

Development of a Web-Based Decision Support System for Academic Program Selection Using the Weighted Product Method

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ABSTRACT

In the era of digital transformation, higher education institutions face increasing demands to provide effective, data-driven tools that support student decision-making. One critical decision for prospective students is selecting an academic program that aligns with their interests, academic abilities, and future career goals. This study presents the development of a web-based Decision Support System (DSS) that applies the Weighted Product (WP) method to recommend the most suitable academic program for new university applicants. The system allows users to input criteria such as academic performance, aptitude test scores, and personal interests. These inputs are then processed using the WP method, which calculates a weighted score for each available program option. The top-ranked programs are displayed as recommendations to the user. The system was evaluated through User Acceptance Testing (UAT) involving 30 participants, and the results showed a high level of user satisfaction in terms of ease of use, accuracy, and responsiveness. This solution not only reduces subjectivity and inefficiencies in manual selection processes but also encourages informed, data-based decision-making. The implementation of this DSS demonstrates how technology can enhance educational guidance services and improve student placement outcomes in higher education.

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1. INTRODUCTION

In the digital era, educational institutions are increasingly embracing information systems to streamline processes and improve decision-making efficiency. One of the areas that can benefit from such innovations is the selection of academic programs by prospective students. The transition from manual to digital systems in academic decision-making has shown to improve accuracy, transparency, and user satisfaction [1], [2]. Many students, especially fresh high school graduates, experience confusion in choosing the right study program due to limited information, lack of guidance, and insufficient understanding of their own interests and competencies [3], [4]. This mismatch can lead to academic dissatisfaction and high dropout rates [5]. To address these issues, decision support systems (DSS) have been widely used to assist users in evaluating alternatives and selecting the most suitable option based on multiple criteria [6]. Particularly, web-based DSS offers accessibility and scalability which are highly suitable for educational settings [7], [8]. Various

methods, such as the Analytic Hierarchy Process (AHP), Simple Additive Weighting (SAW), and Weighted Product (WP), have been implemented to support such systems [9]–[11].

The Weighted Product (WP) method, as a part of multi-criteria decision-making (MCDM), has proven to be efficient for ranking alternatives with multiple attributes [12]. Unlike SAW, which uses addition, the WP method utilizes multiplication to aggregate the criteria scores, making it more sensitive to large differences in weights and values [13]. Several studies have demonstrated the effectiveness of WP in various decision-making domains, including scholarship selection, employee recruitment, and medical diagnosis systems [14]–[16]. Its application in the educational domain, however, remains limited, especially in the context of academic program recommendation systems [17]. A system that employs the WP method can help match student preferences and competencies with appropriate study programs, improving the alignment between student interests and program characteristics [18]. Furthermore, the use of such models can support institutional efforts in guiding prospective students objectively and systematically [19]. The method's flexibility, coupled with the accessibility of a web-based platform, enhances the practicality and impact of its implementation [20].

Despite the growing number of technology-based educational solutions, many institutions still rely on conventional methods for academic advising. At Universitas Sumatera Utara, for instance, program selection is often done manually through interviews with marketing or academic staff, which is time-consuming and prone to subjective bias. This traditional approach also lacks scalability and standardization [5], [10]. Moreover, without a structured model, students may select programs that are inconsistent with their academic background, skills, or career aspirations [4], [8]. Integrating a decision support system into the admissions process can minimize these issues and facilitate data-driven decision-making [6], [9]. A DSS that can analyze various inputs such as academic performance, personal interests, and aptitude test results will offer a more comprehensive evaluation mechanism [11]. Additionally, digital transformation in education aligns with global trends in adopting smart campus frameworks and enhancing institutional digital maturity [2], [12].

The development of a web-based DSS using the WP method is expected to contribute positively to both student experience and institutional outcomes. By guiding students toward study programs that best match their profile, the system can improve student satisfaction, reduce academic mismatch, and potentially increase retention and graduation rates [15], [17]. From the institutional perspective, such a system enhances the quality of the admissions process, enables data analytics, and strengthens reputation through improved academic performance indicators [18]. Moreover, web technologies allow for real-time data input, multi-user interaction, and integration with other institutional systems such as academic records and recommendation engines [13], [19]. Prior research indicates that web-based systems, when designed with user-centric approaches, can significantly improve usability and acceptance among prospective students [14], [20]. Thus, the integration of the WP method into a web platform represents an ideal combination of algorithmic accuracy and technological flexibility to support academic decisions.

This paper presents the development of a web-based decision support system to assist in academic program selection for new students using the Weighted Product method. The main objective is to provide an intelligent tool that can assist prospective students in choosing study programs that best align with their interests, academic abilities, and long-term goals. The remainder of the paper is organized as follows: Section 2 presents the methodology for system design and data processing, Section 3 discusses the results and user feedback, and Section 4 provides conclusions and directions for future development. The findings of this study are expected to contribute to the advancement of digital decision support tools in education and serve as a model for other institutions aiming to modernize their admissions process.

2. METHOD

This research employed the Research and Development (R&D) approach using the Waterfall software development model, which includes the following phases: requirement analysis, system design, implementation, testing, and deployment. This methodology was chosen because it provides a structured and sequential development process suitable for building a decision support system with clearly defined requirements and output.

2.1. Requirements Analysis

At this stage, a needs assessment was conducted by interviewing university staff from the marketing and academic departments, as well as prospective students. The aim was to identify the current problems in academic program selection and understand user expectations. Based on this assessment, it was found that program selection is still done manually and lacks systematic evaluation criteria. The data used in the system include academic scores (e.g., high school GPA), interests, aptitude test results, and self-assessment questionnaires.

2.2. System Design

The system was designed using a web-based architecture to ensure accessibility and ease of use. The frontend was developed using HTML, CSS, and JavaScript, while the backend utilized PHP and MySQL for data management. The Weighted Product (WP) method was embedded into the system logic to process input data and rank available study programs. In this method, each criterion is assigned a weight based on its importance, and each alternative (study program) is evaluated using a multiplicative formula:

$$S_i = \prod_{j=1}^n x_{ij}^{w_j}$$

Where:

S_i : The score for alternative i

x_{ij} : The value of criterion j for alternative i

w_j : The weight of criterion j

All input data are normalized before computation to ensure comparability between different scales of criteria.

2.3. Implementation

The system was implemented using a modular structure, consisting of several components:

- a. User Interface Module for student data input and results display
- b. Data Processing Module for performing normalization and WP calculations
- c. Admin Module for managing criteria, weights, and program data

Sample data from 50 prospective students were used during implementation for system testing and validation.

2.4. Testing

The testing phase used black-box testing to ensure that each module functioned correctly according to the specified inputs and outputs. In addition, user acceptance testing (UAT) was carried out with a group of 10 academic staff and 20 prospective students to evaluate system usability, accuracy of recommendations, and interface friendliness. Feedback was collected via questionnaires and direct observation.

2.5. Deployment

Finally, the system was deployed on a local web server using Apache and tested for multiple simultaneous users. The system was designed to be scalable and integrated with existing student admission platforms if needed. Future improvements were also identified based on user feedback.

3. RESULTS AND DISCUSSION

3.1. System Implementation Results

The web-based Decision Support System (DSS) for academic program selection was successfully developed using the Weighted Product (WP) method. The system was implemented with an intuitive user interface consisting of form inputs for user data such as academic performance, interests, and aptitude test scores. Administrators could define the criteria and assign their respective weights through a dedicated admin dashboard. The front-end was built using HTML, CSS, and JavaScript, while the back-end was developed using PHP with MySQL as the database.

The system flow is as follows:

- a. Prospective students log in and enter their personal data.
- b. The system processes the input based on predefined criteria and weights.
- c. A ranked list of recommended academic programs is displayed to the user based on the WP method.

This implementation addresses previous issues in manual selection processes that lacked consistency and objectivity. The recommendation output provides more structured and data-driven decisions, ensuring better alignment with student interests and competencies.

3.2. Sample Output

A sample case from one prospective student inputting the following values:

- a. Academic Score: 85
- b. Aptitude Test: 78
- c. Interest in Technology: High

Using pre-defined weights (Academic Score: 0.5, Aptitude: 0.3, Interest: 0.2), the WP calculation provided ranked results as:

- a. Informatics Engineering – Score: 0.893
- b. Information Systems – Score: 0.852
- c. Computer Engineering – Score: 0.810

These results indicate the highest recommendation is for Informatics Engineering. Students reported that this guided decision helped them realize previously unconsidered options aligned with their actual profile.

3.3. User Acceptance Testing (UAT)

To evaluate system effectiveness and user satisfaction, a User Acceptance Test was conducted with 30 participants (20 prospective students and 10 staff members). The evaluation criteria included:

- a. Ease of Use
- b. Accuracy of Recommendations
- c. System Speed and Responsiveness
- d. Visual Interface Quality

The results are summarized below:

Table 1. Evaluation Criteria

Evaluation Criteria	Satisfaction Level (out of 5)
Ease of Use	4.6
Accuracy of Recommendations	4.5
Responsiveness	4.4
Visual Design	4.3

The high average score across all categories (mean = 4.45) indicates that the system is well-received. Participants appreciated the data-driven recommendations and intuitive interface.

3.4. Discussion

The implementation of the WP method in a decision support system for academic program selection brings several advantages:

- a. It enables objective evaluation of candidates based on multiple weighted criteria.
- b. It reduces manual errors and improves decision-making consistency.
- c. It fosters better self-reflection among students, as they consider their aptitude and interests more seriously.

Compared to other DSS techniques like Simple Additive Weighting (SAW), the WP method provides a multiplicative model that is more sensitive to low values, thus reducing the likelihood of inflated scores due to high performance in only one criterion.

However, challenges such as determining appropriate weight values and ensuring accurate user input remain and will be considered in future work.

4. CONCLUSION

This research has successfully developed a web-based Decision Support System (DSS) that utilizes the Weighted Product (WP) method to assist prospective students in selecting the most suitable academic program based on multiple criteria. The system enables automated, objective, and consistent decision-making by processing academic performance, aptitude tests, and student interests.

The results demonstrated that the WP method is effective in generating accurate and reliable program recommendations. User acceptance testing (UAT) showed high levels of user satisfaction in terms of system usability, accuracy of recommendations, and visual interface quality. The system also helps reduce subjectivity and inefficiencies in the manual selection process traditionally used in higher education institutions.

In addition, the system provides added value for both prospective students and educational institutions by aligning student competencies and interests with the most appropriate program options. This can potentially improve student retention, academic performance, and future career satisfaction.

Future research may focus on integrating adaptive learning algorithms or machine learning techniques to further refine recommendations. Expanding the criteria set and implementing mobile-based access are also recommended to enhance system accessibility and personalization.

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