
THE RANKING OF THE BEST EDUCATORS BY APPLYING FUZZY LOGIC SUGENO BASED ON PERFORMANCE ASSESSMENT

Hendra Cipta

Program Studi Matematika, Fakultas Sains dan Teknologi,
Universitas Islam Negeri Sumatera Utara Medan, Indonesia
Email: hendracipta@uinsu.ac.id

Abstract

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In improving the quality of education, mastery of the material is one of the important elements that must be considered by teachers and students. In addition, improving the quality of education is carried out by improving facilities and infrastructure, increasing the professional staff, teaching staff, and improving the quality of students. The purpose of this research was to determine the best educators based on performance assessment. Indicators research refer to PP. No. 19 of 2005 concerning Standar Nasional Pendidikan (SNP) namely knowledge, attitudes, communication, and professionalism. In this case, fuzzy logic Sugeno method is used to rank the best educators in their field. The results showed that there were 3 best educators, namely educator B ranked 1 with an assessment result of 2.25, educator C got rank 2 with an assessment result of 1.65 and educator A with an assessment result of 0.65 got rank 3. It is hoped that with the application of this method, the school can be more effective in assessing educators by adding more indicators to be assessed later.

Keywords: Educator, Performance Assessment, Fuzzy Logic Sugeno

1. Introduction

Education is a system where there are components that influence it, including curriculum, facilities, students and educators. In the school of education system, the main activity is to organize learning activities which are entirely the responsibility of the educator [1].

The teachers need to have many ability to innovating and applying various learning strategies that are considered in accordance with the talents and interests of students in accordance with student development, including utilizing various sources and learning media in achieving the teaching and learning process [2].

As the times continue to developing, educators are required to continue to improving their performance and quality in order to produce human resources (HR) of higher quality, skilled, innovative, productive, and able to competing [3]. In PP No. 19 of 2005 concerning Standar Nasional Pendidikan (SNP), the government formulates four professional indicators of educators including: (1) Eligibility of knowledge, (2) Eligibility of attitudes, (3) Feasibility of communication, and (4) Feasibility of professionals [4].

Based on the indicators above, to get the ranking of the best educators, a decision-making system (DSS) with fuzzy logic is used. Fuzzy logic is a logic that deals with the concept of partial truth where classical logic states that everything can be expressed in binary (0 or 1) terms [5]. Fuzzy logic allows membership values between 0 and 1 [6]. Many theories in the development of fuzzy logic show that basically fuzzy logic can be used to various model systems. One of the systems being modeled is a fuzzy inference system. Fuzzy logic is a generalization of classical logic which has two membership values, namely 0 and 1, while in the fuzzy set the membership value lies in the range of 0 and 1 [5], [7].

The fuzzy logic is used in this research is the fuzzy logic Sugeno. In this method will provide the accuracy of the ranking data of educators based on the performance assessment. So that later, the school in providing performance assessments of the educators is more efficient if more assessment indicators are added, not just one or two indicators but more than it.

2. Method

2.1 Location Research

This research was held in SMK Namira Tech Nusantara Medan, Jln. Setia Budi Pasar I No. 76 Medan Tanjung Sari, Medan Selayang Subdistrict 20133. And in the mathematics department, Faculty of Science and Technology, Universitas Islam Negeri Sumatera Utara Medan.

2.2 The Data Collection Technique

The data collection was carried out by collecting sample data from 30 respondents where respondents were given a questionnaire to choose the best educators. The procedures in this data collection are:

- 1) Making a questionnaire form in 14 questions,
- 2) Questionnaire were given as the number of samples by giving assessments to 9 educators at SMK Namira Tech Nusantara Medan.
- 3) After getting an assessment of the 30 samples, the questionnaire was tested with validity and reliability tests.
- 4) If it has been declared valid and reliable, then the questionnaire is declared feasible to be used.

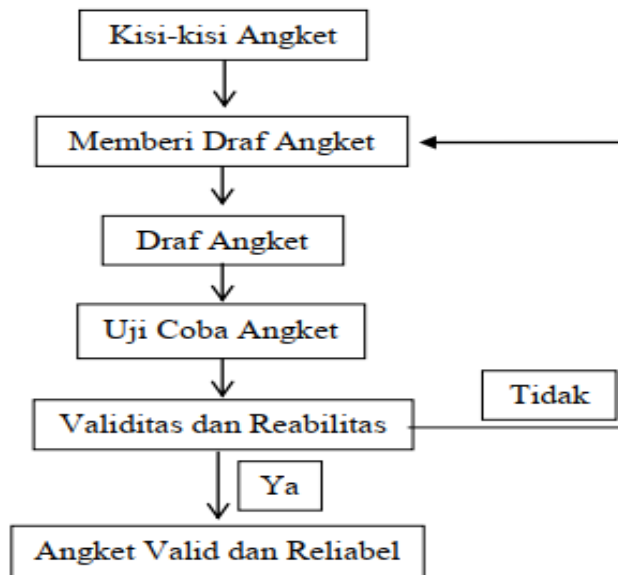


Figure 1. Flowchart Data Collection

2.3 The Data Analysis Technique

After the questionnaire data is tested and the validity and reliability values are obtained, then at this stage the data is then processed by applying fuzzy logic Sugeno with performance assessment.

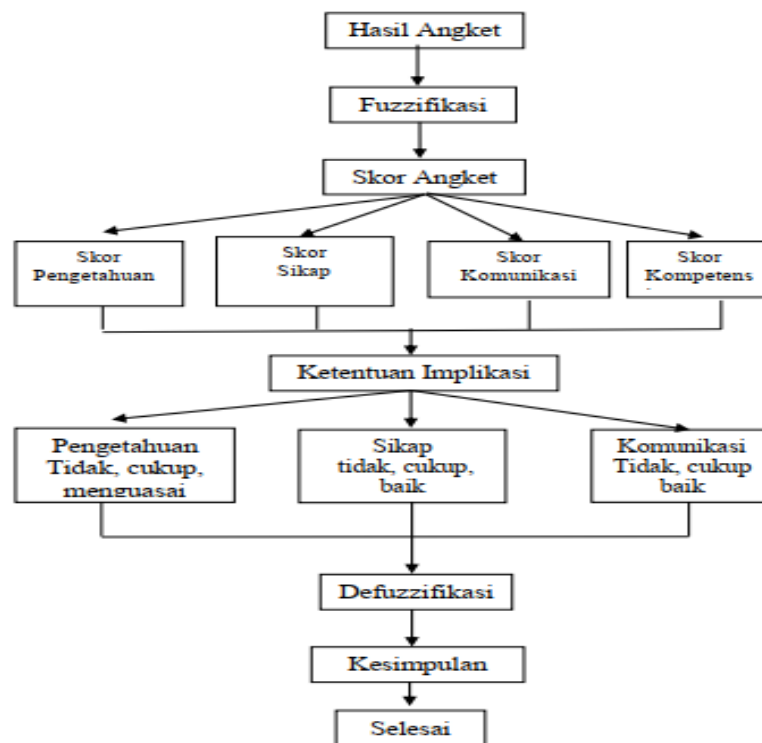


Figure 2. Flowchart Data Analysis

2.4 Fuzzy Logic Sugeno

Fuzzy logic Sugeno is a fuzzy inference system for rules that are represented in the form of IF-THEN where the output is not a fuzzy set but a constant or linear equation [8]. The form of the Zero-Order Sugeno fuzzy logic model is [9] :

$$IF(x_1 \text{ is } A_1) \cap (x_2 \text{ is } A_2) \cap (x_3 \text{ is } A_3) \cap \dots \cap (x_N \text{ is } A_N) \text{ THEN } = k \quad (1)$$

where A_N is fuzzy set as the antecedent and k is a constant (firm) as the consequent.

The procedure of Fuzzy logic Sugeno are [7], [8]:

- 1) Fuzzification formation
- 2) Formation of base rules fuzzy data
- 3) Composition rules: the fuzzy set solution is obtained by taking the minimum value.

$$\mu_{sf} [X_i] = \min(\mu_{sf} [X_i]; \mu_{kf} [X_i]), i = 1, 2, 3, \dots, N \quad (2)$$

4) Defuzzification defuzzification (Z^*) is done by finding the centralized average value [10]:

$$Z^* = \frac{\sum_i^N \alpha_i Z_i}{\sum_i^N \alpha_i} ; i = 1, 2, 3, \dots, N \quad (3)$$

3. Results and Discussion

3.1 Researched Educator

The educators who will be examined in this research are:



No.	NUPTK	Nama	Gender	Email
1.	3435762664200033	SYAHRIALSYAH S, M.PD.I	Laki-laki	sahrialsyahsinar@gmail.com
2.	7753753654110042	Sutarman Jaya, S.Kom	Laki-laki	soetarmanjaya@gmail.com
3.	7534770682130003	Rahmat Hidayat, S.Kom	Laki-laki	92.rahmathidayat@gmail.com
4.	-	Mhd. Abdurrahman Sayyaf, S.Pd, G.r	Laki-laki	abdurrahman.sayyaf.04@gmail.com
5.	-	Hadi Surya, S.Pd	Laki-laki	hadi30surya@gmail.com
6.	-	Selamet Riyadi, S.Kom	Laki-laki	slametriyadi.idm@gmail.com
7.	-	Widya Arianty, S.E	Perempuan	widyaarianty170845@gmail.com
8.	-	Indra Wahyudha, S.T	Laki-laki	-
9.	-	Samantha Azalia Lubis	Perempuan	samanthaazalia16@gmail.com

Figure 3. List of Educators

3.2 Fuzzy Set Formation

3.2.1 Testing Respondent Data With Validation and Reliability Test

Based on the results of the test by giving a questionnaire to 30 students by assessing 9 educators, the results of the validity and reliability test.

Table 1. Respondent Data of Students

RESP	Skor Total Item			
	Knowledge	Attitudes	Communication	Professional
RESP 1	12	13	15	14
RESP 2	11	13	14	15
RESP 3	11	13	14	14
RESP 4	11	12	13	13
...
...
RESP 27	12	13	16	16
RESP 28	12	14	16	16
RESP 29	14	13	18	18
RESP 30	11	13	17	17

Table 2 Data Test of Validation and Reliability

No.	r hitung SPSS	r tabel	Cronbach's Alpha	r tabel	Description
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Qustions	Value				
1	0,538	0,361	0,695	0,40	Valid
2	0,490	0,361	0,695	0,40	Valid
3	0,643	0,361	0,695	0,40	Valid
4	0,442	0,361	0,757	0,40	Valid
5	0,580	0,361	0,757	0,40	Valid
6	0,385	0,361	0,757	0,40	Valid
7	0,469	0,361	0,667	0,40	Valid
8	0,514	0,361	0,667	0,40	Valid
9	0,462	0,361	0,667	0,40	Valid
10	0,567	0,361	0,667	0,40	Valid
11	0,451	0,361	0,654	0,40	Valid
12	0,514	0,361	0,654	0,40	Valid
13	0,492	0,361	0,654	0,40	Valid
14	0,567	0,361	0,654	0,40	Valid

3.2.1 Forming a Fuzzy Set and the Talking Universe

The formation of fuzzy sets start from changing the linguistic variables of performance assessment indicators, namely knowledge, attitudes, communication and professionals into a fuzzy set that has a universe of speech.

Table 3 The Fuzzy Sets and Talking Universe

Function	Variable	Name of Fuzzy Set	Talking Universe	Domain
Input	Knowledge	Tidak Menguasai		[10, 14]
		Cukup Menguasai	[10, 14]	[11, 13]
		Menguasai		[12, 14]
	Attitudes	Tidak Baik		[11, 12]
		Cukup Baik	[11, 14]	[12, 13]
		Baik		[12, 14]
Output	Communication	Tidak Baik		[13, 15]
		Cukup Baik	[13, 18]	[14, 16]
	Professional	Baik		[15, 18]
		Tidak Kompeten		[13, 15]
		Cukup Kompeten	[13, 18]	[14, 16]
		Kompeten		[15, 18]

3.2.2 Forming Fuzzy Set and Its Membership Functions

Given:

$$Z = \begin{cases} \text{Tidak Kompeten} & k \leq 14 \\ \text{Cukup Kompeten} & 14 < k \leq 15 \\ \text{Kompeten} & 15 < k \leq 16 \end{cases}$$

and then produce some fuzzy set for variable are:

- 1) Fuzzy Set for Variable Knowledge

Its membership function can be shown as follows:

$$\mu_{tdkmenguasai}(X) = \begin{cases} 1 & ; x \leq a \\ \frac{b-x}{b-a} & ; a \leq x \leq b \\ 0 & ; x \geq b \end{cases}$$

$$\mu_{tdkmenguasai}(X) = \begin{cases} 1 & ; x \leq 11 \\ \frac{12-x}{12-11} & ; 11 \leq x \leq 12 \\ 0 & ; x \geq 12 \end{cases}$$

$$\mu_{ckpmenguasai}(X) = \begin{cases} 1 & ; x \leq a, x \geq c \\ \frac{x-a}{b-a} & ; a \leq x \leq b \\ \frac{c-x}{c-a} & ; b \leq x \leq c \end{cases}$$

$$\mu_{ckpmenguasai}(X) = \begin{cases} 1 & ; x \leq 11, x > 13 \\ \frac{x-11}{12-11} & ; 11 \leq x \leq 12 \\ \frac{13-x}{13-11} & ; 12 \leq x \leq 13 \end{cases}$$

$$\mu_{menguasai}(X) = \begin{cases} 1 & ; x \leq b \\ \frac{x-b}{c-b} & ; b \leq x \leq c \\ 0 & ; x \geq c \end{cases}$$

$$\mu_{menguasai}(X) = \begin{cases} 1 & ; x \leq b \\ \frac{x-b}{c-b} & ; b \leq x \leq c \\ 0 & ; x \geq c \end{cases}$$

$$\mu_{menguasai}(X) = \begin{cases} 1 & ; x \leq 12 \\ \frac{x-12}{13-12} & ; 12 \leq x \leq 13 \\ 0 & ; x \geq 13 \end{cases}$$

2) Fuzzy Set for Variable Attitudes

Its membership function can be shown as follows:

$$\mu_{tdkbaik}(X) = \begin{cases} 1 & ; x \leq 12 \\ \frac{12-x}{12-12} & ; 12 \leq x \leq 12 \\ 0 & ; x \geq 12 \end{cases}$$

$$\mu_{ckpbaik}(X) = \begin{cases} 1 & ; x \leq 12, x > 13 \\ \frac{x-12}{12-12} & ; 12 \leq x \leq 12 \\ \frac{13-x}{13-12} & ; 12 \leq x \leq 13 \end{cases}$$

$$\mu_{baik}(X) = \begin{cases} 1 & ; x \leq 12 \\ \frac{x-12}{13-12} & ; 12 \leq x \leq 13 \\ 0 & ; x \geq 13 \end{cases}$$

3) Fuzzy Set for Variable Communication

Its membership function can be shown as follows:

$$\mu_{tdkbaik}(X) = \begin{cases} 1 & ; x \leq 14 \\ \frac{15-x}{15-14} & ; 14 \leq x \leq 15 \\ 0 & ; x \geq 15 \end{cases}$$

$$\mu_{ckpbaik}(X) = \begin{cases} 1 & ; x \leq 14, x > 16 \\ \frac{x-14}{15-14} & ; 14 \leq x \leq 15 \\ \frac{16-x}{16-14} & ; 15 \leq x \leq 16 \end{cases}$$

$$\mu_{baik}(X) = \begin{cases} 1 & ; x \leq 15 \\ \frac{x-14}{16-15} & ; 15 \leq x \leq 16 \\ 0 & ; x \geq 16 \end{cases}$$

4) Fuzzy Set for Variable Professional

Its membership function can be shown as follows:

$$\mu_{tdkbaik}(X) = \begin{cases} 1 & ; x \leq 14 \\ \frac{15-x}{15-14} & ; 14 \leq x \leq 15 \\ 0 & ; x \geq 15 \end{cases}$$

$$\mu_{ckpbaik}(X) = \begin{cases} 1 & ; x \leq 14, x > 16 \\ \frac{x-14}{15-14} & ; 14 \leq x \leq 15 \\ \frac{16-x}{16-14} & ; 15 \leq x \leq 16 \end{cases}$$

$$\mu_{baik}(X) = \begin{cases} 1 & ; x \leq 15 \\ \frac{x-14}{16-15} & ; 15 \leq x \leq 16 \\ 0 & ; x \geq 16 \end{cases}$$

3.3 The Ranking Of The Best Educators Based On Performance Assessment

The ranking of the best educators with their performance are obtained with the membership degrees of incompetent, quite competent and competent as follows:

1) Knowledge Performance

Educator A with $\mu_{tdkmenguasai} [11,7] = 0,3$

Educator B with $\mu_{ckpmenguasai} [13] = 0,65$

Educator C with $\mu_{menguasai} [11,7] = 0,3$

2) Attitude Performance

Educator A with $\mu_{tdkbaik} [11,7] = \infty$

Educator B with $\mu_{ckpbaik} [13] = 0$

Educator C with $\mu_{baik} [11,7] = 1$

3) Communication Performance

Educator A with $\mu_{tdkbaik} [11,7] = - 0,3$

Educator B with $\mu_{ckpbaik} [13] = 1,3$

Educator C with $\mu_{baik} [11,7] = 0,3$

4) Professional Performance

Educator A with $\mu_{tdkkompeten} [11,7] = 0,65$

Educator B with $\mu_{ckpkompeten}[13] = 0,3$

Educator C C $\mu_{kompeten}[11,7] = 0,65$

It can be concluded that:

Educator A obtained $\mu_{tdkkompeten}[11,7] = 0,3 + \infty + (-0.3) + 0,65 = 0,65$

Educator B obtained $\mu_{ckpkompeten}[13] = 0,65 + 0 + 1,3 + 0,3 = 2,25$

Educator C obtained $\mu_{kompeten}[11,7] = -0,3 + 1 + 0,3 + 0,65 = 1,65$

And all the best educators can see in the table below:

Table 3 The Ranks of Best Educators

Educators	Performance Assessment Results	Rank of Educators
Educator A	0,65	3
Educator C	1,65	2
Educator B	2,25	1

4. Conclusions

The results obtained after assessing 30 respondents with the questionnaire given and processing the data results using fuzzy Sugeno logic gave the results that there were 3 educators who were said to be the best educator based on their background in the field of ability and the field of knowledge they applied at SMK Namira Tech Nusantara Medan. Educator B got rank 1 with a result of 2.25, educator C got rank 2 with a result of 1.65 and educator A with a result of 0.65 got rank 3. This is not easy where the school always provides assessment and evaluation of the performance of educators so that teaching and learning process (PBM) can be carried out in a coordinated manner and it is hoped that the quality of educators will be prioritized for school progress.

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