DECISION SUPPORT SYSTEM IMPLEMENTATION IN DETERMINING STUDENTS TO RECEIVE BOS FUNDING USING THE WASPAS METHOD

Napisah, Rizki Muliono, Nurul Khairina, Muhathir
1,2,3,4Informatics Engineering Study Program, Faculty of Engineering
Medan Area University, Indonesia
E-Mail: rizkimuliono@staff.uma.ac.id

ABSTRACT - Teachers and student aspects such as attendance, parental income, activity participation, achievement scores, and discipline influence success in learning and learning activities at SMA Asy-Syafiyyah Medan. To obtain optimal results, the authors designed an application using the Weighted Aggregated Sum Product Assessment (WASPAS) method to determine students receiving BOS funds. After calculating 5 times with predetermined criteria, Rizki Ridho Silalahi's final result was 0.9197. The system designed for receiving BOS Fund assistance at SMA Asy-Syafiyyah Medan has been tested by inputting criteria data and calculating using the WASPAS method.

Keywords: Decision Support System, BOS Fund, WASPAS Method, Education.

1. INTRODUCTION

Asy-Syafiyyah Medan High School was established on November 1, 2010, at Jalan Tani No. 1 Medan. As an integrated Islamic school, SMA Asy-Syafiyyah has been trusted by many parents to provide education and character development for their children. By the spirit of the vision, namely "Creating a Generation of Smart, Faithful and Characteristic Leaders," SMA Asy-Syafiyyah has produced generations that are the nation's hope. This school uses an integrated form of learning that combines the development of adab, insight, personality, and self-ability and elevates Islamic values and broad sense. Apart from that, Asy-Syafiyyah High School also provides intensive learning about religion, the Qur'an, Arabic, and English as the everyday language for students.

The success of the learning and learning activities process at SMA Asy-Syafiyyah Medan is the result of all the hard work together; besides being influenced by teacher factors, it is also influenced by student factors. Assisting students with academic and non-academic achievements is considered very important to increase achievement for individuals and at school. School fee assistance program. The BOS Fund is a government program that aims to help schools in Indonesia provide optimal learning by assisting with funds. The BOS funds can be used to maintain school facilities and infrastructure, purchase multimedia equipment, and other teaching and learning activities needs.

Within the BOS Fund is a scholarship program that provides tuition assistance to prospective students who are economically disadvantaged and have good academic potential. This program is given for education in superior schools so that these students can graduate on time [1]. Of course, many people have registered as potential recipients of the BOS Fund program. Therefore, we need a system to select BOS funds accurately and transparently by the regulations that apply to the Ministry of Education and Culture. For this reason, the different placements that support implementing the BOS Fund program are determined by several variables, namely school attendance, parents' income, participation in school activities, discipline, and grades. A decision support system is needed to maximize the design and the different calculations provided.
Decision Support System is designed to assist decision-makers in semi-structural situations[2]. "In determining the DSS in these schools using the profile matching method," there were still deficiencies in determining external value factors. There are several methods in the decision support system. In addition, there is the Weighted Aggregated Sum Product Assessment (WASPAS) method for the accuracy of decision-making. The WASPAS method is a method that reduces errors or maximizes budgeting or determining the highest and lowest figures.[3].

According to Manurung's research, the results obtained based on manual calculations and SPSS output show that the calculated F value is 12.086, and the sig value is 0.000. This shows that the F count is more significant than Frable, and the sig value is less than 0.005, so the alternative hypothesis (H1) is accepted, and the null hypothesis (H0) is rejected. Thus, it can be concluded that transparency and accountability significantly influence the performance of BOS Fund management at SDN 11 Sendanu Darulihsan[1].

Based on the research conducted and the implementation of the application from previous research, this method can help obtain BOS Fund data collection information more effectively through the search feature provided in the system. This research also produced a BOS Fund data collection information system with processing features for Admin, Debit, Cash, Credit, Taxes, and Funds. With this application, the Admin section can more easily process data and obtain BOS Fund data collection information through Cash reports, Fund applications, and RKAS. Thus, this application can help simplify data processing and accelerate decision-making [4].

Based on the data and analysis, the study concluded that the principal's policy at SDN 320 Sinunukan was in a suitable category. This shows that the school principal has carried out his duties properly in distributing BOS funds by the provisions in the guidelines for using funds. In addition, the principal has also succeeded in fulfilling his role as educator, manager, administrator, leader, reformer, and mobilizer. Thus, the management of the BOS Fund at SDN 320 Sinunukan has been appropriately implemented [5].

From the research conducted by Sariati on the utilization, reporting, and accountability for the use of BOS funds, it was concluded that the management planning for the BOS funds had been carried out correctly (score 3.63). Meanwhile, the use of BOS funds was also considered good (score 3.78), and the reporting and accountability of BOS funds was considered quite good (score 3.30).[6].

2. RESEARCH METHODS
The Weighted Aggregated Sum Product Assessment (WASPAS) method is a procedure that reduces errors and maximizes the highest and lowest ratings. Shares much better results in Decision Support System determination[7][8][9]. Stages in the WASPAS Method:

1. Normalization In The first step, the criterion numbers are replaced into normalized form with the meeting below:

\[ X_{ij} = \frac{x_{ij}}{\max_{x_{ij}}} \ldots (1) \]

Before being normalized, the criterion value is the original criterion value. After normalization, the criterion value shows the criterion value for the i-th alternative in the j-th criterion. Equation (1) mentioned above is used for the criterion of benefits.

\[ X_{ij} = \frac{\min_{x_{ij}} x_{ij}}{x_{ij}} \ldots (2) \]

2. The WSM calculation uses the following formula in equation (3):

\[ WSM_i = r_i = X_{ij} * w_j \ldots (3) \]

Information:
1. \( W_{ij} \) is the criterion value after normalization.
2. \( w \) is the weight given to each criterion
3. \( i \) indicates the alternative being compared
4. \( j \) means the jth standard being assessed.

3. Calculation of WPM with the formula in equation (4) follows:
   \[ WPM = \prod_{j=1}^{n}(x_{ij})^{w_j} \]........(5)

4. WASPS calculation by combining WSM and WPM calculation results using the method in equation (5) below:
   \[ WSM = 0.5 \times (wn(xij)wj) \]......(6)

The Process of determining the criteria to determine the factors that will be used in assessing candidates. The following are the criteria and weight values for calculations more suitable for the research process.

<table>
<thead>
<tr>
<th>No</th>
<th>Kriteria</th>
<th>Id</th>
<th>Bobot Nilai Kriteria</th>
<th>Keterangan</th>
<th>Jenis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kehadiran</td>
<td>C1</td>
<td>25% = 0,25</td>
<td>Kehadiran atau absensi siswa peran penting untuk penerima Dana BOS.</td>
<td>Benefit</td>
</tr>
<tr>
<td>2</td>
<td>Penghasilan Orang Tua</td>
<td>C2</td>
<td>25% = 0,25</td>
<td>Penghasilan Orang Tua merupakan faktor kriteria yang mempengaruhi dalam pertimbangan.</td>
<td>Benefit</td>
</tr>
<tr>
<td>3</td>
<td>Partisipasi Kegiatan Disekolah</td>
<td>C3</td>
<td>20% = 0,2</td>
<td>Partisipasi kegiatan disekolah adalah kegiatan siswa aktif dalam ekstrakurikuler.</td>
<td>Cost</td>
</tr>
<tr>
<td>4</td>
<td>Nilai Prestasi</td>
<td>C4</td>
<td>15% = 1,5</td>
<td>Penilaian dan rekor tertinggi</td>
<td>Benefit</td>
</tr>
<tr>
<td>5</td>
<td>Kedisiplinan</td>
<td>C5</td>
<td>15% = 1,5</td>
<td>Kedisiplinan adalah mendorong siswa untuk berprilaku sesuai dengan tata terbit yang disekolah</td>
<td>Benefit</td>
</tr>
</tbody>
</table>

The following will describe the system flowchart of the processes contained in Implementing the Decision Support System in Determining Students Recipients of BOS Funds Using the WASPAS Method at Asy Syaffiyah High School Medan.
Figure 1. Determination of BOS Fund beneficiary students

Assigning a value to each criterion is an assessment process for each factor in determining the candidate. Before the candidate is given an assessment, first understand the assessment parameters of each given standard, and the parameter data can be seen as follows:

1. Parameters of school attendance

<table>
<thead>
<tr>
<th>Kode</th>
<th>Kriteria</th>
<th>Keterangan</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>Kehadiran disekolah</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sangat Baik</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Baik</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cukup Baik</td>
<td>70</td>
</tr>
</tbody>
</table>

2. Parameters of participation in school activities

<table>
<thead>
<tr>
<th>Kode</th>
<th>Kriteria</th>
<th>Keterangan</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>K2</td>
<td>Partisipasi kegiatan disekolah</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sangat Baik</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Baik</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cukup Baik</td>
<td>70</td>
</tr>
</tbody>
</table>
4. Discipline parameters

Table 5 Parameters for Discipline Assessment

<table>
<thead>
<tr>
<th>Kode</th>
<th>Kriteria</th>
<th>Keterangan</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>K4</td>
<td>Kedisplinian</td>
<td>Sangat Bagus</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bagus</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cukup Bagus</td>
<td>70</td>
</tr>
</tbody>
</table>

5. Rating Parameters

Table 6 Assessment Parameters

<table>
<thead>
<tr>
<th>Kode</th>
<th>Kriteria</th>
<th>Keterangan</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5</td>
<td>Nilai</td>
<td>Sangat Bagus</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bagus</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cukup Bagus</td>
<td>70</td>
</tr>
</tbody>
</table>

Steps for completing the determination of candidates using the WASPAS method:
1. Creating a Matrix
2. Calculating Normalized Matrix
3. Calculating Qi Values
4. Ranking

Table 7 Student Data Sampling

<table>
<thead>
<tr>
<th>NP</th>
<th>Nama Kandidat</th>
<th>Kehadiran di sekolah</th>
<th>Partisipasi kegiatan di sekolah</th>
<th>Penghasilan Orang tua</th>
<th>Kedisplinan</th>
<th>Nilai</th>
</tr>
</thead>
<tbody>
<tr>
<td>121</td>
<td>Susi Hardiyanti</td>
<td>Sangat Baik</td>
<td>Sangat Baik</td>
<td>4.400.000</td>
<td>Bagus</td>
<td>Cukup Bagus</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>121</td>
<td>Prima Aditama Matondang</td>
<td>Baik</td>
<td>Cukup Baik</td>
<td>2.700.000</td>
<td>Sangat Bagus</td>
<td>Cukup Bagus</td>
</tr>
<tr>
<td>211</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>121</td>
<td>Wira Witama Atmajad</td>
<td>Baik</td>
<td>Baik</td>
<td>2.440.000</td>
<td>Bagus</td>
<td>Cukup Bagus</td>
</tr>
<tr>
<td>212</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>121</td>
<td>Evi Susanti</td>
<td>Cukup Baik</td>
<td>Baik</td>
<td>2.400.000</td>
<td>Sangat Bagus</td>
<td>Bagus</td>
</tr>
<tr>
<td>213</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>121</td>
<td>Risky Ridho Silalahi</td>
<td>Sangat Baik</td>
<td>Cukup Baik</td>
<td>2.780.000</td>
<td>Sangat Bagus</td>
<td>Sangat Bagus</td>
</tr>
<tr>
<td>214</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Convert sample data into assessment data based on weight.

<table>
<thead>
<tr>
<th>NP</th>
<th>Kode Alternatif</th>
<th>K1</th>
<th>K2</th>
<th>K3</th>
<th>K4</th>
<th>K5</th>
</tr>
</thead>
<tbody>
<tr>
<td>121210</td>
<td>A1</td>
<td>90</td>
<td>90</td>
<td>70</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>121211</td>
<td>A2</td>
<td>80</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>70</td>
</tr>
<tr>
<td>121212</td>
<td>A3</td>
<td>80</td>
<td>80</td>
<td>90</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>121213</td>
<td>A4</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td>121214</td>
<td>A5</td>
<td>90</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>90</td>
</tr>
</tbody>
</table>

After obtaining the value of the assessment parameters for each criterion, the subsequent execution follows the WASPAS method previously described. The following is an explanation of the matrix calculation:

1. Creating a Matrix

The decision matrix below is compiled based on the data generated from the conversion of alternative values:

\[
X = \begin{bmatrix}
90 & 90 & 70 & 80 & 70 \\
80 & 70 & 80 & 90 & 70 \\
80 & 80 & 90 & 80 & 70 \\
70 & 80 & 90 & 90 & 80 \\
90 & 70 & 80 & 90 & 90 \\
\end{bmatrix}
\]

This results from calculating the alternative value normalization matrix according to the criteria.

Formula: \(\frac{x_{ij}}{\max \{x_{ij}\}}\)

Normalization of Achievement Criterion 1:
- \(A_{11} = \frac{90}{90}\)
- \(A_{41} = 0.78\)
- \(A_{21} = 0.89\)
- \(A_{51} = 1\)
- \(A_{31} = 0.89\)

Interview Normalization Criteria 2:
- \(A_{12} = 1\)
- \(A_{42} = 0.89\)
- \(A_{22} = 0.78\)
- \(A_{52} = 0.78\)
- \(A_{32} = 0.89\)

Normalization of Written Test Results Criterion 3:
- \(A_{13} = 0.78\)
- \(A_{43} = 1\)
- \(A_{23} = 0.89\)
- \(A_{53} = 0.89\)
- \(A_{33} = 1\)

Normalization of Appearance Criterion 4:
- \(A_{14} = 0.89\)
- \(A_{44} = 1\)
The following are the results of the normalized matrix for each assessment:

\[
\begin{bmatrix}
1 & 1 & 0.78 & 0.89 & 0.78 \\
0.89 & 0.78 & 0.89 & 1 & 0.78 \\
0.89 & 0.89 & 1 & 0.89 & 0.78 \\
0.78 & 0.89 & 1 & 1 & 0.89 \\
1 & 0.78 & 0.89 & 1 & 1
\end{bmatrix}
\]

2. Calculating \(Q_i\) Values

The following is the formula used to calculate the \(Q_i\) value:

\[
Q_i = 0.5 \sum_{j=1}^{n} X_{ij} w_i + 0.5 \prod_{j=1}^{n} (x_{ij})^{w_j}
\]

\(Q_1\) value

\[
= 0.5 \left( (1*0.25) + (1*0.25) + (0.78*0.2) + (0.89*0.15) + (0.78*0.15) \right) + \\
0.5 \left( (10.25) \times (10.25) \times (0.780.2) \times (0.890.15) \times (0.780.15) \right) \\
= 0.4528 + 0.4499 = 0.9027
\]

\(Q_2\) value

\[
= 0.5 \left( (0.89*0.25) + (0.78*0.25) + (0.89*0.2) + (1*0.15) + (0.78*0.15) \right) + \\
0.5 \left( (0.890.25) \times (0.780.25) \times (0.890.2) \times (10.15) \times (0.780.15) \right) \\
= 0.4306 + 0.4288 = 0.8594
\]

\(Q_3\) value

\[
= 0.5 \left( (0.89*0.25) + (0.89*0.25) + (1*0.2) + (0.89*0.15) + (0.78*0.15) \right) + \\
0.5 \left( (0.890.25) \times (0.890.25) \times (10.2) \times (0.890.15) \times (0.780.15) \right) \\
= 0.4556 + 0.4540 = 0.9096
\]

\(Q_4\) value

\[
= 0.5 \left( (0.78*0.25) + (0.89*0.25) + (1*0.2) + (1*0.15) + (0.89*0.15) \right) + \\
0.5 \left( (0.780.25) \times (0.890.25) \times (10.2) \times (1.15) \times (0.890.15) \right) \\
= 0.4500 + 0.4479 = 0.8979
\]

\(Q_5\) value

\[
= 0.5 \left( (1*0.25) + (0.78*0.25) + (0.89*0.2) + (1*0.15) + (1*0.15) \right) + \\
0.5 \left( (1.25) \times (0.780.25) \times (0.890.2) \times (1.15) \times (1.15) \right) \\
= 0.4611 + 0.4586 = 0.9197
\]

3. Ranking

Based on the Final Result values above, the results and ranking of the \(Q_i\) Assessment are as follows:
From the ranking results above, the student data for receiving BOS Fund assistance at schools at SMA Asy-Syafiiyah Medan is based on the top ranking. If two Qi values are the same and both have the same rank, then the management staff will determine the decision regarding receiving BOS Fund assistance at SMA Asy-Syafiiyah Medan.

The use cases diagram, which is designed on a system designed for users, is as follows:

![Use Case Diagram](image-url)
**Activity Diagram**

Figure 3. Activity Diagram of BOS Fund Recipient Students

**Class diagram**

Figure 4. Class Diagram of Students Recipient of Bos Funds.
Sequencediagram

1. Sequences login chart

![Login Sequence Diagram](image1)

Figure 5. Login Sequence

2. Sequences carrier data input

![Main Menu Sequence Diagram](image2)

Figure 6. Main Menu Sequence Diagram

2.1 Results and Discussion

The results discussed in determining students who receive BOS funds using the WASPAS method are by using 5 criteria where the first determines the weight of the requirements for school attendance, parental income, participation in school activities, discipline, and grades, as well as calculating the WASPAS method and testing the WASPAS method.

2.2 Display login system

In research on implementing the decision support system in determining student recipients of BOS funds using the WASPAS method. Before the application is operated, it logs in to the system, which has one login button and two data inputs: input username and password.
b. Dashboard View
This decision support system's dashboard view has several features with the following functions.

- Alternative Data
Alternative data features are features used to input alternative data tested using the WASPAS method. Which has several types of buttons in it, namely:
  1. Process that functions to add new alternative data to the system
  2. Edit is used to make edits to alternative data in the system.
Criteria Data
The criterion data feature is a feature that is used to input criterion data that is tested using the WASPAS method. Which has several types of buttons in it, namely:
1. Process that serves to add new criteria data to the system
2. Edit is used to make edits to the criteria data
3. Delete is used to delete criteria data

Assessment Data
The assessment data feature is a feature that is used to input assessment data that was tested using the WASPAS method. It has several buttons, namely Process, which functions to add new assessment data to the system.
The student calculation page shows several calculation views, such as normalization of weighted assessments, calculation results, candidates, results, and rankings.

2.3 Discussion

In the research that I made, what became a comparison of related research was in determining prospective students who received BOS funds according to predetermined procedures. Even though there were sometimes delays in the Process of disbursing BOS funds, in general, the parents of students were very satisfied with the provision of BOS funds at SMA Asy-Syafiyyah Medan.

Experiments were carried out in the Bos Fund determination system using the WASPAS method; researchers carried out by trying to enter several data samples starting from 100-200-300-400-500 with the input of different criteria values and the results of researchers obtained from testing. This can be seen in the table below, namely as follows:
<table>
<thead>
<tr>
<th>Amount of data</th>
<th>Rank</th>
<th>Name</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>1. (0.5915)</td>
<td>Susi Ardianti Prima Aditama Matonda ng Wira Witama Atmaja</td>
<td>0.327 sec</td>
</tr>
<tr>
<td></td>
<td>2. (0.5709)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. (0.5837)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>1. (0.8717)</td>
<td>Daniel Sugianto Desroni Hasudungan Doni Frengky Sirait</td>
<td>0.446 sec</td>
</tr>
<tr>
<td></td>
<td>2. (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. (0.8764)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>1. (0.8717)</td>
<td>Caries Jun Herefa Cindy Aulia Siahaan Cristiana Brother Tampubolon</td>
<td>0.395 sec</td>
</tr>
<tr>
<td></td>
<td>2. (0.8979)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. (0.9034)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>1. (0.9548)</td>
<td>Dimas Handoko Noraesta Joselyn Alifya Rahmah</td>
<td>0.520 sec</td>
</tr>
<tr>
<td></td>
<td>2. (0.8324)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. (0.8049)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>1. (0.8324)</td>
<td>Chelsy Ananda Pane Mhd. Rezqi Syahpura Nst Fauzi Firmansyah</td>
<td>0.423 seconds</td>
</tr>
<tr>
<td></td>
<td>2. (0.8605)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. (0.9096)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. CONCLUSION

By researching to determine acceptance of BOS funding assistance using the WASPAS method at SMA Asy Syafiiyah Medan using the WASPAS method (Weighted Aggregated Sum Product Assessment), the student candidate who received the boss's funds, namely Rizki Ridho Silalahi, with a final score of 0.9197 was ranked 1st. After conducting trials with several different data sample inputs in determining students who receive BOS funds, the system that has been created can produce students who receive BOS funds in a reasonably short time.

BIBLIOGRAPHY


