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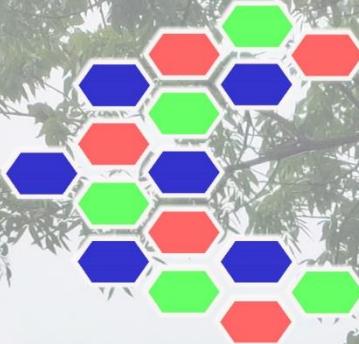


Penelitian Ilmu Komputer
Sistem *Embedded & Logic*



*Unravelling How AI Is Applied In
All Aspects of Life*

Department of Computer Engineering
Universitas Islam "45" Bekasi



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Web-Based E-Log Book Application for Enhancing the Quality of Student Projects

Devanda Radya Ananta, Defri Kurniawan 1 - 10

The Enhancing User Experience for Mother and Children Services at Sungai Duren Health Center in Muara Enim, Indonesia

Rasmila Rasmila, Muhammad Fhardi Akbar 11 - 22

Improving Network Performance of Headquarters and Branches Using Software-Defined Network WAN (SD-WAN)

Muchlisin Muchlisin, Boy Yuliadi 23 - 34

Voice Command-Based IoT on Smart Home Using NodeMCU ESP8266 Microcontroller

Muhammad Ariel Shakaramiro, Aris Gunaryati, Ben Rahman 35 - 46

Exemplary Teacher Selection Using a VIKOR-Based Decision Support System

Dwipa Handayani, Dani Yusuf, Gabriella Putri Larasati, Ozzi Ardhiyanto 47 - 58

Security Analysis of Learning Management System Using Penetration Testing with ISSAF Framework

Rusydi Umar, Imam Riadi, Sonny Abriantoro Wicaksono 59 - 68

Integration of Fuzzy AHP and TOPSIS In Decision Support System for Lecturer Academic Promotion

Rakhmi Khalida, khairunnisa Fadhillah Ramdhania 69 - 78

Learning Tools for Artificial Intelligence Implementation

Herlawati Herlawati 79 - 88

State Transition Method Analysis for Testing the Interactive Multimedia Applications

Santi Purwanti, Khansa Mufidah Fillah, Jaja jaja, Nita Delima 89 - 96

Developing a Web-Based Application for Palm Seedling Eligibility Using C5.0 Algorithm and CART Algorithm

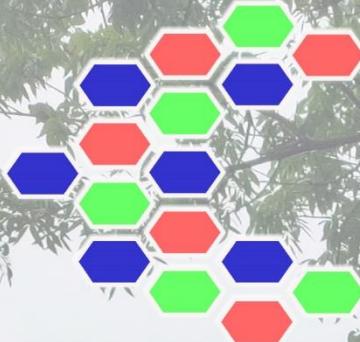
Muhammad Afif Pratama Ginting, Sriani Srian 97 - 108

Enhancing IT Employee Placement Using SMARTER with Centroid Rank Order Weighting for Candidate Suitability

Ben Rahman, Saskia Adinda, Adelia Putri Handayani 109 - 118

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Sistem Embedded & Logic**

Real Time Mask Detection Using Viola Jones Method

Safrida Ika Guslianto, Khairunnas Khairunnas, Tachiyya Nailal Khusna, Miftahul Jannah 119 - 126

Smart Home System for Controlling Household Appliances Utilizing Photovoltaic Technology

Mohammad Khoiruddin, Endang Retnoningsih, Syahbaniar Rofiah 127 - 138

Policy of Academic Revitalization through Information Technology for Quality Management Enhancement in Private Higher Education Institutions in Indonesia

Anuar Sanusi, Firmansyah Firmansyah, Muhammad Said Hasibuan, Nurfiana Nurfiana, Novi Herawadi S 139 - 148

Sales Information System Utilizing 13.56 MHz RFID Member Cards for Enhanced Efficiency in Cooperative Stores

Dani Yusuf, Denis Ahmad 149 - 160

Determining Sales Patterns of Beauty Products Using the Apriori Algorithm in Data Mining

Windi Maharani, Raissa Amanda Putri 161-172

Implementation of Digital Forensics Photorec in Recovering Lost Files on External Storage

Rahmat Novrianda Dasmen, Asti Triwulanda, Rasmila Rasmila, Dedi Kurniawan, Julia Julia 173-178

Event Management System for Faculty of Mathematics and Natural Sciences Organizers

Agung Prajuhana Putra, Lita Karlitasari 179-188

Determining Sales Patterns Using the Apriori Algorithm: A Case Study of Unlocked Cafe's Website Applications

Rafika Sari, Nur Helmy, Allan Desi Alexander 189-200

Expert System for Chiller Machine Damage Detection Using Forward Chaining Algorithm

Achmad Noeman , Atsal Adriansyah, Abrar Hiswara, Dian Hartanti, Prio Kustanto, Hafizah 201-208

Sentiment Analysis of Application Reviews using the K-Nearest Neighbors (KNN) Algorithm

Damar Wijati, Prima Dina Atika, Siti Setiawati, Rasim 209-218

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From Editor-in-Chief



Rahmadya, Ph.D.
Editor-in-Chief

السَّلَامُ عَلَيْكُمْ وَرَحْمَةُ اللَّهِ وَبَرَكَاتُهُ

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Undoubtedly, Artificial Intelligence (AI) has permeated every facet of life. Every scientific field has acquired AI as part of its scientific aspect. The role of computer science becomes increasingly important in enhancing the performance of AI models implemented in these fields. Therefore, this edition of PIKSEL focuses on implementations in areas such as computer science, embedded systems, and logic, which are the focus of this journal.

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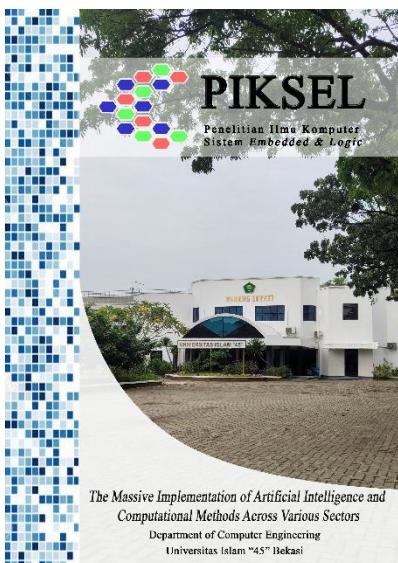


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AUTHOR INDEX

- Devanda Radya Ananta, Defri Kurniawan.** 2024. Web-Based E-Log Book Application for Enhancing the Quality of Student Projects. PIKSEL (Penelitian Ilmu Komputer Sistem Embedded and Logic). 12(1): 1 – 10.
- Rasmila Rasmila, Muhammad Fhardi Akbar.** 2024. The Enhancing User Experience for Mother and Children Services at Sungai Duren Health Center in Muara Enim, Indonesia. PIKSEL (Penelitian Ilmu Komputer Sistem Embedded and Logic). 12(1): 11 – 22.
- Muchlisin Muchlisin, Boy Yuliadi.** 2024. Improving Network Performance of Headquarters and Branches Using Software-Defined Network WAN (SD-WAN). PIKSEL (Penelitian Ilmu Komputer Sistem Embedded and Logic). 12(1): 23-34.
- Muhammad Ariel Shakaramiro, Aris Gunaryati, Ben Rahman.** 2024. Voice Command-Based IoT on Smart Home Using NodeMCU ESP8266 Microcontroller. PIKSEL (Penelitian Ilmu Komputer Sistem Embedded and Logic). 12(1): 35-46.
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- Rakhmi Khalida, Khairunnisa Fadhillah Ramdhania.** 2024. Integration of Fuzzy AHP and TOPSIS In Decision Support System for Lecturer Academic Promotion. PIKSEL (Penelitian Ilmu Komputer Sistem Embedded and Logic). 12(1): 69-78.
- Herlawati Herlawati.** 2024. Learning Tools for Artificial Intelligence Implementation. PIKSEL (Penelitian Ilmu Komputer Sistem Embedded and Logic). 12(1): 79-88.
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- Mohammad Khoiruddin, Endang Retnoningsih, Syahbaniar Rofiah.** 2024. Smart Home System for Controlling Household Appliances Utilizing Photovoltaic Technology. PIKSEL (Penelitian Ilmu Komputer Sistem Embedded and Logic). 12(1): 127-138.
- Anuar Sanusi, Firmansyah Firmansyah, Muhammad Said Hasibuan, Nurfiana Nurfiana, Novi Herawadi S.** 2024. Policy of Academic Revitalization through Information Technology for Quality Management Enhancement in Private Higher Education Institutions in Indonesia. PIKSEL (Penelitian Ilmu Komputer Sistem Embedded and Logic). 12(1): 139-148.
- Dani Yusuf, Denis Ahmad.** 2024. P Sales Information System Utilizing 13.56 MHz RFID Member Cards for Enhanced Efficiency in Cooperative Stores. PIKSEL (Penelitian Ilmu Komputer Sistem Embedded and Logic). 12(1): 149-160.
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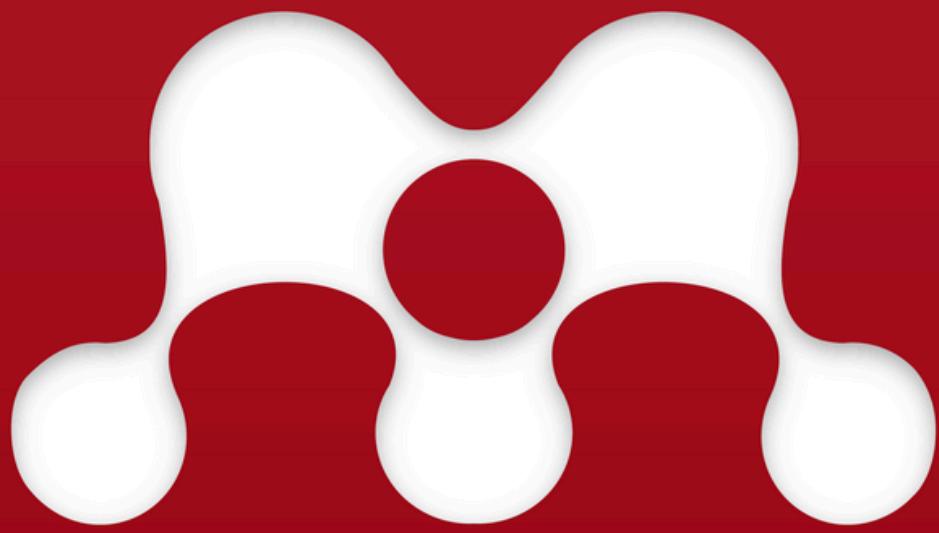
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Exemplary Teacher Selection Using a VIKOR-Based Decision Support System

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Abstract

Yadika 13 Tambun Vocational School has criteria where the school does not yet have a system that can support a decision. The decision support system (DSS) for selecting exemplary teachers in appreciating teacher performance presentations that have been made while being teaching staff is expected to increase motivation so that they can improve their performance. Many DSS methods are used to find a decision in this study. The method to be used is VlseKriterijumska Optimizacija I Kompromisno Resenje, (VIKOR) which can produce the best alternative in the form of ranking of an existing sample by looking at the utility values and weights of each sample. This study describes the design of a decision support system for conducting assessments in selecting exemplary teachers at SMK Yadika 13 Tambun. System design using UML (Unified Modeling Language). The decision support system (DSS) is very helpful for those who will carry out the assessment process, before there was a decision support system the school always found it difficult to make an assessment because it took quite a long time, the assessment was still done manually, it was difficult to calculate the assessment, sometimes there is an error in the assessment results. Therefore, with this decision support system it can help the school and minimize these problems.

Keywords: DSS, Exemplary Teacher Selection, UML, VIKOR, MCDM

1. Introduction

Information technology in today's era is rapidly evolving, where distance and time are no longer barriers in communication. Particularly in Indonesia, advancements in technology have impacted various aspects, permeating into fields such as healthcare, transportation, courier services, business, and banking. The learning innovation undertaken in the development of digital information technology utilizes the rapidly advancing information technology infrastructure in this era of the Fourth Industrial Revolution to enhance the quality of education. (Afrizal Purba & Defriyando, 2020)

Before the advent of computerization, all human tasks were performed manually. With computer-based technology, data processing becomes faster and more accurate, easing human efforts. Computers enable us to innovate and create systems to support various decision-making processes, allowing all units of work to make decisions

quickly, easily, and accurately. The presence of this new technology makes it easier for all workers and students, facilitating their work and schooling. (Anggardi et al., 2022)

An Indonesian private school, SMK Yadika 13 Tambun, was chosen as a study case, where the school does not yet have a system to support decision-making. A decision support system is an integrated set of elements that work together to generate decisions in achieving a common goal. (Waluyo & Fais Irfandi, 2019) SMK Yadika 13 Tambun has its own criteria for selecting exemplary teachers. With the aid of technology, the selection of exemplary teachers can be done quickly and easily, thus creating a decision support system for selecting exemplary teachers to appreciate the performance of teachers during their tenure as educators, and it is hoped that this will increase motivation to improve their performance.

In addition to imparting academic knowledge, teachers also guide students to have good character and morals, distinguishing between right and wrong, appropriate and inappropriate, lawful and unlawful. In carrying out their duties, a teacher is not only required to lead through words but also through behavior, actions, and real-life examples, thus motivating their students and providing good role models. Teachers, as educators, are also pivotal factors in the success of every educational endeavor. (Hazmi, 2019) This is crucial because, according to educational experts' experiences, the attitude and behavior of a teacher are far more effective than mere words, especially those not backed by tangible actions. (Prayitno & Hiswara, 2021)

The selection of exemplary teachers has positive impacts on teachers, as it can motivate all teachers to enhance the quality of their work in the teaching and learning process. It can also serve as a benchmark for teachers who are not selected as exemplary teachers to identify areas for improvement in their teaching quality and mastery of the learning materials. Therefore, SMK Yadika 13 Tambun requires a system that can support decision-making to determine exemplary teachers with the aim of facilitating the selection and assessment of exemplary teachers based on specific criteria. The selection of exemplary teachers utilizes the VIKOR method.

The VIKOR method is a technique that can produce the best alternative in the form of ranking from existing samples by considering the utility values and weights of each sample. The VIKOR method is a multi-criteria decision-making (MDCM) approach that determines a solution approaching the ideal compromise. VIKOR method is a mathematical approach used to solve multi-criteria decision-making problems (Astuti et al., 2021); (Najib et al., 2023). It is hoped that it will run effectively in the process of selecting exemplary teachers.

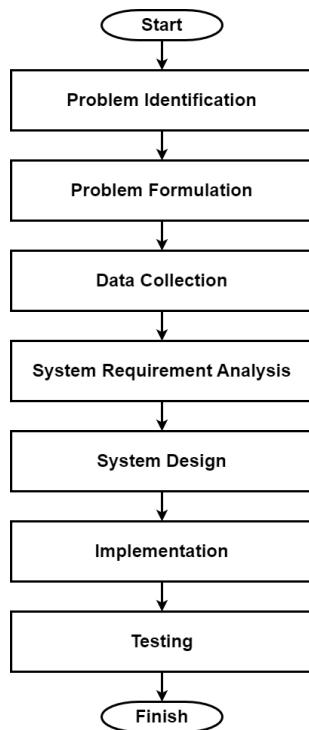
2. Research Method

2.1. System Development Methodology

In this study we employ the Waterfall method. This development approach encompasses several essential stages. Firstly, we initiate the software requirements gathering process, aiming to comprehensively understand user needs. Subsequently, the software design phase involves crafting the data structures and interface. During this stage, the software requirements, previously analyzed, are transformed into a design that will be implemented into the program. Following that, the program is developed using the HTML programming language with integration of the MySQL database. Finally, the program undergoes a thorough testing phase to ensure its proper operation and alignment with the predetermined system development objectives.

2.2. Framework

Figure 1 show the framework used in the VIKOR method for selecting exemplary teachers at SMK Yadika 13 Tambun is as follows.



Source: Research Result (2023)

Figure 1 Framework

2.3. Visekriterijumska Kompromisna Rangiranje (VIKOR) Algorithm

Decision support system using the VIKOR method (Visekriterijumska Kompromisna Rangiranje). The Vikor method aims to determine the best recommendation for cases involving multiple criteria to establish the priority sequence of existing alternatives. (Rahman, 2023) for selecting exemplary teachers at SMK Yadika 13 Tambun, involves criteria established by the school for assessing exemplary teachers. In this selection process, there are 4 (four) criteria: pedagogical, personality, social, and professional.

As an example of implementing the VIKOR method in selecting exemplary teachers, below are the criteria used in the assessment:

- 1) Determining the alternative values for each criterion. There are alternatives from the assessed teacher data, labeled A1 to A15 as an example of implementing the VIKOR method in selecting exemplary teachers. Below are the criteria used in the assessment.

A. Pedagogical Competence (C1)

Mastery of student characteristics. A teacher with strong pedagogical competence will be able to conduct a learning process that is enjoyable for their students. (Rani et al., 2020)

B. Personality (C2)

Demonstrating mature and exemplary personality traits, having a strong work ethic, high sense of responsibility, and pride in being a teacher. The quality of education is greatly determined by various factors, but the most primary and dominant factor is the quality of a teacher's personality. (Husin, 2021)

C. Social (C3)

Communication with fellow teachers, staff, parents, students, and the community. The social competence of a teacher lies in their ability to communicate and socialize effectively, especially with students. (Silalahi & Naibaho, 2023)

D. Professional (C4)

The quality of a professional teacher aims to cultivate excellent students and improve the quality of education. (Eliza et al., 2022)

Below is the alternative table, criteria values C1, C2, C3, C4. The criteria values below are obtained based on recommendations from SMK Yadika 13 Tambun Selatan school authorities.

Table 1 Alternative Values

Code	Alternative	C1	C2	C3	C4
A1	Rohnenny Saurma Tampubolon, S.Pd	30	15	10	9
A2	Jajat Ahmad Munajat, S.Pd	29	15	10	8
A3	Rizki rahmat, S.Pd	25	15	8	8
A4	Juli Dwi Susanti, S.Pd	30	15	10	8
A5	Dhani Setiawan, S.Hi., M.H	27	12	9	8
A6	Dewi Anggraini, SP	26	14	10	9
A7	Ahmad Pudoli, S.Kom	25	14	8	7
A8	Mangonggor L.Gaol, S.Pd	30	11	10	8
A9	Dewi Yuliandari, S.Pd	21	13	8	6
A10	Widi Gunarti, S.Si	30	15	10	7
A11	Rusdi,S. Pd.I	26	15	7	7
A12	Rini Subekti, S.Pd	27	14	9	9
A13	Evi Melawati Silaban, S.Pd	30	13	8	7
A14	Sri Lestari Ningsih, S.Pd	20	12	8	5
A15	Aprilis Diana Sari,S.Pd	22	14	8	7
Maximum		30	15	10	9
Minimum		20	11	7	5

Source: Research Result (2023)

2) Establishing criteria as the basis for evaluating the decision-making process in the selection of exemplary teachers.

Table 2 Criteria Weights

Code	Range Of Values	Alternative
C1	0-30	Pedagogical Competence
C2	0-15	Personality
C3	0-10	Social
C4	0-10	Professional

Source: Research Result (2023)

Table 2 shows the criteria weight, show the normalization table of the weight for each criterion, where all criteria must be normalized by dividing each weight value by the total sum of weights. Based on the importance weight, the criteria can be divided as follows on table 3:

Table 3 Criteria Importance Weights

Description	Weight
Poor	1
Fair	2
Good	3
Excellent	4

Source: Research Result (2023)

3) Determining normalization

To determine the normalization values based on the decision matrix of each alternative obtained from suitability ratings. The value X of each alternative (Ai) on the predetermined criteria (Ci) is given. Normalization calculations are performed using the decision matrix based on the criterion points (r_{ij}) of each alternative Ai on criterion Ci. The following formula is used to calculate normalization.

$$r_{ij} = \frac{x_j^+ - x_{ij}}{x_j^+ - x_j^-} \quad (1)$$

$$X = \begin{pmatrix} 30 & 15 & 10 & 9 \\ 29 & 15 & 10 & 8 \\ 25 & 15 & 8 & 8 \\ 30 & 15 & 10 & 8 \\ 27 & 12 & 9 & 8 \\ 26 & 14 & 10 & 9 \\ 25 & 14 & 8 & 7 \\ 30 & 11 & 10 & 8 \\ 21 & 13 & 8 & 6 \\ 30 & 15 & 10 & 7 \\ 26 & 15 & 7 & 7 \\ 27 & 14 & 9 & 9 \\ 30 & 13 & 8 & 7 \\ 20 & 12 & 8 & 5 \\ 22 & 14 & 8 & 7 \end{pmatrix}$$

from the above calculations, we can obtain the normalized matrix as follows:

$$R_{ij} = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0.1 & 0 & 0 & 0.25 \\ 0.5 & 0 & 0.67 & 0.25 \\ 0 & 0 & 0 & 0.25 \\ 0.3 & 0.75 & 0.33 & 0.25 \\ 0.4 & 0.25 & 0 & 0 \\ 0.5 & 0.25 & 0.67 & 0.5 \\ 0 & 1 & 0 & 0.25 \\ 0.9 & 0.5 & 0.67 & 0.75 \\ 0 & 0 & 0 & 0.5 \\ 0.4 & 0 & 1 & 0.5 \\ 0.3 & 0.25 & 0.3 & 0 \\ 0 & 0.5 & 0.67 & 0.5 \\ 1 & 0.75 & 0.67 & 1 \\ 0.8 & 0.25 & 0.67 & 0.5 \end{pmatrix}$$

4) Calculating the values of S and R

Here are the formulas used to find the values of S and R as follows:

R as follows:

$$s_i = \sum_{j=1}^n w_j \left(\frac{x_j^+ - x_{ij}}{x_j^+ - x_j^-} \right) \quad (2)$$

S as follows:

$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0.325 & 0 & 0 & 1.625 \\ 1.625 & 0 & 2.8889 & 1.625 \\ 0 & 0 & 0 & 1.625 \\ 0.975 & 3.25 & 1.4444 & 1.625 \\ 1.3 & 1.0833 & 0 & 0 \\ 1.625 & 1.0833 & 2.8889 & 3.25 \\ 0 & 4.3333 & 0 & 1.625 \\ 2.925 & 2.1667 & 2.8889 & 4.875 \\ 0 & 0 & 0 & 3.25 \\ 1.3 & 0 & 4.3333 & 3.25 \\ 0.975 & 1.0833 & 0.0833 & 0 \\ 0 & 2.1667 & 2.8889 & 3.25 \\ 3.25 & 3.25 & 2.8889 & 6.5 \\ 2.6 & 1.0833 & 2.8889 & 3.25 \end{pmatrix}$$

The result of the normalized values multiplied by the weights (3.25), (4.33), (4.33), (6.5). After obtaining the results of these multiplications, the next step is to sum up all the calculated results sequentially.

$$R_i = \text{Max } j \left[w_j \left(\frac{x_j^+ - x_{ij}}{x_j^+ - x_j^-} \right) \right] \quad (3)$$

Table 4 The values of S and R

Code	S Value	R Value
A1	0	0
A2	1.95	1.625
A3	6.1389	2.8889
A4	1.625	1.625
A5	7.2944	3.25
A6	2.383333	1.3
A7	8.8472	3.2500
A8	5.958333	4.333333
A9	12.8556	4.875
A10	3.25	3.25
A11	8.883333	4.333333
A12	3.5028	1.4444
A13	8.3056	3.2500
A14	15.8889	6.5
A15	9.8222	3.25
MIN	0	0
MAX	15.8889	6.5

Source: Research Result (2023)

5) Determining the ranking index.

With the following formula:

$$Q_i = \left[\frac{s_i - s^-}{s^+ - s^-} \right] V + \left[\frac{R_i - R^-}{R^+ - R^-} \right] (1 - v) \quad (4)$$

Table 5 Indeks Value

Alternative	(Q) Indeks Value	RANK
A1	0	1
A2	0.1864	4
A3	0.4154	7
A4	0.1761	3
A5	0.4795	8
A6	0.1750	2
A7	0.5284	11
A8	0.5208	10
A9	0.7795	14
A10	0.3523	6
A11	0.6129	13
A12	0.2213	5
A13	0.5114	9
A14	1.0000	15
A15	0.5591	12

Source: Research Result (2023)

From table 5 show that the final result of selecting exemplary teachers using the VIKOR method yields alternatives A1, A6, and A4 as alternatives with the minimum Q value, which are ranked the best.

6) Determining the compromise solution value.

To determine the compromise solution, the following formula is used:

$$Q(A(2)) - Q(Q(1)) \geq DQ \quad (5)$$

$$DQ = \frac{1}{(m - 1)}$$

Where m represents the total number of alternatives. In this compromise solution, the alternatives used to indicate the first and second ranks are alternatives A₁ and A₂ from the ranking.

$$DQ = \frac{1}{(15 - 1)} = \frac{1}{14} = 0.0714$$

$$Q(A2) - Q(A1) = 0.1864 - 0 = 0.1864$$

Based on the calculations above, the result obtained is $0.1864 \leq 0.0714$. Considering the difference value between alternative A₂ and A₁ which yields a larger value than the DQ value, the condition of acceptable advantage is fulfilled.

3. Results and Analysis

3.1. System Implementation

1) Login Page

On the admin and user login pages, one must input the username and password first to access the decision support system.

The screenshot shows a light gray header with the text 'LOGIN PAGE ADMIN'. Below it is a white form area. The first input field is labeled 'Username' and contains the text 'admin'. The second input field is labeled 'Password' and contains several asterisks ('****'). At the bottom is a blue rectangular button with the white text 'Sign In'.

Source: Research Result (2023)

Figure 2 Admin Login Page

The screenshot shows a teal header with the text 'PENILAIAN GURU TELADAN' and a menu icon. Below it is a white form area with the word 'Login' centered. There are two input fields: 'Username' and 'Password'. Below the fields is a small note in green text: 'Belum punya akun ? id:admin pass:admin'. At the bottom is a green rectangular button with the white text 'Login'.

Source: Research Result (2023)

Figure 3 Student Login Page

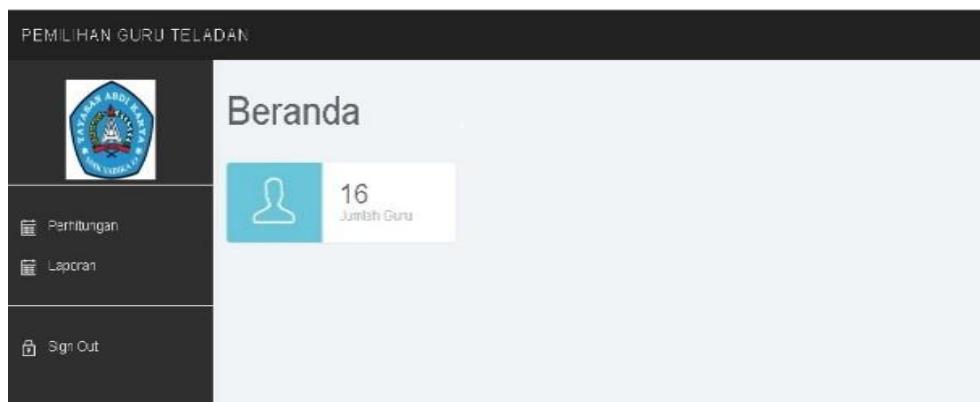
2) Dashboard Page

After logging in as admin or user, the system will automatically display the dashboard page containing teacher data, criteria data, calculations, and reports.

The screenshot shows a dark header with the text 'PEMILIHAN GURU TELADAN'. On the left is a sidebar with a logo and several menu items: 'Beranda' (selected), 'Data Guru', 'Data Kriteria', 'Perhitungan', 'Laporan', 'Pengaturan', and 'Sign Out'. The main content area has a light gray background. It features a user icon and the text '16 Jumlah Guru'.

Source: Research Result (2023)

Figure 4 admin Dashboard Page



Source: Research Result (2023)

Figure 5 Principal's Dashboard Page

A. Pedagogik (C1) (Skala 0-30)
Menguasai karakteristik peserta didik

B. Kepribadian (C2) (Skala 0-15)
Menunjukkan pribadi yang dewasa dan teladan dan memiliki etos kerja, tanggung jawab yang tinggi serta rasa bangga menjadi seorang guru

C. Sosial (C3) (Skala 0-10)
Komunikasi dengan sesama guru, karyawan, orang tua, pesera didik, masyarakat

D. Profesional (C4) (Skala 0-10)
Penguasaan materi, struktur, konsep dan keilmuan yang mendukung mapeinnya dan dapat mengembangkan keprofesionalan melalui tindakan yang reflektif

Enter

Source: Research Result (2023)

Figure 6 Teacher Evaluation Interface

3) Teacher Data Page

Upon displaying the dashboard page, the admin can choose the 'teacher data' menu, which contains teacher information. The admin can add, delete, and modify teacher data as follows:

No	NIP	Nama	Jabatan	Aksi
1	197508022001002	Risnerry Sauma Tamputeh, S.	Guru	
2	19690127199202	Jaya Ahmad Munajat, S.Pd.	Guru	
3	19730615199904	Risti Ramadhani, S.Pd.	Guru	
4	19600213199201	Jati Dewi Susanti, S.Pd	Guru	
5	197910182002005	Dian Setiawan, S.Hi., M.H	Guru	
6	194705122003006	Devi Anggraini, S.Pd	Guru	

Source: Research Result (2023)

Figure 7 Teacher Data Page

4) Criteria Data Page

After entering teacher data, the admin can also access the 'criteria data' menu. On this page, there are criteria used as parameters for assessing exemplary teachers. The admin can add, delete, and modify criteria data. Besides criteria data, this page also includes a 'manage questions' menu, which contains questionnaires used for assessing exemplary teachers, to be filled out by students as follows:

No	Id Kriteria	Nama Kriteria	Kriteria (C)	Bobot	Aksi
1		Pedagogik	C1	4	Edit Hapus
2		Kepribadian	C2	4	Edit Hapus
3		Sosial	C3	4	Edit Hapus
4		Profesional	C4	4	Edit Hapus

Source: Research Result (2023)

Figure 8 Criteria Data Page

No	Seal 1	Seal 2	Seal 3	Seal 4	AKSI	Status
1	A. Pedagogik (C1) (Skala 0-20) Anda yang baik dalam mengajar dan memberikan pengetahuan yang benar dan akurat. Karakteristik pengetahuan positif adalah:	B. Kepribadian (C2) (Skala 0-15) Anda yang baik dalam berinteraksi dengan orang lain. Karakteristik kelembutan dalam berinteraksi dengan orang lain yang baik adalah: Bersikap sopan dan berperilaku dengan baik.	C. Sosial (C3) (Skala 0-10) Anda yang baik dalam mengelola lingkungan sekitar guru. Karakteristik orang baik dalam berperilaku dalam mengelola lingkungan sekitar guru adalah:	D. Profesional (C4) (Skala 0-10) Fungsi sosial matematik, matematika dalam kehidupan sehari-hari, memecahkan masalah, dan dapat menyelesaikan berbagai tugas matematik yang diberikan.	Edit Hapus	<input checked="" type="checkbox"/> Simpan

Source: Research Result (2023)

Figure 9 The Assessment Question Page

5) Calculation Page

Once teacher and criteria data are entered, the admin can access the 'calculations' menu, which contains scores representing the assessment points given by students to the subject teachers they choose. After that, the admin can calculate all these points to determine the exemplary teachers as follows:

No	Nama Guru	Nama Mahasiswa	Skor	Rata-rata	Total
1	Juli Dwi Sulisti	Si IPB	Skor	100	100 0
2	DP Joni Sofyan	Si IPB	Skor	100	100 0
3	Elvina Agustina	Si IPB	Skor	100	100 0
4	Ahmed Putra	Si IPB	Skor	100	100 0
5	Wenny Anggraini	Si IPB	Skor	100	100 0
6	Gita Muliawati	Si IPB	Skor	100	100 0
7	Mira Qurnia	Si IPB	Skor	100	100 0
8	Rizki	Si IPB	Skor	100	100 0
9	Rini Syahrial	Si IPB	Skor	100	100 0
10	Erry Andriani	Si IPB	Skor	100	100 0
11	Wulan Hanifah	Si IPB	Skor	100	100 0
12	Rifki Syahrial	Si IPB	Skor	100	100 0
13	Erry Andriani	Si IPB	Skor	100	100 0
14	Wulan Hanifah	Si IPB	Skor	100	100 0
15	Aisyah Dahni Syah	Si IPB	Skor	100	100 0
16	Julian Pramono	Hasil Perhitungan	Skor	0	0 0

Source: Research Result (2023)

Figure 10 Calculation Result Page

6) Report Page

On the report page, there is an assessment result containing Evaluations. The admin can search for assessment results based on a period and can print out these assessment results.

Ranking	Name	Score
1	Mochamad Syaiful, S.Pd, M.Pd	80.17652
2	Dwi Handayani, S.Pd	80.54627
3	Uziq Chit Sulandri, S.Pd	80.14016
4	Ozzi Ardhiyanto, S.Pd, M.Ir	80.05146
5	Gabriella Putri Larasati, S.Pd	80.29464

Source: Research Result (2023)

Figure 11 Assessment Report Page

7) Teacher Assessment Page

The teacher assessment page contains evaluations to be filled out by students for the selected teachers

TITI Ujianti Alisyah, S.Pd

Evaluasi guru ini baik untuk mengajar dan berinteraksi dengan siswa. Guru ini selalu memberikan pengalaman yang positif bagi siswa-siswinya.

Evaluasi guru ini baik untuk mengajar dan berinteraksi dengan siswa. Guru ini selalu memberikan pengalaman yang positif bagi siswa-siswinya.

Evaluasi guru ini baik untuk mengajar dan berinteraksi dengan siswa. Guru ini selalu memberikan pengalaman yang positif bagi siswa-siswinya.

Evaluasi guru ini baik untuk mengajar dan berinteraksi dengan siswa. Guru ini selalu memberikan pengalaman yang positif bagi siswa-siswinya.

Submit

Source: Research Result (2023)

Figure 12 Teacher Assessment Page

4. Conclusion

The study on the decision support system for selecting exemplary teachers through the VIKOR method at SMK Yadika 13 Tambun lead to several key conclusions. Firstly, the presence of a decision support system significantly aids and streamlines the exemplary teacher selection process. Secondly, the introduction of this system brings about computerization in the assessment of exemplary teachers. Lastly, the decision support system proves effective in minimizing challenges encountered during the selection process of exemplary teachers. Overall, these findings underscore the positive impact of the decision support system in enhancing efficiency and mitigating issues in the selection of exemplary teachers at SMK Yadika 13 Tambun.

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Author Contributions

Dwipa Handayani, Gabriella Putri Larasati proposed the topic; Dwipa Handayani, Gabriella Putri Larasati proposed the research framework; Dwipa Handayani, Ozzi Ardhiyanto, Gabriella Putri Larasati Compiling a Research Journal.

Conflicts of Interest

The author declare no conflict of interest.

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