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 dissubjective 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 criteria 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].
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].

Wiji Lestari, Herliyan [7] concluded that the MOORA 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 data 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 Kismantor 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]:

   ![Waterfall diagram](image)
   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.

   \[
   Entropy(S) = \sum_{i=1}^{n} p_i \cdot \log_2 p_i
   \]
   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:

   \[
   Gain(S, A = Entropy(S) - \sum_{i=1}^{n} \frac{|S_i|}{|S|} \cdot \frac{\log |S|}{\log |S_i|}
   \]

   Table 1. Processed Research

<table>
<thead>
<tr>
<th>No</th>
<th>Kehadiran</th>
<th>Lingkungan</th>
<th>Kerja</th>
<th>Rekomended</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rajin</td>
<td>produktif</td>
<td>baik</td>
<td>baik</td>
</tr>
<tr>
<td>2</td>
<td>Rajin</td>
<td>produktif</td>
<td>baik</td>
<td>baik</td>
</tr>
<tr>
<td>3</td>
<td>Kurang</td>
<td>produktif</td>
<td>baik</td>
<td>baik</td>
</tr>
<tr>
<td>4</td>
<td>Kurang</td>
<td>produktif</td>
<td>baik</td>
<td>baik</td>
</tr>
<tr>
<td>5</td>
<td>Kurang</td>
<td>produktif</td>
<td>baik</td>
<td>baik</td>
</tr>
<tr>
<td>6</td>
<td>Kurang</td>
<td>produktif</td>
<td>baik</td>
<td>baik</td>
</tr>
<tr>
<td>7</td>
<td>Kurang</td>
<td>produktif</td>
<td>baik</td>
<td>baik</td>
</tr>
<tr>
<td>8</td>
<td>Kurang</td>
<td>produktif</td>
<td>baik</td>
<td>baik</td>
</tr>
<tr>
<td>9</td>
<td>Rajin</td>
<td>produktif</td>
<td>baik</td>
<td>baik</td>
</tr>
<tr>
<td>10</td>
<td>Rajin</td>
<td>produktif</td>
<td>baik</td>
<td>baik</td>
</tr>
</tbody>
</table>
a) Menghitung entropy total:

\[
\text{Entropy}[\text{total}] = \left( - \frac{7}{10} \log_2 \left( \frac{7}{10} \right) \right) + \left( - \frac{3}{10} \log_2 \left( \frac{3}{10} \right) \right) = 0.881290099
\]

Following results of calculating the entropy and gain values show in Table 2.

Table 2. Node Calculation Results

<table>
<thead>
<tr>
<th>Total</th>
<th>Jumlah</th>
<th>Ya ($\text{I}$)</th>
<th>Tidak ($\text{S}$)</th>
<th>Entropy</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kehadiran</td>
<td>10</td>
<td>3</td>
<td>7</td>
<td>0.8812</td>
<td>0.39828</td>
</tr>
<tr>
<td>Rajin</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>0.6112</td>
<td>0.7124</td>
</tr>
<tr>
<td>Cukup</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0.2583</td>
<td>0.2834</td>
</tr>
<tr>
<td>Kurang</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>0.5283</td>
<td>0.5283</td>
</tr>
<tr>
<td>Gain[Ke hadiran] = (\left( \frac{7}{10} \times 0.464385619 \right) + \left( \frac{3}{10} \times 0.2583 \right) ) = 0.39828</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.20</td>
<td>0.20</td>
<td>0.35</td>
<td>0.25</td>
</tr>
</tbody>
</table>

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
3) Create a Normalized Decision Matrix
   After creating a decision matrix then Next, look for the divisor weight value for determine the normalized matrix.

   \[
   r_{ij} = \frac{x_{ij}}{\sqrt{\sum x_{ij}^2}}
   \]

   C1
   \[
   x_1 = \sqrt{0.79^2 + 0.78^2 + 0.83^2 + 0.8^2 + 0.8^2 + 0.8^2 + 0.8^2 + 0.8^2 + 0.8^2 + 0.8^2}
   \]
   \[
   A_{11} = \frac{0.79}{2.420} = 0.326
   \]
   \[
   A_{12} = \frac{0.83}{2.420} = 0.343
   \]
   \[
   A_{13} = \frac{0.81}{2.420} = 0.335
   \]
   \[
   A_{14} = \frac{0.8}{2.420} = 0.331
   \]
   \[
   A_{15} = \frac{0.78}{2.420} = 0.322
   \]

   C2
   \[
   x_2 = \sqrt{0.71^2 + 0.5^2 + 0.69^2 + 0.68^2 + 0.68^2 + 0.68^2 + 0.68^2 + 0.68^2 + 0.68^2 + 0.68^2}
   \]
   \[
   A_{21} = \frac{0.71}{2.137} = 0.322
   \]
   \[
   A_{22} = \frac{0.69}{2.137} = 0.323
   \]
   \[
   A_{23} = \frac{0.76}{2.137} = 0.356
   \]
   \[
   A_{24} = \frac{0.68}{2.137} = 0.318
   \]
   \[
   A_{25} = \frac{0.61}{2.137} = 0.285
   \]

   C3
   \[
   x_3 = \sqrt{0.6^2 + 0.81^2 + 0.78^2 + 0.74^2 + 0.76^2 + 0.7^2 + 0.7^2 + 0.7^2 + 0.7^2 + 0.7^2}
   \]
   \[
   A_{31} = \frac{0.6}{2.137} = 0.259
   \]
   \[
   A_{32} = \frac{0.78}{2.137} = 0.337
   \]
   \[
   A_{33} = \frac{0.7}{2.137} = 0.367
   \]
   \[
   A_{34} = \frac{0.7}{2.137} = 0.302
   \]
   \[
   A_{35} = \frac{0.75}{2.137} = 0.324
   \]

   The normalized decision matrix can be viewed in the table below

   Table 5. Normalized Decision Matrix

<table>
<thead>
<tr>
<th>Alternatif</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0.326</td>
<td>0.322</td>
<td>0.259</td>
<td>0.269</td>
</tr>
<tr>
<td>A2</td>
<td>0.322</td>
<td>0.234</td>
<td>0.350</td>
<td>0.341</td>
</tr>
<tr>
<td>A3</td>
<td>0.343</td>
<td>0.323</td>
<td>0.337</td>
<td>0.354</td>
</tr>
<tr>
<td>A4</td>
<td>0.322</td>
<td>0.351</td>
<td>0.216</td>
<td>0.296</td>
</tr>
<tr>
<td>A5</td>
<td>0.335</td>
<td>0.356</td>
<td>0.367</td>
<td>0.350</td>
</tr>
<tr>
<td>A6</td>
<td>0.331</td>
<td>0.322</td>
<td>0.319</td>
<td>0.359</td>
</tr>
<tr>
<td>A7</td>
<td>0.331</td>
<td>0.318</td>
<td>0.328</td>
<td>0.354</td>
</tr>
<tr>
<td>A8</td>
<td>0.165</td>
<td>0.234</td>
<td>0.302</td>
<td>0.301</td>
</tr>
<tr>
<td>A9</td>
<td>0.322</td>
<td>0.285</td>
<td>0.324</td>
<td>0.314</td>
</tr>
<tr>
<td>A10</td>
<td>0.326</td>
<td>0.365</td>
<td>0.179</td>
<td>0.179</td>
</tr>
</tbody>
</table>

   4) Create a Weighted Normalized Matrix
   This step consists of multiplying each matrix which is normalized by importance weights (w), using the formula \( y_{ij} = w_i \). So that generated as in the following table.

   \[
   C1 \Rightarrow A1 = 0.336 \times 0.20 = 0.065
   \]
   \[
   A2 = 0.322 \times 0.20 = 0.064
   \]
   \[
   A3 = 0.343 \times 0.20 = 0.069
   \]
   \[
   A4 = 0.322 \times 0.20 = 0.064
   \]
   \[
   A5 = 0.335 \times 0.20 = 0.067
   \]
   \[
   A6 = 0.331 \times 0.20 = 0.066
   \]
   \[
   A7 = 0.331 \times 0.20 = 0.066
   \]
   \[
   A8 = 0.322 \times 0.20 = 0.064
   \]
   \[
   A9 = 0.326 \times 0.20 = 0.065
   \]
   \[
   A10 = 0.326 \times 0.20 = 0.065
   \]
5) Optimize attributes

By using equation 3, then the Yi value can be calculated, which is seen in table 7.

Table 7. List Yi

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
IV. CONCLUSION

Conclusion of This Research Is That The Process of Based on The Results of System Design student 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.

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