

AHP - SAW DECISION SUPPORT SYSTEM FOR AI-BASED TEACHING MATERIAL RECOMMENDATION

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Abstract: The development of Artificial Intelligence (AI) in education provides significant opportunities for supporting the development of English teaching materials in elementary schools. However, the wide variety of available AI tools makes it difficult for teachers to select the most appropriate tools for their instructional needs. This study aims to analyze and generate recommendations for AI utilization using a Decision Support System (DSS) based on the Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) methods. The AHP method is used to determine the weight of criteria based on their importance, while the SAW method is applied to rank alternative AI tools. This study involves teachers at SDN 15 Padang Genting in identifying criteria and evaluating alternatives. The results show that the proposed DSS model is capable of generating appropriate AI tool recommendations based on predefined criteria. This approach contributes to more objective and systematic decision-making in utilizing AI for developing English teaching materials in elementary education.

Keywords: analytical hierarchy proces; artificial intelligence; decision support system; simple additive weighting; teaching materials

Abstrak: Perkembangan Artificial Intelligence (AI) dalam pendidikan memberikan peluang dalam penyusunan bahan ajar Bahasa Inggris di sekolah dasar. Namun, banyaknya pilihan tools AI menyebabkan guru mengalami kesulitan dalam menentukan tools yang paling sesuai dengan kebutuhan pembelajaran. Penelitian ini bertujuan untuk menganalisis dan menghasilkan rekomendasi pemanfaatan AI menggunakan Sistem Pendukung Keputusan (SPK) berbasis metode Analytical Hierarchy Process (AHP) dan Simple Additive Weighting (SAW). Metode AHP digunakan untuk menentukan bobot kriteria berdasarkan tingkat kepentingannya, sedangkan metode SAW digunakan untuk melakukan perbandingan alternatif tools AI. Penelitian ini melibatkan guru di SDN 15 Padang Genting dalam proses identifikasi kriteria dan penilaian alternatif. Hasil penelitian menunjukkan bahwa model SPK mampu menghasilkan rekomendasi tools AI yang sesuai dengan kebutuhan pengguna berdasarkan kriteria yang telah ditentukan. Pendekatan ini memberikan kontribusi dalam mendukung pengambilan keputusan yang lebih objektif dan sistematis dalam pemanfaatan AI untuk penyusunan bahan ajar Bahasa Inggris di sekolah dasar.

Kata kunci: analisis proses hierarki; bahan ajar; kecerdasan buatan; sistem pendukung keputusan; simple additive weighting.

INTRODUCTION

The rapid development of Artificial Intelligence (AI) in recent years has brought significant transformation in the

field of education, particularly in English language learning at the elementary school level. AI technologies such as Large Language Model (LLM)-based chatbots, grammar checking systems, and

speech recognition-based learning applications have been widely utilized to enhance the quality of teaching materials, making them more interactive, adaptive, and contextually relevant [1], [2], [3]. Previous studies have demonstrated that the use of Artificial Intelligence (AI) in language learning can improve student engagement, enable personalized learning experiences, and enhance the effectiveness of instructional delivery [4], [5]. This aligns with the demands of 21st-century education, which emphasize the integration of digital technologies to support innovative and student-centered learning processes.

However, despite these advantages, the increasing number of available AI tools presents a significant challenge for teachers in selecting the most appropriate tools for developing teaching materials. Existing studies primarily focus on the implementation and benefits of AI in learning environments [6], [7], but have not specifically addressed how to systematically support teachers in selecting AI tools based on multiple criteria. In practice, the selection of AI tools is often subjective and lacks a structured decision-making approach [8], [9].

Therefore, there is a need for a systematic method to support decision-making in selecting AI tools. In this study, the combination of the Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) is proposed, as it enables structured criteria weighting and simple yet effective ranking of alternatives. This approach is considered more suitable for this context compared to other methods such as TOPSIS or Weighted Product (WP), as it offers greater simplicity, transparency, and ease of use for non-technical users such as elementary school teachers.

On the other hand, Decision Sup-

port Systems (DSS) have been widely applied to support multi-criteria decision-making processes in various fields, including education [10], [11]. The Analytical Hierarchy Process (AHP) method is used to determine the weight of criteria based on their relative importance through consistent pairwise comparisons [12], while the Simple Additive Weighting (SAW) method is employed to rank alternatives based on preference values [13]. The combination of these two methods enables a more objective and systematic decision-making process in selecting the best alternative. Nevertheless, studies that integrate DSS methods with AI utilization to provide recommendations for educational tools, particularly in the context of developing English teaching materials at the elementary school level, remain limited.

Based on preliminary observations conducted at SDN 15 Padang Genting Batu Bara, it was found that teachers have begun utilizing several AI tools in developing English teaching materials. However, approximately 70% of teachers reported difficulties in selecting appropriate AI tools that align with their instructional needs. Most of them have tried multiple tools but relied on trial-and-error approaches without systematic guidelines based on clearly defined criteria. This condition indicates the need for a system that can provide structured recommendations to support teachers in making more informed and effective decisions.

Based on the aforementioned discussion, there is a research gap in the absence of a prototype Decision Support System that integrates the AHP and SAW methods to recommend the use of AI tools for developing English teaching materials at the elementary school level. Therefore, this study aims to design a

prototype Decision Support System using the AHP–SAW method to assist teachers in selecting AI tools objectively and systematically. The developed prototype is expected to serve as an initial solution to support decision-making processes and improve the quality of English teaching materials, particularly at SDN 15 Padang Genting Batu Bara.

METHODS

This research employs a prototype design approach to develop a Decision Support System (DSS) for recommending the utilization of Artificial Intelligence (AI) in the development of English teaching materials. The method applied in this study is a combination of the Analytical Hierarchy Process (AHP) and the Simple Additive Weighting (SAW) methods. The AHP method is used to determine the weights of criteria based on their relative importance through pairwise comparisons, while the SAW method is applied to rank alternative AI tools based on preference values. These methods have been widely used in multi-criteria decision-making and are considered capable of producing objective and systematic decisions.

The research was conducted at SDN 15 Padang Genting Batu Bara, involving teachers as respondents in determining criteria and evaluating alternatives. The data used in this study consist of primary and secondary data. Primary data were obtained through observations and interviews to identify system requirements and determine relevant criteria for selecting AI tools. Secondary data were obtained from literature studies related to the use of AI in education and DSS methods based on AHP and SAW.

The methodological process begins with the construction of a decision hier-

archy consisting of goals, criteria, and alternatives. The main objective is to determine the most suitable AI tools for developing English teaching materials. The criteria used include ease of use, content relevance, AI features, learning effectiveness, and accessibility, while the alternatives consist of AI tools commonly used by teachers.

The selection of these criteria is based on a combination of literature review and preliminary observations, including interviews with teachers. The literature review identifies key factors in the adoption of AI in educational contexts, such as usability, relevance, and learning effectiveness. In addition, interviews with teachers were conducted to ensure that the selected criteria reflect practical needs and challenges faced in developing English teaching materials.

Subsequently, a pairwise comparison matrix is constructed using Saaty’s scale. The comparison matrix is expressed in Equation (1):

$$A = [a_{ij}] \tag{1}$$

where a_{ij} represents the comparison value between criterion i and criterion j . The matrix is then normalized to obtain the priority weight of each criterion using Equation (2):

$$\omega_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{i=1}^n a_{ij}} \tag{2}$$

Where ω_i denotes the weight of criterion i and n represents the number of criteria. To ensure the consistency of the pairwise comparisons, the Consistency Ratio (CR) is calculated using Equation (3):

$$CR = \frac{CI}{RI} \tag{3}$$

where the Consistency Index (CI) is calculated as follows:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \tag{4}$$

The comparison is considered consistent if $CR < 0.1$. If the CR value exceeds this threshold, the pairwise comparison needs to be revised.

After obtaining the criteria weights using the AHP method, the next step is to rank the alternatives using the SAW method. This process begins with the construction of a decision matrix containing the values of each alternative against the criteria. The normalization of the decision matrix is performed based on the type of attributes, namely benefit and cost attributes, as expressed in Equation (5):

$$r_{ij} = \begin{cases} \frac{x_{ij}}{\max x_{ij}}, & \text{For benefit attributes} \\ \frac{\min x_{ij}}{x_{ij}}, & \text{For cost attributes} \end{cases} \tag{5}$$

Where r_{ij} is the normalized value and x_{ij} is the value of alternative i with respect to criterion j . The preference value of each alternative is then calculated using Equation (6):

$$V_i = \sum_{j=1}^n w_j r_{ij} \tag{6}$$

Where V_i represents the final score of alternative i , and w_j denotes the weight of criterion j obtained from the AHP method. The alternative with the highest V_i value is selected as the best recommendation.

The entire calculation process is represented in the system prototype, which illustrates the decision-making workflow starting from criteria input, AHP weighting, to SAW ranking. The developed prototype does not focus on full software implementation but rather on representing the system logic and decision-making process. Validation is

conducted by evaluating the suitability of the recommendation results based on user responses. Therefore, the proposed method can be reproduced and serves as a foundation for further development of decision support systems.

RESULTS AND DISCUSSION

The results of this study were obtained through the application of the Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) methods to determine recommendations for Artificial Intelligence (AI) tools in developing English teaching materials at SDN 15 Padang Genting Batu Bara. The data processing was carried out based on the evaluations provided by respondents involved in the study.

The initial stage of the study involved determining the criteria used in the decision support system. These criteria were formulated based on observations, interviews, and literature reviews related to the use of AI in education. The criteria used in this study are presented in Table 1.

Table 1. Criteria for Evaluation in the Decision Support System

Kode	Criteria	Attribute Type
C1	Ease of Use	Benefit
C2	Content Relevance	Benefit
C3	AI Features	Benefit
C4	Learning Effectiveness	Benefit
C5	Accessibility	Benefit

Table 1 shows that all criteria are categorized as benefit attributes, indicating that higher values correspond to better performance. These criteria serve as the basis for weighting using the AHP

method and ranking using the SAW method. The characteristics of the respondents involved in this study are presented in Table 2.

Table 2. Respondent Characteristics

Category	Total
English Teachers	8
Classroom Teachers	12
Total	20

The table indicates that the respondents consist of both English teachers and classroom teachers involved in teaching and preparing instructional materials. These respondents provided the data used in determining the criteria weights and evaluating the alternatives.

Table 3. Criteria Weights Using AHP

Criteria	Weight
Eases Of Use	0.24
Content Relevance	0.20
AI Features	0.15
Learning Effectiveness	0.27
Accessibility	0.14

Table 3 shows that learning effectiveness has the highest weight (0.27), indicating that respondents prioritize AI tools that can improve the quality of learning. Ease of use and content relevance are also important considerations, while AI features and accessibility have relatively lower weights.

The next stage involves evaluating the alternative AI tools based on the pre-defined criteria. The evaluation results are presented in Table 4.

Table 4. Decision Matrix of AI Tool Alternatives

Alternatives	Ease	Relevance	Features	Effectiveness	Accessibility
ChatGPT	5	5	5	5	4
Grammarly	4	4	5	4	5
Canva AI	4	5	4	5	5
Quillbot	3	4	4	4	4
Bing AI	4	4	4	4	5

The data in Table 4 serve as the decision matrix in the SAW method. After normalization and preference value calculation,

The ranking results are obtained as shown in Table 5 Which Will Be Displayed in here.

Table 5. Ranking Results Using (SAW)

Alternatives	Preference Value	Rank
ChatGPT	0.92	1
Canva AI	0.88	2
Grammarly	0.85	3
Bing AI	0.83	4
Quillbot	0.78	5

Based on Table 5, ChatGPT has the highest preference value (0.92) and is therefore recommended as the best AI tool for developing English teaching materials. This result indicates that ChatGPT performs well across most criteria, particularly in learning effectiveness and ease of use. Canva AI and Grammarly also demonstrate relatively high scores but are less flexible in content generation compared to ChatGPT.

The findings indicate that the AHP method effectively determines criteria weights objectively based on their relative importance, while the SAW method provides a systematic and easily

interpretable ranking of alternatives. These results are consistent with previous studies that highlight the effectiveness of AHP and SAW in solving multi-criteria decision-making problems [10], [14].

Furthermore, the result of this study is in line with previous research on the use of Artificial Intelligence in education, which emphasizes that AI tools with strong adaptability, ease of use, and content generation capabilities tend to provide better support for learning processes [4], [5]. In particular, tools such as ChatGPT, which are based on Large Language Models (LLMs), have been reported to enhance learning effectiveness and support the development of teaching materials more flexibly compared to conventional tools. This confirms that the selection of ChatGPT as the top-ranked alternative is not only based on computational results but also supported by findings from existing literature.

The developed prototype system represents the implementation of the AHP–SAW method in a decision-making process. The prototype is designed as a mobile-based interface to facilitate user understanding of the system workflow. It consists of several main stages, including criteria input, AHP-based comparison, alternative input, and recommendation output.

The initial interface of the system is shown in Image 1, which illustrates the criteria input and AHP comparison stages.

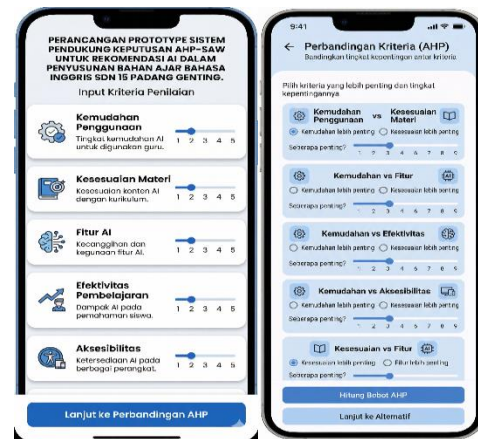


Image 1(a)

Image 1(b)

Criteria Input AHP Pairwise Comparison

Image 1 shows the initial stage of the prototype system. In Image 1(a), users input the criteria values used in the decision-making process. In Image 1(b), users perform pairwise comparisons among criteria to determine their weights using the AHP method.

The next stage of the system is illustrated in Image 2, which shows the alternative input and recommendation output.



Image 2 (a)

Image 2 (b)

Alternative Input Recommendation Results

Image 2 illustrates the subsequent stages of the system. In Image 2(a), users evaluate AI tool alternatives based on the defined criteria. In Image 2(b), the system displays the results in the form of

preference values and rankings of the alternatives.

Overall, the results demonstrate that the proposed prototype Decision Support System is capable of providing relevant and structured recommendations. The system not only performs mathematical calculations but also presents a clear implementation of the decision-making process, making it easier for users to understand and apply. Therefore, the prototype can serve as an effective initial solution for assisting teachers in selecting AI tools systematically in developing English teaching materials.

CONCLUSION

This research developed a prototype Decision Support System (DSS) using the AHP–SAW method to support the selection of Artificial Intelligence (AI) tools for developing English teaching materials at the elementary school level.

The results demonstrate that the proposed approach is able to generate structured and objective recommendations based on predefined criteria. The system successfully identifies the most suitable AI tool by integrating criteria weighting and alternative ranking within a single decision-making framework.

The findings confirm that AI tools with higher usability, relevance, and effectiveness tend to be more suitable for supporting the development of English teaching materials. The developed prototype also provides a clear representation of the decision-making process, making it easier for teachers to understand and apply the system in practice.

This research contributes by proposing a practical AHP–SAW-based decision model and a prototype system that can be used as a reference for selecting

AI tools in educational contexts. Future work should focus on implementing the system in a fully functional platform, expanding the dataset, and evaluating user satisfaction to enhance system effectiveness.

BIBLIOGRAPHY

- [1] E. Kasneci, “ChatGPT for Good? On Opportunities and Challenges of Large Language Models for Education,” *Learn. Individ. Differ.*, 2023.
- [2] I. M. García-López, C. S. González González, M. S. Ramírez-Montoya, and J. M. Molina-Espinosa, “Challenges of implementing ChatGPT on education: Systematic literature review,” *Int. J. Educ. Res. Open*, vol. 8, no. October 2024, 2025.
- [3] X. Weng and T. K. F. Chiu, “Instructional design and learning outcomes of intelligent computer assisted language learning: Systematic review in the field,” *Comput. Educ. Artif. Intell.*, vol. 4, no. December 2022, p. 100117, 2023.
- [4] S. N. Q. A’yun, “Pemanfaatan AI Dalam Pembelajaran Bahasa Inggris: Transformasi Pendidikan Moderen,” *MIJ Maliki Interdiscip. J.*, vol. 3, no. 7, pp. 65–73, 2025.
- [5] W. Wiboolyasar, K. Wiboolyasar, P. Tiranant, N. Jinowat, and P. Boonyakitanont, “AI-driven chatbots in second language education: A systematic review of their efficacy and pedagogical implications,” *Ampersand*, vol. 14, no. May, p. 100224, 2025.

- [6] P. Panagiotidis, “LLM-Based Chatbots in Language Learning,” *Eur. J. Educ.*, vol. 7, no. 1, pp. 102–123, 2024.
- [7] O. Zawacki-Richter, “Systematic Review of AI Applications in Education,” *Int. J. Educ. Technol. High. Educ.*, 2020.
- [8] R. Sari, “Sistem Pendukung Keputusan Pemilihan Media Pembelajaran Online Menggunakan Metode TOPSIS,” *Remik*, vol. 5, no. 1, pp. 69–75, 2020.
- [9] A. B. Paryanti, “JURNAL ILMIAH M-PROGRESS,” vol. 12, no. 2, pp. 139–149, 2022.
- [10] F. D. Putri and D. Kurniadi, “Integrasi Metode Analytic Hierarchy Process (AHP) dan Sistem Digital Untuk Penilaian Kompetensi Mahasiswa Informatika,” vol. 9, pp. 22228–22238, 2025.
- [11] A. Suryadi, A. Adam Muiz, and A. Alpan Hidayat, “Implementation of a Decision Support System for Selecting the Best Supplier Using the SAW Method,” *bit-Tech*, vol. 7, no. 3, pp. 928–935, 2025.
- [12] P. K. D. Pramanik, S. Biswas, S. Pal, D. Marinković, and P. Choudhury, “A comparative analysis of multi-criteria decision-making methods for resource selection in mobile crowd computing,” *Symmetry (Basel)*, vol. 13, no. 9, pp. 1–51, 2021.
- [13] J. F. Merchán Sánchez-Jara, S. González Gutiérrez, J. Cruz Rodríguez, and B. Syroyid Syroyid, “Artificial Intelligence-Assisted Music Education: A Critical Synthesis of Challenges and Opportunities,” *Educ. Sci.*, vol. 14, no. 11, 2024.