Al-Ishlah: Jurnal Pendidikan
Vol.15, 4 (December, 2023), pp. 5015-5022
ISSN: 2087-9490 EISSN: 2597-940X, DOI: 10.35445/alishlah.v15i4.4360

Decision Support Systems in Education: A Revolutionary Approach to Teaching and Learning

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ARTICLE INFO

Keywords:

Decision Support System; Learning; SAW Method; Teaching

Article history:

Received 2023-06-30
Revised 2023-11-08
Accepted 2023-12-28

ABSTRACT

This research investigates how a method known as Simple Additive Weighting (SAW), which is a tool for making decisions based on multiple criteria, might be utilized in the field of education. The goal is to determine the most effective techniques for enhancing the educational process based on a variety of variables, such as student performance, the efficacy of teachers, the relevance of the curriculum, the allocation of resources, and student participation. According to the findings, the solutions that are most likely to be chosen include introducing more interactive teaching methods as well as instituting a school-wide gamification system. However, some limitations of the SAW technique have been recognized. These shortcomings include the method's assumption of the independence of criteria and its sensitivity to weight assignments. The paper's authors concluded by giving suggestions for future research topics. These include the investigation of the impact different weight assignments have on the findings obtained by using the SAW approach, as well as the exploration of other decision-making systems. This research is an important contribution to the expanding body of knowledge on the application of decision-support systems in education and offers insightful information that can be helpful to teachers, school administrators, and policymakers.

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1. INTRODUCTION

Education is a cornerstone of societal development, shaping the future of individuals and communities(Silver, H.F., Hanson, J.R., Strong, R.W. & Schwartz, 1996). However, the traditional approach to teaching and learning has been challenged in recent years due to rapid technological advancements and changing societal needs(Chen et al., 2014; Majid et al., 2012; Zhang et al., 2004). This has necessitated a revolutionary approach to education, one that leverages modern technology to enhance teaching and learning processes.

One such revolutionary approach is the use of Decision Support Systems (DSS) in education(Shee & Wang, 2008). DSS are computer-based information systems that support complex decision-making and problem-solving activities(Aljuaidi, 2017; Doumpos & Zopounidis, 2010; Sahir et al., 2018; Sriyanto

et al., 2020; Verina et al., 2019). They have been widely used in various fields such as healthcare(Csibi et al., 2018), business(Primasari et al., 2018), and now, education(Bondarev et al., 2015). By providing timely, relevant, and accurate information, DSS can help educators and administrators make informed decisions that enhance the learning experience.

A computer-based information system that helps a company or other organization's decision-making processes is called a Decision Support System (DSS)(Karismariyanti, 2011; Kharisman Ndruru, 2020; Primadasa & Juliansa, 2019). DSS are used at an organisation's management, operations, and planning levels (often the middle and upper management levels), and they assist employees in making decisions regarding issues that may be subject to rapid change and cannot be easily stated in advance.

There are three possible configurations for the DSS: totally computerized, somewhat human-powered, or a combination of the two(Fery Romidoni Eprilianto, Tri Sagirani, 2013). Users of decision support systems view the software in a different light than academics do; they see it not as a tool to help decision-making processes but as a tool to facilitate organizational operations. Some DSSs are intended to be utilized by a single user, while others are intended to be utilized by numerous users simultaneously (Parrangan et al., 2018).

Knowledge-based systems are included within DSS. A decision support system (DSS) is an interactive software-based system that, when properly developed, is meant to assist decision-makers in compiling relevant information from raw data, documents, personal knowledge, or business models to identify and solve problems and make decisions. Decision support systems (DSS) are typically used for managerial and strategic decisions, whereas operational applications are employed for routine and structured decisions. DSSs are used in many areas, from healthcare to education, and can help with everything from software operations to strategic planning and policymaking. DSSs can aid with everything from software operations to strategic planning and policymaking. DSS often uses the Simple Additive Weighting (SAW) method for multi-criteria decision-making (Afshari et al., 2010; Haswan, 2017). The SAW method is best for weighing many elements of varying importance. It involves weighing each criterion according to its importance and producing a weighted sum for each choice to rank them in order of preference.

This paper focuses on the application of the Simple Additive Weighting (SAW) method in DSS for education. The SAW method is a popular multi-criteria decision-making method that computes a weighted sum for each alternative to rank them in terms of preference(Cubukcu Cerasi, 2022). By assigning weights to different criteria, the SAW method allows for a more nuanced and comprehensive decision-making process.

Previous research has highlighted the potential of DSS in improving teaching and learning outcomes. For instance, studies have shown that DSS can aid in curriculum planning, resource allocation, student assessment, and teacher performance evaluation(Mora et al., 2017). However, there is a research gap in the application of the SAW method in DSS for education. Most studies have focused on other decision-making methods, leaving the potential of the SAW method largely unexplored (Konstantinidis & Bamidis, 2016).

Moreover, the education sector faces numerous challenges that could potentially be addressed by DSS. These include issues related to resource allocation, curriculum development, student performance evaluation, and teacher assessment(Ploywattanawong, 2016). The use of DSS could help in addressing these challenges by providing a systematic and objective approach to decision-making. This study aims to fill this research gap by investigating the effectiveness of DSS using the SAW method in the education sector. The goal is to understand how this approach can revolutionize teaching and learning processes, enhance decision-making capabilities, and ultimately, improve educational outcomes. The findings of this study could provide valuable insights for educators, administrators, and policymakers, guiding them in their efforts to transform education for the better.

2. METHODS

Simple Additive Weighting (SAW) has minimal steps:

a. Define Criteria and Alternatives: Determine the criteria that are essential for making the choice as well as the options that are currently under consideration.
b. Assign Criteria Weight: Consider the significance of each factor before deciding how much weight to give it. The weights ought to be normalized in such a way that their sum equals 1.
c. Alternatives Score: For each possibility, score each criterion. The alternative's score should represent its criterion compliance.
d. Count the Weight each Alternative: For each choice, multiply the score for each criterion by its weight, then add these products. Each possibility has a weighted sum.
e. Alternatives Ranking: Weighted sums rank the options. The most weighted option is preferred.

See Figure 1 for a diagram processing SAW method in DSS process.

Figure 1. SAW Method process

The first step in adopting the Simple Additive Weighting (SAW) approach in the case study "A Revolutionary Approach to Teaching and Learning" is defining the criteria and alternatives.

Table 1. Criteria for Teaching and Learning

ID Criteria	Criteria Name
C1	Improve Student Performance
C2	Enhance Teacher Effectiveness
C3	Increase Curriculum Relevance
C4	Optimize Resource Allocation
C5	Improve Student Engagement

Mermaid diagrams are used to visualize table 1 criteria.

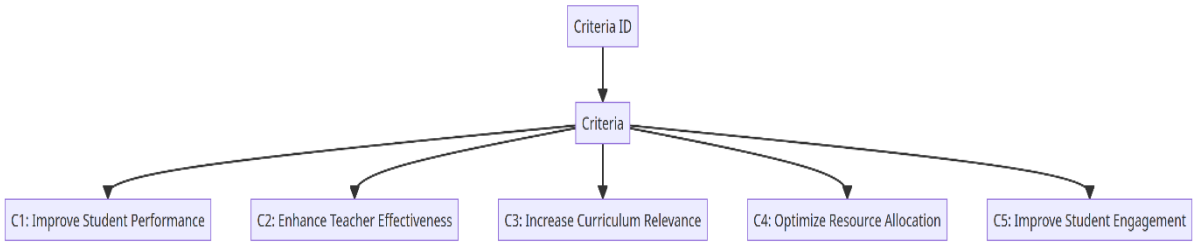

Figure 2. Visualization for Criteria

Table 2. Alternative for Teaching and Learning

ID Alternative	Alternative Name
A1	Implement personalized learning programs
A2	Introduce more interactive teaching methods
A3	Provide regular professional development workshops
A4	Implement a peer-mentoring system
A5	Integrate more real-world examples into the curriculum
A6	Update the curriculum to align with current industry trends
A7	Adopt a more efficient scheduling system
A8	Implement a digital resource management system
A9	Introduce more project-based learning
A10	Implement a school-wide gamification system

Figure 2 illustrates the alternative:

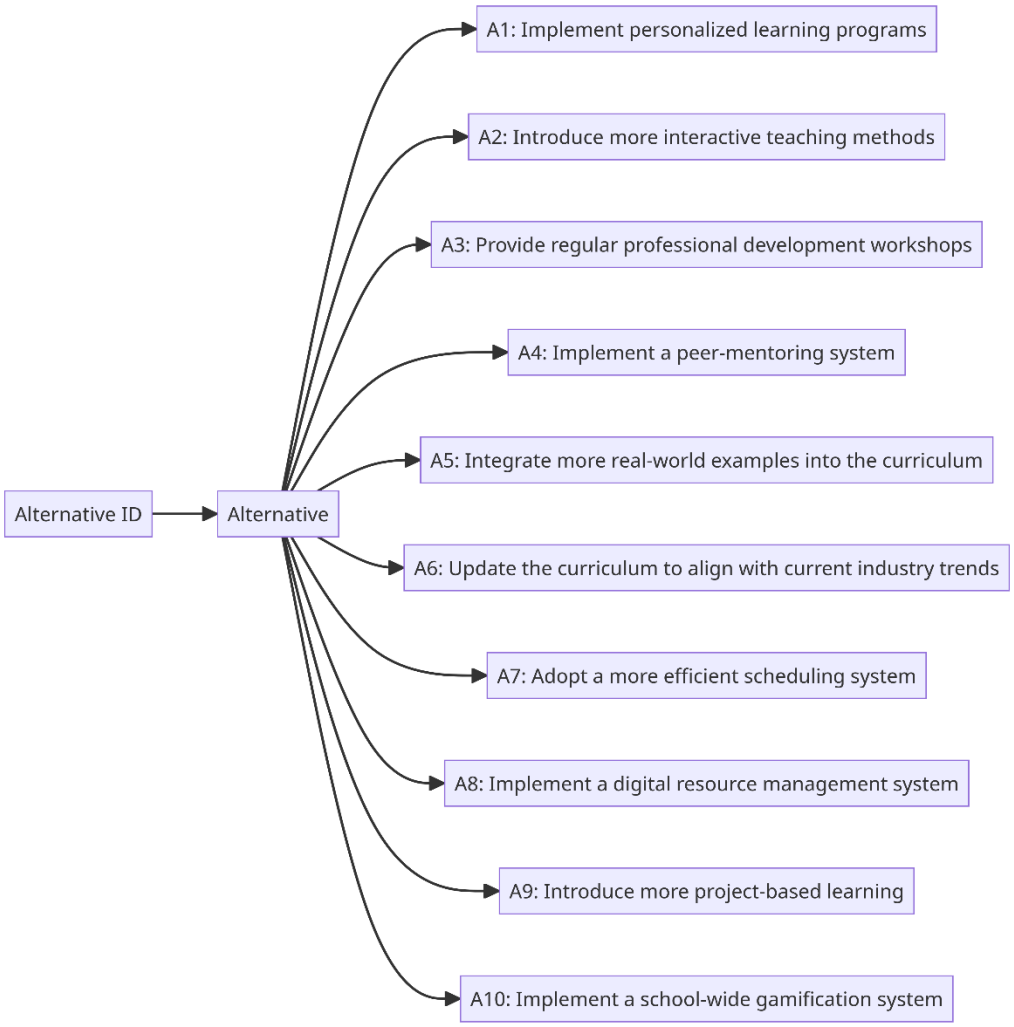

Figure 3. Diagram Alternative value

The Simple Additive Weighting (SAW) approach then weights each criterion by importance. Normalize weights to 1.

Table 3. Weights for each criterion

ID Criteria	Criteria Name	Weight Value
C1	Improve Student Performance	0.25
C2	Enhance Teacher Effectiveness	0.20
C3	Increase Curriculum Relevance	0.15
C4	Optimize Resource Allocation	0.25
C5	Improve Student Engagement	0.15

These weights reflect the relative importance of each criterion in the decision-making process. For example, "Improve Student Performance" and "Optimize Resource Allocation" are considered the most important criteria, each with a weight of 0.25, while "Increase Curriculum Relevance" and "Improve Student Engagement" are considered less important, each with a weight of 0.15.

3. FINDINGS AND DISCUSSION

The next step in the Simple Additive Weighting (SAW) method is to score each alternative for each criterion. Let's assume we have the following scores for each alternative for each criterion.

Table 4. Value Each Alternative in Criterion

Criteria/Alternative	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
C1	85	80	70	75	80	85	90	75	80	85
C2	80	85	90	80	75	80	85	90	75	80
C3	75	80	85	90	75	80	85	70	75	80
C4	90	85	80	75	90	85	80	75	90	85
C5	85	90	75	80	85	90	75	80	85	90

Refer to figure 4 to observe the assigned criteria values for each alternative. Note that figure 2 only provides a sample diagram with two alternatives, but the same principles apply to all alternatives.

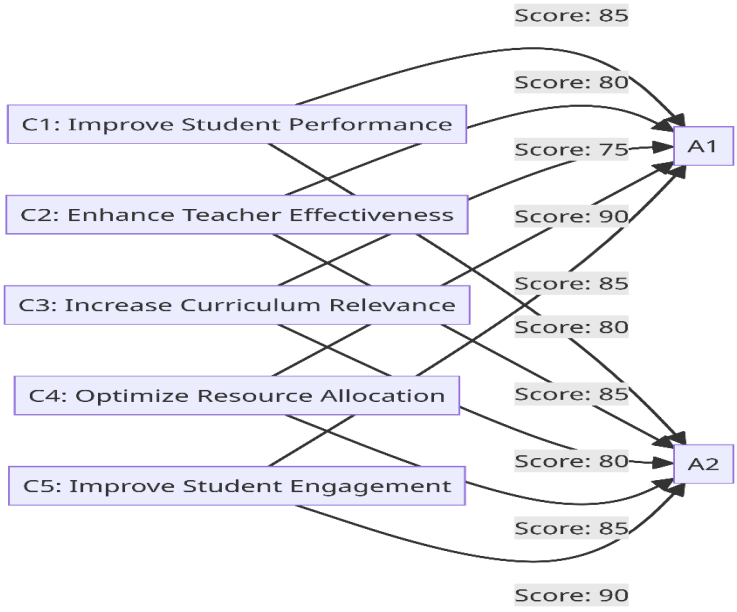

Figure 4. Diagram Criteria to Alternative

Next, we compute the weighted sum for each alternative by multiplying the score for each criterion by the weight of that criterion, and then summing up these value.

$$Weighted\ Sum\ (A1) = (0.25 * 85) + (0.20 * 80) + (0.15 * 75) + (0.25 * 90) + (0.15 * 85) \quad (1)$$

This process would be repeated for each alternative to compute their respective weighted sums. The alternatives would then be ranked based on their weighted sums to determine the most effective strategies or approaches for improving the educational process. Table 5 show all process.

Table 5. Weighted Sum

Alternative ID	Weighted Sum
A1	(0.25 * 85) + (0.20 * 80) + (0.15 * 75) + (0.25 * 90) + (0.15 * 85) = 84.25
A2	(0.25 * 80) + (0.20 * 85) + (0.15 * 80) + (0.25 * 85) + (0.15 * 90) = 84.25
A3	(0.25 * 70) + (0.20 * 90) + (0.15 * 85) + (0.25 * 80) + (0.15 * 75) = 80.25
A4	(0.25 * 75) + (0.20 * 80) + (0.15 * 90) + (0.25 * 75) + (0.15 * 80) = 79.75
A5	(0.25 * 80) + (0.20 * 75) + (0.15 * 75) + (0.25 * 90) + (0.15 * 85) = 82.25
A6	(0.25 * 85) + (0.20 * 80) + (0.15 * 80) + (0.25 * 85) + (0.15 * 90) = 84.75
A7	(0.25 * 90) + (0.20 * 85) + (0.15 * 85) + (0.25 * 80) + (0.15 * 75) = 84.25
A8	(0.25 * 75) + (0.20 * 90) + (0.15 * 70) + (0.25 * 75) + (0.15 * 80) = 78.75
A9	(0.25 * 80) + (0.20 * 75) + (0.15 * 75) + (0.25 * 90) + (0.15 * 85) = 82.25
A10	(0.25 * 85) + (0.20 * 80) + (0.15 * 80) + (0.25 * 85) + (0.15 * 90) = 84.75

Now, we can rank the alternatives based on their weighted sums:

a. A6 and A10 (84.75)
b. A1, A2, and A7 (84.25)
c. A5 and A9 (82.25)
d. A3 (80.25)
e. A4 (79.75)
f. A8 (78.75)

The SAW technique favors Alternatives A6 and A10 due to their highly weighted sums. These alternatives are intended to improve education based on criteria and weights and these options involve school-wide gamification and interactive instruction. The SAW technique quantifies and compares tactics using several criteria. It lets decision-makers weigh all relevant criteria at once and prioritize them. The SAW approach is powerful for complex decision-making, including several factors. SAW, like any decision-making processes, has its drawbacks. It assumes that the criteria are independent, which may not be true. SAW outcomes are also sensitive to criteria weights. Thus, weights must be properly assigned and their effects considered. SAW has been employed in healthcare, risk assessment, and preoperative surgical planning, according to past studies. These studies show that the SAW approach and other multi-attribute decision-making (MADM) strategies can assist decision-makers make better choices. The MADM approaches proposed in this paper are applied for picking the best option evaluated according to the stated criteria. Finding the best answer among many alternatives is the goal of both conventional optimisation and the MADM techniques described in the study. while comparing options that do not have any clear frontrunners while taking into account all evaluation criteria, MADM makes sense. Finding the best option from many available does not alter the data used by the presented MADM techniques. Both the decision matrix and the vector of criterion weights are fixed, and there is a limited set of choices available to be made. As Vinogranova et.al (2015) stated that

when the outcome of the MADM stability evaluation remained nearly unchanged, it was determined that 105 re-estimates were a sufficient amount.

4. CONCLUSION

The Simple Additive Weighting (SAW) method was used in the "Decision Support Systems in Education: A Revolutionary Approach to Teaching and Learning" case study to provide the best ways to improve education. We could weigh many criteria using the SAW approach. According to the criteria and weights, adopting a school-wide gamification system (A6) and using more interactive teaching methods (A10) are the best strategies. SAW has some drawbacks despite its effectiveness. Criteria independence is one of the primary restrictions. SAW outcomes are also sensitive to criteria weights. To produce solid results, weights must be carefully assigned. Future research could compare the SAW method to other multi-criteria decision-making strategies in education. This could provide the best ways to improve education. Future studies should also examine how varied weight assignments affect SAW technique outcomes to determine its sensitivity to weight variations. Finally, SAW method research could examine ways to handle the dependency of criteria.

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