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An Evaluation of Students' Performance in Poster Presentations using Fuzzy Evaluation Method

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HIGHLIGHTS

- Fuzzy Evaluation Method is used as an alternative technique to measure the students' performance of poster presentation.
- The method consists of normalizing the marks, developing the graph of membership function, calculating the degree of satisfaction, and finalizing the marks.
- The samples of this study are from Mathematics and Computer final year students.

ABSTRACT

Poster presentation encompasses many elements such as the organization of poster, the content related to the title proposed, the appearance and the written word. Usually, the poster presentation is used as a platform for student to present their final year project or any other competitions. Students will be evaluated based on the criteria that meets the requirements proposed by the panels or judges. However, their performance in poster presentations does not provide the suitable techniques to estimate the actual value since it involves the elements of fuzziness. In this study, the fuzzy evaluation technique will be applied to measure the performance of the poster presentation. The motivation behind poster presentation is to determine the performance of students using fuzzy evaluation method. The objective of this study is to compare the results between using conventional method and fuzzy evaluation method. The method consists of normalizing the marks, developing the graph of fuzzy membership function, calculating the degree of satisfaction, and finalizing the actual marks. We believed that the result from this study could be able to measure the better output with the consideration of linguistic terms includes excellent, good, moderate, satisfactory, and so on. This method also can be an alternative way to evaluate the performance of the poster presentation.

Keywords: *poster presentation, fuzzy evaluation method, students' performance, membership function*

INTRODUCTION

Posters are designed in a way for society to present the outcomes or demonstrate the evidence of content delivery using several approaches such as statistical evaluation, program evaluation, or mathematical

model. For instance, final year students were used the poster presentations to show their findings which can be seen by the audience and evaluated by the panels. In other words, posters are useful in many sessions, discussions, and exhibitions as they attract the panels and audience to understand the content delivered. Primarily, the presentation must be systematized well in a proper language to keep the audience engaged so that they are interested to understand the content delivered. However, the technique to measure the performance of students in poster presentation need to be concerned. It is because an issue arises since the evaluation process involving the examiners or judges facing a difficulty to define the linguistic standards for each of marks. The selection of attributes to be assessed also important to evaluate the performance of students (Kharola et al. 2015). The elements of fuzziness in the assessment can make the judgement questionable.

In this study, the fuzzy evaluation method provides an alternative way on how poster presentations were assessed and more convenient to be applied compared to other artificial intelligence methods (Zaporozhko et al. 2020). The technique of fuzzy is developed in order to be more analytically and competence since the conventional method is lack of fuzziness elements. Thus, it can be more accurate to finalize the marks. Other than that, it provides an improved result or outcome since it delivers extra evidence of the student presentation for any kind of benchmarks. Moreover, the fuzzy evaluation method is able to manage the unclear systems and the use of language variables. The fuzzy evaluation method including standardizing the marks, acquiring the membership function of the graph, analyzing the degree of satisfaction, and calculating the final marks. The fuzzy evaluation method is a process of many-valued reasoning in which the truth-value may be interval number between 0 and 1. Then, it is improved to carry out the hypothesis of fractional truth between true and false. By using Boolean logic, the truth-values of limit may be the interval between 0 and 1. Datasets of 10 students were collected and selected for evaluation purpose as a sample of this study. The parameters for this study are the content delivery, appearance, poster organization and the written word in terms of language.

METHODOLOGY

Normalizing the Marks

The scores obtained by each of the student must be transferred to normalized value. Normalized value is described as a value in an interval of [0, 1] and it can be found by allocating the mark for each parameter with the total mark. Table 1 shows the example for calculating the normalized value by equation 1.

Table 1: Example of normalized marks obtained by student

Criteria	Total marks	Mark obtained	The Normalized value
Organization (C1)	30	26.5	0.89
Content (C2)	20	17	0.85
Appearance (C3)	20	18	0.9
Written word (C4)	30	24	0.8

$$normalized\,value(NV) = \frac{marks\ obtained\ (MO)}{total\ marks\ (TM)} \tag{1}$$

where (NV) = normalized value for each criterion, (TM) = total marks and (MO) = marks obtained

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Developing the Graph of Fuzzy Membership Function

The graph of membership function is established to display the fuzzification method. Hameed and Sorensen (2010) said that the input value of variables can be designed using graph of triangular membership function. Table 2 shows the standard satisfaction level and its corresponding degree of satisfaction used in this study (Daud et al.,2011). The objective of developing graph membership function is to find the suitable fuzzy membership value of the specific input value as shown in figure 1.

Table 2: Standard satisfaction level and the corresponding degree of satisfaction

Satisfaction levels (X)	Degree of Satisfaction	Maximum Degree of Satisfaction T(X)
Exceptional (ET)	80%-100% (0.8-1.0)	1.0
Excellent (EX)	75%-79% (0.75-0.79)	0.79
Very Good (VG)	70%-74% (0.7-0.74)	0.74
Fairly Good (FG)	65%-69% (0.65-0.69)	0.69
Marginally Good (MG)	60%-64% (0.6-0.64)	0.64
Competent (CT)	55%-59% (0.55-0.59)	0.59
Fairly Competent (FC)	50%-54% (0.5-0.54)	0.54
Marginally Competent (MC)	45%-49% (0.45-0.49)	0.49
Bad (BD)	40%-44% (0.4-0.44)	0.44
Fairly Bad (FB)	35%-39% (0.35-0.39)	0.39
Marginally Bad (MB)	30%-34% (0.3-0.34)	0.34
Fail (F)	0-29% (0-0.29)	0.29

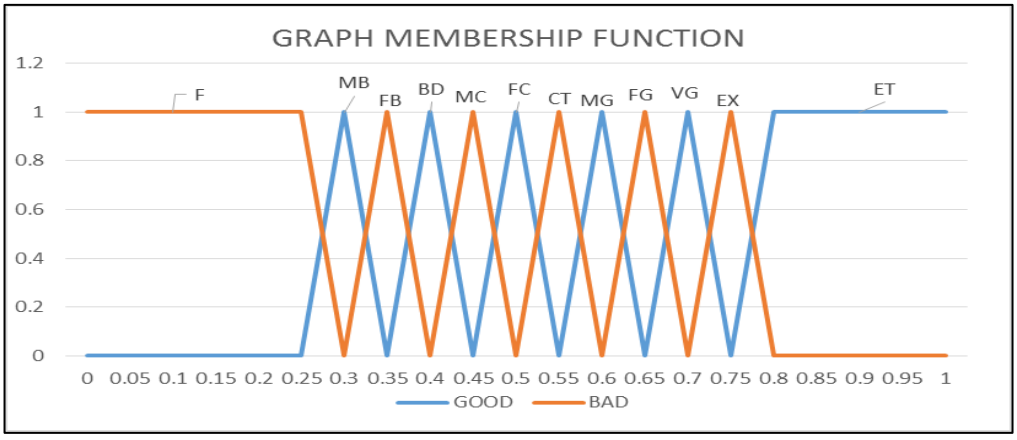

Figure 1: Example of graph membership function for satisfaction level

Calculating the Degree of Satisfaction

Degree of satisfaction marks was computed based on a graph of membership function. As the degree of satisfaction was placed, we can compute the values using following equation 2:

$$\text{Degree of satisfaction} = \frac{A_1(Tx_1) + .A_2(Tx_2).....A_{12}T(x_{12})}{A_1 + A_2 + ...A_{12}} \quad (2)$$

where A = degree of membership value and $T(X)$ = the maximum degree of satisfaction

Computing the Final Mark

The final mark was calculated using the degree of satisfaction level and the equation is stated as follows:

$$\text{Final mark} = \frac{B_1 D(C_1) + B_2 D(C_2) + B_3 D(C_3) + B_4 D(C_4)}{B_1 + B_2 + B_3 + B_4} \quad (3)$$

where B = the total marks obtained and $D(C)$ = degree of satisfaction value for each criterion

FINDINGS AND DISCUSSIONS

Data Collection and Evaluation

Ten Mathematics and Computer students were selected for the samples of this study. There were four criteria to be included in evaluating the performance. These criteria were finalized by judges or examiners to provide the appropriate result as shown in table 3.

Table 3: Samples of poster evaluation marks obtained by students

Criteria	Total Marks	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
C1	30	26.5	26	25.5	27	24.5	24	23.5	23	22.5	20
C2	20	17	16.5	16	15.5	18	15	12	14.5	14	13.5
C3	20	18.5	17.5	17	13	16.5	16	18.5	15.5	15	14.5
C4	30	23.5	26.5	26	25.5	25	24	24	26.5	23.5	21.5
		85.5	**86.5**	**84.5**	**81**	**84**	**79**	**78**	**79.5**	**75**	**69.5**

Normalizing the Marks

The scores obtained by each of the student must be transferred to standardized value. Normalizing value was defined as a value in an interval of [0, 1]. It can be found by distributing the marks for each specification with the total marks. Table 4 depicts the calculation of normalizing students' marks using equation 1.

Table 4: Calculation of Normalizing Students' Marks

Criteria	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
C1	0.88	0.87	0.85	0.9	0.82	0.8	0.78	0.77	0.75	0.67
C2	0.85	0.83	0.8	0.78	0.9	0.75	0.6	0.73	0.7	0.68
C3	0.93	0.88	0.85	0.65	0.83	0.8	0.93	0.78	0.75	0.73
C4	0.78	0.88	0.87	0.85	0.83	0.8	0.8	0.88	0.78	0.72

Plotting the Graph of Fuzzy Membership Function and Calculating the Degree of Satisfaction

The graph of membership function is established to display the fuzziness values. In this process, the input value for any variables is plotted in the graph of triangular membership function with the mode, left endpoint, and right endpoint. Cheng (2004) said triangular fuzzy number is widely used in both research and practice. Since the degree of satisfaction was ranked, then the evaluation of the poster has been performed. Table 5 shows the calculation of the degree satisfaction for each criterion in poster presentation.

Table 5: Calculation of the degree satisfaction for any criteria

St	C	Fuzzy Membership Value												D
		F	MB	FB	BD	MC	FC	CT	MG	FG	VG	EX	ET	
1	C1	0	0	0	0	0	0	0	0	0	0	0.12	0.88	**0.975**
	C2	0	0	0	0	0	0	0	0	0	0	0.15	0.85	**0.969**
	C3	0	0	0	0	0	0	0	0	0	0	0.07	0.93	**0.985**
	C4	0	0	0	0	0	0	0	0	0	0.22	0.78	0	**0.779**
2	C1	0	0	0	0	0	0	0	0	0	0	0.18	0.82	**0.962**
	C2	0	0	0	0	0	0	0	0	0	0	0.17	0.83	**0.964**
	C3	0	0	0	0	0	0	0	0	0	0	0.15	0.85	**0.969**
	C4	0	0	0	0	0	0	0	0	0	0	0.17	0.83	**0.964**
3	C1	0	0	0	0	0	0	0	0	0	0	0.15	0.85	**0.969**
	C2	0	0	0	0	0	0	0	0	0	0	0.8	0.2	**0.832**
	C3	0	0	0	0	0	0	0	0	0	0	0.16	0.84	**0.966**
	C4	0	0	0	0	0	0	0	0	0	0	0.13	0.87	**0.973**
4	C1	0	0	0	0	0	0	0	0	0	0	0.9	0.1	**0.979**
	C2	0	0	0	0	0	0	0	0	0	0.22	0.78	0	**0.779**
	C3	0	0	0	0	0	0	0	0.35	0.65	0	0	0	**0.673**
	C4	0	0	0	0	0	0	0	0	0	0	0.15	0.85	**0.969**
5	C1	0	0	0	0	0	0	0	0	0	0	0.22	0.78	**0.954**
	C2	0	0	0	0	0	0	0	0	0	0	0.05	0.95	**0.99**
	C3	0	0	0	0	0	0	0	0	0	0	0.18	0.82	**0.962**
	C4	0	0	0	0	0	0	0	0	0	0	0.19	0.81	**0.96**
6	C1	0	0	0	0	0	0	0	0	0	0	0.81	0.19	**0.83**
	C2	0	0	0	0	0	0	0	0	0	0.25	0.75	0	**0.778**
	C3	0	0	0	0	0	0	0	0	0	0	0.82	0.18	**0.828**
	C4	0	0	0	0	0	0	0	0	0	0	0.18	0.82	**0.962**
7	C1	0	0	0	0	0	0	0	0	0	0.22	0.78	0	**0.779**
	C2	0	0	0	0	0	0	0.4	0.6	0	0	0	0	**0.62**
	C3	0	0	0	0	0	0	0	0	0	0	0.12	0.88	**0.975**
	C4	0	0	0	0	0	0	0	0	0	0	0.81	0.19	**0.83**
8	C1	0	0	0	0	0	0	0	0	0	0.23	0.77	0	**0.779**
	C2	0	0	0	0	0	0	0	0	0.27	0.73	0	0	**0.727**
	C3	0	0	0	0	0	0	0	0	0	0.22	0.78	0	**0.779**
	C4	0	0	0	0	0	0	0	0	0	0	0.15	0.85	**0.969**
9	C1	0	0	0	0	0	0	0	0	0	0.25	0.75	0	**0.778**
	C2	0	0	0	0	0	0	0	0	0.3	0.7	0	0	**0.725**
	C3	0	0	0	0	0	0	0	0	0	0.26	0.74	0	**0.777**

	C4	0	0	0	0	0	0	0	0	0	0.22	0.78	0	**0.779**
10	C1	0	0	0	0	0	0	0	0.33	0.67	0	0	0	**0.674**
	C2	0	0	0	0	0	0	0	0.29	0.71	0	0	0	**0.676**
	C3	0	0	0	0	0	0	0	0	0.27	0.73	0	0	**0.727**
	C4	0	0	0	0	0	0	0	0	0.26	0.74	0	0	**0.727**

Finalizing the Marks

The panels or judges finalized the actual scores for each parameter. The final mark is computed using the equation 3. Table 6 shows the finalized marks obtained using fuzzy evaluation method.

Table 6: Finalizing the overall students' marks using fuzzy method

Student	Criteria	Degree of satisfaction	Total marks	Final mark for criteria	Finalized marks
1	C1	0.975	30	29.25	**91.70**
	C2	0.969	20	19.38	
	C3	0.985	20	19.7	
	C4	0.779	30	23.37	
2	C1	0.962	30	28.86	**96.44**
	C2	0.964	20	19.28	
	C3	0.969	20	19.38	
	C4	0.964	30	28.92	
3	C1	0.969	30	29.07	**94.22**
	C2	0.832	20	16.64	
	C3	0.966	20	19.32	
	C4	0.973	30	29.19	
4	C1	0.979	30	29.37	**87.48**
	C2	0.779	20	15.58	
	C3	0.673	20	13.46	
	C4	0.969	30	29.07	
5	C1	0.954	30	28.62	**96.46**
	C2	0.99	20	19.8	
	C3	0.962	20	19.24	
	C4	0.96	30	28.8	
6	C1	0.83	30	24.9	**85.88**
	C2	0.778	20	15.56	
	C3	0.828	20	16.56	
	C4	0.962	30	28.86	
7	C1	0.779	30	23.37	**80.17**
	C2	0.62	20	12.4	
	C3	0.975	20	19.5	
	C4	0.832	30	24.9	
8	C1	0.779	30	23.37	**82.56**
	C2	0.727	20	14.54	
	C3	0.779	20	15.58	
	C4	0.969	30	29.07	
9	C1	0.778	30	23.34	**76.75**
	C2	0.725	20	14.5	
	C3	0.777	20	15.54	
	C4	0.779	30	23.37	
10	C1	0.674	30	20.22	**70.09**
	C2	0.676	20	13.52	
	C3	0.727	20	14.54	
	C4	0.727	30	21.81	

Table 7 shows the comparison between fuzzy evaluation method and conventional method with different satisfaction level. Evaluation technique using conventional methods expose to vagueness, uncertainty, and imprecision interpretation (Mamatha et al. 2016). While a different mark contributes to a different grade, Ivanova and Zlatanov (2020) said that the fuzzy model can be used to improve the problem of borderline grade.

Fuzzy evaluation method plays a significant role in determining the students' performance because it is an alternative tool when dealing with uncertainty decisions (Lin et al. 2006). The students' performance is denoted in the form of scores and linguistic terms, which involve elements of uncertainty. The evaluation process was inclusive with the aid of the membership function graph and the fuzzy grade sheet which was introduced by Chen and Lee (1999). Based on the evaluation, it can improve some additional information on the students' performance for each criterion. Besides that, the use of linguistic terms seems to be more beneficial so that the students can work harder to obtain the best level of performance for their future poster presentations. Hence, this approach can be applied as an alternative method in evaluating the students' performance in the poster presentations that may provide an improvement for upcoming event.

Table 7: The results obtained from both methods for 10 students

Student	Conventional Method			Fuzzy Method		
	Final marks	Grade	Linguistic terms	Final marks	Grade	Linguistic terms
1	85	A	Exceptional	91.70	A+	Excellent at 0.07 and exceptional at 0.93
2	86.5	A	Exceptional	96.44	A+	Excellent at 0.18 and exceptional at 0.82
3	84.5	A	Exceptional	94.22	A+	Excellent at 0.8 and exceptional at 0.2
4	81	A	Exceptional	87.48	A	Excellent at 0.1 and exceptional at 0.9
5	84	A	Exceptional	96.46	A+	Excellent at 0.22 and exceptional at 0.78
6	79	A-	Excellent	85.88	A	Excellent at 0.82 and exceptional at 0.18
7	78	A-	Excellent	80.17	A	Excellent at 0.12 and exceptional at 0.88
8	79.5	A-	Excellent	82.56	A	Excellent at 0.15 and exceptional at 0.85
9	75	A-	Excellent	76.75	A-	Very good at 0.22 and excellent at 0.78
10	69.5	B	Fairly good	70.09	B+	Fairly good at 0.27 and very good at 0.73

CONCLUSION AND RECOMMENDATIONS

Fuzzy evaluation method plays an important part since the information based design rules can effortlessly be executed in frameworks with unknown structure. The control design methodology is straightforward and common sense based on linguistic information. Other than that, fuzzy evaluation method is suitable for evaluating the students' performance in any education such as poster performance, video presentation and oral presentation. A multi criteria examination in positioning the students' performance using fuzzy evaluation is proposed. The proposed method uses the application of fuzzy sets and approximate reasoning in choosing the positioning of the quality of educating in a few courses. In other words, it also introduces the normalized value for evaluating the marks which dampen the extraordinary esteem that exists in the information. The use of the model is reasonable in evaluating situations that involve subjectivity, vagueness and imprecise information. Experimental results are comparable and the method used are performed way better in few decisions.

Other than that, fuzzy evaluation method uncovers that significant amount of work has been carried out to recognize the students' performance and further exploration of both the theoretical and empirical literature

review. Therefore, conventional method sometimes is inappropriate and incompetent in some cases. However, fuzzy evaluation method is a very powerful tool to compensate this limitation and deal with vague and complex situations. This clearly uncovers that there is an urgent need for an alternative method for evaluating the students' performance in poster presentation using fuzzy evaluation method. Therefore, it seems clear that there is an urgent need for the implementation of students' performance in poster presentation which investigates the other qualitative factors that are responsive and reliable

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CONFLICT OF INTERESTS DECLARATION

The authors declare no conflict of interests regarding the publication of this article.

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