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

Napisah[1], Rizki Muliono[2], Nurul Khairina[3], Muhathir[4]*
[1,2,3,4]Informatics 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-Syafiiyah 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-Syafiiyah 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-Syafiiyah Medan High School was established on November 1, 2010, at Jalan Tani No. 1 Medan. As an integrated Islamic school, SMA Asy-Syafiiyah 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-Syafiiyah 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-Syafiiyah 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-Syafiiyah 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:

$$X_{ij} = \frac{xij}{max_{xi}x_{ij}} \ldots\ldots (1)$$

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.

$$X_{ij} = \frac{min_i x_{ij}}{x_{ij}} \ldots\ldots (2)$$

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

$$WSM_i = \prime_j^n = X_{IJ} * w_j \ldots (3)$$

Information :

1. *Wij*is is the criterion value after normalization

2. *w*is the weight given to each criterion
3. *i*ndicates the alternative being compared
4. means the jth standard being assessed.

3. Calculation of WPM with the formula in equation (4) follows:

$$WPM = \prod_{j=1}^{n}(x_{ij})^{wj} \ldots\ldots.(5)$$

4. WASPS calculation by combining WSM and WPM calculation results using the method in equation (5) below:

$$WSM = 0{,}5 * (nn(xij)wj) \ldots\ldots(6)$$

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 1 Criteria and Criteria Weight Value

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

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 Syafiiyah High School Medan.

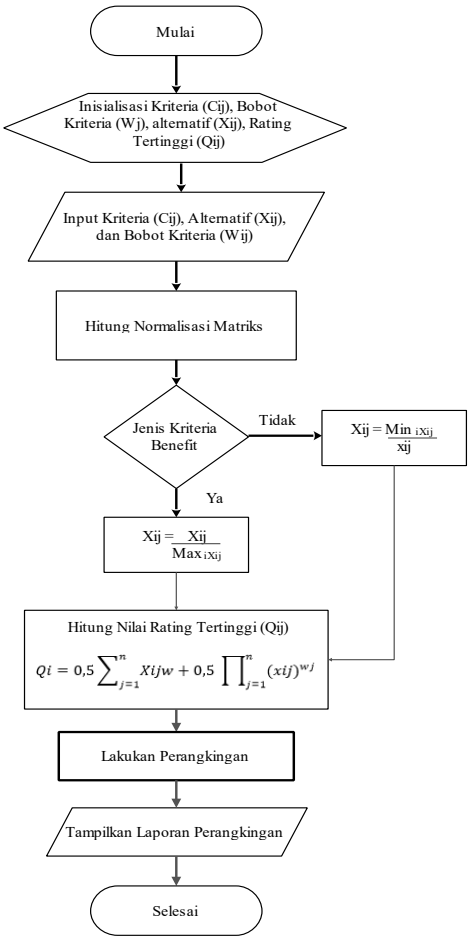

Figure 1. Determination of BOS Fund beneficiary students

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 2 Parameters of School Attendance

Kode	Kriteria	Keterangan	Parameter
K1	Kehadiran disekolah	Sangat Baik	90
		Baik	80
		Cukup Baik	70

2. Parameters of participation in school activities

Table 3 Parameters of Participation in School Activities

Kode	Kriteria	Keterangan	Parameter
K2	Partisipasi kegiatan disekolah	Sangat Baik	90
		Baik	80
		Cukup Baik	70

3. Parents' Income Assessment Parameters

Table 4 Parameters of Parental Income Assessment

Kode	Kriteria	Keterangan	Parameter
K3	Penghasilan Orang Tua	>4.000.000	70
		2.650.000 – 3.999.999	80
		< 2.550.999	90

4. Discipline parameters

Table 5 Parameters for Discipline Assessment

Kode	Kriteria	Keterangan	Parameter
K4	Kedisplinan	Sangat Bagus	90
		Bagus	80
		Cukup Bagus	70

5. Rating Parameters

Table 6 Assessment Parameters

Kode	Kriteria	Keterangan	Parameter
K5	Nilai	Sangat Bagus	90
		Bagus	80
		Cukup Bagus	70

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

NP	Nama Kandidat	Kehadiran disekolah	Partisipasi kegiatan disekolah	Penghasilan Orang tua	Kedisplinan	Nilai
121210	Susi Hardiyanti	Sangat Baik	Sangat Baik	4.400.000	Bagus	Cukup Bagus
121211	Prima Aditama Matondang	Baik	Cukup Baik	2.700.000	Sangat Bagus	Cukup Bagus
121212	Wira Witama Atmaja	Baik	Baik	2.440.000	Bagus	Cukup Bagus
121213	Evi Susanti	Cukup Baik	Baik	2.400.000	Sangat Bagus	Bagus
121214	Risky Ridho Silalahi	Sangat Baik	Cukup Baik	2.780.000	Sangat Bagus	Sangat Bagus

Convert sample data into assessment data based on weight.

Table 8 Appraiser Conversion

NP	Kode Alternatif	K1	K2	K3	K4	K5
121210	A1	90	90	70	80	70
121211	A2	80	70	80	90	70
121212	A3	80	80	90	80	70
121213	A4	70	80	90	90	80
121214	A5	90	70	80	90	90

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 $= \frac{x_{ij}}{max\ ix_{ij}}$

   Normalization of Achievement Criterion 1 :

   A11= $= 1\frac{90}{90}$ A41= $= 0.78\frac{70}{90}$

   A21= $= 0.89\frac{80}{90}$ A51= $= 1\frac{90}{90}$

   A31= $= 0.89\frac{80}{90}$

   Interview Normalization Criteria 2:

   A12= $= 1\frac{90}{90}$ A42= $= 0.89\frac{80}{90}$

   A22= $= 0.78\frac{70}{90}$ A52= $= 0.78\frac{70}{90}$

   A32= $= 0.89\frac{80}{90}$

   Normalization of Written Test Results Criterion 3:

   A13= $= 0.78\frac{70}{90}$ A43= $= 1\frac{90}{90}$

   A23= $= 0.89\frac{80}{90}$ A53= $= 0.89\frac{80}{90}$

   A33= $= 1\frac{90}{90}$

   Normalization of Appearance Criterion 4 :

   A14= $= 0.89\frac{80}{90}$ A44= $= 1\frac{90}{90}$

A24= = $1\frac{90}{90}$ A54= = $1\frac{90}{90}$

A34= = $0.89\frac{80}{90}$

Normalization of Experience Criterion 5:

A15= = $0.78\frac{70}{90}$ A45= = $0.89\frac{80}{90}$

A25= = $0.78\frac{70}{90}$ A55= = $1\frac{90}{90}$

A35= = $0.78\frac{70}{90}$

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 Qi Values

The following is the formula used to calculate the Qi value:

$$Qi = 0{,}5 \sum_{j=1}^{n} Xijw + 0{,}5 \prod_{j=1}^{n} (xij)^{wj}$$

Q1 value

= 0.5 ((1*0.25) + (1*0.25) + (0.78*0.2) + (0.89*0.15) + (0.78*0.15)) +
0.5 ((10.25) x (10.25) x (0.780.2) x (0.890.15) x (0.780.15))
=0.4528 +0.4499 =0.9027

Q2 value

= 0.5 ((0.89*0.25) + (0.78*0.25) + (0.89*0.2) + (1*0.15) + (0.78*0, 15))
0.5 ((0.890.25) x (0.780.25) x (0.890.2) x (10.15) x (0.780.15))
=0.4306 + 0.4288 =0.8594

Q3 value

= 0.5 ((0.89*0.25) + (0.89*0.25) + (1*0.2) + (0.89*0.15) + (0.78*0, 15)
0.5 ((0.890.25) x (0.890.25) x (10.2) x (0.890.15) x (0.780.15))
=0.4556 + 0.4540 = 0.9096

Q4 value

= 0.5 ((0.78*0.25) + (0.89*0.25) + (1*0.2) + (1*0.15) + (0.89*0.15)) +
0.5 ((0.780.25) x (0.890.25) x (10.2) x (1.15) x (0.890.15))
=0.4500 + 0.4479 = 0.8979

Q5 value

= 0.5 ((1*0.25) + (0.78*0.25) + (0.89*0.2) + (1*0.15) + (1*0.15)) +
0.5 ((1.25) x (0.780.25) x (0.890.2) x (1.15) x (1.15))
=0.4611 + 0.4586 =0.9197

3. Ranking

Based on the Final Result values above, the results and ranking of the Qi Assessment are as follows:

Table 9 WASPAS ranking results

No	Kode Alternaftid	Alternatif	Nilai Hasil Akhir	Rangking
1	A5	Risky Ridho Silalahi	0.9197	1
2	A3	Wira Witama Atmaja	0.9096	2
3	A1	Susi Hardiyanti	0.9027	3
4	A4	Evi Susanti	0.8979	4
5	A2	Prima Aditama M.	0.8594	5

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:

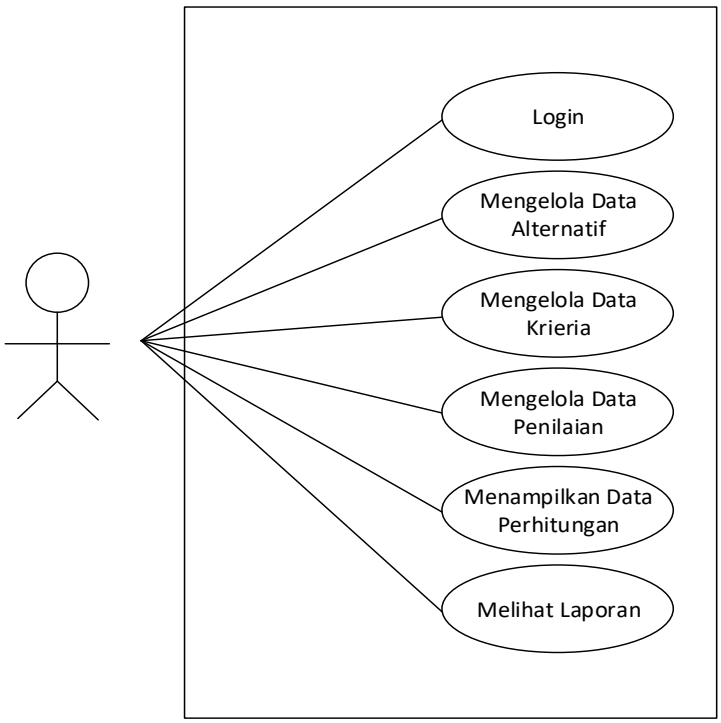

Figure 2. Use Case Diagram

***Activity* Diagram**

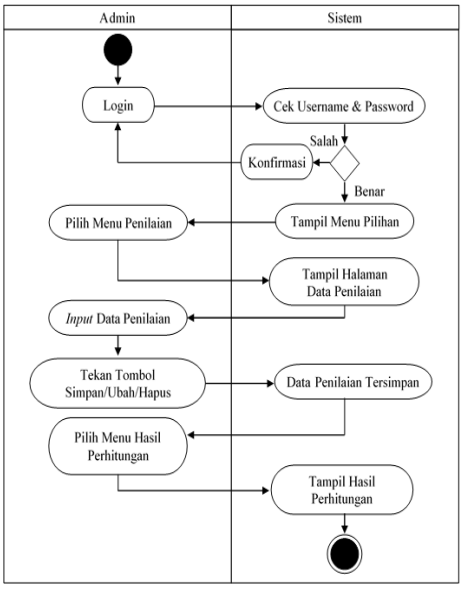

Figure 3. Activity Diagram of BOS Fund Recipient Students

***Class* diagram**

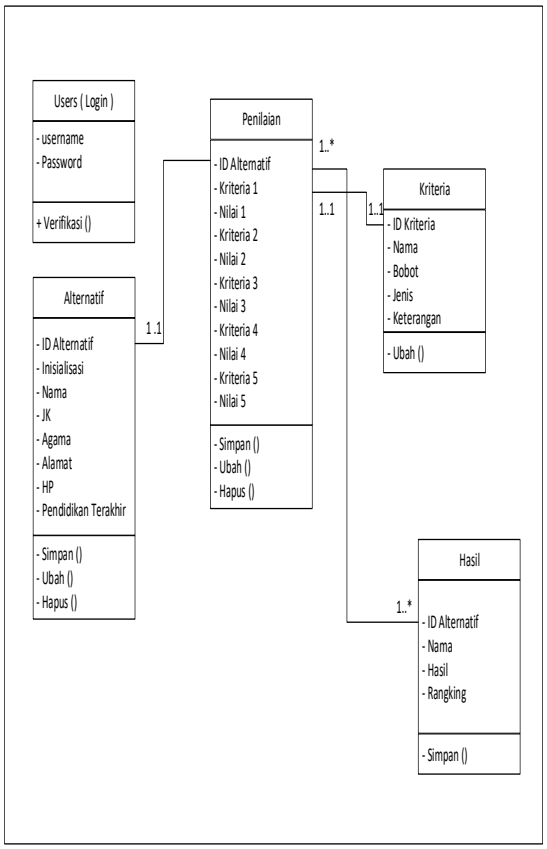

Figure 4. Class Diagram of Students Recipient of Bos Funds.

***Sequence*Diagram**

1. *Sequences*login chart

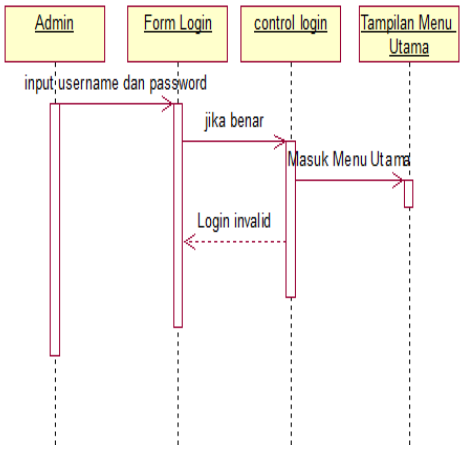

Figure 5. Login Sequence

2. *Sequences*carrier data input

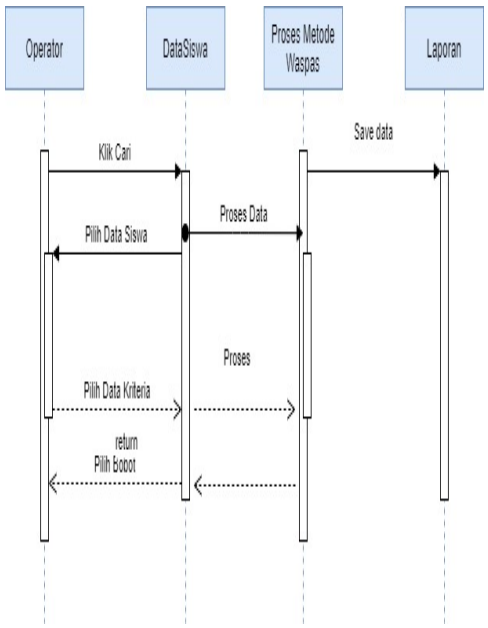

Figure 6. Main Menu Sequence Diagram

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.

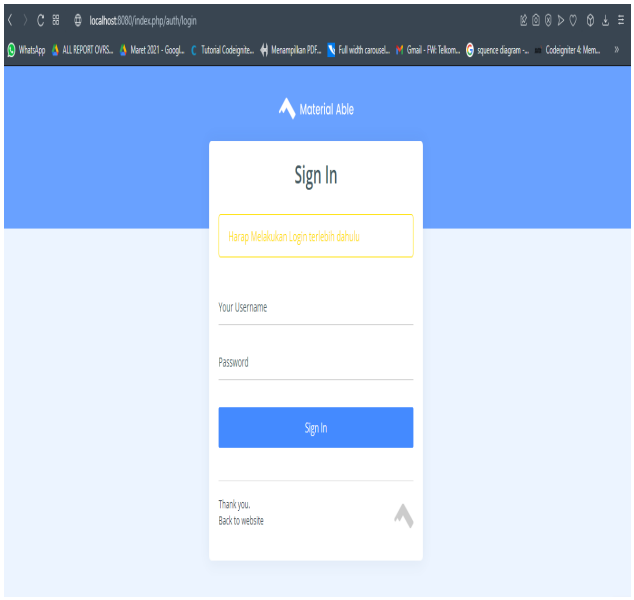

Figure 7. Initial login display

b. Dashboard View

This decision support system's dashboard view has several features with the following functions.

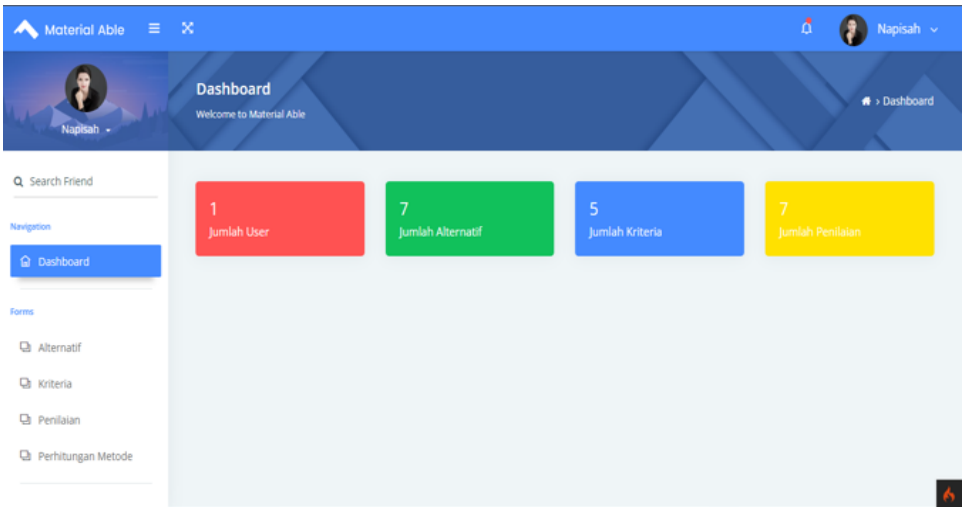

Figure 8. Dashboard View

- 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.

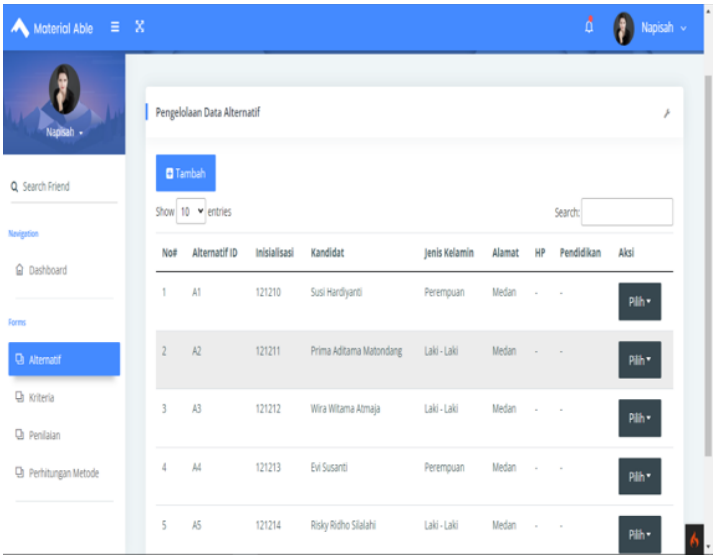

Figure 9. Alternative Display

- 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

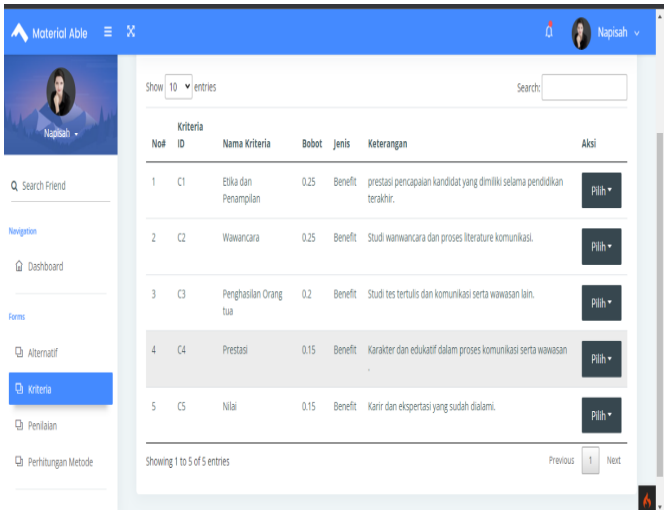

Figure 10. Display criteria

- 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.

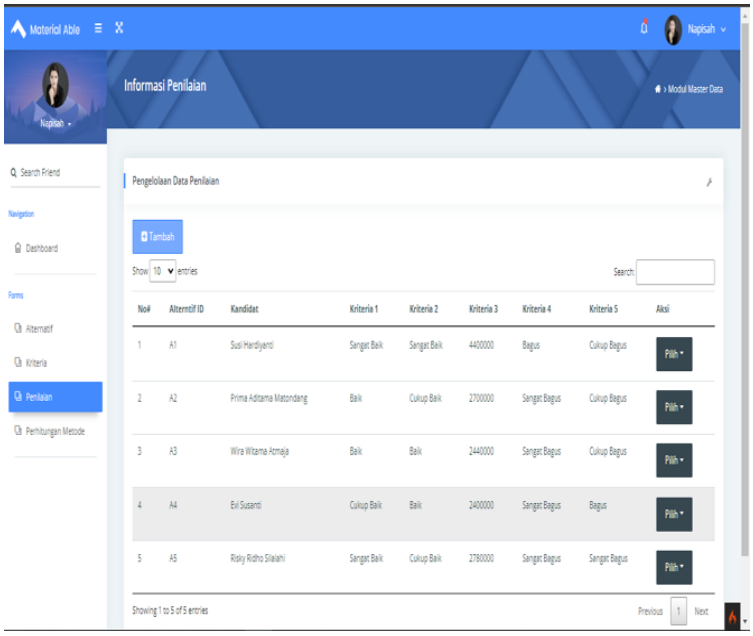

Figure 11. Calculation result assessment data

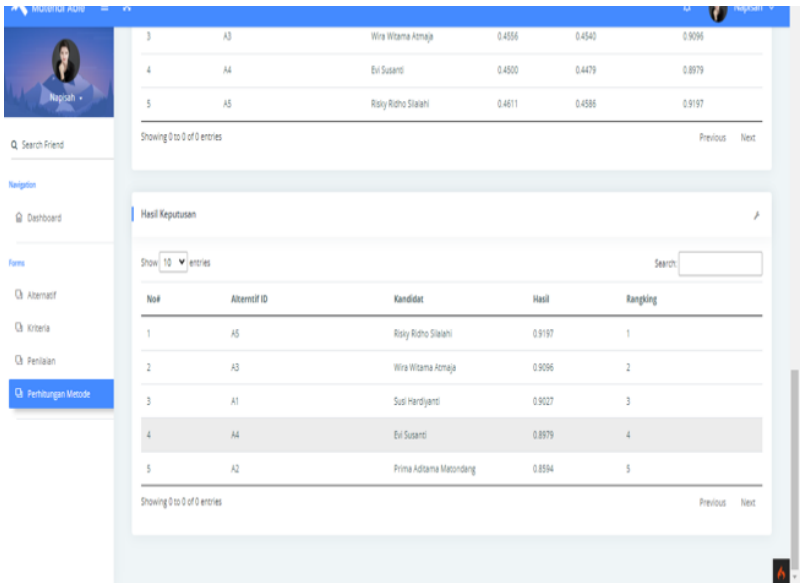

Figure 12. The results of the decisions of students receiving Bos Funds.

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-Syafiiyah 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:

Amount of data	Rank	Name	Time
100	1. (0.5915) 2. (0.5709) 3. (0.5837)	Susi Ardianti Prima Aditama Matondang Wira Witama Atmaja	0.327 sec
200	1. (0.8717) 2. (1) 3. (0.8764)	Daniel Sugianto Desroni Hasudungan Doni Frengky Sirait	0.446 sec
300	1. (0.8717) 2. (0.8979) 3. (0.9034)	Caries Jun Herefa Cindy Aulia Siahaan Cristiana Brother Tampubolon	0.395 sec
400	1. (0.9548) 2. (0.8324) 3. (0.8049)	Dimas Handoko Noraesta Joselyn Alifya Rahmah	0.520 sec
500	1. (0.8324) 2. (0.8605) 3. (0.9096)	Chelsy Ananda Pane Mhd. Rezqi Syahpura Nst Fauzi Firmansyah	0.423 seconds

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

[1] R. Manurung, R. Sitanggang and F. Tinus Waruwu, "Application of the Weighted Aggregated Sum Product Assessment Method in Determining Bidik Misi Scholarship Recipients," Journal of Computer Research (JURIKOM), vol. 5, no. 1, pp. 79-84, 2018.

[2] F. Syahputra, M. Mesran, I. Lubis, and AP Windarto, "Decision Support System for Selecting Outstanding Teachers in Medan City Applying the Preferences Selection Index Method (Case Study: Medan City Education Office)," in KOMIK (National Conference on Information Technology and Computers), Medan, 2018.

[3] NK Daulay, B. Intan dan M. & Irvai, "Comparison of the WASPAS and MOORA Methods in Providing Single Tuition Scholarships," International Journal of Informatics and Computer Science), vol. 5, no. 1, p. 84–94, 2021.

[4] SVM Barus, D. Napitupulu, M. Mesran and S. Supiyandi, "Decision Support System for Permanent Teacher Appointments Applying the Weight Aggregated Sum Product Assessment (WASPAS) Method," Journal of Media Informatika Budidarma, vol. 2, no. 2, pp. 10-15, 2018.

[5] S. Sugiarti, DK Nahulae, TE Panggabean and M. Sianturi, "Decision Support System for Determining Campus Promotion Strategy Policies Using the Weighted Aggregated Sum Product Assessment Method (WASPAS)," JURIKOM (Computer Research Journal), vol. 5, no. 2, p. 103–108, 2018.

[6] Suriati, "Analysis of Management of School Operational Assistance Funds (BOS) in Basic Education Units in Kotamobagu City," 2019.

[7] A. Safitra, IA Lubis, and N. & Siregar, "Decision Support System for Game Selection for Youth Using the WASPAS Method," in the National Seminar on Science & Information Technology (SENSASI), 2018.

[8] Chandra and Hansun, "Application of the Weighted Aggregated Sum Product Assessment (WASPAS) Method in the 2019 Scholarship Acceptance Decision," 2019.

[9] AP Nanda, S. Sucipto and S. Hartati, "Analysis of Determining the Best Shipping Services Using the Weight Aggregated Sum Product Assessment (WASPAS) Method," EXPERT: Journal of Management Information Systems and Technology, vol. 10, no. 2, 2020.