

Application of Simple Additive Weighting Method in Web-Based Student Learning Interest Detection Using Digital Questionnaires

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ABSTRACT

Learning interest plays a vital role in shaping students' motivation and academic achievement, particularly at the junior high school level, where students are required to determine their educational pathways. However, the major selection process in schools is often based on subjective judgments rather than systematic evaluation of students' interests, which may lead to inappropriate recommendations. This study develops a web-based decision support system to identify student learning interests and support major selection using a structured approach. Data were collected from 18 Grade IX students through a digital questionnaire designed based on predefined learning interest criteria. The Simple Additive Weighting (SAW) method is applied to calculate preference scores and generate major recommendations. The research methodology includes requirements analysis, system design, implementation, and testing. System functionality was evaluated using Black Box Testing to ensure that all features operate correctly. The results show that the system successfully processes questionnaire responses and produces consistent recommendations based on SAW calculations. Black Box Testing confirms that all functions operate as expected without errors. The proposed system demonstrates that integrating digital questionnaires with SAW can provide a structured, transparent, and efficient decision support tool for junior high school major selection. Although this system is currently limited to the junior high school level, it has the potential to be further developed for broader educational levels.

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1. INTRODUCTION

Interest in learning is a psychological factor that plays a crucial role in the educational process, as it affects students' motivation, level of engagement, and academic performance. Several studies indicate that students' learning interest has a positive and significant impact on academic achievement, meaning that the higher the level of interest, the better the learning outcomes achieved [1]. Students whose learning interests align with their field of study generally demonstrate more active and consistent learning behavior and are able to develop their potential more optimally. Recent international studies have also shown that student engagement and learning involvement are closely associated with academic performance and educational outcomes. Education itself is an important pillar in supporting a country's progress, where student achievement becomes one of the main indicators of success in the learning process [2]. Therefore, identifying and mapping students' learning interests is an essential step in efforts to improve the quality of education, especially at the junior high school (SMP) level.

At the junior high school level, particularly for ninth-grade students, learners are in the final stage of basic education, which requires readiness in determining the direction of their further studies. At this phase, students begin to face important decisions related to the selection of majors or fields of interest at the senior high school level, which will influence their learning process, competency development, and future educational opportunities. The choice of major is influenced not

only by parents and peers but also by students' expectations, personal interests, and perceptions of educational opportunities. Recent international research has highlighted that major selection decisions are strongly influenced by individual interests, academic expectations, and environmental factors, making appropriate educational guidance essential for students at this stage [3]. However, in practice, the process of selecting majors for ninth-grade junior high school students is often still based on subjective considerations, such as parental influence, peer suggestions, or students' personal perceptions, without being supported by systematic and measurable analysis of learning interests. As a result, many students feel uncertain about whether the chosen major truly suits them or not [4]. This situation can potentially lead to a mismatch between the selected major and the student's actual learning interests.

Based on these conditions, several main problems can be identified, including the absence of a system that is able to objectively measure the learning interests of ninth-grade students, the dominance of subjectivity in the major selection process, and the limited utilization of information technology in supporting decision-making at the junior high school level. A decision support system can help simplify the process of selecting majors and provide appropriate recommendations based on student data, thereby reducing subjectivity [5]. This issue often arises when students choose majors based solely on personal preferences without considering their actual academic abilities and learning interests, which can result in learning difficulties and less optimal academic outcomes [6]. In addition, previous studies have shown that the use of computer-based systems can improve objectivity and accuracy in the major selection process compared to conventional manual methods [7]. Nevertheless, many schools still face limitations in providing tools that are capable of systematically mapping students' learning interests as a basis for major recommendations.

The problem of choosing a major that does not align with students' learning interests is an issue with a high level of urgency. Several studies indicate that a mismatch between the selected major and students' interests can lead to decreased learning motivation and lower academic achievement at the subsequent educational level. Students who choose majors that are not in accordance with their interests are also more vulnerable to experiencing learning difficulties and academic dissatisfaction, which can negatively impact their overall educational outcomes [8]. Ninth-grade students who experience such mismatches often encounter obstacles in following the learning process at the next level, which may lead to decreased motivation, lower academic performance, and reduced participation in learning activities. Furthermore, the development of a decision support system based on the SAW method aims to assist users in determining majors objectively, highlighting the importance of a data-driven approach in minimizing subjectivity compared to manual methods [9]. In vocational education, the curriculum is generally competency-based and integrates theory with practice according to the chosen field of study [10]. In the long term, inappropriate major selection can hinder students' potential development and affect their readiness in planning future education. Therefore, preventive efforts are required to minimize errors in major selection through a more objective and data-oriented approach.

Along with the advancement of information technology, Decision Support Systems (DSS) have been widely applied to support complex and multi-criteria decision-making processes in various fields, including education. Several Multi-Criteria Decision-Making (MCDM) methods have been utilized in DSS, such as the Analytic Hierarchy Process (AHP), the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Rank Order Centroid (ROC), and Simple Additive Weighting (SAW). AHP is effective in determining criteria priorities through pairwise comparisons, but it requires consistency testing and more complex calculations. TOPSIS provides alternative rankings based on their distance from ideal solutions; however, the computational process is relatively more complicated. ROC is commonly used to determine criteria weights but is generally combined with other decision-making methods. Compared to these approaches, SAW offers a simpler calculation process, transparent ranking results, and ease of implementation in web-based systems. Therefore, SAW is considered suitable for supporting major recommendation decisions based on students' learning interest data [11]. Previous studies have applied the SAW method in educational decision-making, particularly for major selection. However, most of these studies primarily focused on academic achievement and have not integrated direct measurement of students' learning interests through structured online questionnaires [12].

Despite the growing application of DSS and MCDM methods in educational decision-making, several limitations remain in existing studies. Recent international studies have highlighted the importance of personalized educational recommendation systems in supporting students' educational decisions [13]. Although web-based DSS and recommendation systems have been widely implemented, most studies focus on academic performance, course recommendations, or higher education contexts [14]. Research specifically addressing the identification of learning interests among Grade IX junior high school students remains limited [15]. Furthermore, the integration of structured online questionnaires with the SAW method in a web-based platform for major recommendation has received limited attention in previous studies. This condition indicates a clear research gap in the development of decision support systems that prioritize learning interest as the primary criterion for major selection. Based on this gap, the present study aims to design and implement a web-based application for detecting the learning interests of Grade IX junior high school students using an online questionnaire. The proposed system applies the SAW method to process learning interest data and generate major recommendations. The main contribution of this study lies in integrating learning interest assessment and SAW-based decision-making within a web-based platform specifically designed for junior high school students. By emphasizing learning interest rather than relying solely on academic performance, the proposed system provides a more comprehensive and objective approach to supporting major selection decisions. The developed application is expected to assist students and schools in selecting majors that match students' learning interest profiles in a structured and technology-based manner.

2. RESEARCH METHOD

This study employed a quantitative approach with a software engineering research design. The objective of this study was to design and implement a web-based Decision Support System (DSS) for detecting the learning interests of Grade IX junior high school students and providing major recommendations for the next level of education. Decision Support Systems have been widely used to support complex decision-making processes by integrating data, analytical models, and user interfaces, thereby improving objectivity and transparency in multi-criteria evaluations. The Simple Additive Weighting (SAW) method was selected because it can process multi-criteria data objectively, measurably, and transparently, making it suitable for educational decision-making. The basic concept of the SAW method is to calculate the weighted sum of performance ratings for each alternative across all criteria [16].

Data collection was conducted using an online questionnaire integrated into the developed web-based system. The participants consisted of 18 Grade IX junior high school students who were selected using a total sampling technique, where all available students in the target group were involved in the study. The use of online questionnaires facilitates the processes of data collection, processing, and storage in a structured and efficient manner and has been widely applied in educational decision support systems [17]. The questionnaire was developed based on five learning interest criteria, namely interest in subject matter, interest in practical activities, learning motivation, suitability with talents, and consistency of interest. These criteria were used to represent students' learning interest profiles and to support the major recommendation process.

To ensure that the questionnaire reflected the intended learning interest indicators, the questionnaire items were developed based on the defined criteria and reviewed during the system design stage. Students completed the questionnaire independently through the web-based system and were informed that there were no right or wrong answers. This procedure was intended to encourage honest responses and reduce potential response bias. However, because the data were collected through self-reported responses, the possibility of subjective bias remains one of the limitations of this study.

The questionnaire responses were converted into numerical values using a Likert scale and then processed using the Simple Additive Weighting (SAW) method. The criteria used in the decision-making process consisted of interest in subject matter, interest in practical activities, learning motivation, suitability with talents, and consistency of interest. Each criterion was assigned a predefined weight according to its importance in assessing students' learning interests. The SAW method was then applied through the processes of decision matrix construction, normalization, weighted score calculation, and ranking to generate major recommendations objectively [18].

The research procedure was carried out systematically to describe the overall system workflow, which is divided into two main processes: the student user flow and the administrator management flow. In the student flow (Figure 1), the process begins when students access the web-based system, fill in their personal data, and complete the learning interest questionnaire. Previous studies have explained that the development of web-based information systems in educational contexts allows questionnaire completion and data storage to be conducted online, thereby accelerating data collection processes and reducing input errors compared to conventional manual methods [19]. All responses provided by students are stored in the system database for further processing in subsequent stages of the SAW calculation.

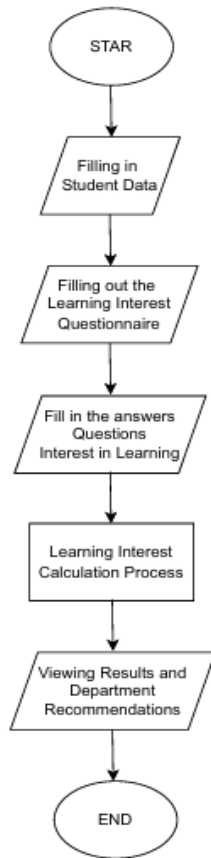


Figure 1. Student system flowchart.
(Source: Developed by the Author)



Figure 2. Admin system flowchart.
(Source: Developed by the Author)

In the administrator flow (Figure 2), the administrator manages the questionnaire data stored in the database. These data are grouped according to the predetermined learning interest assessment criteria and organized into a decision matrix. The process then continues with matrix normalization and preference value calculation using the Simple Additive Weighting (SAW) method. The final result of this calculation process is a recommended major, which is then displayed to students through the system interface.

In this study, the Simple Additive Weighting (SAW) method is used to determine the best alternative based on the weighted sum of each criterion value. Previous research has shown that the SAW method is an effective multi-criteria decision-making technique that calculates weighted scores for each alternative and ranks them to determine the best choice in an objective and efficient manner [20]. In this research, the evaluated alternatives consist of the available major options, while the assessment criteria are structured based on indicators of students’ learning interests. The alternatives and the learning interest criteria along with their respective weights are presented in Table 1 and Table 2.

Table 1. List of alternatives used in the learning interest selection process

Criteria Code	Criteria	Type	Weight
C1	Interest in Material	Benefits	30
C2	Interest in Practice	Benefits	25
C3	Motivation to learn	Benefits	20
C4	Suitability with Talent	Benefits	15
C5	Consistency of Interest	Benefits	10

(Source: Developed by the Author)

Table 2. List of criteria used in the assessment process in the SAW method.

Alternative Code	Alternative
A1	Natural science
A2	Social science
A3	Islamic religion
A4	Software engineering
A5	Computer and Network Engineering

A6	Visual communication design
A7	Pharmacy
A8	Nursing
A9	Dental health
A10	Accounting and financial institutions
A11	Office management and business services
A12	Online business and marketing
A13	Automatic light vehicle engineering
A14	Electrical power installation techniques
A15	Industrial electronics engineering

(Source: Developed by the Author)

The SAW calculation process begins with the construction of a decision matrix based on the value of each alternative with respect to each criterion. The Simple Additive Weighting (SAW) method is a multi-criteria decision-making method that determines the preference value of alternatives by adding the weighted values of each criterion [21]. Next, a normalization process is performed to equalize the assessment scale, because all criteria used in this study are benefit criteria. After normalization, the preference value is calculated by multiplying each normalized value by the corresponding criterion weight and then summing the results. The SAW algorithm applies a weighted summation to determine the ranking of alternatives after the normalization process, so that the alternative with the highest preference value can be identified as the best recommendation [22].

The system implementation is demonstrated through several main interfaces. Figures 3–7 present the main user interfaces, including the student registration page, questionnaire pages, and learning interest assessment pages. Meanwhile, Figures 8–11 illustrate the SAW calculation process, which includes the formation of the decision matrix, normalization results, and preference ranking. These interfaces are designed to ensure that the data input, processing, and result presentation processes can be carried out in a structured, efficient, and user-friendly manner

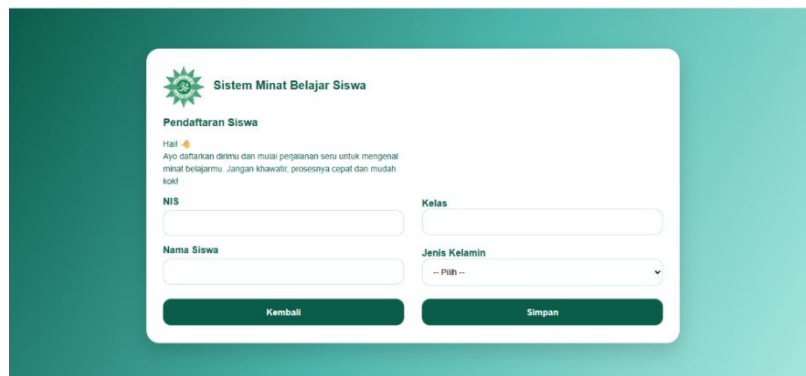


Figure 3. Student registration interface for the learning interest system.
(Source: Developed by the Author)

Figure 3, the student registration page is used as the initial access point to the system, where students enter their basic personal data. This data is stored in the system database and used as the basis for subsequent questionnaire completion and learning interest data processing.



Figure 4. Student identification interface for questionnaire access.
(Source: Developed by the Author)

Figure 4, the questionnaire completion page is used to collect student responses and associate each submission with the corresponding student to support individualized data processing.

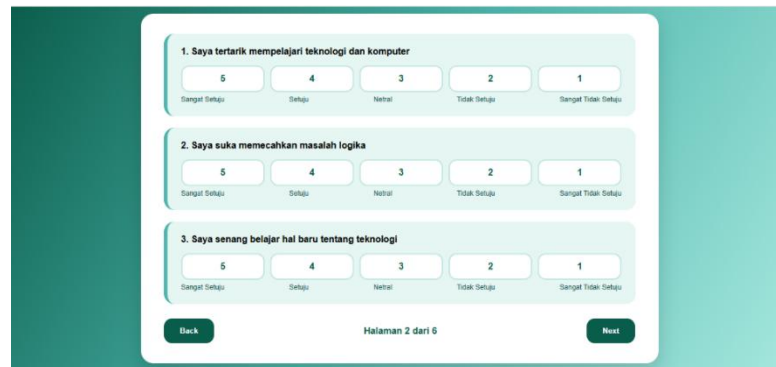


Figure 5. Questionnaire for determining students’ areas of interest. (Source: Developed by the Author)

Figure 5, this page presents the student interest questionnaire, where the responses are collected and used as input data for further processing using the Simple Additive Weighting (SAW) method.

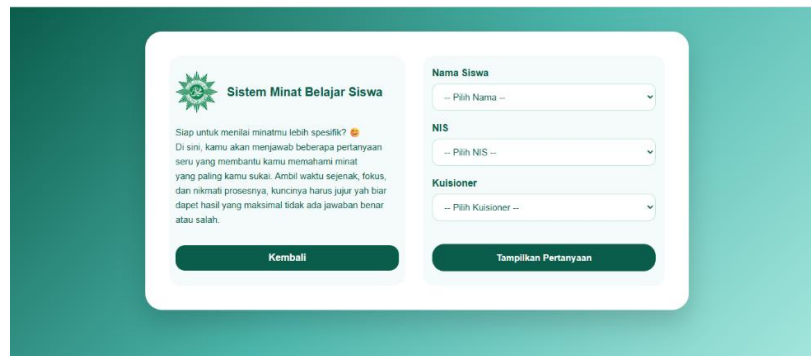


Figure 6. Interface for collecting student interest data. (Source: Developed by the Author)

Figure 6, this page is used to collect detailed learning interest data based on the results of the previous questionnaire, which are then used as input for further processing in the system.



Figure 7. Assessment questions for scoring each criterion. (Source: Developed by the Author)

Figure 7, this page presents questions related to students’ areas of interest, and the collected data are used as input for processing using the Simple Additive Weighting (SAW) method to generate major recommendations.

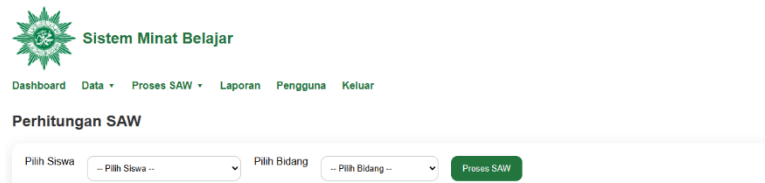


Figure 8. Implementation of the SAW calculation process.
(Source: Developed by the Author)

Alternatif	minat terhadap materi	Keterarikan Praktek	Motivasi Belajar	Kesesuain Dengan Bakat	konsistensi minat
Keperawatan	0	0	0	0	0
kesehatan gigi	0	0	0	0	0
Farmasi	0	0	0	0	0

Figure 9. Decision matrix before normalization.
(Source: Developed by the Author)

Alternatif	minat terhadap materi	Keterarikan Praktek	Motivasi Belajar	Kesesuain Dengan Bakat	konsistensi minat
Keperawatan	0.000	0.000	0.000	0.000	0.000
kesehatan gigi	0.000	0.000	0.000	0.000	0.000
Farmasi	0.000	0.000	0.000	0.000	0.000

Figure 10. Normalization result table.
(Source: Developed by the Author)

Ranking	Alternatif	Nilai SAW
1	Keperawatan	0.0000
2	kesehatan gigi	0.0000
3	Farmasi	0.0000

Figure 11. Preference score ranking of all alternatives.
(Source: Developed by the Author)

Figure 8, Figure 9, Figure 10, dan Figure 11, the calculation page presents the processing of student learning interest data using the Simple Additive Weighting (SAW) method. The system automatically performs the construction of the decision matrix, normalization, and preference score calculation based on student input data. The calculation results are then used as the basis for determining and displaying major recommendations.

The calculation results produce a preference value for each alternative major, where the major with the highest preference value is determined as the primary recommendation for students. In line with previous research on web-based decision support systems for determining high-achieving students, the results of SAW calculations are presented in the form of a ranking from the highest to the lowest preference value, making it easier for users to understand and interpret the recommendation results [23]. The ranking-based visualization helps users clearly identify the most suitable major based on the calculated preference values. In this study, the calculation results are presented systematically to ensure clarity and ease of understanding. Examples of calculation results and major recommendations are visualized on the system results page, as shown in Figure 12 and Figure 13.

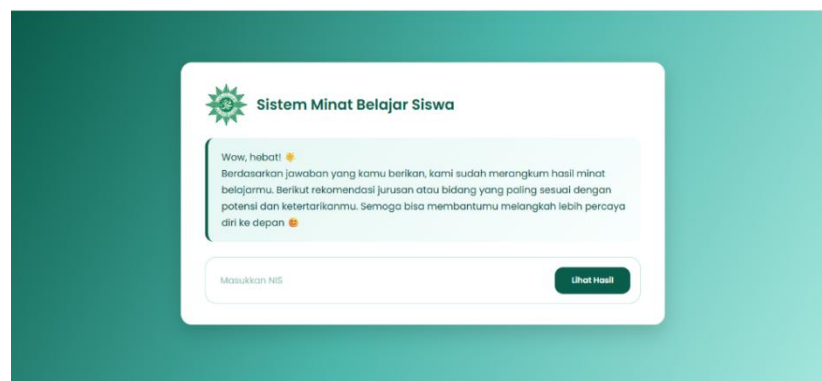


Figure 12. Initial display of student learning interest results and major recommendations.
(Source: Developed by the Author)

Figure 12, the results and major recommendation page presents the final output of the student learning interest assessment, displaying the recommended major based on the Simple Additive Weighting (SAW) method.



Figure 13. Major recommendation results based on the Simple Additive Weighting (SAW) method. (Source: Developed by the Author)

Figure 13, the system displays students’ learning interest information along with the recommended major, which is determined based on the highest preference score generated by the Simple Additive Weighting (SAW) method.

After all system features are implemented, including the registration page, questionnaire completion, the calculation process, and the presentation of results and major recommendations, the next stage of this research is system testing to ensure that all system functions operate according to user requirements. System testing is conducted to evaluate the functionality of the application as a whole. In research on testing decision support systems for determining student majors, it is explained that black-box testing is used to test the main functions of the system without examining the internal program structure, thereby ensuring that all forms and features work in accordance with the specified requirements [24].

System testing was conducted using the black-box testing method to ensure that all system functions operate according to the specified requirements. Black-box testing focuses on validating system functionality by examining the conformity between input and output without considering the internal program structure. Previous studies have shown that black-box testing is effective for evaluating functional requirements in web-based applications, particularly in verifying the accuracy of data processing and output results [25]. The testing process in this study includes filling out the learning interest questionnaire, processing data using the SAW method, and displaying major recommendation results. The test results indicate that the system is able to generate major recommendations that are consistent with the input data provided by students based on their learning interests.

3. RESULTS AND DISCUSSION

3.1 System Implementation Results

This study produced a web-based Decision Support System designed to detect the learning interests of Grade IX junior high school students and provide major recommendations using the Simple Additive Weighting (SAW) method. The system supports two types of users, namely students and administrators. Students can register, enter personal information, and complete learning interest questionnaires online, while administrators manage student data, criteria, questionnaire items, and recommendation results.

The system workflow begins with student registration, followed by the completion of an online learning interest questionnaire. The collected data are stored in the system database and processed to generate individual learning interest profiles. The SAW method is then applied to calculate preference scores for each available major alternative based on predefined criteria and weights.

Based on the calculation results, the major with the highest preference score is selected as the primary recommendation for each student. The implementation results demonstrate that the system can automatically process questionnaire responses, perform SAW calculations, and generate major recommendations in a structured and systematic manner. Furthermore, Black Box Testing results indicated that all system functions operated according to their specified requirements. The integration of data collection, processing, and recommendation generation within a single web-based platform demonstrates that the developed system functions effectively in supporting major selection decisions.

3.2 Discussion of Research Results

The results of the system implementation indicate that the Simple Additive Weighting (SAW) method can support the generation of major recommendations based on students’ learning interest profiles. The use of online questionnaires enables learning interest data to be collected in a structured and measurable manner, thereby reducing the subjectivity commonly associated with conventional manual assessment processes. This finding is consistent with previous studies that report the effectiveness of SAW-based decision support systems in supporting educational decision-making. By integrating data collection, processing, and recommendation generation within a single web-based platform, the proposed system provides a more systematic approach to major selection for Grade IX students.

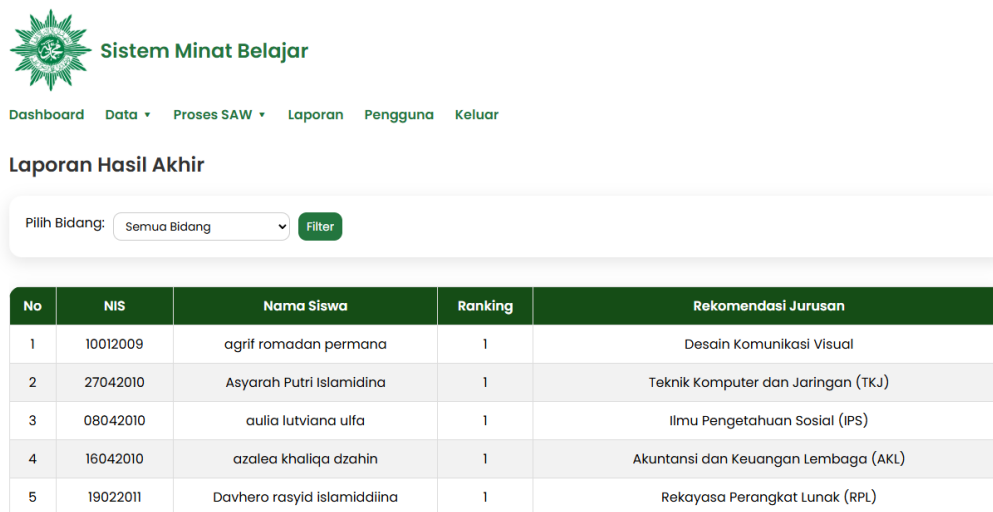


Figure 14. presents the results of the web-based system in detecting students’ learning interests. (Source: Developed by the Author)

As illustrated in Figure 14, the system displays students’ learning interest assessment results along with the recommended majors based on the highest preference scores. This visualization helps translate abstract learning interest tendencies into concrete recommendations, making the results easier for students to understand and interpret.

The findings of this study are consistent with previous research that applied the SAW method in educational decision support systems. Several studies reported that the SAW method is capable of producing objective and transparent rankings of alternatives based on multiple criteria, particularly in the context of major selection and academic decision-making. Compared to conventional manual methods, the integration of SAW within a web-based system enables a more systematic and data-oriented decision-making process, which minimizes human bias and subjectivity.

Furthermore, the results of this study support previous findings that emphasize the role of information technology in improving the accuracy and objectivity of educational guidance services. By automating the data processing and recommendation generation process, the developed system ensures consistent evaluation of students’ learning interests and reduces dependency on subjective judgments from educators or counselors.

From a practical perspective, the developed system provides significant benefits for students by helping them recognize their learning interests at an early stage, which can serve as an important consideration when selecting a major at the next level of education. For schools, particularly in guidance and counseling activities, the system functions as a supporting tool that provides objective, transparent, and data-driven recommendations to assist academic decision-making.

However, this study has several limitations. The system is specifically designed for ninth-grade junior high school (SMP) students and focuses on a predefined set of major alternatives and learning interest criteria. As a result, the findings of this study are limited to this particular educational context and may not be directly generalized to other educational levels or institutions without further modification. In addition, the system relies on self-reported questionnaire data, which may be influenced by students’ perceptions and honesty when responding.

Despite these limitations, system testing results indicate that all system functions operate properly and meet user requirements. Overall, the implementation of the SAW method within a web-based decision support system proves to be effective in supporting an objective, transparent, and technology-based approach for identifying students’ learning interests and providing major recommendations. The system offers meaningful contributions to both students and school administrators as a reliable tool for educational guidance and informed decision-making.

4. CONCLUSION

This study developed a web-based decision support system to identify the learning interest tendencies of Grade IX junior high school students using an online questionnaire and the Simple Additive Weighting (SAW) method. The developed system is capable of transforming students’ responses into structured information that can be used as the basis for generating major recommendations. The implementation results demonstrate that the system can support a more systematic and objective major selection process by considering students’ learning interest profiles.

The integration of the SAW method and online questionnaires provides a transparent decision-making mechanism that can assist schools in reducing subjectivity during major selection. Therefore, schools may utilize the developed system as a supporting tool for educational guidance and counseling activities, particularly in helping students identify educational pathways that align with their interests and potential.

Nevertheless, this study has several limitations. The system was evaluated using data from only 18 Grade IX students, and the questionnaire responses were based on self-reported perceptions, which may introduce subjective bias. In

addition, the study focused solely on learning interest criteria and did not incorporate other factors such as academic achievement, aptitude test results, or socio-economic considerations.

Future research may involve larger and more diverse participant groups, extend the implementation to other educational levels, such as senior high schools or vocational schools, and compare the performance of SAW with other Multi-Criteria Decision-Making methods such as AHP, TOPSIS, or ROC. Further development may also integrate additional assessment criteria and advanced analytical techniques to improve recommendation quality and system scalability.

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