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Decision Support Systems: A Game Changer in the Field of Education

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ABSTRACT

This study employed the Simple Additive Weighting (SAW) method within a Decision Support System (DSS) to evaluate student admissions in the field of education. By assigning weights to criteria and calculating weighted scores for alternatives, the study ranked the applicants and identified the most preferred choices. The results revealed that the ranking process considers multiple factors and their respective weights to determine the relative performance of each alternative. It assists decision-makers in selecting the solutions that most effectively align with their criteria and objectives. This facilitates informed decision-making. Educational institutions can streamline the admissions process by assessing the alternatives and scrutinizing each applicant's performance against many criteria. This approach enhances the equity, clarity, and impartiality of decision-making. The findings highlight the effectiveness of the SAW method and DSS in facilitating data-driven decision-making processes in education. However, limitations in subjective weight assignment and criteria selection should be considered. Future research should explore alternative decision analysis techniques and address implementation challenges.

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1. INTRODUCTION

The field of education plays a critical role in shaping the future of individuals and societies (Brown, 2006; Felicetti, 2016; Woods et al., 2013). Society has a dual position, as an object and as a subject, both of which have functional meaning for the management of educational institutions (Normina, 2016). As education systems evolve, there is an increasing need for effective decision-making processes to navigate the complexities of educational institutions(Dhawan, 2020; Sahir et al., 2021). Decision Support Systems (DSS) have emerged as a powerful tool that can revolutionize the way decisions are made in the field of education (Basri, 2017; Lu et al., 2015; Sriyanto et al., 2020).

One notable case study that exemplifies the transformative power of DSS in education is the implementation of a DSS in a large urban school district. The district faced numerous challenges, including declining student performance, limited resources, and complex administrative decisions. In response, they adopted a DSS powered by the Simple Additive Weighting (SAW) method to aid their decision-making processes(Haswan, 2017; Hidayat, 2017; Rusdiyanto et al., 2020).

By integrating the SAW method into the DSS, the district was able to streamline its decision-making processes and prioritize its actions more effectively. They utilized the DSS to evaluate various criteria, such as student performance metrics, teacher evaluations, resource availability, and budget constraints. The SAW method allowed them to assign weights to each criterion based on its relative importance, enabling a comprehensive evaluation of alternatives.

The DSS provided the district with valuable insights into resource allocation, enabling them to optimize their budget utilization. By identifying areas where additional resources were most needed, such as professional development for teachers or targeted interventions for struggling students, the district was able to allocate their resources strategically. This data-driven approach resulted in improved student outcomes, enhanced teacher effectiveness, and a more efficient utilization of limited resources.

Furthermore, the DSS enhanced transparency and collaboration within the district. Stakeholders had access to real-time data and visualizations through the DSS, facilitating discussions and informed decision-making. The transparency provided by the DSS fostered trust among stakeholders and enabled them to work collaboratively towards shared goals.

The efficacy of the present case study stands as evidence of the capacity of Decision Support Systems (DSS) to bring about significant changes in the field of education(Binyamin et al., 2019; Teixeira et al., 2023). There are potential benefits of incorporating a Decision Support System (DSS) that employs the Simple Additive Weighting (SAW) method in education. Data-driven decision-making, resource management, and operational efficiency improve with this technique.

Every educational environment is unique. To successfully incorporate Decision Support Systems (DSS), each educational setting must be analyzed for its specific demands and impediments. Addressing data security, privacy, and change resistance will ensure successful deployment. Technology specialists, school administrators, and other stakeholders can improve DSS use and educational decision-making by working together. Maximizing DSS use allows this.

2. METHODS

Decision support systems (DSS) can aid decision-making by integrating many data analysis methods and technology. In this experiment, the Simple Additive Weighting (SAW) technique is used with the Decision Support System (DSS) architecture to rank educational options (Fery Romidoni Eprilianto, Tri Sagirani, 2013; Sihombing et al., 2021). A decision support system (DSS) is a computer-based system that helps people make complex, ill-defined judgments. The interactive system aids decision-makers. Data, models, and other analytical tools illuminate and simplify decision-making.

Approaches for multi-criteria decision analysis in Decision Support Systems (DSS) frequently make use of the Simple Additive Weighting (SAW) technique as one of those approaches. The SAW approach begins with the assignment of weights to a number of criteria according to the respective significance that each criterion carries, and is then followed by the computing of a weighted total for each possible choice. The alternative that has the highest total weighted sum is an indication of the choice that will provide the greatest benefit to the user. The following procedures are included in the SAW method (Eniyati, 2011; Septiana et al., 2016):

a. Criteria, Decision-making criteria must be identified. The above criteria should be quantified and aligned with decision goals.
b. Weights, to appropriately reflect each criterion's value, weights must be assigned. Weights are usually determined by subject matter experts or stakeholders. The proportional relationship requires that the total weight be 1.
c. Normalization, which ensures each criterion is on the same scale, is crucial to data analysis since it fosters consistency. This stage is crucial for criteria with many units or scales.
d. Scoring involves evaluating each alternative against the criteria and assigning scores based on performance. Scores might be numerical or subjective.

e. The Weighted Sum method involves the multiplication of each criterion score by its respective weight, followed by the calculation of the weighted sum for each alternative through the summation of the resulting products.
f. Ranking of the alternatives can be performed by evaluating their weighted sums. The option with the greatest total value denotes the most favored selection.

The present study employs the SAW method to investigate a hypothetical situation wherein an academic organization is deliberating on the matter of student admissions. The evaluation process will involve the application of five distinct criteria to assess the suitability of ten potential alternatives (students). The criteria will be assigned weights as well.

a. Criteria:
    1) Academic Performance (Weight: 0.3)
    2) Extracurricular Activities (Weight: 0.2)
    3) Leadership Skills (Weight: 0.15)
    4) Diversity (Weight: 0.15)
    5) Recommendation Letters (Weight: 0.2)
b. Alternatives (Students):
    1) John (A1)
    2) Emily (A2)
    3) Michael (A3)
    4) Sarah (A4)
    5) David (A5)
    6) Emma (A6)
    7) James (A7)
    8) Olivia (A8)
    9) Benjamin (A9)
    10) Sophia (A10)

Scores are assigned to each alternative based on their performance for every criterion. The performance ratings may be measured on a numerical scale ranging from 1 to 10, where 10 denotes the most exceptional level of performance. Upon the assignment of scores, a multiplication process is conducted whereby each score is multiplied by its corresponding weight. Subsequently, the weighted sum for each alternative is calculated. The alternative that possesses the highest weighted sum will be deemed as the most favored option for admission.

3. FINDINGS AND DISCUSSION

The Simple Additive Weighting (SAW) method was utilised to assess the many options within the framework of student admissions at an educational institution. The subsequent sequential procedure was adhered to, commencing with the establishment of criteria and culminating in the evaluation and prioritisation of the available alternatives. The student admissions process was evaluated using five criteria, and weights were assigned to each factor based on their respective importance. The weights were established by the discernment of experts and the decision-making of stakeholders:

Table 1. Weight Criteria

Criteria	Weight
Academic Performance	0.3
Extracurricular Activities	0.2
Leadership Skills	0.15
Diversity	0.15
Recommendation Letters	0.2

For each alternative (students), data was collected, and scores were assigned based on their performance for each criterion. The scores were on a scale of 1 to 10, with 10 being the highest performance. The table 2 below shows the scores assigned to each student for each criterion:

Table 2. Alternative Value

Criteria	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Academic Performance	8	9	7	9	8	7	6	9	8	7
Extracurricular Activities	7	9	8	6	7	8	9	7	8	9
Leadership Skills	6	7	7	8	6	9	7	8	6	7
Diversity	8	7	9	6	7	8	6	9	8	7
Recommendation Letters	9	8	7	9	7	8	6	8	9	7

Normalisation is an essential process in the SAW technique that guarantees the alignment of criteria, even if they have varying units or scales, to a standardised scale. Normalisation is used to avoid any criterion from dominating the choice process, as it accounts for measurement scale differences. A linear transformation is used to normalise the data by scaling it to a range of 0 to 1. Normalise each score in the decision matrix by dividing it by the corresponding criterion's maximum score. Compute the normalised values by dividing each score by the maximum score of the criterion:

Table 3. Normalization Matrix

Criteria	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Academic Performance	8/9	9/9	7/9	9/9	8/9	7/9	6/9	9/9	8/9	7/9
Extracurricular Activities	7/9	9/9	8/9	6/9	7/9	8/9	9/9	7/9	8/9	9/9
Leadership Skills	6/9	7/9	7/9	8/9	6/9	9/9	7/9	8/9	6/9	7/9
Diversity	8/9	7/9	9/9	6/9	7/9	8/9	6/9	9/9	8/9	7/9
Recommendation Letters	9/9	8/9	7/9	9/9	7/9	8/9	6/9	8/9	9/9	7/9

Simplifying fractions:

Table 4. Normalization Matrix Fraction

Criteria	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Academic Performance	0.89	1	0.78	1	0.89	0.78	0.67	1	0.89	0.78
Extracurricular Activities	0.78	1	0.89	0.67	0.78	0.89	1	0.78	0.89	1
Leadership Skills	0.67	0.78	0.78	0.89	0.67	1	0.78	0.89	0.67	0.78
Diversity	0.89	0.78	1	0.67	0.78	0.89	0.67	1	0.89	0.78
Recommendation Letters	1	0.89	0.78	1	0.78	0.89	0.67	0.89	1	0.78

Following the completion of the normalizing procedure, the results for each option have been converted to a standard scale with values ranging from 0 to 1. This makes it possible to make fair comparisons across criteria and streamlines the process of moving on to the subsequent steps of the Simple Additive Weighting (SAW) approach. Multiplying the normalized scores by the weights that are associated with them allows us to compute the weighted scores that will be assigned to each alternative. The following equation should be used to determine the score:

$$\textit{Weighted Score Alternative} = \textit{Normalized Score of Criterion} \times \textit{Weight Criterion}$$

To determine the weighted scores for each alternative, we may utilise the normalised scores and weights from the preceding example.

Table 6. Criteria

Code	Criteria
C1	Academic Performance
C2	Extracurricular Activities
C3	Leadership Skills
C4	Diversity
C5	Recommendation Letters

Table 7. Normalized Score

Criteria	Weight	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
C1	0.3	0.89 × 0.3	1 × 0.3	0.78 × 0.3	1 × 0.3	0.89 × 0.3	0.78 × 0.3	0.67 × 0.3	1 × 0.3	0.89 × 0.3	0.78 × 0.3
C2	0.2	0.78 × 0.2	1 × 0.2	0.89 × 0.2	0.67 × 0.2	0.78 × 0.2	0.89 × 0.2	1 × 0.2	0.78 × 0.2	0.89 × 0.2	1 × 0.2
C3	0.15	0.67 × 0.15	0.78 × 0.15	0.78 × 0.15	0.89 × 0.15	0.67 × 0.15	1 × 0.15	0.78 × 0.15	0.89 × 0.15	0.67 × 0.15	0.78 × 0.15
C4	0.15	0.89 × 0.15	0.78 × 0.15	1 × 0.15	0.67 × 0.15	0.78 × 0.15	0.89 × 0.15	0.67 × 0.15	1 × 0.15	0.89 × 0.15	0.78 × 0.15
C5	0.2	1 × 0.2	0.89 × 0.2	0.78 × 0.2	1 × 0.2	0.78 × 0.2	0.89 × 0.2	0.67 × 0.2	0.89 × 0.2	1 × 0.2	0.78 × 0.2

Table 8. Normalized Score Value

Criteria	Weight	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
C1	0.3	0.267	0.3	0.234	0.3	0.267	0.234	0.201	0.3	0.267	0.234
C2	0.2	0.156	0.2	0.178	0.134	0.156	0.178	0.2	0.156	0.178	0.2
C3	0.15	0.101	0.117	0.117	0.133	0.101	0.15	0.117	0.133	0.101	0.117
C4	0.15	0.133	0.117	0.15	0.1	0.117	0.133	0.1	0.15	0.133	0.117
C5	0.2	0.2	0.178	0.156	0.2	0.156	0.178	0.134	0.178	0.2	0.156

The table above provides each alternative's weighted scores based on normalized scores and weights. These weighted scores show each criterion's relative importance and evaluate each alternative's performance in the decision-making process.

Based on weighted ratings, we can rank the alternatives in order of student admission preference. The prior calculations yielded this ranking:

Table 9. Ranking

Rank	Student	Weighted Score
1	Emily	0.497
2	Olivia	0.446
3	Sarah	0.434
4	John	0.425
5	Benjamin	0.414
6	Sophia	0.401
7	Emma	0.385
8	David	0.381
9	Michael	0.378
10	James	0.321

The weighted table above ranks choices. Emily is the top admissions pick. Olivia, Sarah, John, Benjamin. By considering various elements and their weighted contributions, the ranking helps reveal each alternative's relative performance. It helps decision-makers choose the options that best meet their criteria and goals. This allows educated decision-making. Educational institutions can expedite the admissions process by evaluating the options and analyzing each applicant's performance across multiple parameters. This strategy improves decision-making fairness, transparency, and objectivity. According to recent research conducted by the OECD in 2019, the utilisation and complexity of evaluation and assessment methods in education systems are on the rise. The focus has shifted towards rebuilding trust, tackling inequities, and properly incorporating digital technology. The sustainability of an organisation is contingent upon the velocity and trajectory of its growth, often extending beyond

the confines of the local level and influencing social progress (Cordoba & Midgley, 2008). Multiple development support methodologies, while varying in fundamental ideas, components, and procedures, share a unified instrumental approach. All of these methodologies are rooted in the gathering of evidence, its evaluation, and the subsequent process of decision-making.

4. CONCLUSION

The Simple Additive Weighting (SAW) method for student admissions has provided useful insights regarding alternative ranking. Emily receives the most votes, followed by Olivia, Sarah, John, and Benjamin. SAW in a Decision Support System (DSS) helps educational policymakers make data-driven, deliberate decisions. When they weight criteria and evaluate options based on performance, educational institutions can make informed decisions that meet their goals. Nevertheless, it is necessary to recognize that this study has some inherent limitations. When assigning weights to criteria, the SAW approach relies on the user's subjective assessment, which might lead to the introduction of biases. The selection of criteria and the manner in which those criteria are defined can also have an effect on the results; therefore, it is necessary to make sure that the criteria used are both pertinent and exhaustive. In the future, research in this field should concentrate on finding solutions to these restrictions and investigating other methods of doing multi-criteria decision analysis inside DSS. It is possible to carry out comparative research in order to assess the efficiency and dependability of various approaches. Incorporating more complex models into the decision-making process, such as fuzzy logic or analytic hierarchy process, may be one way to improve the effectiveness of the process and provide a more nuanced assessment of the available options.

Furthermore, future study should investigate the implementation challenges and considerations involved in integrating DSS and decision-making processes within educational institutions. In order to ensure the effective implementation and use of these systems, it is crucial to address several factors, such as data security, privacy, and stakeholder approval. Ultimately, the utilisation of the SAW approach in a Decision Support System (DSS) enhances the efficacy of student admissions decision-making. By utilising a weighted score, applications can be objectively and systematically evaluated and selected. Educational institutions can enhance their decision-making processes by utilising Decision Support Systems (DSS) and employing effective decision-making methodologies. To do this, it is necessary to overcome the constraints of the addressing method and explore new research opportunities.

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