Modeling a Decision Support System for Selection of Natural Stone Suppliers Using the Moora Algorithm

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Abstract—At SMK Negeri 1 Kismantoro, before this system was used, they only used manual methods or subjective, meaning the teacher still chooses students directly. The selection of outstanding students must be thorough used as a reference for the following year to ensure increased academic success. This competition was held Every year SMK Negeri 1 Kismantoro sends a team every year to advance in this competition. System Decision support can be made using several methods, one of which is the Moora method and Gain Ratio. This support system can assist in decision making in student selection achievement for the Kismantoro 1 State Vocational School competition. The operation of the Moore method consists of assigning weights on each criterion. The Increment Ratio method is used to find the criteria used in the Moora method that is, the highest value has 4 of the highest, that is, the card criteria is directly proportional to the gain of (0.44644), practice with a gain of (0.88129), attitude (personality) with a gain of (0.44644), skill with advantage (0.42836). The Moora method can select alternatives and rank them for make recommendations for the best students based on predetermined criteria which are Lutfiyatul Rosida's alternatives (A10) is the student who has the best performance with $Yi-Max = 0.165$.

Keywords: Gain Ratio, LKS, Moora Method, Waterfall

I. INTRODUCTION

Vocational High School (SMK) is a formal educational institution organizing vocational education at the educational level. Vocational education is part of the education system prepare someone to be more capable work on one job group or one areas of work rather than fields other work. According to the explanation of the Law Law Number 20 of 2003 Article 15, Vocational education is education secondary school that prepares students especially for working in certain fields.

Middle School Student Competency Competition Vocational (LKS SMK) is a competition event to measure students' competency abilities vocational school. Students who will compete are students of each student's choice school. The SMK LKS competition is a competition which was held at the district level last provincial level after that national level[1]. (1) Problems experienced by SMK Negeri 1 Kismantoro is the selection of students who will advance The student competency competition is at the time of selection still use the disubjective or chosen by the teacher himself; (2) therefore a system was designed decision support for selecting achievement students for Student Competency Competition level districts use a combination of methods MOORA and Gain Ratio; (3) then this research using the GAIN RATIO method and MOORA algorithm for student selection presenting to advance to the LKS Competition at Vocational Schools Negeri 1 Kismantoro. This research uses GAIN RATIO method for determining criteri and the normalization matrix due to the GAIN method RATIO is good in

determining criteria weights, as well the decision will be determined by the MOORA method; and (4) in this study it only focuses on only addresses the student recommendation process Achievement to advance in the LKS competition, criteria for This research is report card grades, practice grades, skills, and personality values. Development methods using the waterfall method.

II. RESEARCH METHODS

2.1. Related research

This research is related to several studies carried out by several researchers previously, among others.

- Yuan Sa'adati, Sofiansyah Fadli in the title "Analysis of the Use of the AHP Method and MOORA to Determine Outstanding Teachers as a Position Promotion Event" was obtained Conclusion Support system applications decision to determine teachers achieve by using the method AHP and MOORA can be applied and produces the same calculation between manual calculations and calculations system [2].

- Deski Helsa Pane, Kamil Erwansyah in title "Regional Election Priority Model Construction of Telecommunication Towers Based on a combination of AHP methods and methods Moora "conclusions were obtained from seven locations tested, AHP provides value accuracy of 42.85%, Moora method provides an accuracy of 42.85%, whereas a combination of AHP and Moora methods shows performance accuracy of 71.43%[3].

- Renny Puspita Sari, Ilhamsyah, Alfredo Michael Alliandaw in the title "Implementation MOORA Method for Selecting Majors at SMA Negeri 3 Pontianak" was obtained Conclusion Calculation results from 50 samples prospective student data, Support System Decisions based on the MOORA method that is built results in a decision with 6 science classes consisting of 33 students and 3 social studies classes consisting of 17 students[4].

- Suginam, Ermi Suryani Nasution, Sapria Ulandari Lubis, Mesran in the title "System Assistance Recipient Decision Support Poor Students Apply the WASPAS Method and MOORA" concluded that The WASPAS method can be applied internally selection decision support system poor student aid recipients, because this method can provide a Recommendations for student aid recipients are lacking capable of meeting the assessment criteria used in the form of ranking [5].

- Chairul Fadlan, Agus Perdana Windarto, Irfan Jadiri Damanik in the title "Application of the MOORA Method to the System Selection of Chili Seeds (Case: Bandar Village Siantar, Gunung Malela District)" was obtained conclusion that the MOORA method (Multi-Objective Optimization on the basis of Ratio Analysis) can select alternatives and ranking in doing recommendations for the best chili seeds based on where the criteria have been determined alternative Lado (A1) as chili seeds best with a value of Yi (max) = 0.2080[6].

Vihi Atina and Dwi Hartanti "Knowledge Based Recommendation Modeling for Clothing Product Selection Recommendations system" can be concluded that knowledge based recommendation modeling dation for selection recommendation systems clothing provides 5 attribute options search namely brand, price, material, color and size. Knowledge modeling results based recommendation with 20 data samples can make clothing recommendations based on the criteria required by customers by calculating value similarities between customer needs and properties of each product clothes. [7] Rudi Susanto, Mohd Nizam Husen, Adidah Lajis, Wiji Lestari, Herliyani Hasanah "Clustering of Student Perceptions on Developing a Physics Laboratory Based on Information Technology and Local Wisdom" Students' perceptions of utilization laboratory and internal information technology physics learning and development technology-based physics laboratory information and local wisdom in clusters using the K mean algorithm. Questionnaire The research was conducted on 211 students first year of Duta Bangsa University took a physics course. Research result shows that 3 clusters were produced correlated with student perception neutral, agree, and strongly agree. Based on cluster results, 101 students (45.70%) strongly agree, 78 students (35.29%) agree, and 42 students (19.01%) were neutral in nature using laboratories and technology information in physics learning. Besides That, 103 students (46.61%) agreed, 62 students (28.05%) neutral, and 56 students (25.34%) agreed to expand the laboratory information technology-based physics and local wisdom [8].

2.2. Theoretical Basis
1. Student Competency Competition

In the vocational school environment, there are several activities can improve the quality of students namely known as the Competence Competition Students (LKS) organized for encourage vocational schools to improve the quality of processes and learning outcomes so they can compete both in the context of competition and internationally real as a ready workforce candidate enter the world of work.

2. Multi-objective Optimization on The Basics of Ratio Analysis (MOORA)

a multi-objective optimization technique that can successfully applied to solve various types of decision-making problems complex in decision making. Method moora has a level of flexibility and convenience to understand in separating the parts subjective of an inward evaluation process decision weight criteria with several attributes decision making[9-11].

3. Gain Ratio

Gain ratio is a developmental modification from feature selection information gain with reduces power normally. On feature selection gain ratio improves by taking intrinsic information of the attribute. Gain ratio too can fix unstable data, by because it tends to fit the numeric data du class, simple so more computing fast[12-14].

III.   RESEARCH METHODS

To conduct this research, the author using several methods, where methods used in this research are as follows:

3.1. Data Type

The main data of this research is primary data that will be used in the form of an archive stored on the teacher's computer providing it important data such as vocational school report cards Negeri 1 Kismantoro in 2022 and values other things that are needed as internal triggers understand the problems that will arise. Supporting data in this research was obtained

indirectly from various sources such as books, articles or journals.

3.2. Method of collecting data

Data collection methods used in this research include:

1) Library Research
Namely making use of libraries, books, postings as a medium for internal reference material determine the parameters used in this research.

2) Data Source
Namely taking from the blood of students at State Vocational Schools 1 Kismantoro, which consists of several variables in selecting outstanding students to advance LKS competitions will be processed using MOORA method will produce ranking

3.3. System Development Methods

Information systems development means something the method that will be used to do it computer-based system development. The following research stages are presented in chart form as follows[15]:
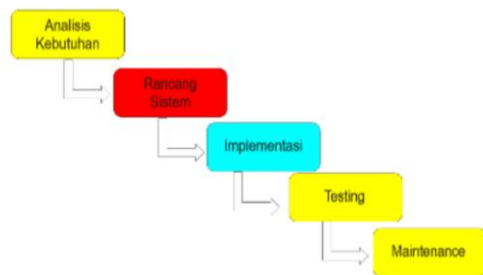

Figure 1. Waterfall diagram

Information:
1) Needs Analysis
This is a necessary initial stage analyze what is needed in creating a decision support system, such as features found on the web, tools that use, website design, etc.

2) System Design
The next step is for researchers to design, designing databases and designing mockups interface and create a system website supporting race selection decisions Student competencies at SMK Negeri 1 Kismantoro. In this process, designing The system is designed as designed.

3) Implementation
After going through the needs analysis stage and system design, the next stage is implementation, where the design has been implemented into a web page. The website for this research was built with using the PHP programming language.

4) Testing
Program units are integrated and tested so that software requirements can be met tailored to your needs and desires. This test is carried out through Black testing Box. Each input menu is checked with sorting and grouping by its function.

5) Maintenance
Maintenance stage of the system being created. Waterfall cycles that run sequentially. Every step has been completed

3.4. Research sites
This research was located at SMK Negeri 1 Kismantoro.

IV. RESULT AND ANALYSIS

4.1. Perhitungan Gain Ratio

Gain Ratio diambil dari algoritma C4.5 dengan Tujuan untuk meningkatkan akurasi prediksi yang dilakukan. perhitungan nilai entropy menggunakan rumus seperti yang ditunjukkan pada Persamaan.

$$Entropy(S) = \sum_{i=1}^{n} -pi * log2\, pi$$

With :
S: Case Set
N : Number of S Partitions
pi : Proportion of Si to S

After getting the entropy value of the collection data, we can measure effectiveness. Size This effectiveness is called information gain. Can be seen in the formula:

$$Gain(S, A = Entropy(S)$$
$$- \sum_{i-1}^{n} \frac{|si|}{|s|} * Entropy(Si)$$

Table 1. Processed Research

no	Keha diran	Lingku ngan	Kerjs ama	Raport	Prak tek	Sikap	Skill	Reko mendasi
1	Rajin	peduli	mampu	bagus	tidak	baik	mampu	tidak
2	cukup	kurang peduli	mampu	bagus	baik	baik	mampu	ya
3	kurang	peduli	tidak mampu	tidak	tidak	kurang	tidak mampu	tidak
4	kurang	kurang peduli	tidak mampu	tidak	tidak	kurang	tidak mampu	tidak
5	rajin	peduli	mampu	bagus	baik	baik	mampu	ya
6	kurang	peduli	mampu	bagus	baik	baik	mampu	ya
7	cukup	kurang peduli	mampu	bagus	baik	baik	mampu	ya
8	rajin	kurang peduli	tidak mampu	bagus	baik	baik	mampu	ya
9	cukup	peduli	mampu	bagus	baik	baik	mampu	ya
10	Rajin	peduli	mampu	bagus	baik	baik	mampu	ya

a) Menghitung entropy total:

$$Entropy[total] = \left(-\frac{7}{10} x log_2 \left(\frac{7}{10}\right)\right)$$

$$+ \left(-\frac{3}{10} x log_2 \left(\frac{3}{10}\right)\right) = 0,881290899$$

$$Entropy[Rajin] = \left(-\frac{3}{4} x log_2 \left(\frac{3}{4}\right)\right)$$

$$+ \left(-\frac{1}{4} x log_2 \left(\frac{1}{4}\right)\right) = 0,811278124$$

$$Entropy[Cukup] = 0$$

$$Entropy[Kurang] = \left(-\frac{1}{3} x log_2 \left(\frac{1}{3}\right)\right)$$

$$+ \left(-\frac{3}{3} x log_2 \left(\frac{3}{3}\right)\right) = 0,528320834$$

$$Gain[Kehadiran]$$

$$= \left(\left(\frac{4}{10} x 0,464385619\right) + \left(\frac{3}{10} x 0\right) + \right.$$

$$\left. \left(\frac{3}{10} x 0,528320834\right)\right) = 0,39828$$

And so on for all criteria. Following results of calculating the entropy and gain values show in table 2.

Table 2. Node Calculation Results

Total	Jumlah	Ya (SI)	Tidak (SI)	Entropy	Gain
Kehadiran	10	7	3	0,8812 90899	
Rajin	4	3	1	0,8112 78124	0,39828
Cukup	3	3	0	0	
Kurang	3	1	3	0,5283 20834	
Lingkungan					
Kurang Peduli	4	3	1	0,8112 78124	0,00580
Peduli	6	4	2	0,9182 95834	
Kerjasama					
Tidak Mampu	3	1	2	0,9182 95834	0,19163
Mampu	7	6	1	0,5916 72779	
Raport					
Bagus	8	7	1	0,5435 64443	0,44644
Tidak	2	0	2	0	
Praktek					
Baik	7	7	0	0	0,88129
Tidak	3	0	3	0	
Sikap					
Baik	8	7	1	0,5435 64443	0,44644
Kurang	2	0	2	0	
Skill					
Mampu	9	8	1	0,5032 58335	0,42836
Tidak Mampu	2	0	2	0	

From the calculation results in Table 2, the value obtained is the highest of several there are 4 which are the highest in use to be a criterion for the MOORA method, that is, it exists Report Card Values, Practice Values, Skills, Attitudes (Personality) so the data obtained from the gain ratio is very high influential for the next steps for be a criterion in the Moora method for selection of students based on the highest score on Gain Ratio.

1.1. MOORA Method Process
1) Determine criteria and data
The data in this problem is the student's name contained in the class:
1. Abdilah Fabrisio Mustofa (A1)
2. Anastasya Dwi Agustine (A2)
3. Archel Thinka Afrin Rediva (A3)
4. Della Aulya Maharany (A4)
5. Desyta Indriani (A5)
6. Deya Amanda Ismawati (A6)
7. Dian Putri Febriana (A7)
8. Duwi Santoso (A8)
9. Ferdiansyah Pratama (A9)
10. Hanif Lutfiyatul Rosida (A10)

There are 4 criteria to be used criteria, namely:
C1 = Report Value (Benefit)
C2 = Practice Value (Benefit)
C3 = Practice Skill (Benefits)
C4 = Personality (Cost)
Table 3. Weighting

C1	C2	C3	C4
0,20	0,20	0,35	0,25

2) Create a Decision Matrix
The decision matrix is a matrix of each value criteria possessed by alternatives. Matrix The decision can be seen in the table below
Table 4. Decision Matrix

Alternatif	C1	C2	C3	C4
A1	79	71	60	60
A2	78	50	81	76
A3	83	69	78	79
A4	78	75	50	66
A5	81	76	85	78
A6	80	71	74	80
A7	80	68	76	79
A8	40	50	70	67
A9	78	61	75	70
A10	79	78	77	40

3) Create a Normalized Decision Matrix

After creating a decision matrix then Next, look for the divisor weight value for determine the normalized matrix.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\{\sum_i^m 1 x_{ij}^2\}}}$$

C1

$$x_1 = \sqrt{\begin{array}{c} 0,79^2 + 0,78^2 + 0,83^2 \\ +0,78^2 + 0,81^2 + 0,8^2 + 0,8^2 \\ +0,4^2 + 0,78^2 + 0,79^2 = 2,420 \end{array}}$$

$$A_{11} = \frac{0,79}{2,420} = 0,326 \quad A_{21} = \frac{0,78}{2,420} = 0,322$$

$$A_{31} = \frac{0,83}{2,420} = 0,343 \quad A_{41} = \frac{0,78}{2,420} = 0,322$$

$$A_{51} = \frac{0,81}{2,420} = 0,335 \quad A_{61} = \frac{0,8}{2,420} = 0,331$$

$$A_{71} = \frac{0,8}{2,420} = 0,331 \quad A_{81} = \frac{0,4}{2,420} = 0,165$$

$$A_{91} = \frac{0,78}{2,420} = 0,322 \quad A_{101} = \frac{0,79}{2,420} = 0,326$$

C2

$$x_1 = \sqrt{\begin{array}{c} 0,71^2 + 0,5^2 + 0,69^2 \\ +0,75^2 + 0,76^2 + 0,71^2 + 0,68^2 \\ +0,5^2 + 0,61^2 + 0,78^2 = 2,137 \end{array}}$$

$$A_{12} = \frac{0,71}{2,137} = 0,322 \quad A_{22} = \frac{0,5}{2,137} = 0,234$$

$$A_{32} = \frac{0,69}{2,137} = 0,323 \quad A_{42} = \frac{0,75}{2,137} = 0,351$$

$$A_{52} = \frac{0,76}{2,137} = 0,356 \quad A_{62} = \frac{0,71}{2,137} = 0,322$$

$$A_{72} = \frac{0,68}{2,137} = 0,318 \quad A_{82} = \frac{0,5}{2,137} = 0,234$$

$$A_{92} = \frac{0,61}{2,137} = 0,285 \quad A_{102} = \frac{0,78}{2,137} = 0,365$$

C3

$$x_1 = \sqrt{\begin{array}{c} 0,6^2 + 0,81^2 + 0,78^2 \\ +0,5^2 + 0,85^2 + 0,74^2 + 0,76^2 \\ +0,7^2 + 0,75^2 + 0,77^2 = 2,137 \end{array}}$$

$$A_{13} = \frac{0,6}{2,137} = 0,259 \quad A_{23} = \frac{0,81}{2,137} = 0,350$$

$$A_{33} = \frac{0,78}{2,137} = 0,337 \quad A_{43} = \frac{0,5}{2,137} = 0,216$$

$$A_{53} = \frac{0,85}{2,137} = 0,367 \quad A_{63} = \frac{0,74}{2,137} = 0,319$$

$$A_{73} = \frac{0,76}{2,137} = 0,328 \quad A_{83} = \frac{0,7}{2,137} = 0,302$$

$$A_{93} = \frac{0,75}{2,137} = 0,324 \quad A_{103} = \frac{0,77}{2,137} = 0,179$$

C4

$$x_1 = \sqrt{\begin{array}{c} 0,6^2 + 0,76^2 + 0,79^2 \\ +0,66^2 + 0,78^2 + 0,8^2 + 0,79^2 \\ +0,67^2 + 0,7^2 + 0,4^2 = 2,229 \end{array}}$$

$$A_{14} = \frac{0,6}{2,229} = 0,269 \quad A_{24} = \frac{0,76}{2,229} = 0,341$$

$$A_{34} = \frac{0,79}{2,229} = 0,354 \quad A_{44} = \frac{0,66}{2,229} = 0,296$$

$$A_{54} = \frac{0,78}{2,229} = 0,350 \quad A_{64} = \frac{0,8}{2,229} = 0,359$$

$$A_{74} = \frac{0,79}{2,229} = 0,354 \quad A_{84} = \frac{0,67}{2,229} = 0,301$$

$$A_{94} = \frac{0,7}{2,229} = 0,314 \quad A_{104} = \frac{0,4}{2,229} = 0,179$$

The normalized decision matrix can be viewed in the table below

Table 5. Normalized Decision Matrix

Alternatif	Kriteria			
	C1	C2	C3	C4
A1	0,326	0,322	0,259	0,269
A2	0,322	0,234	0,350	0,341
A3	0,343	0,323	0,337	0,354
A4	0,322	0,351	0,216	0,296
A5	0,335	0,356	0,367	0,350
A6	0,331	0,322	0,319	0,359
A7	0,331	0,318	0,328	0,354
A8	0,165	0,234	0,302	0,301
A9	0,322	0,285	0,324	0,314
A10	0,326	0,365	0,179	0,179

4) Create a Weighted Normalized Matrix

This step consists of multiplying each matrix which is normalized by importance weights (w), using the formula yij=wi. So that generated as in the following table.

$$C1 \Rightarrow A1 = 0,336 \times 0,20 = 0,065$$
$$A2 = 0,322 \times 0,20 = 0,064$$
$$A3 = 0,343 \times 0,20 = 0,069$$
$$A4 = 0,322 \times 0,20 = 0,064$$
$$A5 = 0,335 \times 0,20 = 0,067$$
$$A6 = 0,331 \times 0,20 = 0,066$$
$$A7 = 0,331 \times 0,20 = 0,066$$
$$A8 = 0,322 \times 0,20 = 0,033$$
$$A9 = 0,326 \times 0,20 = 0,064$$
$$A10 = 0,326 \times 0,20 = 0,065$$

$C2 =\gg A1 = 0{,}322 \times 0{,}20 = 0{,}066$

$A2 = 0{,}234 \times 0{,}20 = 0{,}047$

$A3 = 0{,}323 \times 0{,}20 = 0{,}065$

$A4 = 0{,}351 \times 0{,}20 = 0{,}070$

$A5 = 0{,}356 \times 0{,}20 = 0{,}071$

$A6 = 0{,}322 \times 0{,}20 = 0{,}066$

$A7 = 0{,}318 \times 0{,}20 = 0{,}064$

$A8 = 0{,}234 \times 0{,}20 = 0{,}047$

$A9 = 0{,}285 \times 0{,}20 = 0{,}057$

$A10 = 0{,}365 \times 0{,}20 = 0{,}073$

$C3 =\gg A1 = 0{,}259 \times 0{,}35 = 0{,}091$

$A2 = 0{,}350 \times 0{,}35 = 0{,}122$

$A3 = 0{,}337 \times 0{,}35 = 0{,}118$

$A4 = 0{,}216 \times 0{,}35 = 0{,}076$

$A5 = 0{,}367 \times 0{,}35 = 0{,}128$

$A6 = 0{,}319 \times 0{,}35 = 0{,}112$

$A7 = 0{,}328 \times 0{,}35 = 0{,}115$

$A8 = 0{,}302 \times 0{,}35 = 0{,}106$

$A9 = 0{,}324 \times 0{,}35 = 0{,}113$

$A10 = 0{,}179 \times 0{,}35 = 0{,}116$

$C4 =\gg A1 = 0{,}269 \times 0{,}25 = 0{,}067$

$A2 = 0{,}341 \times 0{,}25 = 0{,}085$

$A3 = 0{,}354 \times 0{,}25 = 0{,}089$

$A4 = 0{,}296 \times 0{,}25 = 0{,}074$

$A5 = 0{,}350 \times 0{,}25 = 0{,}087$

$A6 = 0{,}359 \times 0{,}25 = 0{,}090$

$A7 = 0{,}354 \times 0{,}25 = 0{,}089$

$A8 = 0{,}301 \times 0{,}25 = 0{,}075$

$A9 = 0{,}314 \times 0{,}25 = 0{,}079$

$A10 = 0{,}179 \times 0{,}25 = 0{,}045$

Table 6. Weighted Normalized Matrix

Alternatif	Kriteria			
	C1	C2	C3	C4
A1	0,065	0,066	0,091	0,067
A2	0,064	0,047	0,122	0,085
A3	0,069	0,065	0,118	0,089
A4	0,064	0,070	0,076	0,074
A5	0,067	0,071	0,128	0,087
A6	0,066	0,066	0,112	0,090
A7	0,066	0,064	0,115	0,089
A8	0,033	0,047	0,106	0,075
A9	0,064	0,057	0,113	0,079
A10	0,065	0,073	0,116	0,045

5) Optimize attributes
    By using equation 3, then the Yi value can be calculated, which is seen in table 7.
Table 7. List Yi

ALTERNATIF	MAX C1+C2+C3	MIN C4	Yi Max-Min	Ranking
A1	0,222	0,067	0,155	6
A2	0,234	0,085	0,148	8
A3	0,251	0,089	0,162	3
A4	0,210	0,074	0,136	9
A5	0,266	0,087	0,179	2
A6	0,244	0,090	0,155	7
A7	0,245	0,089	0,156	5
A8	0,186	0,075	0,110	10
A9	0,235	0,079	0,156	4
A10	0,255	0,045	0,210	1

6) Determine the ranking from the calculation results
    Make a ranking of the results from table 7 already calculated, then the data that can be seen can be produced in table 8.
Table 8. Ranking Table

Alternatif	Hasil	Rangking
A1	0,155	6
A2	0,148	8
A3	0,162	3
A4	0,136	9
A5	0,179	2
A6	0,155	7
A7	0,156	5
A8	0,110	10
A9	0,156	4
A10	0,210	1

IV. CONCLUSION

Conclusion of This Research Is That The Process of Based on The Results of System Designstudent Selection Decision Support Achievements To Advance To The Student Competency Competition SMK Negeri 1 Kismantoro Uses The Method MOORA And Gain Ratio Can Be Concluded As Follows: The Gain Ratio Method Is Taken For Look For The Criteria To be used in the moora method, namely with the highest value There are 4 highest, namely the report card criteria with Gain is (0.44644), Practice with gain equal to (0.88129), Attitude (Personality) with gain of (0.44644), skill with gain (0.42836). Meanwhile, the Moora method can be done select alternatives and do it ranking in making recommendations the best performing students based on the criteria-predetermined criteria where alternatives Lutfiyatul Rosida (A10) as a student best performance with Yi-Max value = 0.165.

REFERENCES

[1] Dino Okta Mega Puspitasari 2020 "Student Competency Development Strategy As Preparation for the Competency Competition Students (LKS) in the field of Computer Numerical Control (CNC) Department of Machining Engineering SMKN 5 Surabaya.

[2] Yuan S, Sofiansyah F. 2019 "Analysis Use of AHP and MOORA Methods to Determine Outstanding Teachers as a Position Promotion Event. Synchronous Journal Publications & Engineering Researc Informatics 3(1)

[3] Renny Puspita Sari, Ilhamsyah, Alfredo Michael Alliandaw "Application of the Method MOORA for Selection of Majors Pontianak 3 Public High School" Journal SISFOKOM (Information systems and Computer), Volume 11, Number 2, PP 242- 250.

[4] Suginanm, Ermi Suryani Nasution, Sapria Ulandari Lubis, Mesran "System Assistance Recipient Decision Support Poor Students Apply MethodWASPAS and MOORA" National Seminar Information Science & Technology (SENSATION) ISBN: 978-602-52720-0-4 SENSATION 2018 July 2018.

[5] Chairul Fadlan, et al. 2019 "Implementation MOORA Method in Election Systems Chili Seeds (Case: Bandar Siantar Village Gunung Malela District). Journal of Applied Informatics xand Computing (JAIC).

[6] Vihi Antina and Dwi Hartanti "Knowledge Based Recommendation Modeling For Clothing Product Selection Recommendation System" Engineering Journal Informatics (JUTIF) Vol. 3, no. 5, October 2022, p. 1407-1413.

[7] R. Susanto, M. N. Husen, A. Lajis, W. Lestari and H. Hasanah, "Clustering of Student Perceptions on Developing a Physics Laboratory Based on Information Technology and Local Wisdom," 2021 8th

[8] International Conference on Information Technology, Computer and Electrical Engineering (ICITACEE), Semarang, Indonesia, 2021.

[9] Tya Rahmadani, et.al "Determining Employees to go on Umrah Using the MOORA Method" Journal CyberTech Vol.3. No.2, February 2020, pp. 319~330.

[10] Ridho Hayati Alaawiah, et.al, "Analysis Consumer Satisfaction with Services Workshop Using Algorithmic Methods C4.5", Knight Journal of Application Information Systems (Computer &MANAGEMENT) VOL.2 NO.1 January 2022.

[11] Reni Kurniah, et.al, "Data Application Mining Decision Tree Algorithm C4.5 To Know the Level of Satisfaction Students Against Academic Services and Student Affairs (Case Study Prof. Dr. Hazairin, SH)" Infotech University: Journal of Informatics and Technology Vol.5 No.2, July 2022.

[12] Fajriyan Nur, et.al "Level Comparison Accuracy of Information Gain and Gain Ratio In the K-Nearest Neighbor Jati Method" (Information Engineering Student Journal) Vol. 6 No. 1, February 2022.

[13] Muhammad Sadali, et.al, "System Scholarship Selection Decision Support Using Topsis Based Method WEB (Bank Scholarship Case Study Indonesia)", Infotek.Vol 6 No.1, January 2023.