DECISION SUPPORT SYSTEM USING AHP METHOD FOR TEACHER PERFORMANCE ASSESSMENT

Rahmawati[1], Dewi Ayu Nur Wulandari[2]

Information System[1]
STMIK Nusa Mandiri, Jakarta, Indonesia[1]
www.nusamandiri.ac.id[1]
rachma083@gmail.com[1]

Information System Kota Bogor Campus [2]
Universitas Bina Sarana Informatika, Bogor, Indonesia[2]
www.bsi.ac.id[2]
dewi.dan@bsi.ac.id[2]

Abstract— One effort to measure the level of quality in schools is by measuring the performance aspects of teachers as professional educators who teach at the school. The teacher performance aspect is measured as one of the promotion requirements for a higher position or as a recommendation condition in order to take part in teacher certification activities. In order for teacher performance appraisal to be carried out objectively, a method is needed to assist in the teacher performance appraisal process. AHP method can be used to assist in decision making. This is because the ahp method is a model for structured and comprehensive decision making. From the calculation using the AHP method, it was found that the first priority was obtained by Indra with a weight of 0, 7317 or 73.17%, the second priority was obtained by Reni with a weight value of 0.2279 or 22.79% and the lowest priority was obtained by Supriyatna with a weight value 0.0604 or 6.04%.

Keywords: Decision Support System, Teacher Performance Asessment, AHP .

Abstrak—*Salah satu upaya untuk mengukur tingkat mutu di sekolah adalah dengan mengukur aspek kinerja dari guru sebagai tenaga pendidik profesional yang mengajar disekolah tersebut. Aspek kinerja guru diukur sebagai salah satu syarat promosi untuk jabatan yang lebih tinggi atau sebagai syarat rekomendasi agar dapat mengikuti kegiatan sertifikasi guru. Agar penilaian kinerja guru dapat objektif, maka diperlukan sebuah metode yang dapat membantu dalam proses penilaian kinerja guru. Metode AHP dapat digunakan untuk membantu dalam pengambilan keputusan. Hal ini dikarenakan metode ahp merupakan sebuah model dalam pengambilan keputusan yang terstruktur dan juga komprehensif. Dari hasil perhitungan dengan menggunakan metode AHP diperoleh hasil bahwa Indra.A lebih unggul dengan bobot 0, 7317 atau 73,17%, prioritas kedua diperoleh oleh Reni.A dengan nilai bobot 0,2279 atau 22,79 % dan prioritas terendah diperoleh Supriyatna dengan nilai bobot 0,0604 atau 6,04 %.*

Kata Kunci: *Sistem Pendukung Keputusan, Penilaian Kinerja Guru, AHP.*

INTRODUCTION

The teacher is a competent instructor and has the main task in educating, directing, guiding, training and also teaching science to students. The teacher also helps direct, and train students to become qualified individuals, both in terms of intellectual and morals (Rahayu, 2017). A teacher must have good academic criteria, physically and mentally healthy, educator certification, and competency skills as well as having the expertise to achieve national education goals.

To improve quality at SMK Muhammadiyah 15, it can be measured through the aspects of performance that must be possessed by each teacher so that it can be promoted to a higher position to obtain teacher certification. Decision making to determine whether the teacher's performance meets the quality is based on several criteria set by the school. The criteria for evaluating aspects of teacher performance in Jakarta Muhammadiyah 15 Vocational Schools that have been determined are: 1) Discipline in KBM (Teaching and Learning Activities), 2) There is an increase in learning outcomes of taught subjects, 3) High dedication in work ethic, 4) Loyalty towards the relevant Foundation or Institution and 5) Initiative, communicative and creative to develop the progress of the Foundation and Institution of SMK Muhammadiyah 15 Jakarta.

From the results of the research conducted, the teacher performance appraisal process at SMK Muhammadiyah 15 Jakarta only uses two criteria without looking at the other criteria. Though of all the criteria that have been set some values are very important in evaluating teacher performance so that the assessment results obtained are not objective.

To maintain the quality of education, the quality of teachers must always be monitored. In monitoring the performance of teachers at SD Beji Ungaran, there are still problems due to the limited number of staff carrying out monitoring activities. Because we need a decision support system that is expected to help monitor teacher performance so that the monitoring process can be more effective and efficient and accurate (Rakasiwi, 2018).

In selecting high achieving students, Singosari Delitua Vocational School utilizes a decision support system by implementing the AHP method used to process the data it has. This system is one alternative that can be done and is expected to overcome the problem of storing student data (Sinaga & Zebua, 2014). AHP (Analytical Hierarchy Process) method in helping to make decisions, a decision-maker can make decisions about the selection of the best teacher by their performance based on a multi-criteria set (Paramita, Mustika, & Farkhatin, 2017). Analytical Hierarchy Process (AHP) method is a performance appraisal process that starts from weighting criteria intending to find out the importance weight of each indicator, to produce alternative weights to find out the highest value of the existing alternatives (Saefudin & Wahyuningsih, 2014).The AHP (Analytical Hierarchy Process) method can help in making decisions because the AHP method is a structured and comprehensive decision-making model and the calculation is faster.

The decision support system for teacher performance appraisal at SMK Muhammadiyah 15 Jakarta is expected to be able to solve problems regarding teacher performance appraisal at the school, so that the assessment process can be done more objectively, quickly, and accurately.

MATERIALS AND METHODS

The data source used in this study is teacher assessment data obtained directly from SMK Muhammadiyah 15 Jakarta. The type of data used is the type of primary data, that is data directly obtained from the source, using data collection techniques through observation and also through the interview process

The steps of the research design used are as follows :
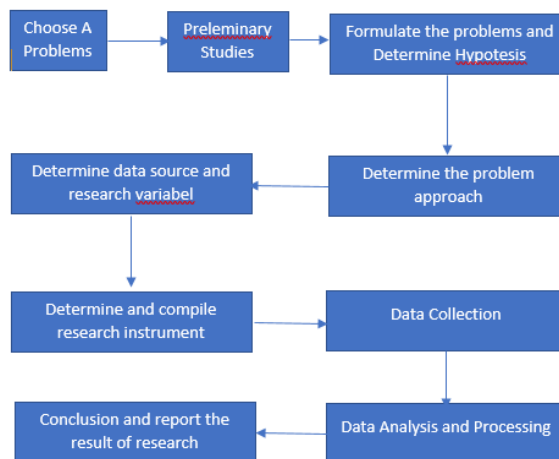
Source: (Rahmawati & Wulandari, 2020)
Figure 1. Tahapan Rancangan Penelitian

In analyzing the data that has been obtained, the authors use quantitative analysis in which researchers use statistical techniques in testing research hypotheses. The statistical data obtained through the research instrument in the form of a questionnaire that was formed using the AHP approach to determine the results and also research discussion. The basic principles of the AHP method are *Decompotition*, *Comparative Judgement, Synthesis of Priority*, dan *Consistency* (Diana, 2018)

A. Decompotition

Decomposition is the stage where a complete problem is defined and simplified into smaller problems. To simplify it, the problem is described in the form of a hierarchy, and grouped into three main components, namely the objectives, criteria and choices.

B. Comparative Judgement

The pairwise comparison matrix is filled in using numbers to represent an element's relative importance to other elements. This is done by comparing each element of the criteria and alternative pairs. The numbers entered in the pairwise comparison matrix are obtained from questionnaires that have been filled out by respondents. In this study, the authors used a sample of 6 respondents consisting of principals, vice-principals and administrative departments. The next step is to find the average comparison for each element by multiplying all elements of the comparison matrix which are then rooted to rank with the number of respondents.

C. Synthesis of Priority

After the pairwise comparison matrix is found, the next is to look for eigenvectors or the

average value (local priority) of each pairwise comparison matrix. The process can be carried out by carrying out the following steps:
1) Add up the values of each column in the matrix
2) Divide each value from the column by the total column in question to get the normalization matrix.
3) Add up the values of each row and divide by the number of elements to get an average value.

D. Consistency

This consistency phase aims to determine the correctness of the vector eigenvalues obtained from the synthesis of the priority process that has been made previously. This consistency ratio is measured by the consistency index divided by a random index based on the size of the matrix. Expected consistency is near-perfect consistency i to produce a near valid decision

RESULT AND DISCUSSION

The following are the results of the calculation of teacher performance appraisal using the AHP (Analytical Hierarchy Process) method, based on the basic principles of the AHP method.

A. Decompotition

To simplify the problem, a decision hierarchy is made which consists of three main components, namely objectives, criteria, and choices. The following is a picture of the decision hierarchy structure used in this study.
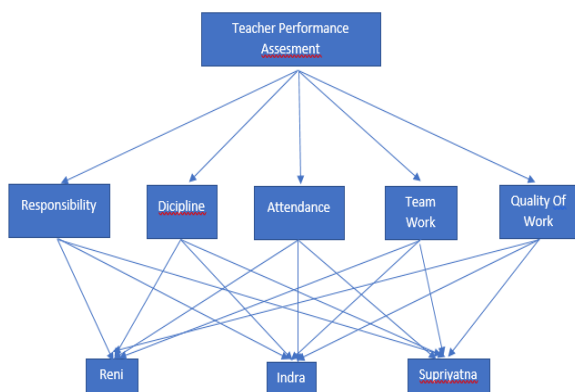
Source: (Rahmawati & Wulandari, 2020)
Figure 2 Teacher Performance Assessment Hierarchy

A. Comparative Judgement
The next step is to create a paired matrix for the criteria and alternatives that have been determined in the hierarchical structure.

1. Comparison of Criteria and Alternative Data (level 1)

After determining the criteria, a weighting is carried out on the relationship between the criteria and criteria. The assessment was conducted by 6 respondents from the Principal, Deputy Principal, and TU Staff by filling out the questionnaire to produce raw data that can be seen in the appendix. The following are the results of the raw data questionnaire which has been translated into a paired comparison table using the Microsoft Excel application.

Table 2. Pairwise Comparison Between Criteria (Responden 1)

Criteria	Respon sibility	Dici pline	Attan dance	Team Work	Quality Of Work
Responsi bility	1	3	5	5	7
Dicipline	0,33	1	5	3	5
Attanda nce	0,20	0,20	1	5	5
Team Work	0,20	0,33	0,20	1	3
Quality Of Work	0,14	0,20	0,20	0,33	1

Source: (Rahmawati & Wulandari, 2020)

Table 3. Pairwise Comparison Between Criteria (Responden 2)

Criteria	Respon sibility	Dici pline	Attan dance	Team Work	Quality Of Work
Responsi bility	1	3	3	5	5
Dicipline	0,33	1	5	3	3
Attanda nce	0,33	0,20	1	5	5
Team Work	0,20	0,33	0,20	1	3
Quality Of Work	0,20	0,33	0,20	0,33	1

Source: (Rahmawati & Wulandari, 2020)

Table 4. Pairwise Comparison Between Criteria (Responden 3)

Criteria	Respon sibility	Dici pline	Attan dance	Team Work	Quality Of Work
Responsi bility	1	3	5	3	3
Dicipline	0,33	1	3	3	5
Attanda nce	0,20	0,33	1	7	5
Team Work	0,33	0,33	0,14	1	3
Quality Of Work	0,33	0,20	0,20	0,33	1

Source: (Rahmawati & Wulandari, 2020)

Table 5. Pairwise Comparison Between Criteria (Responden 4)

Criteria	Respon sibility	Dici pline	Attan dance	Team Work	Quality Of Work
Responsi bility	1	3	7	7	9
Dicipline	0,33	1	5	5	3

Criteria	Respon sibility	Dici pline	Attan dance	Team Work	Quality Of Work
Attanda nce	0,14	0,20	1	7	7
Team Work	0,14	0,20	0,14	1	5
Quality Of Work	0,11	0,33	0,14	0,20	1

Source: (Rahmawati & Wulandari, 2020)

Table 6 Pairwise Comparison Between Criteria (Responden 5)

Criteria	Respon sibility	Dici pline	Attan dance	Team Work	Quality Of Work
Responsi bility	1	3	5	7	7
Dicipline	0,33	1	7	7	5
Attanda nce	0,20	0,14	1	7	5
Team Work	0,14	0,14	0,14	1	5
Quality Of Work	0,14	0,20	0,20	0,20	1

Source: (Rahmawati & Wulandari, 2020)

Table 7. Pairwise Comparison Between Criteria (Responden 6)

Criteria	Respon sibility	Dici pline	Attan dance	Team Work	Quality Of Work
Responsi bility	1	3	7	7	7
Dicipline	0,33	1	5	9	5
Attanda nce	0,14	0,20	1	5	5
Team Work	0,14	0,11	0,20	1	3
Quality Of Work	0,14	0,20	0,20	0,33	1

Source: (Rahmawati & Wulandari, 2020)

After the results of pairwise comparisons between criteria are then entered into a calculation table to get the number of judgments for each criterion that is useful for determining the percentage weights for each criterion.

Table 8. Pairwise Comparison of criteria (level 1)

Criteria	Respon sibility	Dici pline	Attan dance	Team Work	Quality Of Work
Responsi bility	1	3,0000	5,1369	5,4332	5,9925
Dicipline	0,3333	1	4,8568	4,5180	4,2172
Attanda nce	0,1947	0,2059	1	5,9161	5,2884
Team Work	0,1841	0,2213	0,1690	1	3,5569
Quality Of Work	0,1669	0,2371	0,1891	0,2811	1
Responsi bility	1,8789	4,6644	11,3519	17,1485	20,0549

Source: (Rahmawati & Wulandari, 2020)

2. Alternative Comparison Data Based on Criteria (level 2)

After the comparison criteria data has been inputted into Microsoft Excel, the next step is to input alternative comparison data. The alternative chosen must meet the predetermined criteria. There are 3 alternative names of teachers obtained from interviews with the Principal.

Table 9. Comparison of Average Responsibility Criteria

Responsibility	Indra A	Reni A	Supriyatna
Indra A	1	4,0964	7,5044
Reni A	0,2441	1	5,9080
Supriyatna	0,1333	0,1693	1
TOTAL	1,3774	5,2656	14,4124

Source: (Rahmawati & Wulandari, 2020)

Table 10. Comparison of Average Disciplinary Criteria

Dicipline	Indra A	Reni A	Supriyatna
Indra A	1	5,8327	5,9925
Reni A	0,1714	1	4,5180
Supriyatna	0,1669	0,2213	1
TOTAL	1,3383	7,0540	11,5104

Source: (Rahmawati & Wulandari, 2020)

Table 11. Comparison of Average Attendance Criteria

Attandance	Indra A	Reni A	Supriyatna
Indra A	1	5,4332	7,5044
Reni A	0,1841	1	4,7177
Supriyatna	0,1333	0,2120	1
TOTAL	1,3173	6,6452	13,2221

Source: (Rahmawati & Wulandari, 2020)

Table 12. Comparison of Average Team Work Criteria

Team Work	Indra A	Reni A	Supriyatna
Indra A	1	4,3327	6,9014
Reni A	0,2308	1	5,8327
Supriyatna	0,1449	0,1714	1
TOTAL	1,3757	5,5041	13,7341

Source: (Rahmawati & Wulandari, 2020)

Table 13. Comparison of Quality Of Work

Kualitas Kerja	Indra A	Reni A	Supriyatna
Indra A	1	6,5250	7,1966
Reni A	0,1533	1	4,3327
Supriyatna	0,1390	0,2308	1
TOTAL	1,2922	7,7558	12,5292

Source: (Rahmawati & Wulandari, 2020)

B. Synthesis of Priority

This process is carried out to find the eigenvectors or the average value (local priority) of each paired comparison matrix. This following are the results of level 1 and level 2 vector eigenvalues for all criteria and alternatives

Table 14. Eigen Vectors Key Criteria

Criteria	Responsibility	Dicipline	Attandance	Team Work	Quality Of Work	Eigen Vektor
Responsibility	1	3	5,1369	5,4332	5,9925	0,5571
Dicipline	0,3333	1	4,8568	4,518	4,2172	0,2328
Attandance	0,1947	0,2059	1	5,9161	5,2884	0,1125
Team Work	0,1841	0,2213	0,169	1	3,5569	0,0558
Quality Of Work	0,1669	0,2371	0,1891	0,2811	1	0,0417
				Total		**1**

Source: (Rahmawati & Wulandari, 2020)

Table 15. Vector Eigen Responsibility Criteria

Responsibility	Indra	Reni A	Supriyatna	Eigen Vektor
Indra A	1	4,0964	7,5044	0,7002
Reni A	0,2441	1	5,908	0,243
Supriyatna	0,1333	0,1693	1	0,0568
		Total		**1**

Source: (Rahmawati & Wulandari, 2020)

Table 16. Vector Eigen Dicipline Criteria

Dicipline	Indra A	Reni A	Supriyatna	Eigen Vektor
Indra A	1	5,8327	5,9925	0,7414
Reni A	0,1714	1	4,518	0,1932
Supriyatna	0,1669	0,2213	1	0,0654
		Total		**1**

Source: (Rahmawati & Wulandari, 2020)

Table 17. Vector Eigen Attandance Criteria

Attandance	Indra A	Reni A	Supriyatna	Eigen Vektor
Indra A	1	5,4332	7,5044	0,7442
Reni A	0,1841	1	4,7177	0,1966
Supriyatna	0,1333	0,212	1	0,0592
		Total		**1**

Source: (Rahmawati & Wulandari, 2020)

Table 18. Vector Eigen Team Work Criteria

Team Work	Indra A	Reni A	Supriyatna	Eigen Vektor
Indra A	1	4,3327	6,9014	0,7036
Reni A	0,2308	1	5,8327	0,2381
Supriyatna	0,1449	0,1714	1	0,0583
		Total		**1**

Source : (Saefudin & Wahyuningsih, 2014)

Table 19. Vector Eigen Team Work Criteria

Quality Of Work	Indra A	Reni A	Supriyatna	Eigen Vektor
Indra A	1	6,525	7,1966	0,7668
Reni A	0,1533	1	4,3327	0,1738
Supriyatna	0,139	0,2308	1	0,0594
		Total		**1**

Source: (Rahmawati & Wulandari, 2020)

C.   Consistency

The purpose of this stage is to determine the correctness of the vector eigenvalues obtained from the synthesis of the priority process that has been made previously. Done with 2 stages, namely 1) determine the maximum Lamda (λ) and 2) calculate the ratio consistency

1)   Determine Maximum of Lamda (λ)
Done by pairwise comparison matrix multiplied by eigen vector. The pairwise comparison matrix used is not normalized.

$$\begin{bmatrix} 1,0000 & 3,0000 & 5,1369 & 5,4332 & 5,9925 \\ 0,3333 & 1,0000 & 4,8568 & 4,5180 & 4,2172 \\ 0,1947 & 0,2059 & 1,0000 & 5,9161 & 5,2884 \\ 0,1841 & 0,2213 & 0,1690 & 1,0000 & 3,5569 \\ 0,1669 & 0,2371 & 0,1891 & 0,2811 & 1,0000 \end{bmatrix} X \begin{bmatrix} 0,5771 \\ 0,2328 \\ 0,1125 \\ 0,0558 \\ 0,0417 \end{bmatrix} = \begin{bmatrix} 1,0468 \\ 1,0860 \\ 1,2775 \\ 0,9570 \\ 0,8366 \end{bmatrix}$$

The results of the previous product are added up to produce a maximum score of 5.2039.

2)   Calculate the Consistency Ratio
The second steps of the consistency process is to test the consistency of the hierarchy, as follows:
Calculate the consistency index (*Consistency Index* = CI):

$$CI = ((\lambda \max - n) / (n - 1)) \dots\dots\dots (1)$$

Note :
n = the number of row and column matrix pairwise comparisons or number of criteria.

Because the matrix consists of 5 main criteria, the consistency index (CI) value obtained is :
$$CI = \frac{\lambda\max - n}{(n-1)} = \frac{5,2039 - 5}{(5-1)} = 0,0510$$

Calculate the consistency ratio (CR) with :
$$CR = CI / RI \dots\dots\dots (2)$$

Note :
RI are random values obtained from the Random Consistency Index table at a certain n.
CR = 0,0510 / 1,12
CR = 0,0455

Because CR <0.1 (10%), weighting preferences are consistent. Level 1 pairwise comparison matrices based on the main criteria have been filled with consistent considerations and the resulting vector eigen can be relied upon. The next step is to calculate in the same way for each alternative to each criterion so that the final results are obtained as follows:

Table 20. Decision Eigen Vektor

	Resp onsib ility	Dic ipli ne	Atta nda nce	Tea m Wor k	Qualit y Of Work	Resp onsib ility	Dic ipli ne
Indr a A	0,700 2	0,7 414	0,74 42	0,70 36	0,7688	0,577 1	0,6 604
Ren i A	0,243	0,1 932	0,19 66	0,23 81	0,1738	0,232 8	0,2 073
Sup riya tna	0,056 8	0,0 654	0,05 92	0,05 83	0,0594	0,112 5	0,0 547

Source : (Saefudin & Wahyuningsih, 2014)

The decision vector eigenvalue shows that:
a. Indra A has the highest priority weight of 0.7317
b. Reni A has a second priority weight of 0.2279
c. Supriyatna has the lowest priority weight of 0.0604

If it is depicted in graphical form, it can be seen the number of presentations as follows :
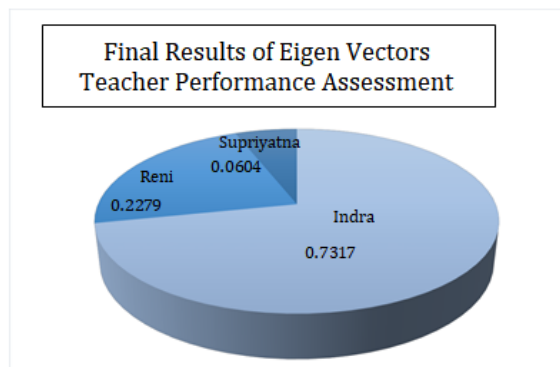
Sumber : (Saefudin & Wahyuningsih, 2014)
Figure 3. Final Results of Eigen Vectors Teacher Performance Assessment

CONCLUSION

Analytical Hierarchy Process method produces good decisions in the completion and calculation of the values of criteria owned by the teacher, so that accurate results are known in the teacher performance appraisal process. Based on the calculation of the AHP, the priority criteria obtained are the most important in evaluating teacher performance where responsibility, discipline, absenteeism, cooperation, and work quality are priorities for SMK Muhammadiyah 15

Jakarta in teacher performance appraisal. After calculating the Analytical Hierarchy Process method using 4 basic principles in the AHP calculation, the results of the teacher's performance evaluation at SMK Muhammadiyah 15 Jakarta with the highest weight were obtained by Indra. A. Data from the calculation of the Analytical Hierarchy Process were obtained from 6 questionnaires filled out by respondents and the final results obtained that Indra A was superior with a weight of 0, 7317 or 73.17%, the second priority was obtained by Reni A with a weight value of 0.2279 or 22.79% and the lowest priority is obtained by Supriyatna with a weight value of 0.0604 or 6.04%.

REFERENCE

Diana. (2018). *Metode Dan Aplikasi Sistem Pendukung Keputusan*. Yogyakarta: Deepublish Publisher.

Paramita, A., Mustika, F. A., & Farkhatin, N. (2017). Aplikasi Sistem Pendukung Keputusan Guru Terbaik Berdasarkan Kinerja dengan Metode Analytical Hierarchy Process (AHP), *03*(01), 9–18.

Rahayu, W. (2017). MODEL PENENTUAN GURU BERPRESTASI BERBASIS ADAPTIVE NEURO FUZZY INFERENCE SYSTEM (ANFIS), *7*(1), 101–107.

Rahmawati, & Wulandari, D. A. N. (2020). *Final Thesis Research Report*. Jakrta.

Rakasiwi, S. (2018). SISTEM PENDUKUNG KEPUTUSAN DALAM MENENTUKAN PENILAIAN KINERJA GURU DENGAN METODE ANALYTICAL HIERARCHY PROCESS (AHP) (STUDI KASUS DI SD BEJI UNGARAN). *Jurnal SIMETRIS*, *9*(2).

Saefudin, & Wahyuningsih, S. (2014). Sistem Pendukung Keputusan Untuk Penilaian Kinerja Pegawai Menggunakan Metode Analytical Hierarchy Process (AHP) Pada RSUD Serang. *JSiI Jurnal Sistem Informasi*, *1*(1), 33–37. Retrieved from http://e-jurnal.lppmunsera.org/index.php/jsii/article/view/78

Sinaga, B., & Zebua, H. M. (2014). SISTEM PENDUKUNG KEPUTUSAN SISWA BERPRESTASI MENGGUNAKAN METODE ANALYTIC HIERARCHY PROCESS (AHP) PADA SMK SINGOSARI DELITUA. *Mantik Penusa*, *16*(2), 1–11.