JUSIKOM PRIMA (Jurnal Sistem Informasi dan Ilmu Komputer Prima)
Vol. 7 No. 1, Agustus 2023 E-ISSN : 2580-2879

DECISION SUPPORT SYSTEM FOR TEACHER PERFORMANCE APPRAISAL WITH SIMPLE ADDITIVE WEIGHTING METHOD

Jijon Raphita Sagala[*1], *Penda Sudarto Hasugian*[2]
[1] *Teknologi Informasi, STMIK Pelita Nusantara, Medan, Indonesia,*
[2]*Teknologi Rekayasa Komputer Jaringan, STMIK Pelita Nusantara, Medan, Indonesia*
E-mail : [1)]sisagala@gmail.com, [2)]penda.hasugian@gmail.com

ABSTRACT- The teacher is the component that most influences the creation of quality educational processes and outcomes. Therefore improvement efforts are made to improve the quality of education. Schools will not make a significant contribution without the support of professional and qualified teachers. Teachers are really required to have high performance. In schools there are still many teacher performance problems. To improve the quality of teacher performance, SD Negeri 064022 conducts teacher performance assessments every 3 months, but the mechanism is not effective due to lack of transparency. Teacher performance appraisal research uses an applied system for efficiency and transparency. The system was developed using the Simple Additive Weighting method. The Simple Additive Weighting method, part of the Decision Support System (DSS), is used to help determine decisions based on alternative data and criteria data..

Keywords*:* Decision Support System, Teacher Performance, Simple Addictive Weighting.

1. INTRODUCTION

Teachers are professional activities that support certain knowledge that is managed in the knowledge they have, so that teacher performance is essentially the result of the knowledge they are responsible for and that teachers also need to have other specialized knowledge to acquire in order to teach better (Sunarto & Gata, n.d.). Continuous teacher performance appraisals are conducted to improve the work ethic of teachers, as well as at State Elementary School 064022. The school also conducts regular teacher performance appraisals according to predetermined rules.

Teacher appraisals generally have various benefits for teachers and schools. For teachers, it will trigger a competitive spirit to be better in the future. One of them is characterized by an increase in the work ethic of the teachers themselves, while for schools it will have an impact on increasing productivity for the school itself. To improve the quality of teacher performance, State Elementary School 064022 conducts teacher performance appraisals every 3 months but the mechanism is less effective due to lack of transparency (Education et al., 2019).

The assessment of teacher performance is to underlie policies regarding teacher promotion and career along with the awards that should be obtained (Dermawan & Triyono, 2022). Therefore, an assessment of teacher performance at 064022 State Elementary School is needed. Meanwhile, teacher performance appraisal at 064022 State Elementary School in determining teacher performance appraisal still occurs difficulties because it is still done manually, without using qualitative data that compares each existing criterion, and causes the loss of old data in bookkeeping, so a system is needed that can carry out teacher performance appraisal more efficiently. The system is a decision support system. In decision support systems there are many methods that can be used including Simple Additive Weighting, Analytical Network Process,

MOORA, TOPSIS, and Analitycal Hierarchy Process, in this study using the Simple Addictive Weighting Method (Mulianti et al., 2019).

2. LITERATURE REVIEW

2.1 Decision Support System (DSS)

The concept of Decision Support System (DSS) was first described in the early 1970s by Michael S. Scott Morton with the term Management Decision Systems. After that, several companies, research institutes, and universities began to research and develop SPK. The purpose of implementing DSS is to make decisions and improve decision-making efficiency when solving semi-structured problems (Ajiansya & Sari, 2022).

A decision support system is a computer system that processes data into information to make decisions about specific semi-structured problems. DSS is designed to support the entire decision-making process, starting from defining the problem, selecting relevant data, and determining the approach used in the decision-making process to evaluating alternative choices (Pramana et al., 2022).

2.2 Phases of Decision Making

While the phases that must be carried out step by step in the decision-making process include the following (Rahayu & Sindar, 2022):

1. Intelligence
   In the Intelligence phase, problems are identified, their goals and objectives, causes, and magnitude are determined. This step is very important because before an action is taken, the problem at hand must be clearly formulated first. Problems are described in more detail and categorized whether they are programmed or non-programmed.
2. Design
   In the Design phase, alternative actions are developed, potential solutions are analyzed, models are created, feasibility tests are conducted, and results are validated.
3. Choice
   In this phase, a selection process is carried out among various alternative actions that may be carried out. The results of the selection are then implemented in the decision-making process.

2.3 Simple Addictive Weighting Method

The Simple Addictive Weighting method is a method also known as the weighted sum method. The basic concept of the Simple Addictive Weighting method is to find the weighted sum of the performance ratings on each alternative on all attributes (Fahrizal, 2016) . The Simple Addictive Weighting method requires a normalization process of the decision matrix (X) to a scale that can be compared with all existing alternative ratings. This method is the best known and most widely used method in dealing with Multiple Attribute Decision Making (MADM) situations. MADM itself is a method used to find the optimal alternative from a number of alternatives with certain criteria (Fa & Majaruni, 2018).

The formula for normalizing is:

$$rij = \begin{cases} \dfrac{Xij}{Max\ Xij} \\ \dfrac{Xij}{Min\ Xij} \end{cases} \begin{matrix} If\ j\ is\ a\ benefit\ attribute \\ If\ j\ is\ a\ cost\ attribute\ (cost) \end{matrix}$$

Where:
Rij = normalized performance rating
Maxij = maximum value of each row and column
Minij = minimum value of each row and column
Xij = rows and columns of the matrix
With rij is the normalized performance rating of alternative Ai on attribute Cj; i = 1,2,...m and j = 1,2,...n. The preference value for each alternative (Vi) is given as :

$$Vi = \sum_{j=1}^{n} Wj\, rij$$

Where:
Vi = Final value and alternative
Wj = Predetermined weight
Rij = Normalization matrix
A larger Vi value identifies that alternative Ai is more selected.

3. METHOD

3.1 Research Framework

The steps taken in this research can be seen in the block diagram below:

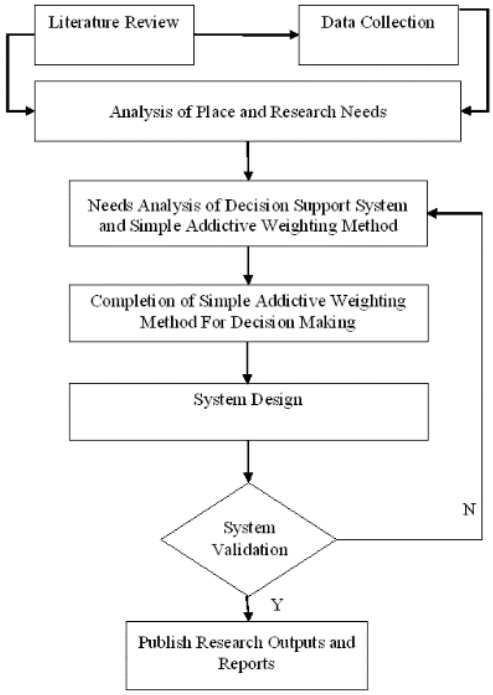

Figure 1. Research Stages

3.2 Framework Description

The research steps that will be carried out based on Figure 3.1 will be described as follows (Ridhawati et al., 2018):

1. Literature Review
   The literature review is related to the concept of decision support systems, the Simple Addictive Weighting method, Teacher Performance Appraisal and other concepts related to this research problem. The literature review is carried out by reviewing sources sourced from

journals and other research results as references to previous research, textbooks, online sources (internet) and other sources related to the research topics discussed.

2. Data Collection
   Data collection carried out in research includes several techniques to provide accuracy of research results.
3. Analysis of Place and Research Needs
   Analyzing the Needs for decision-making in Teacher Performance Appraisal of 064022 State Elementary School by involving Class Teachers and Principals.
4. Needs Analysis of Decision Support System and Simple Addictive Weighting Method
   Analyzing the data requirements that will be used to solve decision-making problems in the Performance Assessment of Teachers of State Elementary School 064022 with the Simple Addictive Weighting Method.
5. Completion of Simple Addictive Weighting Method For Decision Making
   Completion of the SAW Method for Teacher Performance Appraisal problems that are in accordance with the capacity and needs of the system or application.
6. System design
   Make application design using unified modeling language and design the required interface.
7. Validation System
   The system is built using Visual Basic 2010 which is a high-level programming language. Visual Basic 2010 is an object-centered programming language (Object Oriented Programming) used in the creation of Windows applications based on the Graphical User Interface.
8. Publish Research Outputs and Reports
   Publish the results of the system built in making Teacher Performance Appraisal decisions as research output.

4. RESULTS

4.1 Analysis of the Simple Additive Weighting Method

Based on its name, the Simple Additive Weighting method can be interpreted as a simple weighting method or weighted summation on problem solving in a decision support system. The concept of this method is to find a priority scale rating on each alternative in all attributes. The steps used in the research of Teacher Performance Appraisal with Simple Additive Weighting method are as follows:

1. Determine Alternative Ai

Table 1 Alternative Data

Alternative	Alternative Name
A1	Binawati Br Sitepu, S.Pd
A2	Sukaryani Danamik, S.Pd
A3	Marisa Natarlina Ginting, S.Pd
A4	Juli Fitryani Batubara, S.Pd
A5	Rahmad Zulfahmi, S.Pd.i
A6	Rejeki Br Karo, S.Pd
A7	Rasta Tarigan
A8	Sopia Br Barus
A9	Rahmayanti Ginting, S.Pd
A10	Lucky Riandra Surbakti, S.Pd

2. Determine the Cj criteria that will be used as a reference in determining decision making.

Table 2 Criteria Table

Criteria	**Description**	**Weight**
C1	Mastering Learner Characteristics.	10
C2	Mastering Learning Theory and Principles of Educative Learning.	10
C3	Curriculum Development	9
C4	Educative Learning Activities.	9
C5	Developing Learners' Potential.	8
C6	Communication With Learners.	8
C7	Assessment and Evaluation.	7
C8	Act in accordance with religious, legal, social and socio-cultural norms.	7
C9	Showing a mature and exemplary personality.	6
C10	Work Ethic, High Responsibility and Proud to be a Teacher.	6
C11	Be Inclusive, Act Objectively, and Non-Discriminatory.	5
C12	Communication with fellow teachers, education personnel, parents, students and the community.	5
C13	Mastery of Materials, Structures, Concepts and Scientific Thinking Patterns that Support the Subjects Covered.	5
C14	Developing Professionalism Through Reflective Action.	5

3. Of the 14 main criteria, each main criterion has the same sub-criteria. The following is a weight table for sub criteria.

Table 3 Sub Criteria Values

Sub Criteria	Value
Highly Fulfilled	90
Fulfilled	70
Less fulfilled	50

4. Based on the steps in determining the performance appraisal of teachers at 064022 State Elementary School with the Simple Addictive Weighting Method... Then it is done as follows.
   1. Alternative Suitability Rating
      The following table shows the suitability rating of each alternative on each criterion.

Table 4 Suitability Rating of Each Alternative.

No	Alternative	Criteria													
		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
1	A1	90	70	70	70	90	90	90	90	90	90	90	90	90	90
2	A2	70	70	70	70	70	70	70	70	70	50	50	90	90	90
3	A3	90	90	90	70	70	90	90	70	90	90	90	90	90	90
4	A4	70	90	90	70	70	90	90	90	90	90	90	90	90	90
5	A5	90	90	90	70	70	70	90	70	50	50	90	70	50	50
6	A6	70	90	90	70	70	70	50	90	90	90	50	90	90	90
7	A7	90	90	90	70	70	70	50	90	90	90	50	90	90	90
8	A8	70	90	90	70	70	70	50	70	50	50	50	70	50	50
9	A9	90	70	70	70	70	50	90	90	90	90	90	90	90	90
10	A10	70	70	70	90	90	70	90	90	90	90	90	90	90	90

Based on table number 4, it is converted into a decision matrix X with data:

$$X= \begin{matrix} 90\ 70\ 70\ 70\ 90\ 90\ 90\ 90\ 90\ 90\ 90\ 90\ 90\ 90 \\ 70\ 70\ 70\ 70\ 70\ 70\ 70\ 70\ 70\ 50\ 50\ 90\ 90\ 90 \\ 90\ 90\ 90\ 70\ 70\ 90\ 90\ 70\ 90\ 90\ 90\ 90\ 90\ 90 \\ 70\ 90\ 90\ 70\ 70\ 90\ 90\ 90\ 90\ 90\ 90\ 90\ 90\ 90 \\ 90\ 90\ 90\ 70\ 70\ 70\ 90\ 70\ 50\ 50\ 90\ 70\ 50\ 50 \\ 70\ 90\ 90\ 70\ 70\ 70\ 50\ 90\ 90\ 90\ 50\ 90\ 90\ 90 \\ 90\ 90\ 90\ 70\ 70\ 70\ 50\ 90\ 90\ 90\ 50\ 90\ 90\ 90 \\ 70\ 90\ 90\ 70\ 70\ 70\ 50\ 70\ 50\ 50\ 50\ 70\ 50\ 50 \\ 90\ 70\ 70\ 70\ 70\ 50\ 90\ 90\ 90\ 90\ 90\ 90\ 90\ 90 \\ 70\ 70\ 70\ 90\ 90\ 70\ 90\ 90\ 90\ 90\ 90\ 90\ 90\ 90 \end{matrix}$$

   2. Calculate the normalized value of each alternative:

$$r_{ij} = \begin{cases} \dfrac{X_{ij}}{Max\ X_{ij}} \end{cases}$$

Description:
Rij = Normalized Performance Rating Value
Xij = The Attribute Value of Each Criterion
Max Xij = The Greatest Value of Each Criterion
Benefit = The Greatest Value is the Best
Normalization for criteria can be seen as follows.

a. For the criteria of Mastering the Characteristics of Learners.

$$r_{11}\frac{90}{max\{90,70,90,70,90,70,90,70,90,70\}}=\frac{90}{90}=1$$

$$r_{21}\frac{70}{max\{90,70,90,70,90,70,90,70,90,70\}}=\frac{70}{90}=0.78$$

$$r_{31}\frac{90}{max\{90,70,90,70,90,70,90,70,90,70\}}=\frac{90}{90}=1$$

$$r_{41}\frac{70}{max\{90,70,90,70,90,70,90,70,90,70\}}=\frac{70}{90}=0.78$$

$$r_{51}\frac{90}{max\{90,70,90,70,90,70,90,70,90,70\}}=\frac{90}{90}=1$$

$$r_{61}\frac{70}{max\{90,70,90,70,90,70,90,70,90,70\}}=\frac{70}{90}=0.78$$

$$r_{71}\frac{90}{max\{90,70,90,70,90,70,90,70,90,70\}}=\frac{90}{90}=1$$

$$r_{81}\frac{70}{max\{90,70,90,70,90,70,90,70,90,70\}}=\frac{70}{90}=0.78$$

$$r_{91}\frac{90}{max\{90,70,90,70,90,70,90,70,90,70\}}=\frac{90}{90}=1$$

$$r_{101}\frac{70}{max\{90,70,90,70,90,70,90,70,90,70\}}=\frac{70}{90}=0.78$$

b. For the criterion of Mastering Learning Theories and Principles of Educative Learning.

$$r_{12}\frac{70}{max\{70,70,90,90,90,90,90,90,70,70\}}=\frac{70}{90}=0.78$$

$$r_{22}\frac{70}{max\{70,70,90,90,90,90,90,90,70,70\}}=\frac{70}{90}=0.78$$

$$r_{32}\frac{90}{max\{70,70,90,90,90,90,90,90,70,70\}}=\frac{90}{90}=1$$

$$r_{42}\frac{90}{max\{70,70,90,90,90,90,90,90,70,70\}}=\frac{90}{90}=1$$

$$r_{52}\frac{90}{max\{70,70,90,90,90,90,90,90,70,70\}}=\frac{90}{90}=1$$

$$r_{62}\frac{90}{max\{70,70,90,90,90,90,90,70,70\}}=\frac{90}{90}=1$$

$$r_{72}\frac{90}{max\{70,70,90,90,90,90,90,70,70\}}=\frac{90}{90}=1$$

$$r_{82}\frac{90}{max\{70,70,90,90,90,90,90,70,70\}}=\frac{90}{90}=1$$

$$r_{92}\frac{70}{max\{70,70,90,90,90,90,90,70,70\}}=\frac{70}{90}=0.78$$

$$r_{102}\frac{70}{max\{70,70,90,90,90,90,90,70,70\}}=\frac{70}{90}=0.78$$

3. The normalization results are made in the form of a normalization matrix below.

$$X=\begin{Bmatrix} 1 & 0,78 & 0,78 & 0,78 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0,78 & 0,78 & 0,78 & 0,78 & 0,78 & 0,78 & 0,78 & 0,78 & 0,78 & 0,56 & 0,56 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0,78 & 0,78 & 1 & 1 & 0,78 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0,78 & 1 & 1 & 0,78 & 0,78 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0,78 & 0,78 & 0,78 & 1 & 0,78 & 0,56 & 0,56 & 1 & 0,78 & 0,56 & 0,56 \\ 0,78 & 1 & 1 & 0,78 & 0,78 & 0,78 & 0,56 & 1 & 1 & 1 & 0,56 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0,78 & 0,78 & 0,78 & 0,56 & 1 & 1 & 1 & 0,56 & 1 & 1 & 1 \\ 0,78 & 1 & 1 & 0,78 & 0,78 & 0,78 & 0,56 & 0,78 & 0,56 & 0,56 & 0,56 & 0,78 & 0,56 & 0,56 \\ 1 & 0,78 & 0,78 & 0,78 & 0,78 & 0,56 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0,78 & 0,78 & 0,78 & 1 & 1 & 0,78 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{Bmatrix}$$

The final result of the calculation of the simple addtive weight (SAW) method from the normalized sum of the weight values of each criterion.

4. Ranking

Next, the multiplication of the W * R matrix will be made and the sum of the multiplication results to obtain the best alternative by ranking the largest value as follows using the following formula:

$$V_i = \sum_{j=1}^{n} W_j r_{ij}$$

W= [10 10 9 9 8 8 7 7 6 6 5 5 5 5]

Description:
Vi = The final value of the alternative
wj = Predetermined weight
rij = Value matrix normalization
The preference value to determine the ranking results is as follows:

V_1= 10 x 1 + 10 x 0.78 + 9 x 0.78 + 9 x 1 + 8 x 1 + 8 x 1 + 7 x 1 + 7 x 1 + 6 x 1 + 6 x 1 + 5 x 1 + 5 x 1 + 5 x 1 + 5 x 1 = **93,78**

V_2= 10 x 0.78 + 10 x 0.78 + 9 x 0.78 + 9 x 0.78 + 8 x 0.78 + 8 x 0.78 + 7 x 0.78 + 7 x 0.78 + 6 x 0.78 + 6 x 0.78 + 5 x 1 + 5 x 1 + 5 x 1 + 5 x 1 = **78,67**

V_3= 10 x 1 + 10 x 1 + 9 x 0.78 + 9 x 0.78 + 8 x 1 + 8 x 1 + 7 x 0.78 + 7 x 1 + 6 x 1 + 6 x 1 + 5 x 1 + 5 x 1 + 5 x 1 + 5 x 1 = **94,67**

V_4= 10 x 0.78 + 10 x 1 + 9 x 1 + 9 x 0.78 + 8 x 0.78 + 8 x 1 + 7 x 1 + 7 x 1 + 6 x 1 + 6 x 1 + 5 x 1 + 5 x 1 + 5 x 1 + 5 x 1 = **94,00**

V_5= 10 x 1 + 10 x 1 + 9 x 0.78 + 9 x 0.78 + 8 x 0.78 + 8 x 1 + 7 x 1 + 7 x 1 + 6 x 1 + 6 x 1 + 5 x 1 + 5 x 1 + 5 x 1 + 5 x 1 = **82,00**

5. After obtaining the results of multiplication by the W * R matrix and the summation of the multiplication results, the following final decision value is obtained:

Table 5 Ranking Result Value

Alternative	Ranking Result
Marisa Natarlina Ginting, S.Pd	**94,67**
Juli Fitryani Batubara, S.Pd	**94,00**
Binawati Br Sitepu, S.Pd	**93,78**
Lucky Riandra Surbakti, S.Pd	**91,78**
Rasta Tarigan	**89,11**
Rahmayanti Ginting, S.Pd	**88,44**
Rejeki Br Karo, S.Pd	**86,89**
Rahmad Zulfahmi, S.Pd.i	**82,00**
Sukaryani Danamik, S.Pd	**78,67**
Sopia Br Barus	**74,44**

5. CONCLUSION

The conclusion that can be drawn is that from the calculation process carried out with the Simple Addictive Weighting Method, the results obtained are that the Best Teacher Performance Assessment is Alternative A3, namely Marisa Natarlina Ginting, S.Pd with a score of 94.67. With the construction of this system, it can help Principals to see data on Teacher Performance Appraisals that are truly the best because they have been ranked and reduce their doubts.

REFERENCES

Ajiansya, F. P., & Sari, A. O. (2022). *BULLETIN OF COMPUTER SCIENCE RESEARCH Penentuan Siswa Berprestasi Dengan Penerapan Metode Analytical Hierarcy Process*. *2*(3), 107–113. https://doi.org/10.47065/bulletincsr.v2i3.174

Dermawan, M. F., & Triyono, G. (2022). *Sistem Penunjang Keputusan Metode Simple Additive Weighting (SAW) Untuk Penilaian Kinerja Guru Pada SDN Joglo 08 Pagi Decision Support System Simple Additive Weighting (SAW) Method For Teacher Performance Assessment At SDN Joglo 08 Pagi*. *September*, 1574–1581.

Education, B., Mipa, F. P., & Pgri, I. (2019). *Different activities of antibacterial waste from agung*

semeru varieties lumajang towards staphyloccus auerus and pseduomonas aeruginosa.

Fa, A., & Majaruni, M. I. (2018). *Sistem Pendukung Keputusan Penilaian Kinerja Guru Menggunakan Metode Simple Additive Weighting*. *7*(01), 1–11.

Fahrizal. (2016). Sistem Pendukung Keputusan Penilaian Kinerja Guru Dari Beban Kerja Menggunakan Metode Analytical Hierarchy Process (Ahp) (Studi Kasus : Sd Lpi At-Taufiq). *Jurnal Lentera ICT*, *3*(1), 19–27.

Mulianti, G., Hafsari, R., Hartati, M., & Wardhani, L. K. (2019). *Implementasi Simple Additive Weighting (SAW) pada Group Decision Making dalam Penilaian Kinerja Guru*. *14*, 55–63.

Pramana, H. J., Mufizar, T., & Anwar, D. S. (2022). *Sistem Pendukung Keputusan Penilaian Kinerja Guru Dengan Metode AHP dan PROMETHEE*. *10*(1).

Rahayu, S., & Sindar, A. (2022). *Sistem Pendukung Keputusan Penilaian Kinerja Guru Menggunakan Metode Simple Additive Weighting*. *2*(2), 103–112.

Ridhawati, E., Siregar, G. K., & Iriawan, D. (2018). *METODE SIMPLE ADDITIVE WEIGHTING (SAW) PADA SISTEM PENDUKUNG KEPUTUSAN PENILAI KINERJA GURU (PKG) (STUDI KASUS SMP 17 1 PAGELARAN)*. *2*, 38–49.

Sunarto, P. R., & Gata, G. (n.d.). *PENILAIAN KINERJA GURU PADA SMK YADIKA 5 DENGAN MENGGUNAKAN METODE ANALYTICAL HIERARCHY PROCESS (AHP)*. 265–271.