

Implementation of the Weighted Product Method in the Best Student Selection Decision Making System Application

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Abstract: Decision support systems are information systems that are interactive and provide information, data modeling and manipulation techniques, and help decision makers in semi-structured and unstructured conditionals. School is an institution or an effective place to transform knowledge from educators to students and as a means of education. Here students get additional knowledge and moral formation. One of the school assignments is to produce students who are able to advance the nation. The selection of the best students is carried out in a period with the aim of stimulating enthusiasm in each student to continue to improve their learning achievement in school. The best student selection is done by determining a student who is recommended by the teacher based on the criteria determined by the school. In order for the desired results to be maximized and appropriate in the process of selecting the best students with using the Product Weighting Method (WP).

1 INTRODUCTION

School is one of the effective places for science transformation activities and also educational facilities for students. Here students will get the provision of knowledge such as guidance. The National Education System stipulates that the world of national education has the duty to develop capabilities and shape the character of the nation's civilization and aims to develop the potential of students to become human beings who have faith and piety to God Almighty, have good morals, are knowledgeable, creative, independent and become a democratic citizen and has integrity and responsibility.

One of the criteria for being able to advance the nation is provided the best student. The selection of the best students must be done periodically and continuously with the aim that students always encourage their enthusiasm to continuously improve their learning achievement. The process of selecting the best students is not an easy matter (Kusrini & Kom, 2007). The problem in the process of selecting

the best students is done by choosing one student recommended by the teacher whose criteria have been determined by the school, but the desired results are not maximal due to inaccuracies data in the selection process so the results have an impact on the results of the decisions given inappropriately. Should to determine the best students needed the right formula, fast and fair according to the development of science and technology today, in making a decision support system for selecting the best students who can do calculations quickly, to help, accelerate and simplify the decision making process. One of the decisions that can be used in selecting the best students is to use the Fuzzy Multiple Attribute Decision Making (FMADM) model, which is a model used to find the best alternative from a number of alternatives based on multi criteria (Itik, Alici, Ilkhchi, & Moallemi, n.d.) (Sigit & Kapuji, 2014).

Weighted Product Method (WP) is a way of solving problems in making a decision. The use of methods in decision support systems must have the correct criteria, besides that it must determine the importance of each criterion. WP method requires a

normalization process because this method will multiply the results of the assessment of each attribute. The results of the multiplication have not been meaningful if not compared (divided) with standard values. The weight for the benefit attribute will function as a positive rank in the multiplication process, while the cost weight will function as a negative rank.

The purpose of the study is to explain the process of selecting the best students by applying the WP method in the best student decision support decision system as an alternative to assist the headmaster in determining the best student selection and can optimize performance through the existing system.

2 RESEARCH METHODS

The research methods carried out in the implementation of this study are (Kusrini & Kom, 2007):

1. Data Collection
Data collection used is reading and collecting scientific books and journals related to decision support systems using the Weighted Product (WP) method.
2. Troubleshooting
Studing and understanding the theoretical basis associated with the problems to be discussed.
3. Testing Problems
The use of a method in developing the right system and adapted to the problem.
1. Implementation of the Problem
The implementation phase is carried out starting from the coding of programs to implement all the design of decision support systems that already use the programming language.
2. Making Reports
Preparation of Research Reports is a stage where reporting all things and data that have been done during the research in preparing the Research report.

3 THEORICAL FOUNDATION

3.1 Decision Support Systems

Decision support system is a settlement tool interactive in information system that provides data / information, modeling, and manipulating data (Nofriansyah & Defit, 2017). This system is used to help decision makers in semiterstructured and unstructured decision situations, where no one knows exactly how decisions should be made.

Decision Support System Application or DSS uses data, presents interface design for easy users, and combines the ideas and thoughts of the decision maker (Limbong, Simarmata, Fauzi, et al., 2018). DSS will be more intended to support management in carrying out analytical work in situations that are less structured and with unclear criteria(Limbong, Simarmata, Sriadhi, et al., 2018).

The objectives of DSS are:

1. Helping a manager for making decisions on semi-structured problems is also unstructured.
2. Providing a basis for support for all consideration of managers, but not intended to replace the role and function of a manager
3. Increasing the effectiveness of decisions taken by managers is more than an improvement in efficiency
4. Computational speed. Computers provide opportunities for decision makers to use computational formulas quickly, precisely at very low costs
5. Increased productivity.
6. Quality support. Computer technology can improve the quality of decisions made. For example, the more data accessed, the more alternatives can be evaluated.
7. Competitive. Management and optimization of company resources. Very high competitiveness will make decision-making tasks difficult.
8. Overcoming cognitive limitations in processing and storage. The human brain has limited ability to process, and produce output in the form of information.

3.2 Weighted Product (WP) Method

Weighted product method is a method in determining a decision by doing a process and connecting each attribute rating, where the rating of each attribute is raised first with the weight of the attribute in question (Wang, Liu, Wang, & Lai, 2010) (Alfita, Teknik, Trunojoyo, & Product, n.d.). This process is called the normalization process. The preference for alternative Ai is given as follows:

- a. Determination of W weight value

$$W_j = \frac{w_j}{\sum w_j} \dots\dots\dots(2.1)$$

- b. Determination of the value of Vector S

$$S = (W_{ij}^{A_{wj}} \cdot w) \cdot (W_{in}^{A_{wn}} \cdot w) \dots\dots(2.2.)$$

- c. Determines the value of Vector V

$$V_{jn} = \frac{s_i}{\sum s_i} \dots\dots\dots(2.3)$$

Where :

V = Alternative preferences are considered as vector V

W = Weight of criteria / subcriteria
 j = Criteria
 i = Alternative
 n = Number of criteria
 S = Alternative preference analogous to vector S

The steps in calculating the Weighted Product method are as follows:

1. Multiplying all attributes for all alternatives with the weight as a positive rank for the cost attribute.
2. The multiplication result is summed to produce a value for each alternative
3. Divide the value of V for each alternative with the value of each alternative
4. Found the best alternative sequence that will be a decision.

4 RESULT AND DISCUSSION

4.1 Problem Analysis

From observations and field studies it is known that the selection of the best students is still mostly done manually, in the sense that it has not utilized the computer's capabilities as a whole, so there are still some problems found (Nofriansyah & Defit, 2017) (SITORUS & Wardoyo, 2004), including:

1. Difficulties in presenting teacher assessment results data in a fast time.
2. Difficulties in filing all the results of the assessment from one period, for material evaluation to the next period in the selection of the best students.

The requirements that have been determined by the school in the selection of the best students, namely as follows:

1. Average value
2. Attitude
3. Knowledge

4.2 Implementation of Weighted Product Methods

In choosing the best student to be one of the students who is entitled to be the best student with students who have met the criteria set by the school. As a researcher sample the author included 5 data students who would be selected as the best students. With the attached data applied the WP (Weighted Product) method, the necessary criteria and weights in performing calculations so that the best alternatives will be obtained are as follows:

- a. Determining each of each criterion can be seen in table 1:

Table 1: Description of Criteria

Criteria	Explanation
C1	Report Card
C2	List of attendees
C3	Attitude
C4	Skills
C5	Achievement

- b. Furthermore, the decision maker gives the Preference Weight for each criterion as W shown in table 2:

Table 2: Determination of W Value

Criteria	Range (%)	Weight
C1	25	0,25
C2	25	0,25
C3	20	0,20
C4	15	0,15
C5	15	0,15

Sufficient (S), Fairly Good (FG), and Very good (VG) as shown in Figure 1:

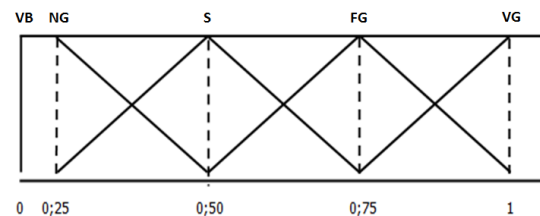


Figure 1: Weight of Criteria

- c. From each of these criteria will be determined the weights. The weight consists of five fuzzy numbers, which are Very Bad (VB), Not Good (NG),

Information :
 Very bad = 0
 Not Good = 0.25

Sufficient = 0.50
 Fairly Good = 0.75
 Very Good = 1

d. Determining criteria value data can be seen in table 3: 3:

Table 3: Original Student Data

No	Alternative	Criteria				
		Report Card	List attendees	Attitude	Skills	Achievement
1	A ₁	84,325	2	B	B	Nothing
2	A ₂	84,855	0	B+	B+	Nothing
3	A ₃	83,555	3	B	B	Nothing
4	A ₄	82,52	2	B-	B	Nothing
5	A ₅	86,19	2	A	A	Exist

The Fuzzy Weighting is as follows:

a. Report Card Value Criteria (C1)

In the value variable the skills consist of five fuzzy numbers, namely Very Good, More than Good, Good, More than Enough, Not Good. As shown in the following table:

Table 4: Determines Report Card Criteria

Report Card	Fuzzy Criteria	Weight
90-99	Very Good	1
80-89	More than Good	0,75
70-79	Good	0,50
60-69	More than Enough	0,25
≤ 59	Not Good	0

b. Attendance Criteria (C2)

In the variable Attendance Value consists of five fuzzy numbers, namely Very Good, Good Enough, Good, Not Good, Bad. As shown in the following table:

Table 5: Determines Attendance Criteria

List of attendees	Fuzzy Criteria	Weight
0	Very Good	1
1	Good Enough	0,75
2	Good	0,50
3	Not Good	0,25
>4	Bad	0

c. Attitude Criteria (C3)

The Attitude Value variable consists of five fuzzy numbers Very not good (C), Poor (B-), Sufficient (B), Fairly Good (B +), Very Good (A), As shown in figure 6:

From the picture above Crisp numbers can be converted. For more details, it can be formed in table 6:

Table 6: Determines Attitude Value Criteria

Attitude Value	Fuzzy Criteria	Weight
A	Very good	1
B+	Pretty good	0,75
B	Good	0,50
B-	Not good	0,25
C	Very not good	0

d. Skill Criteria (C4)

The value variable consists of five fuzzy numbers, namely enough (C), more than enough (C +), good (B), more than good (B +), very good (A). As shown in figure 5:

Table 7: Determining Skills Criteria

Skill Value	Fuzzy Criteria	Weight
A	Very good	1
B+	Pretty good	0,75
B	Good	0,50
B-	Not good	0,25
C	Very not good	0

e. Achievement Criteria (C5)

Table 8: Determines Achievement Criteria

Achievement	Weight
Any	0,75
Nothing	0,25

Match rating of each student. Based on alternative data above, a suitability rating of each alternative can be formed on each criterion, shown in table 9:

Table 9: Compatibility Rating

No	Alternative	Criteria				
		Report Card	List of attendees	Attitude	Skills	Achievement
1	A ₁	0,75	0,50	0,50	0,50	0.25
2	A ₂	0,75	1	0,75	0,75	0.25
3	A ₃	0,75	0,25	0,50	0,50	0.25
4	A ₄	0,75	0.50	0,25	0,50	0.25
5	A ₅	0,75	0,50	1	1	0,75

Previously we have made weight repairs so that $\Sigma W = 1$,

then the calculation is obtained as follows:

$$W_1 = \frac{0,25}{0,25 + 0,25 + 0,20 + 0,15 + 0,15} = \frac{0,25}{1} = 0,25$$

$$W_2 = \frac{0,25}{0,25 + 0,25 + 0,20 + 0,15 + 0,15} = \frac{0,25}{1} = 0,25$$

$$W_3 = \frac{0,20}{0,25 + 0,25 + 0,20 + 0,15 + 0,15} = \frac{0,20}{1} = 0,20$$

$$W_4 = \frac{0,15}{0,25 + 0,25 + 0,20 + 0,15 + 0,15} = \frac{0,15}{1} = 0,15$$

$$W_5 = \frac{0,15}{0,25 + 0,25 + 0,20 + 0,15 + 0,15} = \frac{0,15}{1} = 0,15$$

Formation of vector S Then calculated by the equation as follows:

$$S = (W_{ij}^{A_{wj}} * W) * (W_{in}^{A_{wn}} * W)$$

$$S_1 = (0,75^{0,25}) * (0,50^{0,25}) * (0,50^{0,20}) * (0,50^{0,15}) * (0,25^{0,15}) = 0,9306 * 0,8408 * 0,8705 * 0,9012 * 0,8122 = 0,49854$$

$$S_2 = (0,75^{0,25}) * (1^{0,25}) * (0,75^{0,20}) * (0,75^{0,15}) * (0,25^{0,15}) = 0,9306 * 1 * 0,9440 * 0,9577 * 0,8122 = 0,68332$$

$$S_3 = (0,75^{0,25}) * (0,25^{0,25}) * (0,50^{0,20}) * (0,50^{0,15}) * (0,25^{0,15}) = 0,9306 * 0,7071 * 0,8705 * 0,9012 * 0,8122 = 0,41928$$

$$S_4 = (0,75^{0,25}) * (0,50^{0,25}) * (0,25^{0,20}) * (0,50^{0,15}) * (0,25^{0,15}) = 0,9306 * 0,8408 * 0,7578 * 0,9012 * 0,8122 = 0,43401$$

$$S_5 = (0,75^{0,25}) * (0,50^{0,25}) * (1^{0,20}) * (1^{0,15}) * (0,75^{0,15}) = 0,9306 * 0,8408 * 1 * 1 * 0,9577 = 0,74935$$

The value of vector V is used for ranking and is calculated by the equation as follows:

$$V_{jn} = \frac{S_i}{\sum S_i}$$

$$V_1 = \frac{0,49854}{2,7845} = 0,17904$$

$$V_2 = \frac{0,68332}{2,7845} = 0,2454$$

$$V_3 = \frac{0,41928}{2,7845} = 0,15058$$

$$V_4 = \frac{0,43401}{2,7845} = 0,15587$$

$$V_5 = \frac{0,74935}{2,7845} = 0,26911$$

Based on calculations above the decision support system in selecting the best students, the best value is the chosen alternative can be seen in Table 10:

Table 10: Ordering Results and WP Method Calculation

No	Student's name	Rank	Value of Calculation Results
1	(A5) Marisa Nurul Atika	1	0,26911
2	(A2) M. Khairul Hayat Tarigan	2	0,2454
3	(A1) Prasetyo	3	0,17904
4	(A4) Yuliana Safitri	4	0,15587

5	(A3) Herdiani Syahputri	5	0,15058
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Based on the results of calculations and results of sorting out the WP method above that students who are selected to be the best students are looking at the highest score, the best choice is the A5 alternative, Marisa Nurul Atika with a value of 0.26911 who is the best student.

5 CONCLUSION

From the results of the analysis and discussion that has been carried out, the conclusions can be taken as follows:

1. The technique for implementing the best student selection is determined based on conditions such as report cards, attendance, attitudes, skills and achievements.
2. The process of selecting the best students in this study uses the Weighted Product (WP) method which helps in making decisions from several alternatives that must be taken with the criteria into consideration.
3. There are six forms in this system: login form, admin main menu form, student data input form, criteria weighting form, WP method process form. So that it can facilitate the school in the process of selecting the best students and the data produced is more effective and efficient.
4. This decision support system needs to be developed with other methods such as Fuzzy Multi Criteria Decision Making (FMCDM), Weighted Product (WP) and others.

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