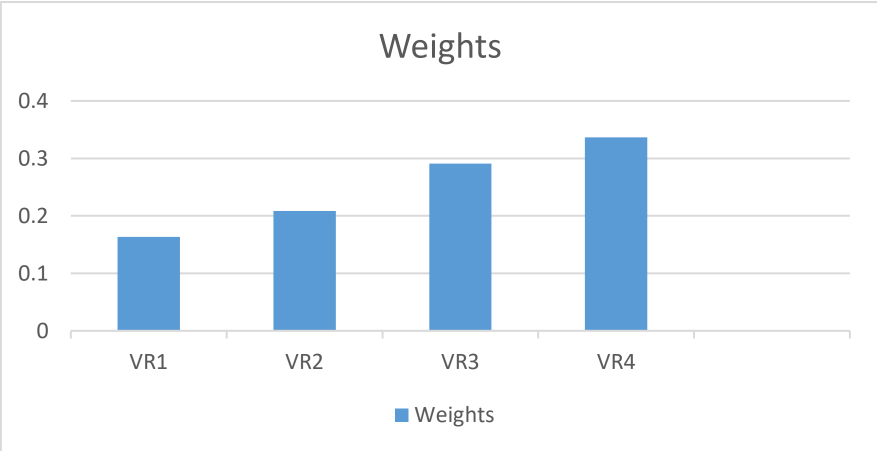

Figure 6: The criteria's weights of VR

4. Conclusions

In this paper, we introduce the AHP and neutrosophic sets for the application of PE teaching. The AHP method is used for computing the weights of criteria. Four main criteria and fourteen sub-criteria were used in this paper. We use the single-value neutrosophic scale for evaluated criteria and main criteria.

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