Candidate Selection of Athletes Sparring for Boy Category *Pencak Silat* Using TOPSIS: Case Study in PSHT *Pencak Silat*)

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Abstract. Pencak silat is one of the original cultures of the Indonesian people. But the general champion of the pencak silat branch is no longer dominated by Indonesia. Therefore, to be able to compete with other universities or overseas athletes, there needs to be a strict selection from each region. There are 22 criteria used for the selection of prospective sparring athletes. Therefore it is necessary to have a system that can facilitate the trainer to choose students to be sent to compete on behalf of the branches of each class. This study uses the TOPSIS (Technique For Order Preference By Similarity To Ideal Solution) method for student ranking and is selected as needed. Testing is done by the system and comparing the results of the competition from 12 sessions consisting of class A, class B, class C and class D with 42 athlete candidates. The suitability level of this application is 66.67%.
Keywords: Pencak silat, athletes, TOPSIS

1. Introduction

Pencak silat is one of the original cultures originating from Indonesia, which has now been accepted by the international community, then developed as a modern sport that is accepted by the wider community. This is evidenced from championships such as the SEA Games, Asian Indoor Games and other world championships, that the overall champion in the pencak silat branch championship is no longer dominated by Indonesia. The International Pencak Silat Alliance (PERSILAT) on March 11, 1980 together with the countries of Singapore, Malaysia and Brunei Darussalam was finally declared as the founding countries of the International Pencak Silat and PERSILAT organizations officially became members of the Olympic Council of Asia (OCA) [1].

In general, in selecting athletes to be sent to the championship the martial arts, institution still relies on the feelings of the coach. Coaches usually only observe a few athletes who attract their attention. In relation with this condition, a decision support system is needed to solve the problem. The attributes which are used to support the decision consist of several things that makaes Multiple Attribute decision Making (MADM) is used to determine the best alternative criteria from certain criteria. One of them uses The Technique for Order of Preference by Similarity to Ideal Solution method or commonly known as TOPSIS. This method was chosen because it is based on the concept that the best alternative not only has the shortest distance from the positive ideal solution, but also has the longest distance from the negative ideal solution [2].

This method uses the calculation of several criteria which have weights used in the selection process by giving preference weights based on the level of importance desired by the trainer. From the calculation process, values are obtained from highest to lowest and taken by a number of students based on needs. With the existence of a computer-based system is expected to be a solution to the expected player selection.

2. Methods

2.1 Pencak Silat

Pencak silat is a typical Indonesian martial art. Its development which is currently growing rapidly both domestically and abroad, this is evidenced by world championships that are often held to determine the level of ability from the results of coaching and training processes [3]. In pencak silat there are two categories which are important, namely the art category including single, double and team and then the match category [4]. In the category of sparring a martial art featuring two fighters from different teams both facing each other using elements of defence and attack [5].

The category of sparring is a body contact sport so that physical conditions and techniques are needed [4]. Classes are divided into categories based on sex, age and body weight; based on article 3 of the 2012 IPSI National Conference, early age groups for male and female are aged 9-12 years in class A of 26-27 kg, class B of 27-28 kg and so on with the difference 1 kg for each class. The total amount of the class are 12 classes for men and 10 classes for girls. Article 4 explains pre-teen group for male and female; 12-14 years old A class 34-37 kg, class B 37-40 kg and so on with a difference of 3 kg for each classes. The total amount of the class are 12 classes for boys and 10 classes for girls. Article 5 mentions Pre-adolescent groups for male and female; aged 14-17 years A class 39-43 kg, class B 43-47 kg and so on with a difference of 4 kg which the total amount of the class are 12 classes for boys and 10 classes for girls. Article 6 mentions adult group for male and female, aged 17 - 35 years old class A of 45 - 50 kg, class B of 50 - 55 kg and so on with a difference of 5 kg which the total amount of the class are 12 classes for boys and 10 classes for girls. Article 7 class of warriors for male and female, with age above 35 years class A of 45 - 50 kg, class B of 50 - 55 kg and so on with a difference of 5 kg which the total amount of the class are 12 classes for men and 10 classes for girls [6].

In this pencak silat decision support system, the criteria used are 22 criteria namely:

a. Balance test: to measure the level of static balance

b. Run 20 m: to find out the running speed

c. Stutle run: to find out agility

d. Trunk extension: to find out flexibility

e. Tripple hop: to find out the muscle explosive power

f. Sit ups: to determine the strength of the abdominal muscles

g. Push up: to determine the strength of the arm muscles

h. Bleep test: to find out Vo2Max capacity

i. Skills: to find out the martial arts skills

j. Kick Speed: to know the speed of the kick. There are three types of criteria, namely right and left leg straight kicks, right and left side legs and right and left sickles.

k. Kick agility: to find out the kick agility. There are three types of criteria, namely right and left leg straight kicks, right and left side legs and right and left sickles.

l. Coordination test: to find out the coordination of kicks and punches

2.2. TOPSIS method

Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method is one of the methods used to solve the Multi Attribute Decision Making (MADM) problem. The TOPSIS method is based on the concept that the best alternative not only has the shortest distance from the positive ideal solution, but also has the longest distance from the negative ideal solution. The TOPSIS method has several advantages, including a simple and easily understood concept, efficient computation, and

the ability to measure the relative performance of decision alternatives in a simple mathematical form [7]. In general, the TOPSIS procedure follows the following steps:

1). Making a normalized decision matrix TOPSIS requires a performance rating of each A_i alternative on each normalized C_j criterion, [8]:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} xij^2}}$$

Where:

r_{ij} = result of normalization of the decision matrix R

i = 1, 2, ..., m (i are possible alternatives)
j = 1, 2, ..., n (j are measured alternative attribute)

2). Making a normalized decision matrix weighted with a weight $W = (w_1, w_2, ..., w_n)$

$$Y = \begin{matrix} w_{11}r_{11} & .. & w_{1n}r_{1n} \\ .. & .. & .. \\ w_{m1}r_{m1} & .. & w_{nm}r_{nm} \end{matrix}$$

3). Determine the positive ideal position and the negative ideal position

$$A^+ = y_1^+, y_2^+, ..., y_n^+$$
$$A^- = y_1^-, y_2^-, ..., y_n^-$$

With

$$y_j^+ =$$
$$\begin{cases} \max_i y_{ij} & \text{, if j is the profit attribute} \\ \min_i y_{ij} & \text{, if j is the cost attribute} \end{cases}$$

$$y_j^- =$$
$$\begin{cases} \min_i y_{ij} & \text{, if j is the profit attribute} \\ \max_i y_{ij} & \text{, if j is the cost attribute} \end{cases}$$

4). Determine the distance between the values of each alternative with the ideal solution matrix and the negative ideal solution matrix. The distance between the A_i alternatives and the positive ideal solution is formulated as follows:

$$D_1^+ = \sqrt{\sum_{j=1}^{n} (y_1^+ - y_{ij})^2}$$

Where i = 1, 2, ... m The distance between the alternative A_i and the negative ideal solution is formulated as follows:

$$D_1^- = \sqrt{\sum_{j=1}^{n} (y_{ij} - y_1^-)^2}$$

Where i = 1, 2, ..., m

5). Determine the preference value for each alternative. The preference value for each alternative (V_i) is given as follows:

$$v_i = \frac{D_i^-}{D_i^- + D_i^+}$$

Where i = 1, 2, ..., m

3. Result

Implementation of the software is done by creating interfaces and making software for the selection process of martial arts athletes. The programming language used is PHP, while for database processing using MySQL. Input from the system is martial arts athlete data and weight of each criterion. The output of the system is martial arts athletes that have been sorted from the highest value to the lowest value in each class.

In tables 1 to 4 below are examples of the results of biomotorik tests and the skills of three prospective athletes.

Table 1. Biomotorik test

Balance (Second)	Speed (Second)	Agility (Second)	Speed (Cm)	Power (Cm)	Power (Times)		Vo2Max
Strok Standing Balance Test	Run 20 Meters	Running Back and Forth	Lift the Body to the Top	Three Jumps	Sit Ups	Push Ups	Multi-Step
26.38	3.39	16.6	20	590	70	40	35
18.64	3.48	11.61	30.6	703	58	39	34.3
31.05	3.22	13.31	29	720	77	39	39.9

Table 2. Skill test

Basic Skil (Grades)						Speed (Times)						Agility (Times)	Coordination (Times)
Straight		Side		Sickle		Straight		Side		Sickle		Side	Hands dan Feet
ka	ki	ka	ki	ka	ki	Ka	ki	ka	ki	ka	ki		
84	85	78	80	82	81	19	19	19	15	23	21	15	33
85	86	89	89	78	76	20	19	17	15	19	17	15	38
88	89	86	85	80	85	20	20	16	14	18	16	16	39

The test results are then subjected to the calculation phase using TOPSIS which results are as follows:

Table 3. Results TOPSIS to test biomotorik

Balance (Second)	Speed (Second)	Agility (Second)	Speed (Cm)	Power (Cm)	Power (Times)		Vo2Max
Strok Standing Balance Test	Run 20 Meters	Running Back and Forth	Lift the Body to the Top	Three Jumps	Sit Ups	Push Ups	Multi-Step
3	2	3	5	2	5	4	3
2	1	5	5	4	5	4	3
3	3	5	5	4	5	4	3

Table 4. TOPSIS results for skills tests

Basic Skil (Grades)						Speed (Times)						Agility (Times)	Coordination (Times)
Straight		Side		Sickle		Straight		Side		Sickle		Side	Hands dan Feet
ka	ki	ka	ki	ka	ki	ka	ki	ka	ki	ka	ki		
4	5	4	4	4	4	3	3	3	2	4	4	2	2
5	5	5	5	4	4	4	3	3	2	3	3	2	3
5	5	5	5	4	5	4	4	2	1	3	2	2	3

System testing in this study was conducted in order to show that the system that was built was able to work in accordance with the specifications of the underlying needs. To find out the suitability of the implementation of the system using the TOPSIS method, it is sought the equation of the ranking position of the system with the results of the match, from 42 prospective athlete data divided into 10 competition sessions to minimize injury by comparing a maximum of 4 athlete candidates in each session. The following table of the results of the match and the results of the system calculations can be seen in tables 5 to table 16.

Table 5. Compatibility Level of Class A Session 1

No	Match Results	*TOPSIS Result*
1	Roni	Roni
2	Yudi	Yudi
3	Salam	Salam

Table 6. Compatibility Level of Class B Session 2

No	Match Results	*TOPSIS Result*
1	Narko	Narko
2	Arik	Arik
3	Beni	Beni
4	Tio	Tio

Table 7. Conformity Comparison of Class B Session 3

No	Match Results	*TOPSIS Result*
1	Ardi	Ardi
2	Dayat	Dayat
3	Abdul	Abdul
4	Feri	Feri

Table 8. Conformance Comparison Rates for Class B Session 4

No	Match Results	*TOPSIS Result*
1	Supri	Supri
2	Iwan	Iwan
3	Aris	Aris
4	Mahmud	Mahmud

Table 9. Conformity Comparison of Class B Session 5

No	Match Results	*TOPSIS Result*
1	Somad	Somad
2	Iqbal	Iqbal
3	Bagus	Bagus
4	Angga	Angga

Table 10. Conformance Comparison Rates for Class B Session 6

No	Match Results	*TOPSIS Result*
1	Arif	Agus
2	Agus	Arif
3	Anggi	Anggi
4	Agus b	Agus b

Table 11. Conformance Comparison Rates for Class C Session 7

No	Match Results	*TOPSIS Result*
1	Rudi	Sofiyan
2	Sofiyan	Rudi
3	Fajar	Fajar
4	Bambang	Bambang

Table 12. Conformance Comparison Level Class C Session 8

No	Match Results	*TOPSIS Result*
1	Eko	Eko
2	Faid	Faid
3	Danang	Danang

Table 13. Conformance Comparison Rates for Class C Session 9

No	Match Results	*TOPSIS Result*
1	Rafa	Rafa
2	Imam	Imam
3	Andik	Andik

Table 14. Conformance Comparison Rates for Class C Session 10

No	Match Results	*TOPSIS Result*
1	Joko	Joko
2	Fian	Wahyu
3	Wahyu	Fian

Table 15. Conformance Comparison Rates for Class D Session 11

No	Match Results	*TOPSIS Result*
1	Bayu	Bayu
2	Rohmat	Rohmat
3	Wafik	Wafik

Table 16. Conformance Comparison Rates for Class D Session 12

No	Match Results	*TOPSIS Result*
1	Faris	Bima
2	Taufik	Taufik
3	Bima	Faris

4. Conclusion

Based on the TOPSIS method for the selection of male pencak silat, the precise category candidates match the suitability level of 66.67%. The scores were obtained from the results of the implementation of the TOPSIS method system with the results of 12 match sessions consisting of class A, class B, class C and class D with a total of 42 prospective athletes taking the test.

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