Decision Support System using WP Algorithm for Teacher Selection

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Abstract. Education is the most important thing done by every country. Going to higher education cannot be done briefly. There are several stages in implementing this education. One of them is Junior High School (SMP) education. This research took place in one school. This education requires teachers who are professional and have good performance. The decision support system with the Weighted Product (WP) method can be used to help select teachers who can join the school. The Weighted Product method works by calculating five criteria as the basis for selecting and seeking teachers. The results of this method are the teacher ranking scores from highest to lowest. The benefits obtained; the school can make acceptance based on the system implemented.

1. Introduction

A school is a place where students do their education. Junior High School is one of the schools that children must take after completing their elementary school graduation period. Transferring the level of education from elementary school requires excellent and reliable teachers in guiding students to carry out education properly and structured.

The school also needs qualified teachers who are patient in educating school children who are in the school. Junior high school education is where children begin to learn to become adults and learn more about the world of education. There are no words at play in implementing junior high school education to need qualified teachers. This is done so that the children in the school are able to understand the
lessons well and with direction. The provision of important material will be carried out during the teaching and learning process [1].

Finding a good teacher is not easy to do. There are many teachers available, but not all teachers have good talents and interests in teaching [2], [3]. The search for teachers continues. At this time the search for teachers was carried out conventionally by opening job applications and interview tests [4], [5]. There is a need for a system that can determine which teachers can become permanent teaching staff. The decision support system is one solution to get professional teachers who have high working power.

Many decision support system methods can be used in conducting teacher acceptance [6]. In determining the best teacher, the writer chose the Weighted Product (WP) method [7], [8]. This method can assist the school in determining the best teacher based on each prospective teacher's criteria. Several criteria will be established in determining the best teacher. This method will process the criteria and assign each of these criteria a weight according to the included alternatives' value. This method is expected to contribute to this research.

2. Literature
2.1 Weighted Product

The Weighted Product (WP) method is a method of deciding on a ranking problem by analyzing criteria using rankings and multiplicative each criterion for each alternative [9]. The decision will be influenced by the weight assigned to each criterion. Each attribute must be ranked first with the weighted preference obtained so that the results can then be calculated by multiplying between the criteria [10].

There are several steps that must be done to find the Weighted Product value. WP completion steps as follows:

1. Determine the criteria
   Namely the criteria that will be used as a reference in decision making, namely Ci and the nature of each criterion.
2. Determine the suit rating
   Such as the suitability rating of each alternative on each criterion, and a decision matrix.
3. Perform weight normalization
   Normalized Weight = Weight of each criterion / the sum of all criterion weights. The value of the total weight must meet the equation:
   \[ \sum_{j=1}^{n} W_j = 1 \]
4. Determine the vector value S
   By multiplying all the criteria for an alternative with the weight as the positive power for the benefit criteria and the weight functioning as the cost criterion's negative power. The formula for calculating the preference value for the alternative Ai is given as follows:
   \[ S_i = \prod_{j} X_{ij}^{w_j}, i = 1, 2, ..., m \]

Description:
- \( S \) : expresses the alternative preference analogous to the vector \( S \)
x : represents the criterion value  
w : states the criterion weight  
i : stated an alternative  
j : states the criteria  
n : states the number of criteria

5. Determine the vector value $V$

It is the value that will be used for ranking. The formula can calculate the relative preference value of each alternative:

$$Vi = \left( \prod_{j=1}^{n} X_{ij}^w \right) / \left( \prod_{j=1}^{n} X_{ij}^w \right) ; i = 1, 2, ..., m$$

Information:

$V$ : expresses an alternative preference which is analogous to a vector $V$.  
x : represents the criterion value  
w : states the criterion weight  
i : stated an alternative  
j : states the criteria  
n : states the number of criteria

6. Ranking the Vectors Values and making conclusions as a final step

2.2 Honorary Teacher

According to Wikipedia, the definition of an honorary teacher is a non-permanent teacher who has not had a minimum status as a Candidate for Civil Servants and is paid per school hour. Often, they are paid voluntarily and even below the official minimum wages. In plain view, they often look not much different from permanent teachers, even wearing Civil Servant uniforms like a permanent teacher. It violates the rules set by the government. They are underemployed. In general, they become volunteers in order to be appointed as Candidates for Civil Servants through the honorary route or as waiters for the opportunity to pass the general formation Candidates for Civil Servants [4].

According to the Secretary-General of the Ministry of Education and Culture, Didik Suhardi, quoted on the kemendikbud.go.id page, currently there are 3,017,296 teachers in Indonesia. A total of 2,114,765 are in public schools, while 902,531 are in private schools. A total of 1,174,377 civil servant teachers in both public and private schools have been certified. Then, as many as 217,778 non-PNS teachers have been certified. "Those who have not been able to do this are those who are not yet S-1. We are accelerating this," said Didik. Meanwhile, there are currently 700,000 Honorary Teachers in Indonesia.

Honorary teachers according to the criteria set by the Ministry of Administrative Reform and Bureaucratic Reform are as follows:

1. Based on the Shade of the Ministry
   a. Ministry of Education and Culture  
   b. Ministry of Religion
2. Based on the Service Place,  
   a. Honorary Teacher at Public Schools  
   b. Honorary Teacher in Private School

3. Methodology

3.1 Research purposes
This study aims to define the systematic scoring strategies that removed the teacher’s bias and create fairness and consistency in scores. It is also aimed to highlight the big difference in the selection of the candidate. This study aims to select teachers according to the abilities possessed by prospective teachers who take part in the test. The research objectives are based on the background in this research, including:

1. To conduct teacher acceptance using a decision support system technique.
2. To test the Weighted Product decision support system in processing alternative data to determine which teacher candidates are eligible to be selected.
3. To determine the criteria used in selecting teachers.
4. To determine the preference weight used as a comparison component in determining vector values.

3.2 Criteria

The criteria are the characteristics that will be assessed by the Weighted Product method in obtaining the selection of honorary teachers. There are five characteristics used in this study. Determination of the criteria is taken based on the characteristics often used in school in admitting honorarium teachers.

The following tables will describe the criteria used in determining honorarium teachers.

Table 1. Education

| Education | Score |
|-----------|-------|
| Very good | 9-10  |
| Good      | 7-8   |
| Moderate  | 5-6   |
| Enough    | 3-4   |
| Bad       | 1-2   |

The education criterion is to determine how high the level of education a prospective honor teacher has.

Table 2. Skill

| Skill   | Score |
|---------|-------|
| Very good | 9-10  |
| Good     | 7-8   |
| Moderate | 5-6   |
| Enough   | 3-4   |
| Bad      | 1-2   |

The skill criteria will determine how good the person's reliability is when he has been appointed as an honorarium teacher.

Table 3. Appearance

| Appearance | Score |
|------------|-------|
| Very good  | 9-10  |
| Good       | 7-8   |
Appearance is very important for a teacher. This reflects the faith of a teacher, especially in the teaching and learning process.

**Table 4. Presence**

| Presence   | Score |
|------------|-------|
| Very good  | 9-10  |
| Good       | 7-8   |
| Moderate   | 5-6   |
| Enough     | 3-4   |
| Bad        | 1-2   |

The presence of a teacher determines the level of student discipline. The arrival of teachers on time can increase the punctuality of students in attending lessons at school.

**Table 2. Knowledge**

| Knowledge | Score |
|-----------|-------|
| Very good | 9-10  |
| Good      | 7-8   |
| Moderate  | 5-6   |
| Enough    | 3-4   |
| Bad       | 1-2   |

A teacher must have broad insights in order to provide answers and knowledge to their students.

### 4. Result and Discussion

The implementation of the application for determining honorariums in schools is desktop-based. Several components need to be provided so that the application program can function correctly and by the previous design. The system requirement is a system that can run application programs in a structured and directed manner.

This research requires two types of systems, namely hardware and software. These systems are interrelated so that the application program can function properly and correctly. Hardware and software specifications can be seen in the following sections.

**Table 6. Candidate Data**

| Candidate | Code | C1 Education | C2 Skill | C3 Appearance | C4 Presence | C5 Knowledge |
|-----------|------|--------------|---------|---------------|-------------|--------------|
| Teacher 1 | A1   | 7            | 9       | 9             | 2           | 2            |
| Teacher 2 | A2   | 8            | 2       | 3             | 3           | 3            |
| Teacher 3 | A3   | 8            | 9       | 9             | 2           | 8            |
Table 6 shows the data used as initial data from the decision support system calculation process to determine honorarium teachers using the Weighted Product method. There are as many as 10 data as sample data that will be tested in this process.

Tests are carried out to get the correct results between the application program and manual calculations. The application program must produce the correct value and the design determined, especially in the calculation of the Weighted Product method. Calculations are made to make full compatibility of results, and expectations can be achieved. Several variables which are input parameters must be met before performing calculations. The following is a complete calculation description of determining honorarium teachers.

| Teacher 4 | A4  |  5  |  9  |  1  |  1  |  5  |
|-----------|-----|-----|-----|-----|-----|-----|
| Teacher 5 | A5  |  3  |  8  |  7  | 10  |  9  |
| Teacher 6 | A6  |  8  |  7  | 10  |  6  |  9  |
| Teacher 7 | A7  |  2  |  3  |  4  |  6  | 10  |
| Teacher 8 | A8  |  4  |  2  |  2  |  2  |  9  |
| Teacher 9 | A9  |  6  |  1  |  8  |  9  |  3  |
| Teacher 10| A10 |  6  | 10  | 10  |  3  |  5  |

CANDIDATE DATA
==============
Teacher 1 = 7 9 9 2 2
Teacher 2 = 8 2 3 3 3
Teacher 3 = 8 9 9 2 8
Teacher 4 = 5 9 1 1 5
Teacher 5 = 3 8 7 10 9
Teacher 6 = 8 7 10 6 9
Teacher 7 = 2 4 4 6 10
Teacher 8 = 4 3 2 2 9
Teacher 9 = 6 2 8 9 3
Teacher 10 = 6 10 10 3 5

PREFERENCE WEIGHT
================
W[0] = 10
W[1] = 8
W[2] = 6
W[3] = 8
W[4] = 8

W[0] = 10 / 40 = 0,25
W[1] = 8 / 40 = 0,2
W[2] = 6 / 40 = 0,15
W[3] = 8 / 40 = 0,2
W[4] = 8 / 40 = 0,2

WP VALUE
=======
V[1] = (7^0,25) * (9^0,2) * (9^0,15) * (2^0,2) * (2^0,2)
V[1] = 4,631
V[2] = (8^0,25) * (2^0,2) * (3^0,15) * (3^0,2) * (3^0,2)
V[2] = 3,5351
V[3] = (8^0,25) * (9^0,2) * (9^0,15) * (2^0,2) * (8^0,2)
V[3] = 6.3181
V[4] = ((5 ^ 0.25) * (9 ^ 0.2) * (1 ^ 0.15) * (1 ^ 0.2) * (5 ^ 0.2)
V[4] = 3.2017
V[5] = ((3 ^ 0.25) * (8 ^ 0.2) * (7 ^ 0.15) * (10 ^ 0.2) * (9 ^ 0.2)
V[5] = 6.5691
V[6] = ((8 ^ 0.25) * (7 ^ 0.2) * (10 ^ 0.15) * (6 ^ 0.2) * (9 ^ 0.2)
V[6] = 7.7853
V[7] = ((2 ^ 0.25) * (4 ^ 0.2) * (4 ^ 0.15) * (6 ^ 0.2) * (10 ^ 0.2)
V[7] = 4.3845
V[8] = ((4 ^ 0.25) * (3 ^ 0.2) * (2 ^ 0.15) * (2 ^ 0.2) * (9 ^ 0.2)
V[8] = 3.4845
V[9] = ((6 ^ 0.25) * (2 ^ 0.2) * (8 ^ 0.15) * (9 ^ 0.2) * (3 ^ 0.2)
V[9] = 4.7477
V[10] = (6 ^ 0.25) * (10 ^ 0.2) * (10 ^ 0.15) * (3 ^ 0.2) * (5 ^ 0.2)
V[10] = 6.0222

RANKING RESULT

V[1] = 0.0453
V[2] = 0.0346
V[3] = 0.0618
V[4] = 0.0313
V[5] = 0.0643
V[6] = 0.0762
V[7] = 0.0429
V[8] = 0.0341
V[9] = 0.0465
V[10] = 0.0589
V[11] = 0.0338

5. Conclusion
After researching getting honorary teachers in schools, the author can conclude several statements. The Weighted Product method is very good at determining honorarium teachers. Admission of honorarium teachers can be made by using a decision support system application. There are five criteria taken, and these criteria are the right criteria in determining honorarium teachers. The preference weights can balance the criteria in determining which criteria are more dominant to use.

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