



# The Selection of Learning Platforms to Support Learning using Fuzzy Multiple Attribute Decision Making

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## Abstract

The utilization of information technology in learning has functioned as a tool in the teaching and learning process during the Covid-19 pandemic. The need for the availability of a learning platform using LMS (Learning Management System) or free e-learning that is easily obtained from the public network (internet) makes the utilization of the learning platform indispensable for the teaching and learning process. Learning platforms available on the internet can also be used independently by students. However, not all existing learning platforms can be used as the appropriate means to improve the quality of education. The educator policies are needed to utilize the existing learning platforms so that learning objectives can be achieved. This study will analyze how to choose the right learning platform for an educational institution using SAW (Simple Additive Weighting)-based Fuzzy Multiple Attribute Decision Making (FMADM) method. FMADM is a method used to find the optimal alternative from a number of alternatives with certain criteria. The purpose of this study is to assist educators in deciding the most appropriate learning platform that can be used to support the teaching and learning process during the Covid 19 pandemic. The main finding is that MS.Teams has the best performance and is the respondent's choice to be used as an online learning medium at Semarang of University.

*Keywords:* Covid 19 Pandemic, Information Technology, Learning Platform, FMADM.

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## 1. Introduction

The fuzzy multiple attribute decision making has been used in various disciplines, such as Machine selection in flexible manufacturing cell (Wang et al., 2002), determine the student achievement scholarship recipients (Kurniawan et al., 2019), e-learning innovation performance (Su et al., 2016), teaching quality evaluation (Zhao, 2014), major selection at senior high school (Khasanah et al., 2015), decision support system for smartphone recommendation (Okfalisa et al., 2021), population information for disaster management (Zhang et al., 2014) and maintenance assessment in the hospitals (Karimi et al., 2020).

The COVID-19 pandemic hitting the whole world has drastically changed all sectors of life, including education. It has been almost a year that face-to-face learning, which is usually held in schools, has turned into distance learning with online learning media (Li et al., 2021). The choice of learning platforms that can be used for free or paid provides an opportunity for educators to try the existing learning platforms (Tarik et al., 2021). The use of the right learning platform can support online teaching and learning process, although there will sometimes be problems or obstacles during its implementation (Liu et al., 2020). The problems and obstacles that may occur can be caused by internal factors or external factors from the educational institution (Shin and Chan, 2004).

The internal factors that can cause obstacles in the process of using information technology to support the learning process can be in the form of limited funds, students' internet balance, or the educator resources who still have not mastered the technology (Robey et al., 2020; Alavi and Gallupe, 2003). Meanwhile, the external factors that hinder the successful use of technology in the learning process usually collide with regulations from the bureaucracy that are currently in effect (Sakina et al., 2020; Saleh and Dewi, 2020).

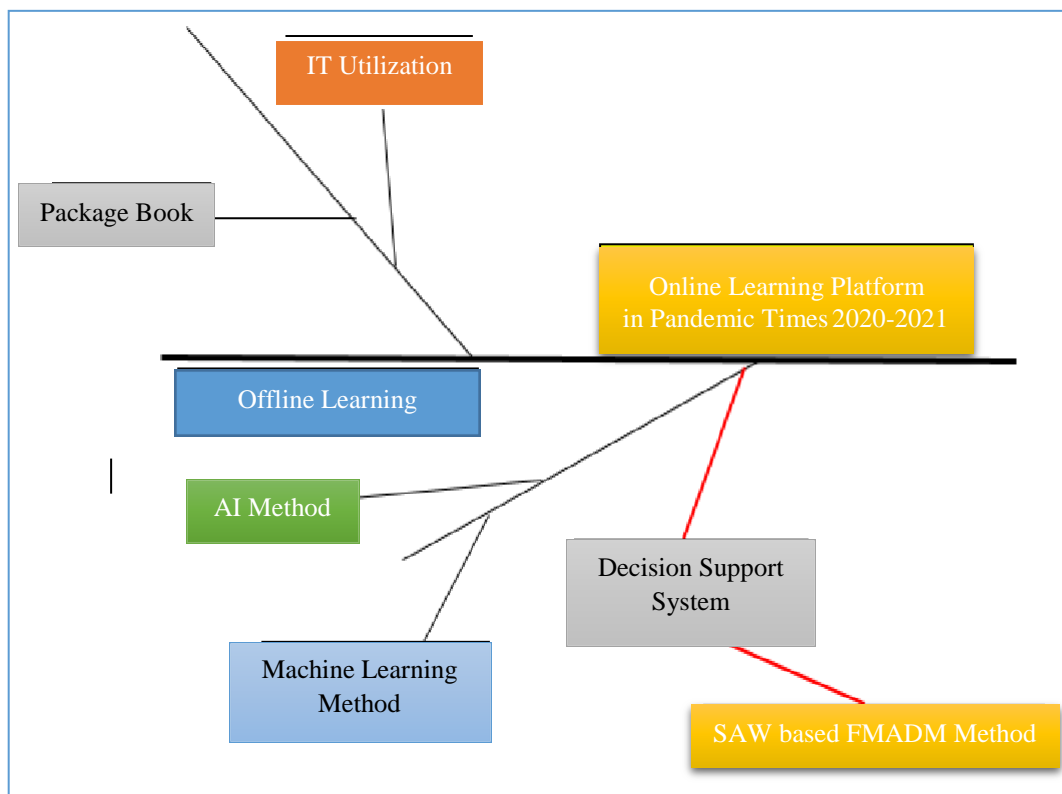
Garg and Jain (2017) presented development of a hierarchical model using Fuzzy Multiple Attribute Decision Making (FMADM) method for the selection of E-learning websites. They found that the Fuzzy Multiple Attribute Decision Making could be an efficient and effective assessment tool. Naveed et al. (2020) studied of the analytic

hierarchy process (AHP) with group decision-making (GDM) and Fuzzy AHP (FAHP) to study the diversified factors from different dimensions of the web-based E-Learning system. Gong et al. (2021) presented propose a new integrated MCDM approach on the basis of linguistic hesitant fuzzy sets (LHFSs) and the TODIM (an acronym in Portuguese of interactive and multi-criteria decision making) method to evaluate and select the best e-learning website for network teaching. They show that the Results show that the LHF-TODIM model being proposed is more practical and effective for solving the e-learning website selection problem under vague and uncertain linguistic environment.

The main contribution of this study is analyzing the learning platforms that are able to provide positive factors for the online learning which of course are expected to be able to improve the students' performance while participating in the online learning.

## 2. Methodology

The determination of the form of the material presentation is based on the suitability of the nature of the learning material with the characteristics of each form of media presented. The study that will be carried out is to try to analyze the alternative learning platforms that are able to provide positive factors for online learning which of course are expected to be able to improve students' performance while participating in online learning. By knowing the positive aspects of the various alternative learning platforms available during this Corona pandemic, the learning platform users can choose the learning platforms that are available free or paid according to their individual needs. The road map of this paper can be seen in Figure 1.



**Figure 1.** Research Road Map

The research choosing LMS or e-learning platforms available on the internet is widely used during the Covid 19 pandemic. The researchers will determine four learning platforms to be the research objects. From each learning platform, the researchers will review what criteria to use as benchmarks for further assessment. The researchers then choose to use the Decision Support System (DSS) method of SAW (Simple Additive Weighting)-based Fuzzy Multiple Attribute Decision Making (FMADM) (Mujiarto et al. 2019; Patria, 2021, Trisnawan et al., 2019). The results of the SAW-based FMADM trial will be compared with the processing using of google collab tool. Hopefully, the output of this research can be a reference for educators in selecting the existing learning platforms to support the online teaching and learning process.

### 2.1 Fuzzy Multiple Attribute Decision Making (FMADM)

Fuzzy Multiple Attribute Decision Making is a method used to find the optimal alternative from a number of alternatives with certain criteria (Zeng, 2006; Sukono et al., 2020). The essence of FMADM is to determine the weight value for each attribute, then proceed with a ranking process that will select the alternatives given. Basically,

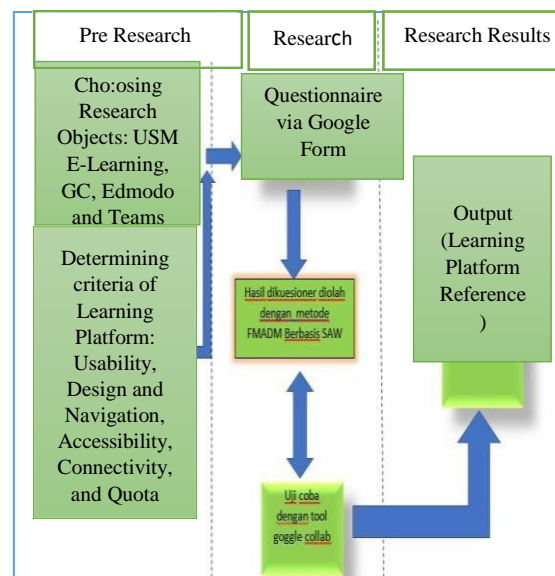
there are 3 approaches to find the attribute weight value, namely the subjective approach, the objective approach and the integration approach between subjective and objective. Each approach has advantages and disadvantages. In the subjective approach, the weight value is determined based on the subjectivity of the decision maker, so that several factors in the alternative ranking process can be determined independently (Hien and Haddawy, 2007). There are several methods that can be used to solve FMADM problems, namely:

- a. Simple Additive Weighting Method
- b. Weighted Product
- c. ELECTRE
- d. Technique for Order Preference by Similarity to Ideal Solution
- e. Analytic Hierarchy Process

In this study, Simple Additive Weighting Method is used (Setyani and Saputra, 2016). The basic concept of SAW method is to find the weighted sum of the performance ratings for each alternative on all attributes. SAW method requires the process of normalizing the decision matrix to a scale that can be compared with all available alternative ratings. In addition, SAW is a multi-attribute procedure based on the concept of weighted addition.

## 2.2 Research Stages

The research method used in this research is the research and development method. The research and development method are the research method used to produce certain products and test the effectiveness of these products." The stages of research carried out based on the development of research steps are three significant steps which are further broken down into several stages adapted to the ongoing research, namely First, pre- research which includes identifying research problems by choosing the available learning platforms and most often used during the Covid 19 pandemic.



**Figure 2.** Research Stages

During the research period, four learning platforms were E-learning, Edmodo, Google Classroom, and Microsoft Teams. Five criteria were determined from the four selected learning platforms from each learning platform: Usability Criteria, Design and Navigation Criteria, Accessibility, Connectivity, and Internet balances need. Second, the research stages include testing the learning platform in the teaching and learning process to provide criteria for each learning technology to be tested. At the end of the semester, before accessing Final Examination, the students will be asked to fill out a google form containing questions to answer questions about the learning platform used during online learning. The questionnaire results will be the input in the trial of the learning platform using the SAW-based FMADM method. The trial will also be carried out using the google collab tool, compare the results obtained in point with point. The next stage is the Results Validation. Third is the research results stage, recommendations for the existing learning platforms. The research stages in more detail can be seen in Figure 2.

The Questionnaires were distributed via google form. The respondents who filled out the questionnaire were 45 students from the morning class of Applied Network course participants and 72 students participating in the Morning class of Microprocessor course. The students filled out the questionnaire at the end of the even semester 2020/2021 academic year before taking Final Semester Exam.

### 3. Results and Discussions

Table 1 is the basis for the assessment that can be given to the results of the questionnaire. For example: If a respondent gives an assessment of 80 against the Usability Criteria of the Edmodo learning platform, it means that the value obtained is: 0.75.

**Table 1.** Value Range

Average Value	Value
Value < 60	0
Value i = 60 - 69	0.25
Value = 70 - 79	0.5
Value = 80 - 89	0.75
Value > 90	1

From the results of the questionnaire processing, an assessment of the Edmodo platform for usability (C1) = 0.5, design and navigation (C2) = 0.75, accessibility (C3) = 0.75 and connectivity (C4) = 1. The data from the questionnaire processing is shown in Table 1.

In Table 2, there is a weighted value that will be given to each learning platform criterion according to its level based on the results of a survey on students who for 1 semester have used the Edmodo, MS.Teams, USM E-learning, and Google classroom learning platforms.

**Table 2.** Criteria Weight

Weight	Description
0	Very Low
0.2	Low
0.4	Medium
0.6	Middle
0.8	Height
1	Very High

The results of the questionnaire average scores from the Edmodo, MS. Teams, E-Learning, and Google classroom learning platforms are shown in Table 3. The MS. Teams platform has a value of 1 Usability where students do not encounter problems when submitting assignments via MS. Teams and able to foster student interest in participating in online learning easily without feeling bored or bored. Students choose Edmodo, MS. Teams, and Google classroom as learning platforms that are easy to access and use. Edmodo and Google classroom are considered the most stable learning platforms in utilizing their internet connection.

Based on the Table 3, it is read that MS. The team before the data was processed using the SAW-based FMADM method had shown that it was the most stable platform among the Edmodo, E-Learning, and Google classroom platforms.

**Table 3.** Questionnaire of Learning Platform Average Value

Alternative	C1	C2	C3	C4
Edmodo	0.5	0.75	0.75	1
MS Teams	1	1	0.75	0.75
E-Learning USM	0.25	0.5	0.5	0.5
Google classroom	0.75	0.75	0.75	1

Note:

C1 = Usability

C3 = Accessibility

C2 = Design and Navigation

C4 = Connectivity

The value of the weight vector determined for each criterion is:

$$W = [0.8 \ 0.6 \ 0.8 \ 0.6]$$

The final step is to calculate the final result of the preference value to find the best learning platform which can be a recommendation, namely:

Edmodo	$= 0.5 * 0.8 + 0.75 * 0.6 + 0.8 * 0.75 + 0.6 * .1 = 2.05$
MS Teams	$= 1 * 0.8 + 1 * 0.6 + 0.75 * 0.8 + 0.75 * 0.6 = 2.45$
E-learning USM	$= 0.25 * 0.8 + 0.5 * 0.6 + 0.5 * 0.8 + 0.5 * 0.6 = 1.2$
Google classroom	$= 0.75 * 0.8 + 0.75 * 0.6 + 0.75 * 0.8 + 1 * 0.6 = 2.25$

The calculation results found that MS Teams produced the highest score of 2.45, and it is supported by students' assessment while using four learning platforms. MS Teams is the learning platform with better usability, design and navigation, accessibility and connectivity than Edmodo, E-Learning and Google classroom.

#### 4. Conclusion

After processing the data from the questionnaire results using the SAW-based FMADM method, the conclusions obtained are: of the four learning platforms used during online learning in the even semester of 2020/2021, it turns out that MS Team is the platform that respondents judge to have usability or the best level of ability in uploading material (text, video), assigning tasks compared to Edmodo, USM E-Learning and Google classroom.

MS Team is a platform that respondents are more interested in design and navigation than Edmodo, USM E-Learning and Google classroom. Edmodo, MS Teams and Google classroom were assessed by respondents as having the same accessibility compared to USM E-Learning. The respondents rated Edmodo and Google classroom as having more stable connections than MS Teams and USM E-Learning. It is possible because Edmodo and Google classroom platforms do not have features for streaming virtual meetings. Overall, from the results of calculations using the SAW-based FMADM method, the final preference value of MS Teams is 2.45, which means MS Teams has the best performance and is respondents' choice to be used as online learning media. MS Teams is a paid learning platform from Microsoft 365 rented by USM, so that in the future, the use of MS Teams can be used as an online learning tool for all USM students.

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