Journal of Information Systems and Application Development
Volume 2 Number 2 September 2024 pages 89-99
P-ISSN: 2988-5698 | E-ISSN: 2988-4721
https://jurnal.unmer.ac.id/index.php/jisad

The participants selection system for Al-Qur'an tahfidz competition using the Simple Additive Weighting method

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Abstract. The Hidayatullah Foundation is an Al-Qur'an-based school that has a tahfidz Al-Qur'an program that is taught every day to students. By holding the Tahfidz competition, it is hoped that it can provide motivation to students to increase their enthusiasm for memorizing the Al-Qur'an. However, so far the selection system that has been carried out by the school still uses manual methods by estimating students who are deemed capable without thorough calculations being carried out. So the selection of students is felt to be unfair and there is no opportunity for other students to take part in the competition. The application of the decision support system uses the Simple Additive Weighting (SAW) method with the results of the grades and ranking of the best students in the Tahfidz program which is carried out through a system calculation process with the first rank with alternative A10 getting a result of 0.996342132 named Alicia from class 3. The test results using the confusion matrix show the value accuracy of 96.9% which indicates a high level of accuracy. It was concluded that the SAW method could be used to select students to take part in competitions.

Keywords: Al-Qur'an tahfidz competition, Simple Additive Weighting, Decision Support Systems, confusion matrix

Submitted: 07-08-2024 | **Accepted:** 30-08-2024 | **Published:** 15-09-2024

How to Cite:
N. Hidayah, I. H. Santi, and Y. Primasari, "The participants selection system for Al-Qur'an tahfidz competition using the Simple Additive Weighting method," *Journal of Information System and Application Development*, vol. 2, no. 2, pp. 89-99, September 2024, doi: 10.26905/jisad.v2i2.14012.

INTRODUCTION

Religious education aims to shape students to be able to live their lives according to religious teachings. Contribute to the formation of national character with various strategies and methods that are quite impressive and convincing. The Islamic education teaching system is directed not only at achieving increased intelligence (reason) for students, but is expected to form a complete person (having faith and noble morals) [1].

MI Hidayatullah, located at Jl. Kalimantan No. 28, Sananwetan Village, Sananwetan District, Blitar City, has been established since 1997. One of the leading programs owned by MI Hidayatullah is the Tahfidz Al-Qur'an program which has been established since 2017 as part of a series of religious programs at the school. This program aims to improve the skills of reading the Qur'an and the ability to memorize it properly and correctly. Through the holding of the Tahfidz competition, it is hoped that it can provide motivation to students to increase their enthusiasm in memorizing the Qur'an.

MI Hidayatullah has participated in the Tahfidz Al-Qur'an competition since 2019. So far, the selection system still uses a manual method with estimates of students who are considered capable without any calculations being carried out comprehensively. So that the selection of students is considered unfair and there is no opportunity for other students to take part in the competition. So it needs to be resolved by using a software system that can provide assistance in making more structured

DOI: 10.26905/jisad.v2i2.14012

decisions to achieve results that are in accordance with expectations. Several previous studies have proposed Simple Additive Weighting (SAW) which is applied to SPK, for example in the [2] entitled "Application of the AHP Method for Determining the Best Students in the Tahfidz Qur'an Program" suggests using other methods to determine accuracy and provide more objective values. In the study [3] entitled "Decision Support System for the O2SN Pencak Silat Branch Selection Using the SAW Method" it can easily determine a web-based system in the selection of prospective pencak silat athletes who participate in O2SN. Another study conducted by [4] entitled "Implementation of the SAW Method for Selecting the Best Students" obtained the final results in the form of ranking so that it will be easier to determine who will be selected as the best student. For other research in the journal [5] entitled "Scholarship Acceptance Decision Support System with the SAW Method" can run well according to the results of the functionality test producing the expected output. In addition, it can produce rankings as the best reference for prospective scholarship recipients. Therefore, the researcher intends to apply SPK to the system of prospective participants in the Tahfidz Al-Qur'an competition with the Simple Additive Weighting (SAW) method to make it easier for schools to select students.

METHOD

The study used quantitative descriptive which describes the problem according to the facts obtained [6]. The study was conducted for 6 months from January to July with an interview process, observation, and literature study. The data collection technique through interviews conducted with teachers at MI Hidayatullah related to the Tahfidz program. So that data was obtained from students who participated in competitions and championships from 2019 to 2024 who had won 4 championships. In addition, the data obtained includes criteria and weights as variables for selecting the best students who will be sent to the competition. This study used the technical instructions for the Gebyar Olympiad Achievement Student (GELAR) 7 MTsN 2 Kota Blitar which included fluency, *fashohah*, and *tajwid*.

The Simple Additive Weighting (SAW) method is an approach to decision making that involves adding weights by setting weight values on certain attributes and then ranking alternatives based on the addition [7], as shown in Figure 1.

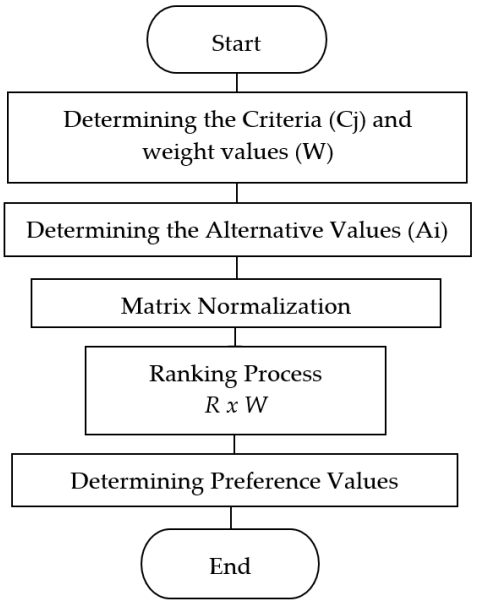


Figure 1. SAW Flowchart

Steps for the Simple Additive Weighting (SAW) method are as follows:

1. Determine the Criteria (Cj) and weight value (W)
2. Determine the Alternative value (Ai)

3. Matrix Normalization
4. Ranking process
5. Determine the Preference Value

Confusion matrix is a technique used to evaluate the performance of a classification method. Provides information that compares the results of the system classification with the aim of measuring its level of accuracy. Confusion matrix is also a method that is often used to calculate accuracy in data mining [8]. Evaluation methods can be derived from confusion matrix such as accuracy, error rate, specificity, precision, and false positive rate [9]. The stages in calculating the confusion matrix [10] as shown in Figure 2.

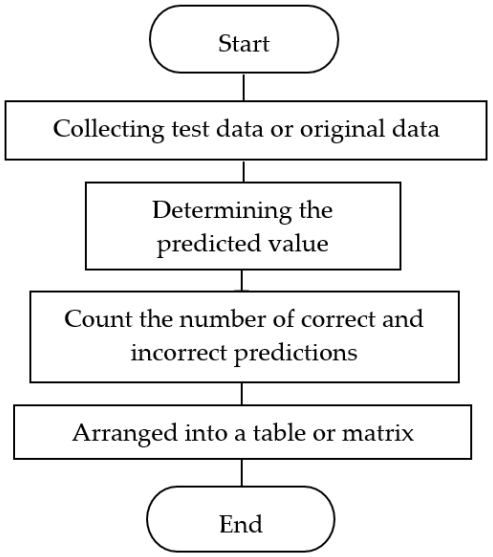


Figure 2. Confusion Matrix Flowchart

Calculation steps with confusion matrix as follows:

1. Collect test data or original data
2. Create prediction values in testing
3. From the results of the original data and predictions, calculate
    a. The number of correct predictions for each class
    b. The number of incorrect predictions for each class, sorted by class
4. Then after getting it, it is arranged into a table or matrix

RESULTS AND DISCUSSION

Data Calculation

The data used in this study were obtained from the results of interviews. Interviews were conducted with Tahfidz tutors in January which contained 3 criteria in determining prospective participants, including fluency (C1), *fashohah* (C2), and *tajwid* (C3). There is a weight for each criterion with a weight of (C1) 30%, (C2) 50%, and (C3) 20%. To determine the type of criteria, if the profit is taken, the maximum value from each column will be taken, while the cost will be taken the minimum value from each column [11] . Student data to be selected totaling 65 students with alternatives A1 to A65 as in Table 1.

Table 1. Alternative Values in Each Criteria

Alternative	Smoothness	Fashohah	Tajweed
A1	90.13	92	92
A2	91.89	90.41	90.27
A3	91.89	90.78	91.22
…	…	…	…
…	…	…	…
…	…	…	…
A64	83.83	83	85
A65	82.6	82	82.4

Normalization matrix is obtained by calculating the normalization performance rating value (rij). In this study, all criteria use the benefit attribute. Calculating each criterion with the maximum value obtained includes (C1) 92.24, (C2) 92, and (C3) 92. The results are obtained in Table 2.

$$R_{ij} = \frac{X_{ij}}{Maxij} \quad (1)$$

Table 2. Matrix Normalization

Alternative	C1	C2	C3
A1	0.977124892	1	1
A2	0.996205551	0.982717391	0.981195652
A3	0.996205551	0.98673913	0.991521739
…	…	…	…
…	…	…	…
…	…	…	…
A64	0.908824805	0.902173913	0.923913043
A65	0.895490026	0.891304348	0.895652174

After obtaining the normalization matrix (R), the next process is multiplying the data by the weight using alternatives. The results can be seen in Table 3.

$$\text{Ranking Process} = W_j R_{ij} \quad (2)$$

Table 3. Ranking Process Results

Alternative	Weight		
	30%	50%	20%
A1	0.293137467	0.5	0.2
A2	0.298861665	0.491358696	0.19623913
A3	0.298861665	0.493369565	0.198304348
…	…	…	…
…	…	…	…
…	…	…	…
A64	0.272647441	0.451086957	0.184782609
A65	0.268647008	0.445652174	0.179130435

Preference value (Vi) by calculating the sum of the results of the multiplication process. The results of the preference value can be seen in Table 4.

$$Vi = \sum_{j=1}^{n} W_j R_{ij} \quad (3)$$

Table 4. Preference and Ranking Results

Alternative (Ai)	Preferences (Vi)	Ranking
A1	0.993137467	4
A2	0.986459491	18
A3	0.990535578	9
…	…	…
…	…	…
…	…	…
A64	0.908517007	57
A65	0.893429617	65

In this study, data from 4 students will be used, including the first rank with alternative A10 getting a result of 0.996342132 named Alicia from class 3. For the second rank from alternative A48 named Raeesa from class 5 with a result of 0.994698612, for the third rank alternative A46 named Adzkia from class 3 with a result of 0.994565217, and the fourth rank alternative A4 named A'izza with a result of 0.993137467.

Testing Accuracy Selection of Candidates

Determining the original value obtained from the sum of the existing values without the SAW method process. After that, a ranking is carried out which produces the original ranking and then the original results are obtained with 2 categories, namely TL which is not passed and L which is passed as in Table 5.

Table 5. Original Values

Alternative	Amount mark original	Ranking original	Original results
A1	273.14	13	TL
A2	272	20	TL
A3	273.89	8	TL
…	…	…	…
…	…	…	…
…	…	…	…
A64	251.83	57	TL
A65	247	65	TL

Determine the predicted value that produces the ranking and predicted results. The predicted results are determined based on 2 categories TL and L where the pass category is selected from the 4 highest values. The results of the predicted values can be seen in Table 6.

Table 6. Prediction Values

Alternative (Ai)	Preferences (Vi)	Ranking	Prediction Results
A1	0.993137467	4	L
A2	0.986459491	18	TL
A3	0.990535578	9	TL
…	…	…	…
…	…	…	…
…	…	…	…
A64	0.908517007	57	TL
A65	0.893429617	65	TL

Calculating the number of correct and incorrect predictions is obtained by comparing the predicted and original values. If the prediction result passes and the original result does not pass, then the prediction is said to be wrong and vice versa. While if the prediction and the original are correct then the prediction is said to be a correct prediction. For the number of correct and incorrect predictions as in Table 7. After obtaining the results from the comparison of correct and incorrect prediction values, a confusion matrix was found as in Table 8.

Table 7. Amount Prediction right and wrong

Prediction Correct	3
Wrong Prediction	2

Table 8. Confusion Matrix Results

Prediction	Original Pass	Original Not Passed
Prediction Pass	TP (3)	FN (1)
Prediction Failed	FP (1)	TN (60)

After obtaining True Positive (TP), True Negative (TN), False Positive (FP), False Negative (FN), then the testing accuracy is conducted as shown in Table 9. The accuracy calculation is the result of calculating all correct prediction values divided by the total data [12] as follows. The error rate (ER) is the result of calculating all incorrect prediction values divided by the total data [11]. Specificity is measuring the proportion of negative cases that are actually detected [13] as follows. Precision is measuring the proportion of correct positive predictions from all positive predictions [14] as follows. After testing using the confusion matrix, an accuracy value of 96.9% was obtained, ER 3.1%, specificity 98.36065574%, and precision 75% so that testing using the confusion matrix is much better in calculating the accuracy of the SAW method prediction.

Table 9. Testing Accuracy Results

Accuracy	ER	Specificity	Precision
96.9 %	6.9%	98.36065574%	75%

Application of the SAW Method to the Web-Based System

The implementation of the Simple Additive Weighting (SAW) method on the system uses PHP language, with database storage on phpMyAdmin, and CSS display. The display flow on the system can be seen below. The Main Page as shown in Figure 3 displays the name of the system and the method to be used and the method to be used.

Figure 3. Main Page

For the next page, there is a criteria weight page as shown in Figure 4. On this page there is also a form consisting of criteria, weight, and attribute. Its function is to input the criteria weight that will be

used to calculate data including the cost and benefit groups. In addition, criteria can be added or reduced so that they can be used in other problems.

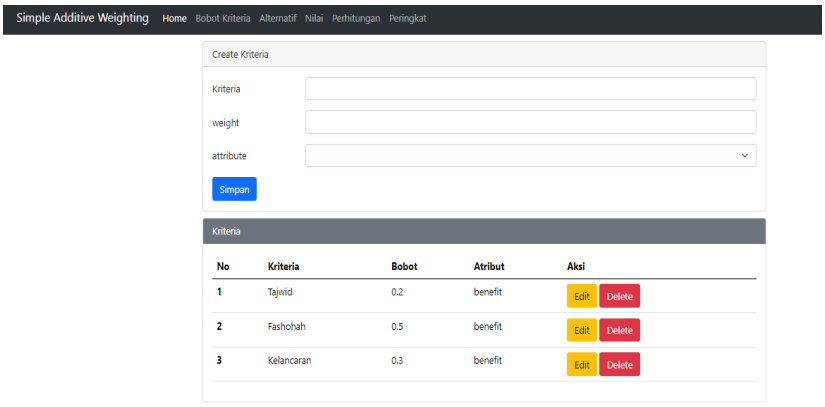


Figure 4. Criteria Weight Page

The Alternative Data Page displays a form to input alternative data and the respective values that have previously determined the criteria and weight values. However, what will be displayed in the alternative data page table are name, alternative and gender. The gender column functions for problems that require ranking with gender criteria. There is also an action column whose function is to delete and edit data as in Figure 5.

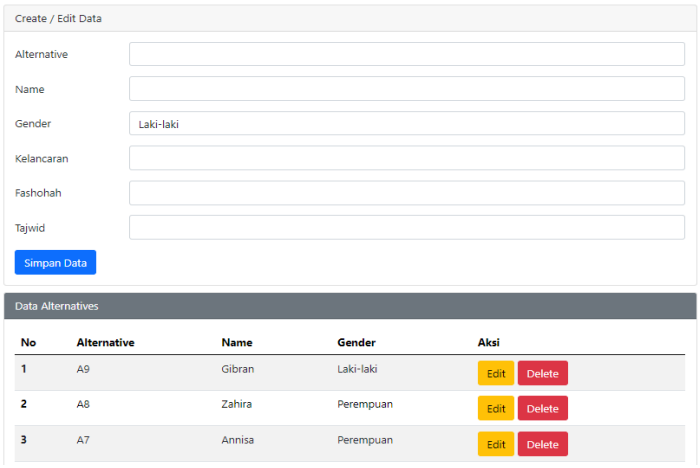


Figure 5. Alternative Data Page

A warning occurs if the form has not been filled in completely, then the storage system will not run and an error occurs as in Figure 6. After inputting from the alternative page, the system displays the values contained in the value page with the aim of making it easier for users to understand the system as in Figure 7.

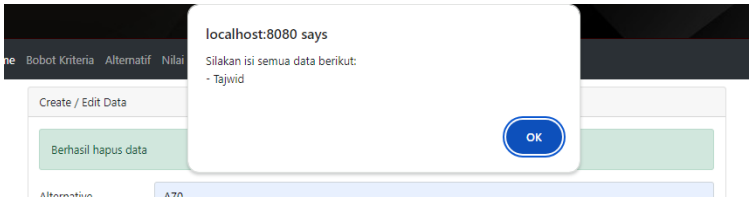


Figure 6. Notification Warning

Data saw_values

id	id_alternative	id_criteria	nilai
1	1	1	90.13
2	1	2	92
3	1	3	92
4	2	1	91.89
5	2	2	90.41
6	2	3	90.27
7	3	1	91.89
8	3	2	90.78
9	3	3	91.22
10	4	1	90.67

Figure 7. Result Page

There is another page, which is Normalization Matrix Page that shows the calculation of normalization matrix. The data that has been inputted and stored in the database will automatically be calculated by the system. Before entering this page, there is information on the benefit or cost figures that will be used in the matrix normalization process as in Figure 8. The display of the entire matrix normalization can be seen in Figure 9.

Attribute Information

Attribute	Max Value	Min Value
Kelancaran	92.24	82.6
Fashohah	92	82
Tajwid	92	82.4

Figure 8. Informatin Attributes

Normalisasi Matriks (Setelah Menentukan Cost dan Benefit)

Alternative	Name	Gender	Kelancaran	Fashohah	Tajwid
A1	A'izza	Perempuan	0.9771248916	1	1
A2	Faradina	Perempuan	0.9962055507	0.9827173913	0.9811956522
A3	Jehan	Perempuan	0.9962055507	0.9867391304	0.9915217391
A4	Keysha	Perempuan	0.9829791847	0.9855434783	0.9891304348
A5	Advysa	Perempuan	0.9661751951	0.9691304348	0.9647826087

Figure 9. Matrix Normalization Page

On the ranking process, the matrix normalization value will multiplied with weight value from criteria. Figure 10 shows the information about criteria weight, and the data of ranking result is generated as shown in Figure 11.

Attribute Information

Attribute	Weight
Kelancaran	0.3
Fashohah	0.5
Tajwid	0.2

Figure 10. Criteria Weight Information

Matriks Setelah Dikalikan Bobot

Alternative	Name	Gender	Kelancaran	Fashohah	Tajwid
A1	A'izza	Perempuan	0.293137467	0.5	0.2
A2	Faradina	Perempuan	0.298861665	0.491358696	0.19623913
A3	Jehan	Perempuan	0.298861665	0.493369565	0.198304348
A4	Keysha	Perempuan	0.294893755	0.492771739	0.197826087

Figure 11. Ranking Result

After the ranking process is obtained, the last step is to display the preference value and ranking from the highest to the lowest ranking. The data displays 2 options, namely the overall ranking and the ranking by gender. The reason the championship is separated by gender is to ensure equal opportunities and to make the assessment fairer. The display of ranking by gender can be seen in Figure 12 and the overall ranking can be seen in Figure 13.

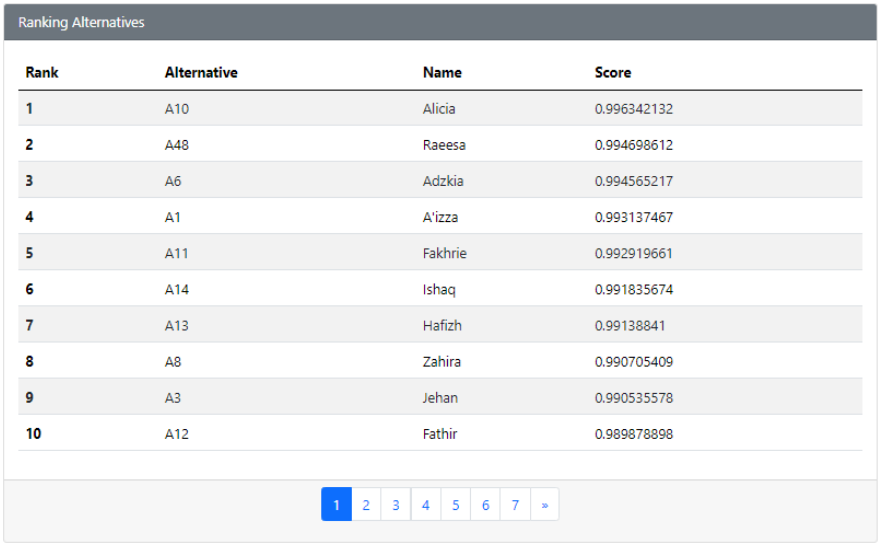
Nilai Preferensi dan Ranking Perempuan

Rank	Alternative	Name	Final Score
1	A10	Alicia	0.9963421321
2	A48	Raeesa	0.9946986123
3	A6	Adzkia	0.9945652174
4	A1	A'izza	0.9931374675

Nilai Preferensi dan Ranking Laki-laki

Rank	Alternative	Name	Final Score
1	A11	Fakhrie	0.9929196614
2	A14	Ishaq	0.9918356744
3	A13	Hafizh	0.9913884102
4	A12	Fathir	0.9898788981
5	A9	Gibran	0.9881360251

Figure 12. Ranking Result by Gender



Ranking Alternatives

Rank	Alternative	Name	Score
1	A10	Alicia	0.996342132
2	A48	Raeesa	0.994698612
3	A6	Adzkia	0.994565217
4	A1	A'izza	0.993137467
5	A11	Fakhrie	0.992919661
6	A14	Ishaq	0.991835674
7	A13	Hafizh	0.99138841
8	A8	Zahira	0.990705409
9	A3	Jehan	0.990535578
10	A12	Fathir	0.989878898

1 2 3 4 5 6 7 »

Figure 13. Ranking Result Overall

CONCLUSION AND SUGGESTIONS

Based on the research that has been conducted, the following conclusions can be drawn. The application of the Simple Additive Weighting (SAW) method in the selection of prospective participants in the Tahfidz Al-Qur'an competition refers to the assessment based on the criteria of fluency, *fashohah*, and *tajwid*, so that 4 students were selected, including the first rank with alternative A10 getting a result of 0.996342132 named Alicia from class 3. For the second rank from alternative A48 named Raeesa from class 5 with a result of 0.994698612, for the third rank alternative A46 named Adzkia from class 3 with a result of 0.994565217, and the fourth rank alternative A4 named A'izza with a result of 0.993137467. The results of testing the Simple Additive Weighting (SAW) method in determining prospective participants in the Tahfidz Al-Qur'an competition using a confusion matrix produced an accuracy value of 96.9%, ER 3.1%, specificity 98.36065574%, and precision 75%, which indicates a fairly high level of accuracy.

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