Decision Support System Analytical Hierarchy Process in Learning Method Selection

Zulfi Azhar1,2*, Wakhinuddin1, Waskito1, Hansi Effendi1, Mukhlidi Muskhir1

1Universitas Negeri Padang, Padang, Indonesia
2Information System, STMIK Royal, Kisaran, Indonesia

*zulfi_azhar@yahoo.co.id

Abstract. In artificial intelligence lectures at STMIK Royal, lecturers give lectures directly to students. In the implementation of these lectures, there is less variety so that students feel bored and the expected learning objectives are less than optimal. So that a broader knowledge is needed in providing lectures with learning methods to students properly and successfully. In selecting the effective learning method in this study using the Analytical Hierarchy Process (AHP) method, because this method is able to analyze using a number of criteria and selected alternatives. This research method by comparing the matrix with several criteria and alternatives from the results of filling out the questionnaire. This study produces several alternatives in a ranking, namely indirect learning strategies, interactive learning, independent learning and direct learning.

1. Introduction

Learning method as a method used to implement plans that have been prepared in the form of real and practical activities to achieve learning objectives. Learning methods can be used to implement learning strategies with lectures, demonstrations, discussions, simulations, laboratories, debates, and others. The ability of educators or lecturers is part of the consideration in selecting learning methods. Lecturers who do not master the use of learning methods will not be good at implementing the learning process. The ability of students or students needs consideration where lecturers must be able to see the intellectual abilities of their students by using the right method. The number of students or students is also used in determining the learning method, if the number of students is large, it will be more efficient to use the lecture and question and answer method compared to other methods. The type of material presented by the lecturer is very important to consider in specific terms. Time can also influence lecturers in determining the learning method in addition to many other activities. Facilities also influence the determination by the method of observation/practice.

The learning process produces quality learning, so an educator needs the ability to apply learning methods that are in accordance with the needs in the classroom which can improve the quality of the learning process itself. In artificial intelligence lectures at STMIK Royal, lecturers give lectures directly to students. In the implementation of the lecture there is less variety so that students feel bored and the expected learning objectives are less than optimal. During the current pandemic, the learning process is already using online, so it needs broader knowledge in giving lectures to students properly and successfully. So that lecturers must use more effective learning methods that are able to solve solutions to problems that occur. This is a problem that occurs so it needs knowledge and solutions to get a solution to the problem. In choosing the best learning method, it is necessary to select several criteria and several alternatives that support solving these problems. And in the selection of effective learning methods in this study by using the Analytical Hierarchy Process (AHP) method.
is used because this system is able to analyze using a number of criteria and alternatives in selecting
the best learning method. Use AHP requires a number of criteria sought by purpose. A number of
alternatives are options will be determined through a process calculation. The system on the AHP is
more simple and effective inside use of yield retrieval best. Detailed knowledge in composing that
reality complex into the element section principal, then divided into its parts again, gradually hierarchy
[1], [2], [3], [4], [5], [6], [7], [8], [9], [10], [11], [12], [13], [14], [15], [16], [17], [18].

Lecturers are expected to use methods that can attract students, so that students are interested in
learning, want to work hard and try to complete the task until it is finished. This can be done by using
a variety of methods to reduce student boredom which will reduce students’ interest in learning. The
learning method is a method or stage used in the interaction between students and educators to achieve
predetermined learning objectives in accordance with the material and learning method mechanisms
[19]. The learning method simplifies the process of teaching and learning activities. The success of a
learning process can be measured by how many methods are used in teaching [20]. The learning
method (instruction method) is an accumulation of teaching concepts (teaching) and learning concepts
[21].

2. Methodology

The method uses several steps, namely collect document data from filling forms given to respondents
from students and lecturers as many as 50 respondents. This form is filled out according to the comparison
between criteria as well as alternatives. Analyzing data with enter several criteria set by several alternative
options are selected in achieving that goal planned. Using the test process on System with Using a matrix
application excel, in the test process the calculation of the AHP method done by calculation on the system.
By using the AHP calculation formula and the result is more Consistency Ratio smaller than 0.1.

![Figure 1. Hierarchical Structure in the AHP Method](image_url)

| Table 1. Hierarchical Value |
|-----------------------------|
| **Relative Intensity** | **Definition** | **Explanation** |
| 1 | Of equal value | Two requirements are of equal value |
| 3 | Slightly more value | Experience slightly favours one requirement over another |
| 5 | Essential or strong value | Experience strongly favours one requirement over another |
| 7 | Very strong value | A requirement is strongly favored and its dominance is demonstrated in practice |
| 9 | Extreme value | The evidence favouring one over another is of the highest possible order of affirmation |
| 2, 4, 6, 8 | Intermediate values between two adjacent judgements | When compromise is needed |
3. Result and Discussion

Data were collected from the field by selecting from a number of criteria using a filling form for assessment. Students and lecturers as respondents at STMIK Royal were asked to compare the required criteria. The data will be processed for analysis. A number of criteria influence the selection of learning methods: Learning Objectives (C1), Teacher Ability (C2), The Abilities of Students (C3), The Number of Student (C4) and Type of material (C5), Time (C6) and Existing Facilities (C7).

| Criteria | C1 | C2 | C3 | C4 | C5 | C6 | C7 |
|----------|----|----|----|----|----|----|----|
| C1       | 1  | 5  | 5  | 4  | 4  | 5  | 5  |
| C2       | 0.2| 1  | 5  | 5  | 3  | 3  | 3  |
| C3       | 0.2| 0.2| 1  | 5  | 3  | 3  | 3  |
| C4       | 0.25| 0.2| 0.2| 1  | 4  | 3  | 3  |
| C5       | 0.25| 0.333| 0.333| 9.25| 1  | 3  | 3  |
| C6       | 0.2| 0.333| 0.333| 0.333| 0.333| 1  | 5  |
| C7       | 0.2| 0.333| 0.333| 0.333| 0.333| 0.2| 1  |
| Total    | 2.3| 7.4| 12.2| 15.917| 15.667| 18.2| 23 |

Table 3. Normalization Criteria

| Criteria | C1   | C2   | C3   | C4   | C5   | C6   | C7   | Jumlah |
|----------|------|------|------|------|------|------|------|--------|
| C1       | 0.435| 0.676| 0.410| 0.251| 0.255| 0.275| 0.217| 2.519  |
| C2       | 0.087| 0.135| 0.410| 0.314| 0.191| 0.165| 0.130| 1.433  |
| C3       | 0.087| 0.027| 0.082| 0.314| 0.191| 0.165| 0.130| 0.997  |
| C4       | 0.109| 0.027| 0.016| 0.063| 0.255| 0.165| 0.130| 0.776  |
| C5       | 0.109| 0.045| 0.027| 0.016| 0.064| 0.165| 0.130| 0.556  |
| C6       | 0.087| 0.045| 0.027| 0.021| 0.021| 0.055| 0.217| 0.474  |
| C7       | 0.087| 0.045| 0.027| 0.021| 0.021| 0.011| 0.043| 0.256  |
| Total    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 7      |

Table 4. Priority and Ranking

| Criteria | Nilai Priority | Priority (Persentage) | Rangking |
|----------|----------------|-----------------------|----------|
| C1       | 0.360          | 36                    | 1        |
| C2       | 0.205          | 20,5                  | 2        |
| C3       | 0.142          | 14,2                  | 3        |
| C4       | 0.109          | 10,9                  | 4        |
| C5       | 0.079          | 7,9                   | 5        |
| C6       | 0.068          | 6,8                   | 6        |
| C7       | 0.037          | 3,7                   | 7        |
| Total    | 1              | 100                   |          |

Figure 2. Hierarchical Structure In AHP method
Table 5. Random Index (RI)

| n  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| RI | 0  | 0,58 | 0,90 | 1,12 | 1,24 | 1,32 | 1,41 | 1,45 | 1,49 | 1,51 | 1,48 | 1,56 | 1,57 | 1,59 |

The criterion assessment is declared true (consistent) if the Consistency Ratio is fulfilled (CR) < 0,1

Consistency Ratio (CR) = CI / RI

CR  = Consistency Ratio
CI  = Consistency Index
RI  = Random Index
CI  = (λ max-n) / n -1,
n  = number of elements

λmaks  = the result of the maximum eigenvalues of the pairwise comparisons matrix.
The result of the maximum eigenvalue (λmaximum) with the sum of the multiplication results of the number in table 2 with the priority column in table 4. The results of the maximum eigenvalues are:

\[ \lambda_{\text{maks}} = (2,3*0,360) + (7,4*0,205) + (12,2*0,142) + (19,917*0,109) + (15,667*0,079) + (18,2*0,068) + (23*0,037) \]
\[ = 7,065 \]

CI  = (7,065 - 7) / 7 - 1 = 0,010751279

Determination of the RI value from the number of criteria (n) in table 5. The number of criteria is 7, the RI value = 1,32 Then the CR value = CI / IR = 0,0101751279 / 1,32 = 0,008144909

The result of CR value = 0,008144909 is eligible, CR < 0,1. It can be explained that the determination of the criteria that influence the choice of learning methods is stated to be consistent / correct. In the alternative comparison matrix with the selected criteria, namely Learning Objectives (C1). The alternatives in choosing the learning method are: Direct Learning Strategies (A1), Indirect Learning Strategies (A2), Interactive Learning (A3) and Independent Learning (A4).

The results of the maximum eigenvalues (λmaximum), table 6 by adding up the multiplication results of the number in the alternative comparison matrix column with the priority column in table 8. The results of the maximum eigenvalues are:

\[ \lambda_{\text{maks}} = (12*0,077) + (1,867*0,501) + (4,667*0,263) + (7,333*0,159) \]
\[ = 6,548 \]

CI  = (6,548 - 4) / 4 - 1 = 0,109639417.

Determination of the RI value, from the number of alternative elements (n). The number of alternative elements is 4, then n = 4, the number RI = 0,9. For the CR value,

CR  = 0,109639417 / 0,9 = 0,093100315.

The results of the assessment at CR = 0,093100315 have met the requirements, CR < 0,1 in the process of determining the selection of criteria in the learning method can be declared true (consistent). The final result of this test is that the selection of learning methods based on the criteria for Learning Objectives (C1) is the 2nd alternative (A2), namely Indirect Learning Strategies which is selected according to the selected criteria.
Table 6. Alternative Calculations

| Alternative | A1 | A2 | A3 | A4 |
|-------------|----|----|----|----|
| A1          | 1  | 0.2| 0.333| 0.333|
| A2          | 5  | 1  | 3  | 3  |
| A3          | 3  | 0.333| 1  | 3  |
| A4          | 3  | 0.333| 0.333| 1  |
| Total       | 12 | 1.867| 4.667| 7.333|

Table 7. Normalization Alternatives

| Alternative | A1 | A2 | A3 | A4 | Jumlah |
|-------------|----|----|----|----|--------|
| A1          | 0.083| 0.107| 0.071| 0.045| 0.307  |
| A2          | 0.417| 0.536| 0.643| 0.409| 2.004  |
| A3          | 0.250| 0.179| 0.214| 0.409| 1.052  |
| A4          | 0.250| 0.179| 0.071| 0.136| 0.636  |
| Total       | 1   | 1   | 1   | 1   | 4      |

Table 8. Priority and Ranking

| Alternative | Priority | Priority (Percentage) | Rangking |
|-------------|----------|-----------------------|----------|
| A1          | 0.077    | 7.7                   | 4        |
| A2          | 0.501    | 50.1                  | 1        |
| A3          | 0.263    | 26.3                  | 2        |
| A4          | 0.159    | 15.9                  | 3        |
| Total       | 1        | 100                   |          |

4. Conclusion

The final results in this study, The AHP method provides an alternative solution in the selection of learning methods in artificial intelligence courses at STMIK Royal. The alternative assessment will be more optimal by selecting more and more objective criteria. By using the AHP method, it is able to implement scientifically in determining the choice of learning methods in artificial intelligence courses.

References

[1] Z. Azhar and M. Handayani, “ANALISIS FAKTOR PRIORITAS DALAM PEMILIHAN PERUMAHAN KPR MENGGUNAKAN METODE AHP,” J. Manaj. Inform. dan Sist. Inf., 2018, doi: 10.36595/misi.vi12.38.

[2] Z. Azhar, “Analisis Pemilihan Mata Kuliah Praktek Menggunakan Metode AHP,” Pros. Semin. Nas. Ris. Inf. Sct., 2019, doi: 10.30645/senaris.vi10.126.

[3] Z. Azhar, “Faktor Analisis Prioritas Dalam Pemilihan Bibit Jagung Unggul Menggunakan Metode AHP,” Semin. Nas. Teknol. Komput. Sains ..., 2020.

[4] R. A. Suherdi, R. Taufiq, and A. A. Permana, “Penerapan Metode AHP dalam Sistem Pendukung Keputusan Kenaikan Pangkat Pegawai Di Badan Kepegawaian Dan Pengembangan Sumber Daya Manusia Kota Tangerang,” Sintak, 2018.

[5] S. Indra, Adi and T. Rohmat, “Penerapan Metode Analytical Heirarchy Process (Ahp) Dalam Sistem Pendukung Keputusan (Spk) Pemensiunan Pada Badan Kepegawaian Dan Pengembangan Sumber Daya Manusia Kota Tangerang,” Pros. SINTAK 2018, 2018.

[6] R. Umar, A. Fadlil, and Y. Yuminah, “Sistem Pendukung Keputusan dengan Metode AHP untuk Penilaian Kompetensi Soft Skill Karyawan,” Khazanah Inform. J. Ilmu Komput. dan Inform., 2018, doi: 10.23917/khif.v4i1.5978.

[7] L. O. Iwan Rijayan1), “SISTEM PENDUKUNG KEPUTUSAN PEMILIHAN KARYAWAN BERPRESTASI BERDASARKAN KINERJA MENGGUNAKAN METODE ANALITYC HIERARCHY PROCESS,” Semin. Nas. Inform. 2012 (semnasIF 2012) UPN”Veteran” Yogyakarta, 30 Juni 2012, 1986.
A. Fauzi and T. Hidayatulloh, “Penilaian Kinerja Karyawan Pada PT. Telecom Visitama Menggunakan Metode Analytical Hierarchy Process,” *Indones. J. Comput. Inf. Technol.*, 2017.

D. Desyanti, “SISTEM PENDUKUNG KEPUTUSAN PEMILIHAN KARYAWAN TELADAN MENGGUNAKAN METODE ANALITIC HIERARCHY PROCESS (AHP),” *INOVTEK Polheng - Seri Inform.*, 2016, doi: 10.35314/isi.v1i1.l127.

S. Sudarto, “Pemanfaatan Analytical Hierarchy Process (AHP) sebagai Model Sistem Pendukung Keputusan untuk Pemilihan Karyawan Berprestasi,” *J. SIFO Mikroskil*, 2011.

Iskandar and E. S. Pasaribu, “Sitem Pendukung Keputusan Promosi Jabatan Karyawan Dengan Metode Analytical Hierarchy Process (AHP) Studi Kasus Pada PT.Selular Global Net Medan,” *Teknol. Dan Sist. Inf.*, 2015.

M. H. SA, “SISTEM PENDUKUNG KEPUTUSAN REKRUTMEN KARYAWAN DI PT INDO BERAS UNGGUL MENGGUNAKAN METODE ANALYTICAL HIERARCHY PROCESS (AHP),” *KOMPUTA*, 2014.

K. Makkasau, “PENGUNAAN METODE ANALYTIC HIERARCHY PROCESS (AHP) DALAM PENENTUAN PRIORITAS PROGRAM KESEHATAN (STUDI KASUS PROGRAM PROMOSI KESEHATAN),” *J@TI UNDIP J. Tek. Ind.*, 2013, doi: 10.12777/jati.7.2.105-112.

Z. Azhar, “PENERAPAN METODE ANALYTICAL HIERARCHY PROCESS DALAM PEMILIHAN BIBIT JAGUNG UNGGUL,” *JURTEKSI (Jurnal Teknol. dan Sist. Informasi)*, 2020, doi: 10.33330/jurteksi.v6i2.528.

Z. Azhar, “Analisis Faktor Prioritas dalam Pemilihan Mata Kuliah Praktek pada Prodi Sistem Informasi Menggunakan Metode AHP,” *Digit. Zo. J. Teknol. Inf. dan Komun.*, 2020, doi: 10.31849/digitalzone.v11i1.3393.

Z. Azhar and J. Hutahaean, “Penerapan Metode Analytical Hierarchy Process Dalam Pemilihan Tempat Cafe di Kisaran,” *Build. Informatics, Technol. Sci.*, 2020, doi: 10.47065/bits.v2i2.560.

R. D. F. S. M. Russo and R. Camanho, “Criteria in AHP: A systematic review of literature,” in *Procedia Computer Science*, 2015, doi: 10.1016/j.procs.2015.07.081.

M. Afandi, E. Chamalah, and O. P. Wardani, *Model Dan Metode Pembelajaran Di Sekolah*. 2013.

M. K. Nasution, “Penggunaan metode pembelajaran dalam meningkatkan hasil belajar siswa,” *Stud. Didakt. J. Ilm. Bid. Pendidik.*, 2017.

E. R. Dewi, “Metode Pembelajaran Modern Dan Konvensional Pada Sekolah Menengah Atas,” *PEMBELAJAR J. Ilmu Pendidikan, Keguruan, dan Pembelajaran*, 2018, doi: 10.26858/pembelajar.v2i1.5442.