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THE BEST TEACHER SELECTION DECISION SUPPORT SYSTEM BASED ON PERFORMANCE ASSESSMENT AT SMPIT AS SU'ADAA USING SIMPLE ADDITIVE WEIGHTING (SAW) METHOD

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Abstract

One of the efforts in improving the quality of human resources is to measure the performance of a teacher through a teacher selection. One of the information systems needed is a decision support system for selecting the best teacher. This is needed because the Principal and the Curriculum Section in the process of assessing teacher performance and determining the results of the best teacher selection decisions still use manual methods and do not have a decision support system and there is no appropriate method in selecting the best teachers. This research aims to create a decision support system with the Simple Additive Weighting (SAW) method, and create a MySQL database to store all data. The selection of the best teacher is determined by summing up the results of the assessment of existing criteria with predetermined weight. The results will be ranked according to the calculations in the Simple Additive Weighting (SAW) method. By applying the basic additive weighting method, design systems support principals and the curriculum department in identifying the most effective teachers based on measurable, objective performance indicators.

Keywords: *Best Teacher Selection, Decision Support System, MySQL, Simple Additive Weighting*

1. INTRODUCTION

The role of the teacher in the world of education is very important to ensure the quality of the teaching and learning process. The best teacher assessment aims to encourage motivation, dedication, loyalty and professionalism in teachers, which is expected to have a positive impact on improving their performance. The teaching profession requires continuous and proportional development in accordance with the teacher's career situation. In addition, so that the functions and tasks inherent in the functional positions of teachers can be carried out in accordance with applicable regulations, it is necessary to conduct an assessment of teacher performance that ensures a quality learning process at all levels of education (Farokhah & Kala'lembang, 2019).

In an effort to improve the quality of education for students as the nation's next generation, competent teachers are needed in providing education to students. One of the efforts to improve the quality of human resources is to measure the performance of a teacher through a teacher selection. In the world of education, information systems are very important for data processing and speeding up work processes. Technology can provide many benefits in carrying out human activities. One of the information systems needed is a decision support system for selecting the best teacher (Fitri Duwiyanti, 2019).

Decision Support System (DSS) in education can be seen as an important asset to support smoothness and accuracy in achieving a goal. SMPIT AS SU'ADAA desperately

needs an information system that is accurate and makes it easier for schools to help determine the selection of the best teachers. This is necessary because the Principal and the Curriculum Section in the process of assessing teacher performance and determining the results of the best teacher selection decisions still use manual methods and do not have a decision support system and there is no appropriate method for selecting the best teachers.

2. RESEARCH METHOD

2.1. Method of collecting data

In conducting this research, the authors collect data by means of literature studies, interviews, and observations

2.2.1. Study of literature

Literature study was conducted to find theoretical references relevant to the problems found by collecting a number of books, journals and the internet. Among them are research conducted by Putra et al. (2018) this study uses the indicators of the achievement teacher variable. The greatest value was obtained on the alternative chosen as the best alternative and had a satisfactory performance in the teaching process to students.

The following is research conducted by Hertyana (2018) which has the criteria of discipline, initiative, achievement, cooperation, order, performance and social. With the largest final result value of 95 with the name of the employee Rahmayanti.

Then the research conducted by Suhandi et al. (2020) in this system, an analysis menu has been created in which there is a calculation form to calculate alternative and normalized values as well as a database for data storage

2.2.2. Interview

Interviews were conducted by means of direct question and answer with the principal and the curriculum section of SMPIT AS SU'ADAA to find data and information related to the process of selecting the best teachers and what criteria will be used.

2.2.3. Observation

Observations were made by visiting the research site directly to find out the current conditions regarding the process of selecting the best teacher at SMPIT AS SU'ADAA.

2.2. System Basic Concept

A system is a collection of two or more elements or objects that interact and are interconnected to achieve a goal and are composed of smaller subsystems that support a larger system (Irawan & Neneng, 2021).

A system is a network of interrelated procedures, gathered together to carry out an activity or to complete a certain goal (Augustini, 2017).

2.3. Decision Support System

Decision Support System (Decision Support System) is an interactive information system that provides information, modeling and manipulating data (Simarmata et al., 2018).

In decision making, the DSS application uses a flexible, interactive, and adaptable CBIS (Computer Based Information System), which is then developed to support solutions to specific unstructured management problems (Susanto & Marisa, 2020).

A decision support system or Decision Support System (DSS) is the implementation of Multi Attribute Decision Making (MADM). The application of a decision support system can apply several methods, for example Linear Weighted Method (LWM), and Simple Additive Weighting (SAW). The results of LWM and SAW have different effects due to differences in the normalization process. The SAW method can be implemented in web form using the PHP programming language (Salim, 2018).

2.4. Simple Additive Weighting (SAW) Method

One method of solving problems that is often also known as the weighted addition method. The basic concept of the SAW method is to find the weighted sum of the performance ratings on each alternative of all attributes. This method requires the decision maker to determine the weight for each attribute (Rusdiana et al., 2019).

The SAW method requires the process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings.

Analysis of the data in the selection of the best teachers at SMPIT AS SU'ADAA for determining criteria using Pedagogic, Personality, Social, and Professional criteria. The formulas and steps in the SAW method are as follows:

1) Determine the alternative, namely Ai.
2) Determine the criteria that will be used as a reference in making decisions, namely Cj.
3) Determine the weight for each criterion Wj, J = 1,2 …m with an important note $\sum$ W j.
4) Create a match rating table for each alternative on each criterion.
5) Make a decision matrix (X) which is formed from the suitability rating table for each alternative on each criterion. The value of X for each alternative (Ai) on each criterion (Cj) that has been determined, where, i=1,2,…m and j=1,2,…n.
6) Normalizing the decision matrix by performing a comparison process on all existing alternative values, the normalization formula is:

$$r_{ij} = \begin{cases} \dfrac{X_{ij}}{\text{Max } X_{ij}} & \text{if j is profit attribute} \\ \dfrac{\text{Min } X_{ij}}{X_{ij}} & \text{if j is a cost attribute (cost)} \end{cases}$$

Information:

Rij : normalized performance rating value.
Xij : attribute value of each criterion
Maxi Xij : the largest value of each criterion
Mini Xij : the smallest value of each criterion
Benefit : if the biggest value is the best
Cost : if the smallest value is the best.

7) The results of the normalized performance rating value (rij) form a normalized matrix

(R)

8) Calculating preference values for eachalternatively, Vi is given as follows

$$\mathbf{V_i} = \sum_{j=1}^{n} \boldsymbol{Wj\ rij}$$

Information:

Vi : Rank for each alternative

Wj : The value of the weight of each criterion

rij : Normalized performance rating value. A larger Vi value indicates that alternative Ai is the best alternative.

2.5. Programming language

The programming language used in making this system is to use the PHP programming language and MySQL database and implement the Simple Additive Weighting (SAW) method on the selection of the best teachers based on performance assessments at SMPIT AS SU'ADAA. The web is made dynamic by using PHP, so that if there are improvements in the web, it can be done more easily and more efficiently (Haqi, 2019).

2.6. Waterfall Method

The Waterfall method is the simplest SDLC model, this model is suitable for software development with specifications that do not change (Handayani, 2018).

2.7. United Modeling Language (UML)

United Modeling Language(UML) is a collection of diagrams that build object-based software and already have standards (Fitri Ayu and Nia Permatasari, 2018).

2.8. Entity Relationalship Diagram (ERD)

Entity Relationalship Diagram(UML) describes the relationship between entities in a diagram in the database (Situngkir et al., 2020).

3. RESULTS AND DISCUSSION

The following are the results of the study which are divided into two parts, namely the calculation section and the application section.

3.1. Calculations using the Simple Additive Weighting (SAW) Method

The first step is to determine the Alternative data, namely Ai, which consists of 20 teachers and the criteria needed for decision making as the second step after determining the Alternative data. Table 1 and Table 2 respectively show the Alternatives and Criteria used in this study.

Table 1 Alternative Data

Alternate Code	Alternative
A1	Arif Hidayatullah, SEI
A2	Lailah Fauziah, S.Pd
A3	Nola Dwi Ratnawaty, S.Pd
A4	Mai Turgiyanti, S.Pd
A5	Norma Listorini, S.Pd
A6	Devi Andriani, S. Ag
A7	Jihan Miftahul Azmi, S.Pd
A8	Siti Sahauni, S.Pd
A9	Imelinda Habibah, S.Pd
A10	Sapna, S.Pd
A11	Azizah Mumtahanah, S.Pd
A12	Syaeful Bachri, S.Pd
A13	Aam Ma'sumah, S.Pd.I
A14	ABD Rofie, S.Pd.I
A15	Ridwan Hidayat, S.Pd
A16	Dina Hanifa, S.Pd
A17	Suci Ani Rohmawati, S.Pd
A18	Abdul Malik, A.Md
A19	Ulyatun Nuha, S.Pd.I
A20	Mulkan Azima, S.Pd.I

Table 2 Criteria

NO	Criteria	Sub Criteria
1	C1 – Pedagogy	Mastering the characteristics of students
2	C1 – Pedagogy	Mastering learning theory and educational learning principles
3	C1 – Pedagogy	Curriculum development
4	C1 – Pedagogy	Educational learning activities
5	C1 – Pedagogy	Development of student potential
6	C1 – Pedagogy	Communication with students
7	C1 – Pedagogy	Assessment and evaluation
8	C2 – Personality	Act in accordance with national religious, legal, social and cultural norms
9	C2 – Personality	Show a mature and exemplary personality
10	C2 – Personality	Work ethic, high responsibility, pride in being a teacher
11	C3 – Social	Be inclusive, act objectively, and not discriminate
12	C3 – Social	Communication with fellow teachers, education staff, parents, students, and the community
13	C4 – Professional	Mastery of materials, structures, concepts and scientific mindsets that support the subjects taught
14	C4 – Professional	Developing professionalism through reflective actions
15	C4 – Professional	Teachers are at school even though they do not carry out student guidance

Next, give a weighted value for each criterion. In this case, it has been determined by the school, in which percentage the school assigns a score to each criterion

Table 3 Criteria Weight Value

NO	Criteria (Cj)	Weight (W)
1	C1 – Pedagogy	0.40
2	C2 – Personality	0.30
3	C3 – Social	0.15
4	C4 – Professional	0.15

The next step is to determine whether each criterion includes Cost or Benefit. Below Table 4 shows the Cost or Benefit of each criterion

Table 4 Cost Benefit

NO	Criteria (Cj)	Cost or Benefits
1	C1 – Pedagogy	Benefits
2	C2 – Personality	Benefits
3	C3 – Social	Benefits
4	C4 – Professional	Benefits

The next step is to create a match rating table for each alternative on each criterion. The results of the sub-criteria are obtained from assessments in schools by assessing with direct observation and monitoring by the assessor, which is part of the school curriculum. Assessment is rated on a scale of 1, 2, 3, or 4. Minimum value per competency = 1 and maximum value = 4.

The competency value of each of these sub-criteria will be assessed by the system, namely by adding up the sub-criteria values and then dividing by the number of sub-criteria. The results of each criterion are obtained and will be calculated using the system using the Simple Additive Weighting (SAW) method for selecting the best teacher at SMPIT AS SU'ADAA. To calculate the criterion value of each criterion (Ci) use the following rules:

$$Ci = \frac{\text{Total competency scores}}{\text{Many competencies}} = \text{Result}$$

After calculating Ci, the results will be entered into the table. The following is Table 5 showing the compatibility rating

Table 5 Match Rating

Alternate Code	Teacher name	Criteria			
		Pedagogic	Personality	Social	Professional
		C1	C2	C3	C4
A1	Arif Hidayatullah, SEI	3.285714286	3.666666667	4	3
A2	Lailah Fauziah, S.Pd	3,428571429	4	4	3
A3	Nola Dwi Ratnawaty, S.Pd	3,428571429	3.666666667	4	3
A4	Mai Turgiyanti, S.Pd	3.571428571	4	4	3
A5	Norma Listorini, S.Pd	3	3.666666667	4	3
A6	Devi Andriani, S. Ag	3	4	4	3
A7	Jihan Miftahul Azmi, S.Pd	3,428571429	4	4	3
A8	Siti Sahauni, S.Pd	3,428571429	3	3.5	3
A9	Imelinda Habibah, S.Pd	3,428571429	3.666666667	3.5	3
A10	Sapna, S.Pd	3,428571429	3.666666667	3.5	3
A11	Azizah Mumtahanah, S.Pd	3.285714286	3.666666667	3.5	3
A12	Syaeful Bachri, S.Pd	3.285714286	4	4	3
A13	Aam Ma'sumah, S.Pd.I	3.285714286	4	4	3
A14	ABD Rofie, S.Pd.I	3.142857143	3.666666667	3.5	3
A15	Ridwan Hidayat, S.Pd	3.142857143	3.666666667	3	3
A16	Dina Hanifa, S.Pd	3.571428571	4	4	3
A17	Suci Ani Rohmawati, S.Pd	3.142857143	4	4	3
A18	Abdul Malik, A.Md	3,428571429	3.666666667	3.5	3
A19	Ulyatun Nuha, S.Pd.I	3.142857143	3.666666667	3.5	3
A20	Mulkan Azima, S.Pd.I	3	4	3.5	3

The next step is to normalize the weight of each criterion based on Cost or Benefit into r_{ij} and then multiply r_{ij} by the percentage weight of the criteria to become C_n. Then add up C_n and get V_i, which is the result of normalization. Below is a normalized matrix

Table 6 Normalization Matrix

Normalization Matrix			
0.92	0.916667	1	1
0.96	1	1	1
0.96	0.916667	1	1
1	1	1	1
0.84	0.916667	1	1
0.84	1	1	1
0.96	1	1	1
0.96	0.75	0.875	1
0.96	0.916667	0.875	1
0.96	0.916667	0.875	1
0.92	0.916667	0.875	1
0.92	1	1	1
0.92	1	1	1
0.88	0.916667	0.875	1
0.88	0.916667	0.75	1
1	1	1	1

0.88	1	1	1
0.96	0.916667	0.875	1
0.88	0.916667	0.875	1
0.84	1	0.875	1

The last step is the search for the best ranking or value by order V_i from the highest value to the lowest. Table 6 shows from the final normalization that has been sorted.

Table 7. Final Normalization Table

No	Alternative	ΣV_i
1	Mai Turgiyanti, S.Pd	1
2	Dina Hanifa, S.Pd	1
3	Lailah Fauziah, S.Pd	0.984
4	Jihan Miftahul Azmi, S.Pd	0.984
5	Aam Ma'sumah, S.Pd.I	0.968
6	Syaeful Bachri, S.Pd	0.968
7	Nola Dwi Ratnawaty, S.Pd	0.959
8	Suci Ani Rohmawati, S.Pd	0.952
9	Arif Hidayatullah, SEI	0.943
10	Sapna, S.Pd	0.940
11	Abdul Malik, A.Md	0.940
12	Imelinda Habibah, S.Pd	0.940
13	Devi Andriani, S. Ag	0.936
14	Azizah Mumtahanah, S.Pd	0.924
15	Mulkan Azima, S.Pd.I	0.917
16	Norma Listorini, S.Pd	0.911
17	ABD Rofie, S.Pd.I	0.908
18	Ulyatun Nuha, S.Pd.I	0.908
19	Ridwan Hidayat, S.Pd	0.890
20	Siti Sahauni, S.Pd	0.890

After performing calculations using the Simple Additive Weighting method, it was decided that the teacher with the alternative code A4 named Mai Turgiyanti, S.Pd and A16 named Dina Hanifa, S.Pd was chosen as the best teacher with the highest score of 1.

3.2. System Design

The method used in the design of this research system is United Modeling Language (UML), namely Use Case Diagrams, Activity Diagrams, Sequence Diagrams, Entity Relationship Diagrams (ERD), and Class Diagrams.

3.2.1. Use Case Diagrams

Use Case Diagrams formed based on the function of the interaction between one or more actors with the system to be created. In this case, it explains the use case diagram showing the functionality of a system and what functions exist in the system. In the use case diagram there are main menus, namely Login, Manage Criteria Weights, Manage Sub Criteria Values, Manage Teacher Data, Manage Assessments, View Calculations, Main Page, and Logout. Use Case Diagram can be seen in Figure 1.

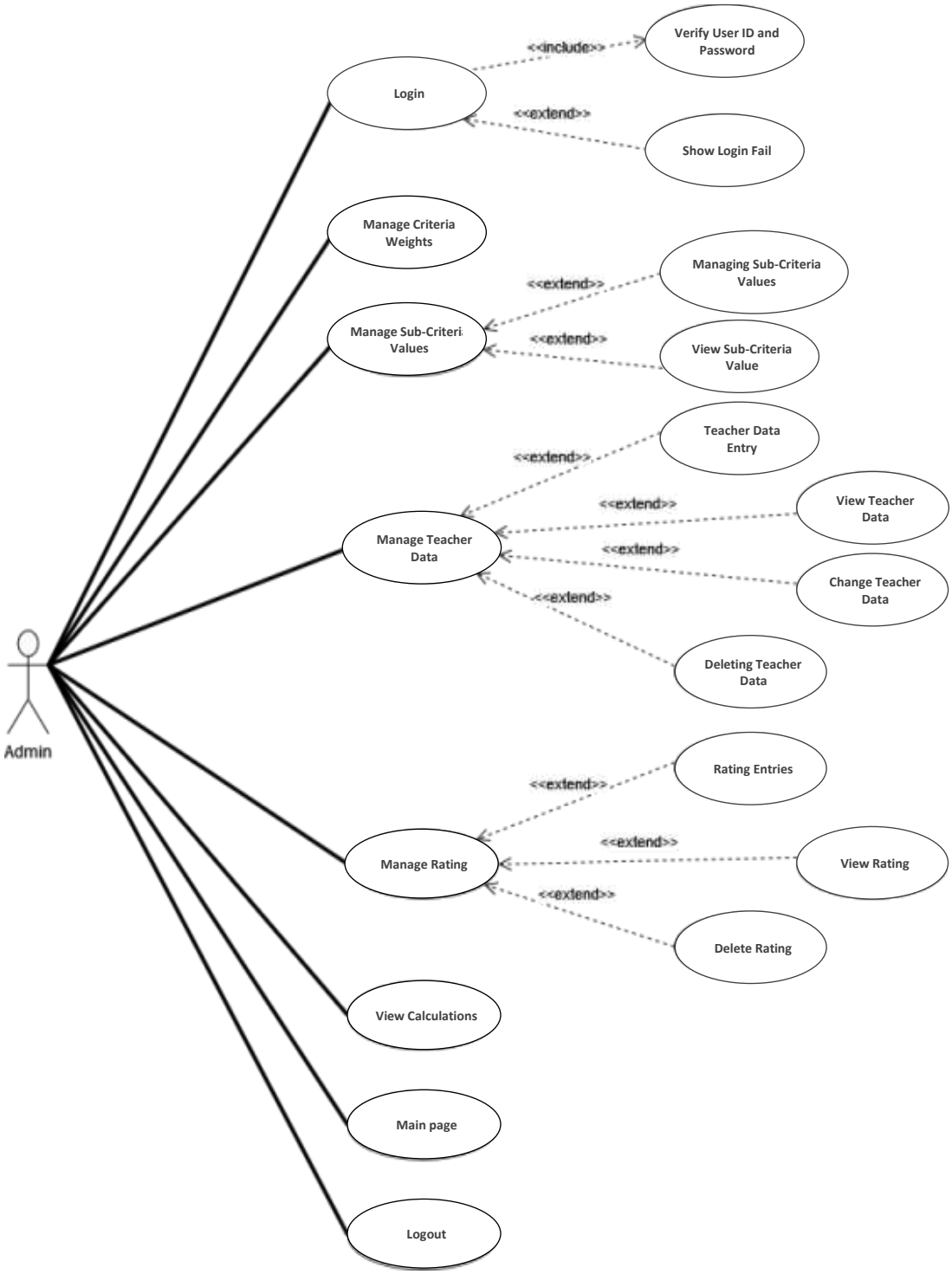

Figure 1 Use Case Diagrams

3.2.2. Activity Diagrams

Activity Diagrams describes the activities of the system not what the actors do, so the activities that the system can do. Activity Diagram can be seen in Figure 2

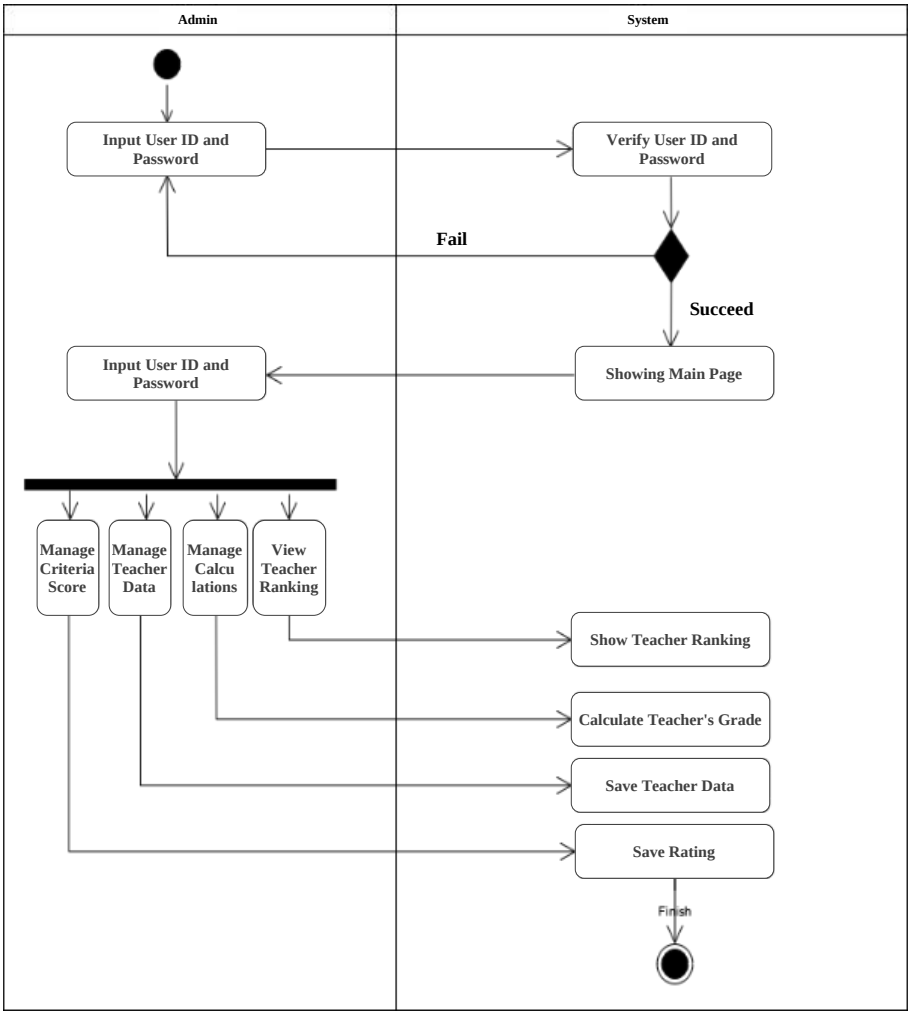

Figure 2 Activity Diagrams

3.2.3. Sequence Diagrams

Sequence Diagrams shows the flow of the system for each functionality. Sequence Diagrams in this research design were made of 5 pieces, namely the criteria weighting sequence diagram, the sub-criteria score sequence diagram, the teacher sequence diagram, the assessment sequence diagram, and the calculation sequence diagram. 5 sequence diagrams can be shown in Figure 3, Figure 4, Figure 5, Figure 6, Figure 7.

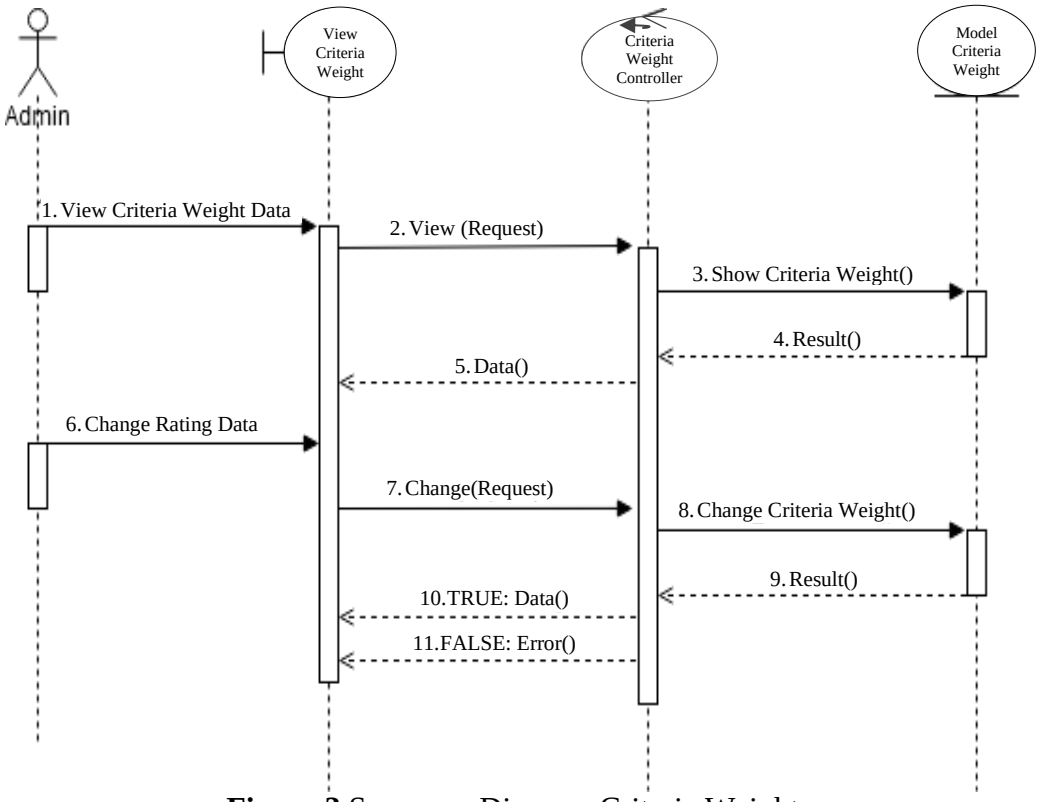

Figure 3 Sequence Diagram Criteria Weight

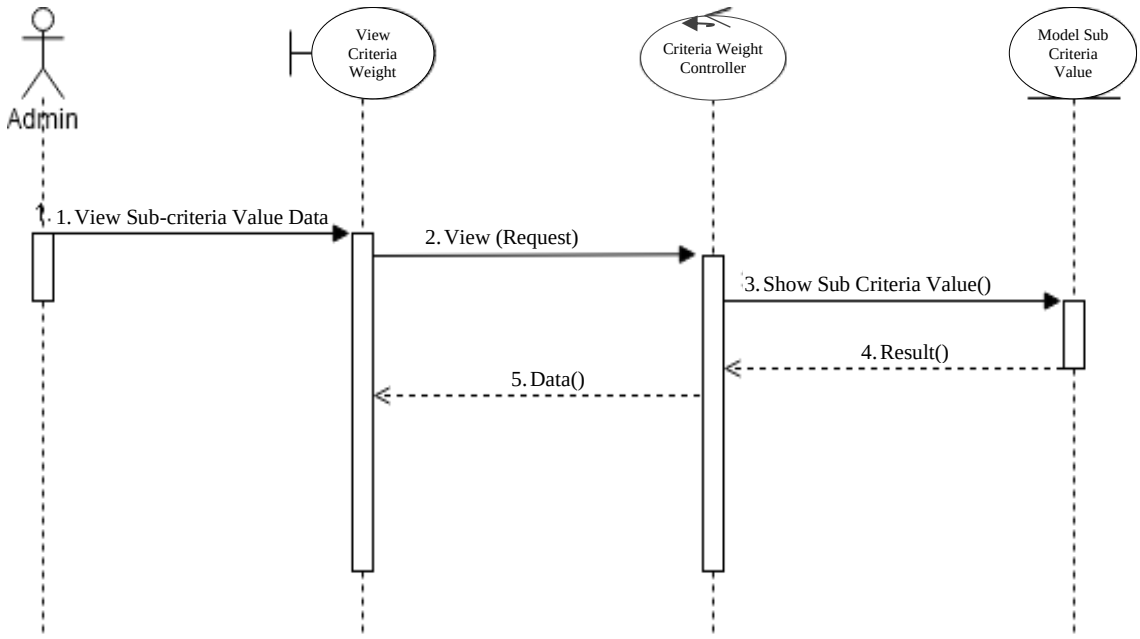

Figure 4 Sequence Diagram of Sub Criteria Value

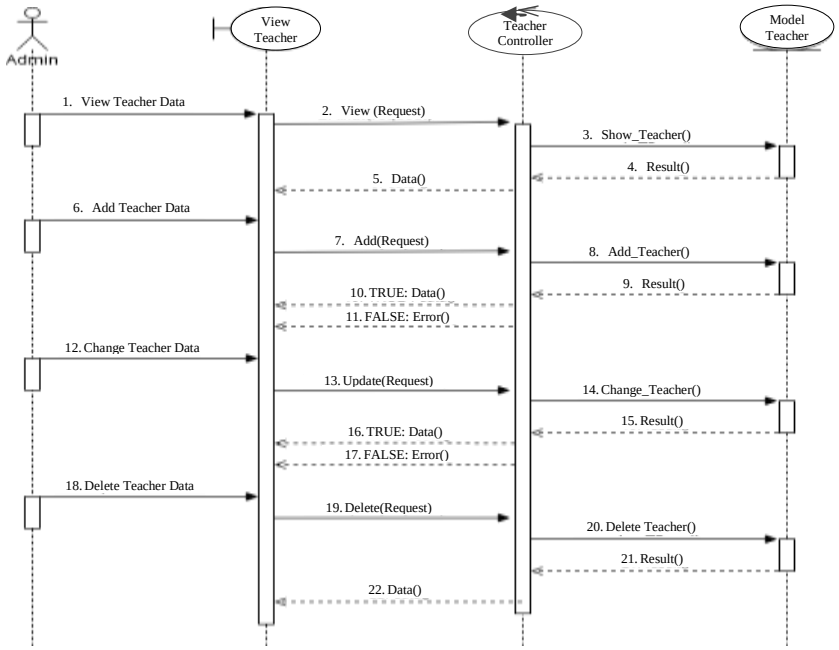

Figure 5 Sequence Diagram of Teacher

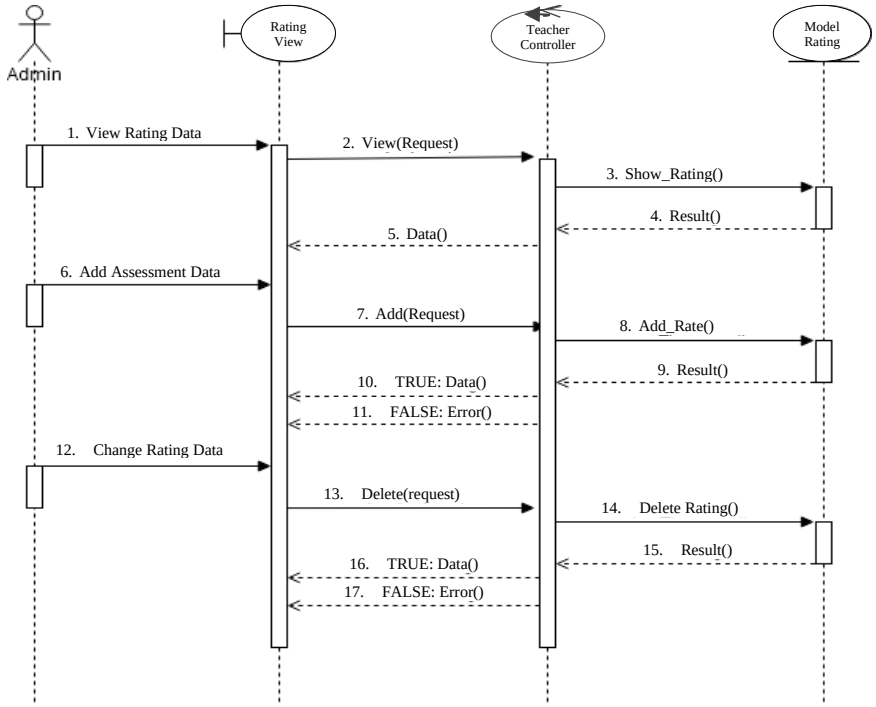

Figure 6 Rating Diagram Sequence

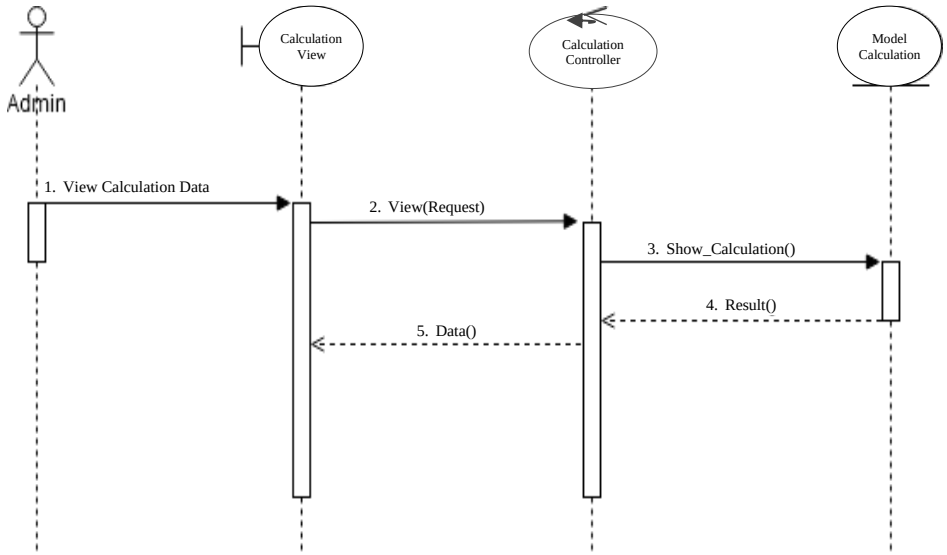

Figure 7 Sequence Diagrams Calculation

3.2.4. Class Diagram

Class Diagram can show the class that was formed during program implementation. In the class diagram, 7 classes are formed including the Main class, the other classes that are formed are the log in class, the calculation class, the criterion weight class, the sub-criteria value class, the teacher class, and the assessment class. Each class is related to one another. Class Diagram can be shown in Figure 8

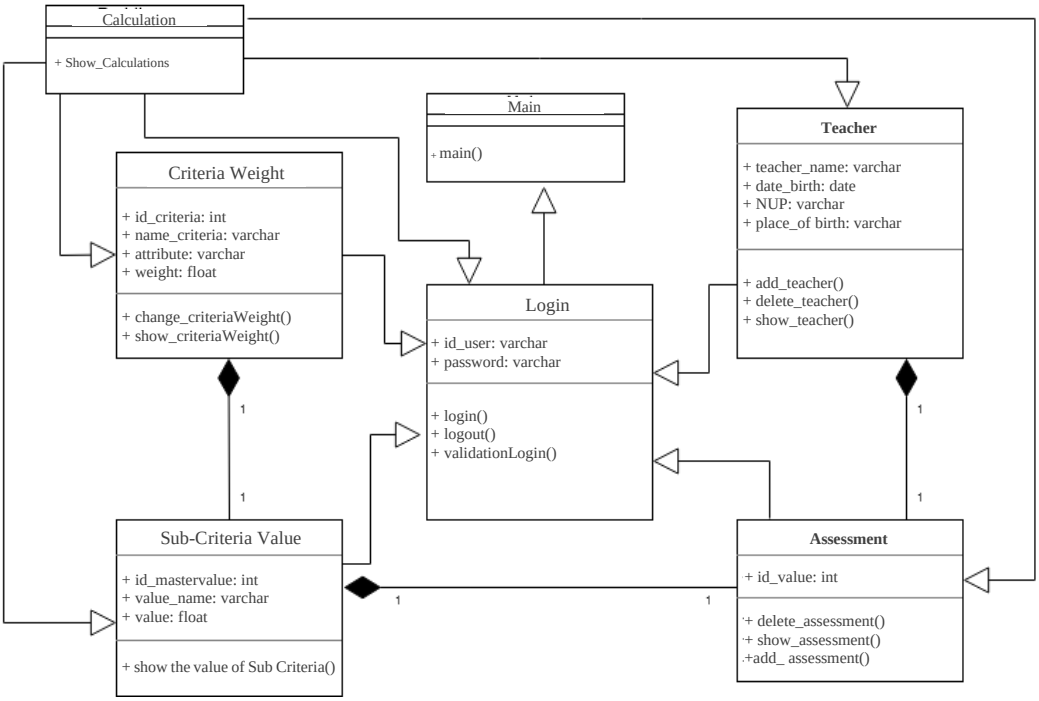

Figure 8 Class Diagram

3.2.5. Entity Relationship Diagram (ERD)

Entity Relationship Diagram (ERD) describes the relationship between storage in graphical notation conceptual data modeling. Entity Relationship Diagram can be depicted in Figure 9

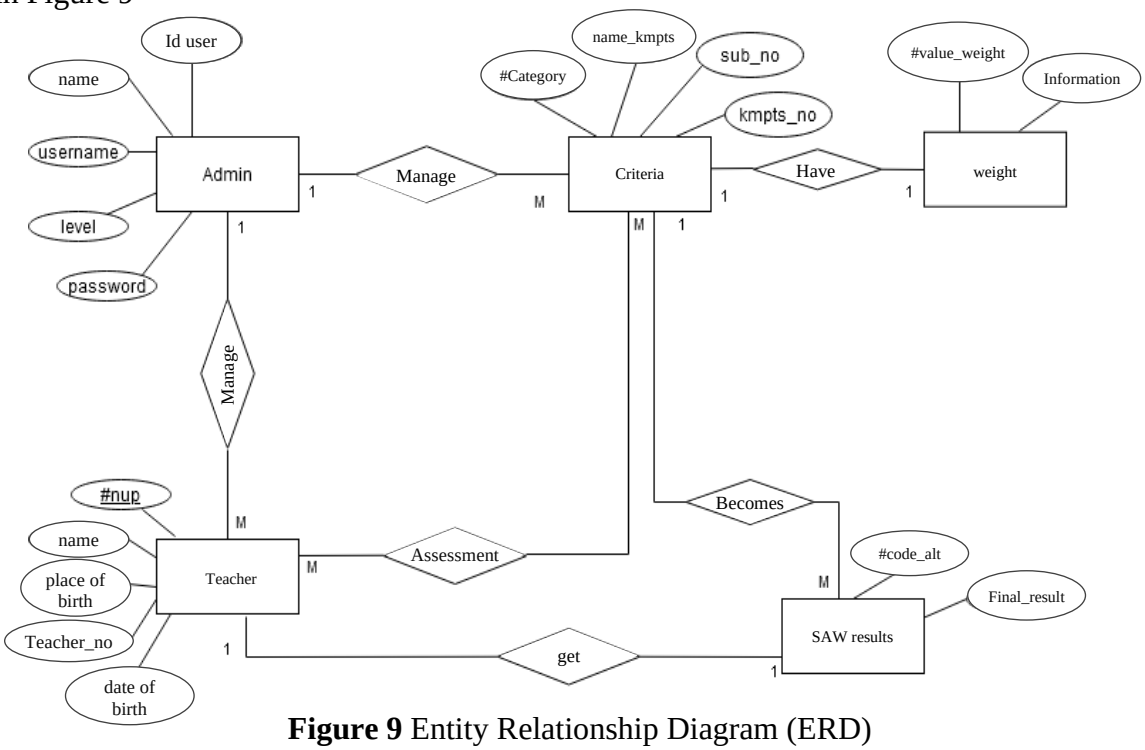

Figure 9 Entity Relationship Diagram (ERD)

3.3. System Implementation

The system is implemented in the form of a web with the PHP programming language. The system uses a MySQL database for data storage. The following is a display of the web of the best teacher assessment decision support system based on performance assessment at SMPIT AS SU'ADAA using the Simple Additive Weighting (SAW) method.

Figure 10 Login Page View

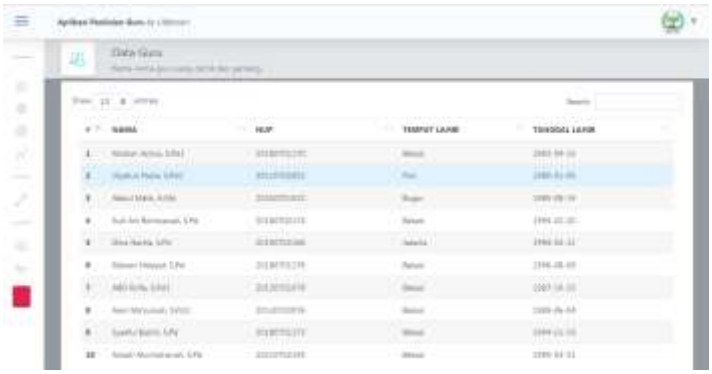

Figure 11 Teacher Data Page Display

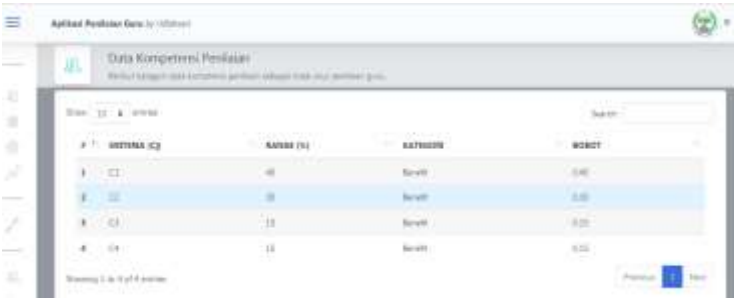

Figure 12 Criteria Page View

Figure 13 Criteria Weights Page View

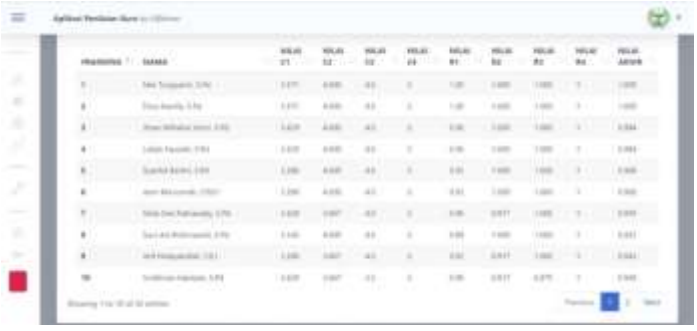

Figure 14 Rating Page View

Figure 15 Ranking Page View

3.4. System Test

Tests carried out at this stage are testing blackbox testing. Blackbox testing is a test to find out whether the system functionality can run as expected by the system maker. The results of the Blackbox Testing test of the best teacher selection decision support system based on performance assessment at SMPIT AS SU'ADAA using the Simple Additive Weighting (SAW) method that has been made can be shown in Table 7.

Table 7 Blackbox Testing

No	Feature	Input	Output	Status
1	Login	Entering the correct User ID and Password	Login to the system	Valid
2	See Sub Criteria	Pressing the competence menu	Showing sub criteria	Valid
3	Rating View	Entering teacher grades	Saved teacher grades	Valid
4	Calculations View	Pressing the Teacher's Grades Summary menu	Displaying calculations using the SAW method	Valid
5	Manage Teacher Data	Input teacher data in the add teacher menu	Teacher data saved	Valid
6	logout	Press the logout button	Log out of the system	Valid

4. CONCLUSION

Based on the research that has been done, a conclusion can be drawn, namely, the design and manufacture of systems with the application of the simple additive weighting method can help principals and the curriculum department in making decisions about selecting the best teachers based on performance assessments with predetermined and objective values.

Making a database using MySQL to make it easier for the curriculum field to process data quickly and then store the data that has been stored safely.

Suggestions for further research is that it can be used for different and useful case studies. Selection of a better algorithm can be done in order to form a much better decision support system.

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