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INTEGRATED AHP - TOPSIS DECISION SYSTEM FOR FAIR STUDENT PERFORMANCE EVALUATION

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Abstract: Giving awards is essential to motivate students; however, selecting outstanding students at the junior high school level is often conducted manually and subjectively, which can lead to unfairness and prolonged processing time. This study develops a Decision Support System (DSS) that integrates the Analytical Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) to support objective and transparent student selection. A quantitative descriptive approach was employed, with data collected through questionnaires, interviews, and documentation at two state junior high schools in Banjarmasin City. Seven assessment criteria were applied: attendance, behavior, uniform neatness, extracurricular participation, academic grades, competition achievements, and disciplinary records. AHP was used to determine the weight of each criterion, while TOPSIS ranked students based on these weights. The web-based system was developed using PHP and MySQL and evaluated using the Technology Acceptance Model (TAM). Results show that academic grades had the highest weight (28.5%), followed by attendance (22.3%) and competition performance (15.2%). The TAM evaluation yielded average scores of 4.32 for Perceived Ease of Use, 4.40 for Perceived Usefulness, 4.15 for Attitudes Towards Use, and 4.28 for Behavioral Intention to Use. The DSS produces accurate rankings, is well-received by users, and offers an efficient, fair, and replicable solution for data-driven educational governance in the digital era.

Keywords: AHP; Banjarmasin; decision support system; student selection; TOPSIS

Abstrak: Pemberian penghargaan penting untuk memotivasi siswa, namun pemilihan siswa berprestasi di tingkat SMP sering dilakukan secara manual dan subjektif, sehingga menimbulkan ketidakadilan dan memakan waktu lama. Penelitian ini mengembangkan Decision Support System (DSS) yang mengintegrasikan metode Analytical Hierarchy Process (AHP) dan Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) untuk mendukung seleksi siswa secara objektif dan transparan. Pendekatan kuantitatif deskriptif digunakan dengan pengumpulan data melalui angket, wawancara, dan dokumentasi pada dua SMP Negeri di Kota Banjarmasin. Tujuh kriteria penilaian digunakan: kehadiran, perilaku, kerapian seragam, partisipasi ekstrakurikuler, nilai akademik, prestasi kompetisi, dan catatan pelanggaran. AHP menentukan bobot kriteria, sedangkan TOPSIS merangking siswa berdasarkan bobot tersebut. Sistem berbasis web dikembangkan menggunakan PHP dan MySQL, kemudian dievaluasi dengan Technology Acceptance Model (TAM). Hasil menunjukkan nilai akademik memiliki bobot tertinggi (28,5%), diikuti kehadiran (22,3%) dan prestasi kompetisi (15,2%). Evaluasi TAM menghasilkan skor rata-rata Perceived Ease of Use 4,32, Perceived Usefulness 4,40, Attitudes Towards Use 4,15, dan Behavioral Intention to Use 4,28. DSS ini mampu menghasilkan pemeringkatan yang akurat, diterima positif oleh pengguna, serta menjadi solusi efisien, adil, dan replikatif untuk mendukung tata kelola pendidikan berbasis data di era digital.

Kata kunci: AHP; Banjarmasin; seleksi mahasiswa; sistem pendukung keputusan; TOPSIS

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INTRODUCTION

Education plays a pivotal role in shaping future human resources [1]. One important effort is selecting high-achieving students, which serves to identify learners with significant potential [2]. Student achievement—covering both academic and non-academic aspects such as discipline, extracurricular activities, and attitudes—is a key indicator of educational quality [3]. At the junior high school level, this process should be systematic and objective to ensure fairness [4].

In practice, however, student selection often relies on manual teacher assessments, which are subjective, time-consuming, and prone to bias [5-8]. Such weaknesses reduce the reliability of outcomes [9], highlighting the need for a decision-making framework that minimizes bias and increases transparency. DSS offers a solution by automating the process and incorporating diverse criteria in a standardized way [10]. Yet, the integration of robust MCDM methods—particularly AHP and TOPSIS—remains underutilized in junior high school contexts.

AHP enables structured weighting of criteria through pairwise comparisons [11-12], while TOPSIS ranks alternatives based on proximity to the ideal solution [13-15]. Their integration provides a systematic, data-driven process that enhances objectivity and credibility [16-18]. Previous studies confirm the effectiveness of MCDM in related domains, such as aid recipient selection [19], learning model development [20], major selection [21], and scholarship evaluation [22]. However, limited research applies AHP–TOPSIS integration for outstanding student selection, presenting a critical gap.

Purpose of the Study: This study aims to develop an integrated DSS framework combining AHP and TOPSIS for the holistic selection of outstanding junior high school students. By incorporating multiple criteria—attendance, behaviour, neatness, extracurricular participation, academic performance, competition results, and discipline—the framework is expected to produce fairer and more comprehensive evaluations, contributing to improved decision-making in educational practice.

METHOD

This study applies a descriptive quantitative design with AHP–TOPSIS as a DSS framework. The process consists of four stages: (1) defining the DSS design and criteria; (2) data collection through questionnaires, interviews, and documentation from two public junior high schools in Banjarmasin; (3) analysis using AHP–TOPSIS; and (4) system development with PHP–MySQL, followed by evaluation using TAM.

Decision Criteria and Weights

Seven criteria were identified based on expert judgment and AHP calculation. Their relative importance (weights) is shown in Table 1.

AHP Method

Weights are derived through pairwise comparison:

$$\omega_i = \frac{(\prod_{j=1}^{n} a_{ij})^{\frac{1}{n}}}{\sum_{k=1}^{n}(\prod_{j=1}^{n} a_{kj})^{\frac{1}{n}}} \qquad (1)$$

Explanation:

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ω_i	:	weight of the i-th criterion
a_{ij}	:	pairwise comparison value between criterion i and criterion j
n	:	total number of criteria compared
$\sum_{k=1}^{n} (\prod_{j=1}^{n} a_{kj})^{\frac{1}{n}}$	:	normalization factor ensuring that the sum of all weights equals 1

Consistency is ensured if $CR \leq 0{,}1$, with:

$$C_i = \frac{\lambda max - n}{n-1}, CR = \frac{CI}{RI} \quad (2)$$

Explanation:

C_i	:	consistency index
λmax	:	maximum eigenvalue of the pairwise comparison matrix
n	:	number of criteria
CI	:	Random Index, a standard value based on the matrix size
CR	:	Consistency Ratio, used to measure the consistency of judgments

TOPSIS Method

Students (alternatives) are ranked through five steps: (1) normalization of the decision matrix, (2) applying weights, (3) determining positive/negative ideal solutions, (4) calculating distances to each solution, and (5) computing the closeness coefficient:

$$V_i = \frac{D_i^-}{D_i^+ + D_i^-} \quad (3)$$

Where higher V_i indicates better performance.

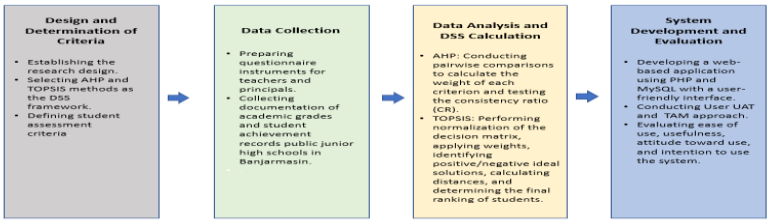

Figure 1. Research Framework of the AHP–TOPSIS

Table1. Criteria and Weights for High-Achieving Student Selection

No	Criteria	Description	Weight (w_i)
1	Student Attendance	Attend regularly and rarely late	0.12
2	Behavior	No record of rule violations	0.15
3	Uniform Neatness	Compliance with dress code	0.08
4	Extracurricular Activity	Active participation supported by documentation	0.1
5	Academic Performance	Average grade > 7.5	0.25
6	Competition Achievements	Achievements in academic/non-academic competitions	0.18
7	Disciplinary Notes	No history of serious violations (truancy, fighting, etc.)	0.12
Σ	—	—	1

System Development and Evaluation The DSS was developed with PHP

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and MySQL for web-based access. UAT with TAM showed positive acceptance in terms of usefulness, ease of use, and intention to use.

RESULT AND DISCUSSION

Result AHP

The weighting of criteria in the high-achieving student selection was carried out using AHP, which decomposes the problem into a hierarchy: (1) main goal—selection of outstanding students; (2) seven criteria—K1 (Attendance), K2 (Behavior), K3 (Neatness), K4 (Extracurricular Participation), K5 (Subject Grades), K6 (Competition Achievements), and K7 (Violation Record); and (3) 140 student alternatives from two schools in Banjarmasin. Pairwise comparisons from experts (teachers and principals) were arranged in a matrix, then normalized to obtain priority weights. The final weights of each criterion are presented in Table 2.

Normalization With TOPSIS

The TOPSIS method was used to rank students based on seven criteria: attendance, behavior, uniform neatness, extracurricular participation, academic grades, competition achievements, and disciplinary records. Data from 140 students in two junior high schools were analyzed, with five students taken as sample alternatives. The decision matrix was first normalized to equalize scales, then multiplied by AHP-derived weights to form the weighted normalized matrix. The next step identifies the positive ideal solution (D^+) and negative ideal solution (D^-). Each student's distance to A^+ and A^- is computed using the Euclidean formula, and the final preference value is obtained as:

$$V_i = \frac{D_i^-}{D_i^+ + D_i^-} \quad (2)$$

Table 2. Weighted Normalized Decision Matrix

Alternative	K1 (x w1)	K2 (x w2)	K3 (x w3)	K4 (x w4)	K5 (x w5)	K6 (x w6)	K7 (x w7)
A1	0.071	0.051	0.058	0.082	0.054	0.076	0.083
A2	0.068	0.072	0.068	0.062	0.069	0.06	0.068
A3	0.068	0.072	0.068	0.062	0.069	0.06	0.068
A4	0.068	0.072	0.068	0.062	0.069	0.06	0.068
A5	0.068	0.072	0.068	0.062	0.069	0.06	0.068

Table 3. Final Preference Value and Ranking

Student	Preference Value (V_i)	Ranking
A1	0.5811	1
A2	0.4189	2
A3	0.4189	3
A4	0.4189	4
A5	0.3978	5

The results of the students' preference scores and final rankings are presented in the following table 3.

Implementation and Evaluation

The DSS was implemented as a web-based application using PHP and MySQL on Windows 10, accessible via Mozilla Firefox. It supports schools in conducting objective and efficient student selection, with AHP calculating cri-

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terion weights and TOPSIS ranking students by preference scores. The criteria page (Figure 3) allows users to manage assessment criteria by adding, modifying, or deleting data.

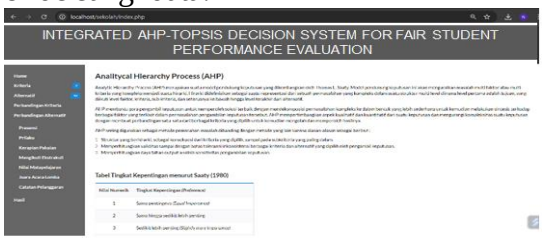

Figure 2. Main Page View

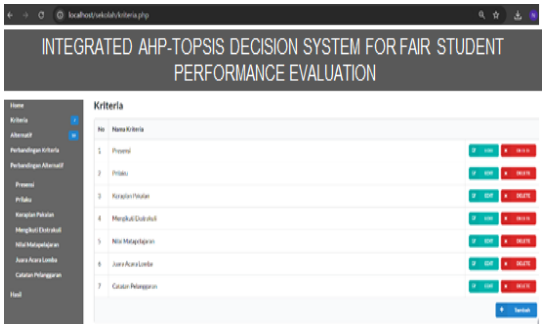

Figure 3. Criteria Page View

To evaluate the success of the system implementation, UAT was conducted using the TAM approach (Table 4).

Table 4. Results TAM

TAM Variable	Average Score	Category
Perceived Ease of Use	4.32	Strongly agree
Perceived Usefulness	4.4	Strongly agree
Attitudes Towards Use	4.15	Agree
Behavioral Intention to Use	4.28	Strongly agree

Discussion

The findings show that integrating AHP–TOPSIS into a DSS makes the selection of high-achieving students more objective, structured, and accountable. In this study, AHP determined the relative importance of seven criteria based on teacher and principal input, while TOPSIS ranked students according to their closeness to the ideal solution. Similar applications in VANET performance [23], precision manufacturing [24], and vehicle preference selection [25] confirm the model's effectiveness in handling multi-criteria problems.

The main advantage of this hybrid model lies in its ability to combine diverse academic and non-academic data while producing consistent rankings. However, challenges remain regarding evaluator subjectivity in AHP, as also noted in project consultant assessments [26]. To strengthen credibility, triangulating DSS results with historical records and teacher feedback is recommended.

Beyond student selection, the model can support decisions such as scholarship awards (PIP) and academic competition nominations. Prior studies also show that combining AHP–TOPSIS with fuzzy logic or GIS enhances its versatility across domains [27].

In short, AHP–TOPSIS is a flexible and valid approach for multi-criteria decision-making, improving fairness, objectivity, and efficiency in education. This study provides a step forward in DSS development for junior high schools. However, future work should integrate automated databases, adopt hybrid weighting (e.g., AHP–EWM [28]), and test the model in diverse school settings for broader validation.

CONCLUSION

The DSS developed in this study uses a combination of the AHP and TOPSIS methods to select high-achieving junior high school students objectively. Of the seven assessment

criteria, the highest weighting is given to academic grades (28.5%), followed by student attendance (22.3%) and competitive achievement (15.2%). The system is implemented web-based using PHP and MySQL and tested using the TAM approach. The evaluation results show an excellent level of acceptance from users with average scores: ease of use (4.32), system usefulness (4.40), attitude towards use (4.15), and intention to use (4.28). These findings prove that the AHP-TOPSIS system is not only technically effective but also well-received by teachers and principals and has the potential to be replicated to improve the quality of decision-making in education.

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