Decision Support System of Achieving Student Using Weighted Product Method

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Abstract--- Higher education as part of the national education system that has a strategic role in educating the life of the nation. Students are people who are trying to develop themselves through the process of education on the path, level and type of education. The Weigted Product (WP) method was chosen because the method is solved by using multiplication to connect the value of the attribute, where the value must be raised with the attribute weight value in question. Criteria criteria that have been determined include: average value, discipline, attendance, extracurricular, and Non-Academic. The results of this study there were 6 alternatives, that alternative student with a value = 0.145790734 as a student with the lowest and alternative value Diamond = 0.212196782 as the student with the best value.

Keywords--- Decision Support System, Weighted Product, Achieving Students.

I. INTRODUCTION

1.1 Background

Everyone has different knowledgeand abilities. Knowledge and ability can develop and evolve, being achieving one is pride for self and others. Achieving people have a very large development of science and knowledge. Higher education as part of the national education system has a strategic role in educating the nation's life and advancing science and technology by paying attention and applying the humanity values as well as civilizing and empowering the sustainable Indonesian nation [1]

But choosing a school can also influence education in exploring the achievements that will be achieved. This school gives predicate to achieving student based on academic values obtained and fulfills the criteria determined by the school. In managing the data, high achieving student still use manual methods, namely by using Microsoft Excel, so that it requires a longer time and the results obtained are not maximal.

The study conducted by Muhamad Muslihudin *et al.* Implemented the Weighted Product method to determine Bidik Misi STMIK Pringsewu Scholarship (2018), a decision support system for receiving Bidik Misi scholarship in STMIK Pringsewu -the criteria that have been determined. From the results of the obtained values, alternative 1 gets the greatest value, namely with the highest GPA and included in the category of students from poor families [2].

The study conducted by Muhammad Faisal in the selection decision support system of outstanding students in Pgri 3 junior high school used Weighted Product method (2018), the information generated from this system is

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ranking achievement students based on criteria data and weight data. The resulting ranking can be used to assist teachers in making decisions about the achieving student [3].

Using this Weighted Product the method is more efficient this method uses shorter time to perform calculation. This method was chosen because it can determine the weight values for each attribute, then proceed with a ranking process that will determine the students who are performing according to the criteria.

1.2 Problem Formulation

Based on the background described above, the problem that will be discussed is how to design a decision-making system in determining achieving students using Weighted Product method

1.3 Objectives

Therefore the objectives were:

1. To determine decision support system in determining achieving student.
2. To facilitate school in selecting achieving student.

1.4 Benefit

The benefits of this research are:

1. To facilitate achieving student selection.
2. Can minimlize the mistake in determining achieving student performed manually.

II. THEORETICAL BASE

2.1 Student

Students mean people, children who are studying (studying, attending school). While according to article 1 paragraph 4 of Law of the Republic of Indonesia Number 20 of 2013. Regarding the national education system, students are people who try to develop themselves through the educational process on certain paths and levels and types of education [4]

2.2 Decision Support System

According to Kusrini, (2007, p. 15) Decision support system is an interactive information systems that provides information, modeling and improvement of data. This system is used to help decision-making in semi-structured situations and unstructured situations, where one does not know exactly how decisions should be made (Alter, 2002) [5]

The purpose of decision support system consists of (Turban, 2005): [5]

- Helping manager in making decision or semi structured problem.
- Giving support to manager consideration and not to change manager's function.
- Improving decision effectiveness taken by manager and more than fixing the efficiency.
- Allowing decision makers to do lots of computing quickly at a low cost.
- Improving productivity

- Quality support
- Competitive
- Overcoming cognitive limitations in processing and storage.

2.3 Fuzzy Multiple Attribute Decision Making

In Sutini journal and Muhamad Muslihudin (2016) FMADM is a method used to find optimal alternatives from a number of alternatives with certain criteria. The essence of FMADM is to determine the weight values for each attribute, then proceed with the ranking that will select the alternatives given. Basically, there are 3 approaches to find attribute weight score namely subjective approaches, objective approaches and integration approaches between subjective and objective.

There are several methods that can be used to solve FMADM problems, among others (Kusuma Dewi, 2006):[6][7]

a. Simple Additive Weighting Method (SAW)

b. Weighted Product (WP)

c. ELECTRE

d. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

e. Analytic Hierarchy Process (AHP)

2.4 Achievement

According to KBBI, achievement is an important indicator of the results obtained during education. According to Magfiroh (2011: 24) Achievement of a task-oriented behavior according to internal and external criteria that involves individuals to compete with others. [8]

2.5 Achieving Student

A student who fulfills the educational requirements in the school scope.

2.6 Characteristics of Achieving Student

- Learn diligently
- Brave to try new things
- Not afraid of being wrong , as long as he is on the right path
- Not easily affected by new things that are not clear whether good or wrong

III. RESEARCH METHODOLOGY

3.1 Data Collection

Methods used in data collection were observation, interview and literature study.

3. 1.1.Observation

Observation is a method of collecting data through direct observation or a careful and direct review of the field or location of the study. In this case, research based on research design needs to visit the location of research to

observe directly various things or conditions that exist in the field. Through observation the writer can see and observe directly and collect information that may not be obtained during interviews [9]

3.1.2 Interview

By using interview method the author gave questions based on the observed problem about the achievements in the school. Interview was carried out at the SMK Muhammadiyah 1 Pringsewu and it was to determine achieving students in learning process from all existing departments. It can make students continue to higher education without test.

3.1.3 Literature Study

Literature study. Is a method done to find sources from books, undergraduate thesis and journal?

3.2 Weighted Product Method

Weighted Product (WP) is one method used to solve the Multi Attribute Decision Making (MADM) problem. Weighted Product Method (WP) uses multiplication to connect attribute score (criteria), where the score of each attribute (criteria) must be raised first with the weight of the attribute (criteria) in question [7]

The preference for alternative Ai is given as follows [10]

$$S_i = \prod_{j=1}^{n} X_{ij}^{wj} \tag{1}$$

Where:

S : Alternative preference is analogized as vector S

X : Criteria score

W : criteria/sub criteria weight

i : Alternative

j : Criteria

n : The number of criteria

Where $\sum W_j = 1$. W_j is positive rank for the profit attribute and is negative for the cost attribute.

Relative preference from every alternative can be given as follows:

$$V_i = \frac{\prod_{j=1}^{n} X_{ij}^{wj}}{\prod_{j=1}^{n} (X_j^*)} \tag{2}$$

Where:

V : Alternative preference is analogized as vector V

X : criteria score

W : criteria/subcriteria weight

i : Alternative

j : the number of crtieria

n : the number of criteria

*: The number of criteria scored in vector S

3.2.1   Criteria and Weight

In the process of the weighted product method, required criteria that will be used as calculation material in calculating the achievement at school.

Table 1: Criteria Description

Criteria	Description
C1	Average score
C2	Displince
C3	Attendance
C4	extraculicular
C5	Non academic

Furthermore, decision making gives preference weight for each W criteria (initial weight) can be seen in table 2.

Table 2: Weight Description

Criteria	Range	Weight
C1	Very low	1
C2	low	2
C3	Pretty good	3
C4	Good	4
C5	Very good	5

From each of these criteria it will be determined the weights as follows:

Information:

Bad   = 1

Less good   = 2

Pretty good   = 3

Good   = 4

Very good   = 5

3.3 Research Framework

The research framework is a research step presented using systematic chart form, aimed to facilitate existing problems. The research framework in the Achieving Student Decision Making System using the Weighted Product method.
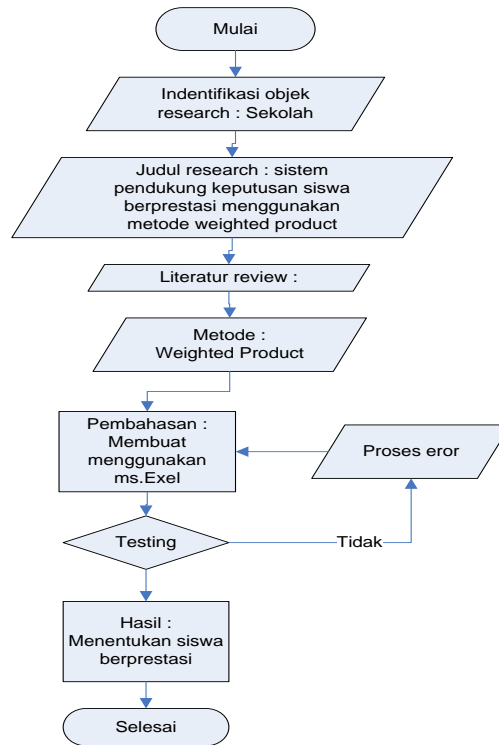
Figure 1: Framework Chart

IV. DISCUSSION

4.1 Manual Test

To solve the problem with the Weighted Product method, determining the criteria that will be used as a reference in making decision criteria used to determine the achievements to be given to students

Table 3: Code and Criteria Provision

Criteria	Criteria Provison	Weight score
C1	Average score	30%
C2	disiplince	20%
C3	Attendance	20%
C4	extraculicular	10%

Table 4: Average Score Criteria (C1)

Average score criteria	Weight	score
90-100	Very good	5
70-80	Good	4
50-60	Low	2
<50	Very low	1

Table 5: Discipline (C2)

Disiplince critieria	Weight	Score
task	Very low	1
Uniform	Very good	5
Stationary	Low	2
Cleanliness	Good	4

Table 6: Attendance (C3)

Attendance criteria	Weight	Score
Alpha>5	low	2
Permission <3	Very good	5
Sick <5	Good	4
Absence >10	Very low	1

Table 7: Extraculicular (C4)

Extraculicular	Weight	score
Scout in District level	Pretty good	3
Futsal among schools	Very low	1
Volley in national level	good	4
Flag Hoisting troop in national level	Very good	5
Drumbandin District level	Low	2

Table 8: Non Academic (C5)

Non academic	Weight	Score
ILC in District Level	Pretty good	3
Robotic in national level	Very good	5
Arabic language in national level	Good	4
LKS in district level	Low	2

4.1.1 Determine Compatibility Rating

The first step was to determine the alternative with the specified criteria value. The alternatives to be examined were:

A1 = Candra

A2 = Agus

A3 = Intan

A4 = Salsa

A5 = Bella

A6 = Nisa

Table 9: Alternative

Alternative	Criteria				
	C1	C2	C3	C4	C5
A1	5	4	1	3	2
A2	2	5	1	4	3
A3	4	2	4	3	5
A4	4	4	2	4	1
A5	1	2	5	5	4
A6	5	1	5	3	2

The second step was calculation using WP method which begins by making improvements to the weight of criteria where the score = 1, and the score of W = 0.3 0.2 0.1 0.2. Manually repairing weight data can be seen as follows:

$$W_1 = \frac{0,3}{0,3+0,2+0,2+0,1} = \frac{0,3}{1} = 0,3$$

$$W_2 = \frac{0,2}{0,3+0,2+0,2+0,1} = \frac{0,2}{1} = 0,2$$

$$W_3 = \frac{0,2}{0,3+0,2+0,2+0,1} = \frac{0,2}{1} = 0,2$$

$$W_4 = \frac{0,1}{0,3+0,2+0,2+0,1+0,2} = \frac{0,1}{1} = 0,1$$

$$W_5 = \frac{0,2}{0,3+0,2+0,2+0,1+0,2} = \frac{0,2}{1} \, 0,2$$

4.1.2 Determine vector S and V score

The third step was to determine the value of the S vector first. By multiplying the data for each alternative value a match rating that has a positive rating from the results of the weight improvement. The manual calculation data for determining the S vector value of each alternative can be seen as follows

1. Candra

   $S_1 =$

   $(5^{0,3})(4^{0,2})(1^{0,2})(3^{0,1})(2^{0,2})$

   $= 2,741707526$

2. Agus

   $S_2 =$

   $(2^{0,3})(5^{0,2})(1^{0,2})(4^{0,1})(3^{0,2})$

   $= 2,430710571$

3. Intan

   $S_3 =$

   $(4^{0,3})(2^{0,2})(4^{0,2})(3^{0,1})(5^{0,2})$

   $= 3,537872041$

4. Salsa

   $S_4 =$

   $(4^{03})(4^{0,2})(2^{0,2})(4^{0,1})(1^{0,2})$

   $= 2,639015822$

5. Bella

   $S_5 =$

   $(1^{0,3})(2^{0,2})(5^{0,2})(5^{0,1})(4^{0,2})$

   $= 2,456456052$

6. Nisa

   $S_6 =$

   $(5^{0,3})(1^{0,2})(5^{0,2})(3^{0,1})(2^{0,2})$

$$= 2{,}866837831$$

The fourth step was to determine the value of vector V. The score of vector V was used to obtain the highest alternative score of each vector V. The process of manually searching for the score of vector V can be seen as follows:

1. Candra

$$V_1 = \frac{2{,}741707526}{16{,}67259984} = 0.164443911$$

2. Agus

$$V_2 = \frac{2{,}430710571}{16{,}67259984} = 0.145790734$$

3. Intan

$$V_3 = \frac{3{,}537872041}{16{,}67259984} = 0.212196782$$

4. Salsa

$$V_4 = \frac{2{,}639015822}{16{,}67259984} = 0.158284601$$

5. Bella

$$V_5 = \frac{2{,}456456052}{16{,}67259984} = 0.147334913$$

6. Nisa

$$V_6 = \frac{2{,}866837831}{16{,}67259984} = 0.171949058$$

From the results above it can be concluded that achievement alternative can be given V1 = 0.212196782

4.2 Research Result

The results of manual system calculations above using the WP method can be concluded that the alternative selection of outstanding students was Diamond with = 0.174807831 highest on Diamond alternatives

4.3 Application System Test

The application of student achievement decision making system using Microsoft Excel is as follows:

Table 10: Alternative and Criteria

Alternative	Criteria				
	C1	C2	C3	C4	C5
Candra	5	4	1	3	2
Agus	2	5	1	4	3
Intan	4	2	4	3	5
Nisa	4	4	2	4	1
Bella	1	2	5	5	4
Salsa	5	1	5	3	2

Table 11: Criteria and Weight

C1	C2	C3	C4	C5
0.3	0.2	0.2	0.1	0.2

Table 12: Alternative Score

Alternative	A1	A2	A3	A4	A5	A6
C1	1.620656597	1.231144413	1.515716567	1.515716567	1	1.620656597
C2	1.319507911	1.379729661	1.148698355	1.319507911	1.148698355	1
C3	1	1	1.319507911	1.148698355	1.379729661	1.379729661
C4	1.116123174	1.148698355	1.116123174	1.148698355	1.174618943	1.116123174
C5	1.148698355	1.24573094	1.379729661	1	1.319507911	1.148698355

Table 13: Vector S

Alternative	Value	Vector S	Total	Ranking
A1	2.741707	16.67259984	0.164443911	3
A2	2.43071	16.67259984	0.145790734	6
A3	3.537872	16.67259984	0.212196782	1
A4	2.639015	16.67259984	0.158284601	4
A5	2.456456	16.67259984	0.147334913	5
A6	2.866837	16.67259984	0.171949058	2

V. CLOSING

5.1 Conclusion

As for the conclusion obtained by writer as follows:

1. Metode *Weighted product* (WP) dapat membantu dalam mengambil keputusan untuk menentukan seleksi siswa berprestasi.

2. Weighted product method (WP) can help in making decisions to determine the selection of achieving student.

3. With a decision-making system for selecting achieving student in the processing of teaching and learning.

4. From 6 students can be obtained that Agus score = 0.1618 as student with the lowest score and Intan score = 0.1748 as student with the best score.

5.2 Suggestion

In the future, DSS should use real data from school. In the future, it is expected that this system can be applied using other decision support systems or comparing weighted product methods with other decision-making system methods such as using Simple Additive Weighted (SAW), Topsis, Analytic Hyperarchy Prosess (AHP) methods, or other SPK methods. And can be implemented using website or application.

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