

# Development Strategy of Educator Competencies in the Navy Educational Institute Using SWOT-Fuzzy MCDM Approach

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Strategic environment development demands better capacity building and defence capabilities to face future challenges. The Navy educational institutions are expected to adapt with the development of science and technology. It is aligned with the quality of educators available. Nowadays, available educators cannot focus one hundred percent on the job. This is because there are other tasks and workloads, so the role of service to students and institutions is not in accordance with professional standards. The aim of paper is give an analysis and strategy for the development of an educator's competence in the Indonesian Navy (TNI AL). This research uses SWOT analysis and Fuzzy Multi criteria Decision Making method (F-MCDM). The result paper showed 4 (four) strategies for the development of educator competence. The strategies consist of seven points for the Strength-opportunity (SO) strategy; seven points for the II Weakness-Opportunity (WO) strategy; six points for the III Weakness-Threat (WT) strategy; and seven points for the Strength-Threat IV strategy (ST). Based on Fuzzy MCDM, this paper showed the weighted value of several strategies, such as: 0.2841 for Strategy I (S-O); 0.2844 for Strategy II (W-O); 0.2177 for Strategy III (W-T); 0.2138 for Strategy IV (S-O). Strategy II has the highest weight and become the chosen strategy in developing educator competence. This strategy consist of 6 (six) sub strategies.

**Key words:** *Educator Competence, Development Strategy, SWOT, Fuzzy MCDM.*



## Introduction

Significant research efforts in the last few stages has added much to the knowledge of creativity and educators (Siswono, et al, 2018; Ekawati, et al, 2017; Siswono, et al, 2018, January; Prawoto, et al, 2018). It has brought attention to our understanding of teaching, specifically in terms of what educators they are, what they do, and of their ambitions, which has often been ignored in the study of education teachers (Lanier & Little, 1986). Questions such as "What is the educator's background?" (Siswono, et al, 2019) have also been raised, as well as those regarding the duties and expenses educators are expected to have, and what it means exactly to be a "good" educator. These questions, however, have not been sufficiently investigated. Therefore, very little has been found about the quality and limitations of educational teachers. Gender educators are translated as "students," and thus provide substantial results for the development of students into competent teachers (Koster et al, 2005).

Strategic environment development demands greater capacity building and defence capabilities to face future challenges (Gerspacher, 2012). Increased defence capabilities require quality human resources with the ability to cover intellectual, personal, and physical aspects. These qualities are established through Navy educational institutions. Navy educational institutions are expected to adapt with the development of science and technology. It is aligned with the quality of educators available.

Nowadays, available educators cannot focus one hundred percent on the job. This is because there are other tasks and workloads, so the role of service to students and institutions is not in accordance with professional standards.

The aim of paper is to give an analysis and strategy for the development of educator competence in the Indonesian Navy (TNI AL). This research uses SWOT analysis and Fuzzy Multi criteria Decision Making method (F-MCDM).

## Literature Reviews

The paper draws from and is supported by many studies. Dalal A. Alqiawi and Sawsan (2015) concluded that the competence of good teachers centred on three main elements: Academic, Professional, and Personal. These three dimensions are divided into a number of standards and under each standard there are a number of indicators; which are all organized in a single model. Adnan Hakim (2015) stated that the technique used is a proportional sampling technique with data analysis using multiple regression. It showed that pedagogical, personal, professional, and social competence have a significant influence in improving learning performance. Pahrudin, et al (2016) stated that the technique used is descriptive and employed survey data using SPSS

in determining the direct / no direct influence of pedagogical, personal, professional, and social competence for the achievement of economic lessons positively.

Buyukozkan and Guleryuz (2016) also presents about Fuzzy MCDM uses to select alternative energy with the criteria of quantitative and qualitative analysis Buyukozkan & Guleryuz (2016). Toklu (2017) explains that Fuzzy MCDM is used to determine the level of customer loyalty (Toklu, 2017). Suharyo, et al (2017) offers the Fuzzy MCDM to select the naval base location with political, economic, and technical factors (Suharyo, Manfaat, & Armono, 2017). Lumaksono (2014) shows that SWOT analysis is used to obtain the weight value from the expert in identifying the internal and external factors of the traditional shipbuilding industry (Lumaksono, 2014). Malik, et al (2013) explains that SWOT analysis can determine the external and internal factors to support of strategy formulation in business schools in the Kingdom of Saudi Arabia (Malik, Al-Khatani, & Naushad, 2013). Shahbandarzadeh and Haghghat (2010) shows the integration results of each level and provide a final assessment of the market selection strategy (Shahbandarzadeh & Haghghat, 2010). Junior, et al (2014) supply the method to rank countries in calculating the number of gold medals, silver medals and bronze medals won (Junior, de-Melo, & Meza, 2014).

### **Educator Competency**

The ability or competence of Navy Educators is in principle the same as the professional teacher in general because the roles, duties and functions are the same. Therefore, Navy Educators must have pedagogic competence, social competence, personality competence and professional competence. Competence is the main capital for Navy educators who are central in the teaching and learning process so that this should be a major concern and priority of the interested parties and educational leaders as administrators.

There are several stakeholders involved in the competence of Navy educators, such as: 1) Ministry of Education; 2) Ministry of Defence; 3) Indonesian Navy (TNI AL); 4) LAPAN; 5) PINDAD; 5) LEN Industries.

In managing Indonesian Navy (TNI AL) educator competency development, stakeholders are required to apply strategies appropriately. In this case, there are several related strategic criteria, such as: 1) Pedagogic; 2) Personality; 3) Social; 4) Professional; 5) Ability to understand the doctrine of the Navy; 6) Ability to implement Navy doctrine in the scope of education; 7) Ability to integrate the doctrine of the Navy with the interests of national education; 8) Utilize information and communication technology for the benefit of learning; 9) Explore the use of technology; 10) Have a passion to improve continuously towards improving the outcome of a business, both in the quality and quantity of education; 11) Have the sense

that every job should be reported, informed, and discussed with colleagues to maximize results;  
12) Be part of a culture of shame, and of appropriate time-management.

### SWOT Analysis

SWOT analysis is an effective strategic planning tool for analysing the organization of internal and external influences (Learned, Christensen, Andrews, & Guth, 1965). SWOT analysis consists of internal and external factors. Internal factors (strengths, weaknesses) are used to test assets within an organization. External factors (opportunities, threats) are used to investigate factors in the environment beyond organizational control that affect organizational performance (Wheelen & Hunger, 1995), (Hill & Westbrook, 1997).

The SWOT analysis shows the right strategy in four categories (SO, ST, WO and WT) (Lumaksono, 2014). Strength-Opportunity (SO) takes advantage of opportunities by using existing strengths. Strength-Threat (ST) uses the strength to eliminate or reduce the effects of threats. Weakness-Opportunity (WO) strategies are used to benefit from opportunities by external environmental factors by fixing weaknesses. Lastly, Weakness-Threat (WT) strategies are used to reduce the impact from threats by fixing the weakness (Yuksel & Dagdeviren, 2007).

**Table 1:** Matrix SWOT (Malik. Al-Khatani, & Naushad, 2013)

INTERNAL/EXTERNAL FAKTOR	STRENGTH (S) (Maximal)	WEAKNESS (W) (Minimal)
OPPORTUNITIES (O) (maximal)	S-O Strategy (Maximal-Maximal)	W-T Strategy (Minimal-Minimal)
THREATS (T) (Minimal)	S-T Strategy (Maximal-Minimal)	W-O Strategy (Minimal-Maximal)

### Fuzzy Multi Criteria Decision Making (F-MCDM)

Zadeh (1965) promoted the fuzzy set theory concept (Chitnis, Sarella, Khambete, & Shrikant, 2015). This concept is defined mathematically by specifying the value of each individual representing the membership class in the fuzzy set (Zadeh, 1965). Consequently, fuzzy theory has become a useful tool for automating human activity with information based on uncertainty. This value represents the rate which the individual is similar to or compatible with the concept shown by the fuzzy set. Thus, an individual can enter in fuzzy formation to a bigger or lesser

extent. This membership value is indicated by real numbers ranging from closed intervals between 0 and 1.

## Methods

This research uses SWOT analysis and Fuzzy Multicriteria Decision Making method (F-MCDM). The subjects in this research are 5 educator competencies in the Indonesian Navy Education Institute. The technique used is descriptive and employs survey data using SPSS.

The instruments of this study are linear representation, Triangular Fuzzy Number (TFN), and Linguistic Variables.

### a) Linear representation

In a linear representation, the mapping to membership level is described as a straight line. This form is the simplest and most appropriate choice for a less obvious approach. There are 2 (two) fuzzy sets derived from linear conditions: the first is the set increment starting from the domain value with the zero membership level [0] to move right into the domain value with the higher membership level (Suharyo, Manfaat, & Armono, 2017).

#### Membership Functions

$$\mu[x] = \begin{cases} 0; & x \leq a \\ (x - a)/(b - a); & a \leq x \leq b \\ 1; & x \geq b \end{cases} \quad (1)$$

The second condition is the opposite of the first. The straight line starts from the domain value with the highest membership level on the left side, then switches to the value of the domain that has a lower membership (Suharyo, Manfaat, & Armono, 2017).

#### Membership Functions

$$\mu[x] = \begin{cases} (b - x)/(b - a); & a \leq x \leq b \\ 0; & x \geq b \end{cases} \quad (2)$$

### b) Triangular Fuzzy Number (TFN)

In TFN, every single value has a member function that consists of three values. Each value represents the lower, middle and top values.

$$A = (a_1, a_2, a_3)$$

TFN membership functions for the image above is as follows:

$$\begin{aligned}\mu[x] &= &= 0 & \text{for } x < a_1 \\ &= &= \frac{x - a_1}{a_2 - a_1} & \text{for } a_1 < x < a_2 \\ &= &= \frac{a_3 - x}{a_3 - a_2} & \text{for } a_2 < x < a_3\end{aligned}\quad (3)$$

### c) Linguistic Variables

The linguistic variable is a variable that has a description of a fuzzy number and is generally represented by a fuzzy set (Garg, Agarwal, & Choubey, 2015). In this study, a fuzzy triangle number has been used to represent linguistic variables on a scale of 0 to 1 to assess criteria and alternatives. These linguistic variables are represented as very weak (VW), weak (W), medium (M), strong (S), very strong (VS).

Liang (1999) proposes fuzzy Multi Criteria Decision Making (MCDM), which is based on idealism and anti-ideal concepts (Liang, 1999). In this section, it describes the MCDM fuzzy approach introduced by Dursun and Karsak, which is based on fuzzy information integration and the 2-tuple linguistic representation model (Dursun & Karsak, 2010).

**Table 2:** Correlation Score

Score	Strength of Corelation
1-2	Very Weak
3-4	Weak
5-6	Moderate
7-8	Strong
9-10	Very Strong

## Results and Discussion

### *SWOT Analysis*

In the SWOT analysis the data used is descriptive qualitative and is obtained directly from the informant. This study obtained some identification which was derived from 6 experts from the Navy.

**Table 3:** Interaction Matrix of Internal Factors

<b>Internal Factors</b>	
<b>Strength (S)</b>	<b>Weakness (W)</b>
<ol style="list-style-type: none"> <li>1. Educator has the ability to use curriculum and innovative teaching methods.</li> <li>2. Educator has a code of ethics of teaching.</li> <li>3. There is able to apply ICT-based learning process</li> <li>4. A good relationship between the Principal and the Educators</li> <li>5. Educator has a high dedication to education</li> <li>6. Educator has the ability to demonstrate what will be taught.</li> <li>7. Educator has the ability to manage the class</li> <li>8. Educator has sufficient knowledge and understanding of educational media</li> <li>9. Educator has the knowledge and ability to evaluate the learning outcomes.</li> </ol>	<ol style="list-style-type: none"> <li>1. Low discipline level.</li> <li>2. Not all educators is able to facilitate ICT-based learning.</li> <li>3. Educator teaches more than one subject.</li> <li>4. Low morale of educators.</li> <li>5. Educators often leave the classroom.</li> <li>6. Lack of dedication of some educators to his duty.</li> <li>7. Educators less master the various theories of learning, so boring.</li> <li>8. Lack of educators spirit to learn a lot about various disciplines.</li> <li>9. The low level of Educators welfare</li> </ol>
<b>External Factors</b>	
<b>Opportunity (O)</b>	<b>Threat (T)</b>
<ol style="list-style-type: none"> <li>1. Many education opportunities to the advanced strata</li> <li>2. Awarding for educator achievement.</li> <li>3. The existence of Navy support in the field of education.</li> <li>4. Leadership commitment to improve the quality of education.</li> <li>5. The existence of government support for the welfare of educators.</li> <li>6. Navy needs of education services.</li> <li>7. The infrastructure is quite complete.</li> <li>8. There is good correlation with the Directorate of Higher Education.</li> </ol>	<ol style="list-style-type: none"> <li>1. Navy is still not maximal in giving welfare of educators.</li> <li>2. Rapid development of technology.</li> <li>3. Lack of Navy attention to educational progress.</li> <li>4. An increasingly complex security threat, including security threats in education.</li> <li>5. There is a change in the status of military lecturer into a lecturer in a civil college.</li> <li>6. More lecturers as consultants than educators.</li> </ol>

From Table 3, internal factors or factors that come from within consist of two points of strength and weakness. Both will have a better impact in a study when the strength is greater than the weakness. Based on the results of identification through SWOT analysis, the research obtained 9 points in the form of strength and 9 points of weakness.

From Table 3, external factors are a factor from outside the entity. This factor consists of 2 points of threat and opportunity. The existence of these opportunities and threats will of course provide data that must be included in the research so as to produce strategies to deal with it. Based on the results of identification through SWOT analysis, the research obtained 8 points in the form of opportunities and 6 points of threat.

Based on the matrix in table 3, achievable strategic plans can be determined (table 4), including, among others, SO Strategy (Strengths-Opportunities), WO Strategy (Weaknesses-Opportunities), ST Strategy (Strengths-Threats), and WT Strategy (Weaknesses-Threats).

**Table 4:** Interaction Matrix of External Factors

<b>Strategies</b>	
<b>Strength-Opportunity (S-O)</b>	<b>Weakness-Opportunity (W-O)</b>
<ol style="list-style-type: none"> <li>1. Educators can attend training, procurement of latest weaponry equipment.</li> <li>2. Improved educational instruments for educators.</li> <li>3. Improving the welfare of educators with lecturer certification benefits.</li> <li>4. Procurement of facilities appropriate to the educational needs to support the learning process.</li> <li>5. Improving the quality of human resources with advanced scholarship grant.</li> </ol>	<ol style="list-style-type: none"> <li>1. Educators are given the opportunity to continue his education with a scholarship.</li> <li>2. Educators were given ICT-based learning training</li> <li>3. Educators are given a gadget allowance</li> <li>4. Award for high achievement</li> <li>5. Recruitment of Educators comes from the best personnel and has dedicated.</li> <li>6. Educators are required to meet the standards determined by the Directorate of Higher Education.</li> </ol>
<b>Strength-Threat (S-T)</b>	<b>Weakness-Threat (W-T)</b>
<ol style="list-style-type: none"> <li>1. Educators welfare is more concerned</li> <li>2. Educators holds curriculum changes relevant to current alutsista technology</li> <li>3. Educators provide tiered feedback on educational progress</li> <li>4. Educators learn more and read the current conditions of factual threats in education</li> <li>5. The principal provides motivation and seeks to improve the welfare of educators.</li> <li>6. The principal provides teaching, mentoring and research to the educator.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reforming the teaching schedule for Educators</li> <li>2. The threats to the education world include low spirit of teaching, lack of dedication as educators with improved welfare of educators.</li> <li>3. Lack of mastery of theory and lack of educators in devoting their knowledge to the addition of scholarships to the school of high school</li> <li>4. Attention to the education sector with additional budget</li> </ol>

The strategy consists of seven points for the Strength-opportunity (SO) strategy; seven points for the II Weakness-Opportunity (WO) strategy; six points for the III Weakness-Threat (WT) strategy; seven points for the Strength-Threat IV strategy (ST).

### **Fuzzy MCDM**

The next step is to determine the strategy of choice by Fuzzy MCDM (F-MCDM). The choice of strategy that exists after the SWOT analysis is given weight in rank. Previously, the questionnaire was filled by 6 competent expert assessors (E1; E2; E3; E4; E5; E6) in the field of educator competence.

The questionnaire scale consists of two separate, linguistic scales and numerical scales. The strategies consist of SO Strategy (Strengths-Opportunities), WO Strategy (Weaknesses-Opportunities), ST Strategy (Strengths-Threats), and WT Strategy (Weaknesses-Threats).

**Table 5:** Criteria Value of Strategy

NO	Criteria of Good Strategies	E1	E2	E3	E4	E5	E6
1	Pendagogic	8	7	9	7	8	7
2	Personality	8	8	9	7	9	7
3	Social	9	7	8	6	7	6
4	Professional	9	8	9	8	8	8
5	Able to understand the doctrine of the Navy	8	9	8	7	7	7
6	Able to implement Navy doctrine in the scope of education	8	9	8	7	7	7
7	Able to integrate the doctrine of the Navy with the interests of national education	7	8	8	6	6	6
8	Utilizing information and communication technology for the important of learning	8	9	7	8	8	7
9	Explore the use of technology	7	8	7	9	7	8
10	Have a passion to improve continuously towards a better way to process the outcome of a business, both the quality and quantity of education	8	7	8	7	7	7
11	Have the spirit of every job should be reported, informed, and discussed or asked advice to colleagues, whose impacts bring maximum results	7	6	7	7	6	7
12	Culture of shame, culture timely for educator	8	7	7	8	7	8

**Table 6:** Value of Criteria and Strategy Recapitulation

NO	CRITERIA	Strategies	E 1	E 2	E 3	E 4	E 5	E 6
1	Pendagogic	S1 (SO)	8	8	9	7	8	7
		S2 (WO)	9	8	9	7	8	5
		S3 (WT)	8	7	9	6	8	6
		S4 (ST)	7	7	8	6	7	5
2	Personality	S1 (SO)	8	7	9	6	8	7
		S2 (WO)	7	8	8	8	9	7
		S3 (WT)	8	7	8	5	8	7
		S4 (ST)	8	7	8	6	8	6
3	Social	S1 (SO)	9	7	8	6	7	6
		S2 (WO)	7	8	9	5	6	7
		S3 (WT)	8	7	8	6	6	6
		S4 (ST)	7	6	8	6	6	5
4	Professional	S1 (SO)	8	8	9	7	8	8
		S2 (WO)	8	9	9	8	8	6
		S3 (WT)	8	8	9	7	8	7
		S4 (ST)	9	8	8	6	6	6
5	Able to understand the doctrine of the Navy	S1 (SO)	7	9	8	6	7	7
		S2 (WO)	8	9	8	7	6	8
		S3 (WT)	7	8	8	6	6	7
		S4 (ST)	7	8	7	6	7	6
6	Able to implement Navy doctrine in the scope of education	S1 (SO)	6	8	8	7	7	8
		S2 (WO)	7	9	7	6	7	8
		S3 (WT)	6	7	7	7	7	7
7	Able to integrate the doctrine of the Navy with the interests of national education	S1 (SO)	7	6	8	6	6	8
		S2 (WO)	7	7	8	6	6	7
		S3 (WT)	8	6	7	6	5	6
		S4 (ST)	7	6	7	6	5	5
8	Utilizing information and communication technology for the important of learning	S1 (SO)	8	9	7	8	8	6
		S2 (WO)	7	8	7	7	7	6
		S3 (WT)	8	8	7	7	7	6
		S4 (ST)	7	8	7	7	6	6
9	Explore the use of technology	S1 (SO)	8	7	7	8	7	8
		S2 (WO)	8	7	7	8	6	7
		S3 (WT)	9	8	6	9	7	8
		S4 (ST)	8	7	6	8	6	7
10	Have a passion to improve continuously towards a better way to process the outcome of a business, both the quality and quantity of education	S1 (SO)	7	6	8	7	6	7
		S2 (WO)	7	6	8	7	6	7
		S3 (WT)	8	6	7	8	6	6
		S4 (ST)	7	7	7	7	6	6
11	Have the spirit of every job should be reported, informed, and discussed or asked advice to colleagues, whose impacts bring maximum results	S1 (SO)	6	7	7	7	7	9
		S2 (WO)	7	6	6	6	6	7
		S3 (WT)	6	6	6	6	6	7
		S4 (ST)	7	7	7	6	5	6
12	Culture of shame, culture timely for educator	S1 (SO)	8	6	7	8	7	8
		S2 (WO)	8	7	7	7	6	8
		S3 (WT)	8	6	7	7	7	7
		S4 (ST)	7	6	6	6	5	6

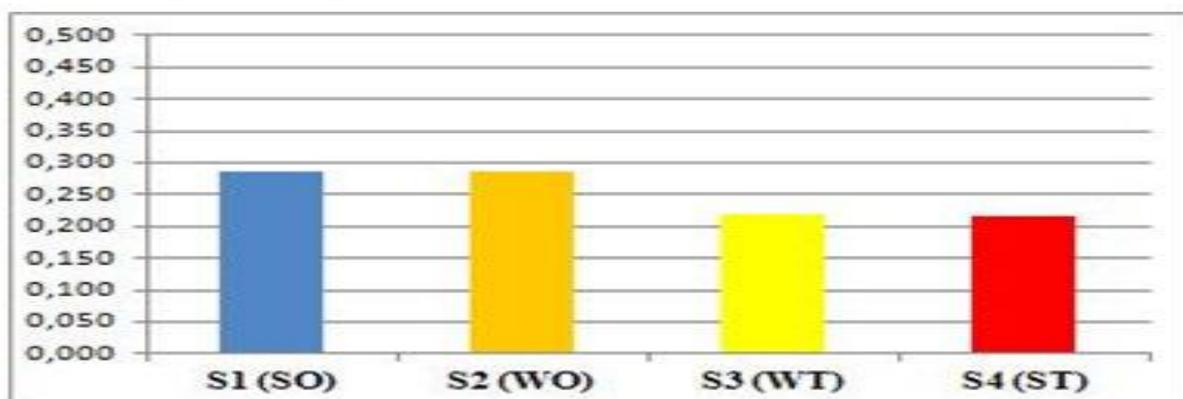
**Table 7:** Utility Value of Any Alternative Strategies

UTILITY VALUE OF ANY ALTERNATIVE STRATEGIES							
XR -S1(SO)	162,290	35,722	651,562	-136,580	22,693	122,801	37,605
-S2(WO)	131,712	18,681	279,760	-77,829	14,210	76,897	36,748
-S3(WT)	118,173	13,629	176,637	-60,341	10,784	58,356	36,723
-S4(ST)	230,675	53,513	1718,186	-214,598	38,776	209,831	37,179
XL -S1(SO)	82,635	3,735	384,732	7,886	19,815	107,224	10,427
-S2(WO)	91,059	5,929	206,482	11,655	14,769	79,923	8,533
-S3(WT)	106,712	10,117	159,804	17,967	13,333	72,150	22,340
-S4(ST)	87,117	4,783	1052,731	9,574	32,593	176,372	42,236
Ut(Gt) -S1(SO)	8,046	3,518	0,485	1,517			
-S2(WO)	5,273	4,244	1,140	1,552			
-S3(WT)	3,816	5,897	3,206	0,988			
-S4(ST)	14,326	3,972	2,446	0,763	4,820		

**Table 8:** Value and Ranking of Strategies

Strategy	Fti	RANKING
S1 (SO)	0,2841	II
S2 (WO)	0,2844	I
S3 (WT)	0,2177	III
S4 (ST)	0,2138	IV

**Figure 1.** Graph of Strategies Rank



The fuzzy method of MCDM is a decision support system used to select the best alternative from several alternatives based on several criteria determined by the decision maker.



The MCDM fuzzy method is used to assign weights to any strategy used to determine the competence of educators. An alternative weight on each strategy was subsequently obtained as a result of the decision. Based on data analysis with fuzzy MCDM, the weighted value of several strategies, included: 0.2841 for Strategy I (S-O); 0.2844 for Strategy II (W-O); 0.2177 for Strategy III (W-T); and 0.2138 for Strategy IV (S-O).

Strategy II has the highest weight and is the chosen strategy in developing educator competence. This strategy has many sub strategies, such as: 1) Educators are given the opportunity to continue his education with a scholarship; 2) Educators are given ICT-based learning training; 3) Educators are given a gadget allowance; 4) Award for high achievement; 5) Recruitment of Educators comes from the best and most dedicated personnel; 6) Educators are required to meet the standards determined by the Directorate of Higher Education.

### **Conclusion**

The competence development strategy of educators in this research is expected to inform the Navy education institute. Based on the results of research, this paper indicated 4 (four) strategies for the development of educator competence. The strategies consist of seven points for the Strength-opportunity (SO) strategy; seven points for the II Weakness-Opportunity (WO) strategy; six points for the III Weakness-Threat (WT) strategy; and seven points for the Strength-Threat IV strategy (ST). Based on Fuzzy MCDM, this paper showed the weighted value of several strategies, such as: 0,2841 for Strategy I (S-O); 0,2844 for Strategy II (W-O); 0,2177 for Strategy III (W-T); 0,2138 for Strategy IV (S-O). Strategy II has the highest weight and is the chosen strategy in developing the educator competence. This strategy consists of 6 (six) sub strategies.



## REFERENCES

- Adnan Hakim. 2015. Contribution of Competence Teacher (Pedagogical, Personality, Professional Competence and Social) on the Performance of Learning. The International Journal Of Engineering and Science, Vol 4, Issue 2, PP. 01-12.
- Buyukozkan, G., & Guleryuz, S. 2016. Fuzzy Multi Criteria Decision Making Approach for Evaluating Sustainable Energy Technology Alternatives. International Journal of Renewable Energy Sources , 1, 1-6.
- Chitnis, K., Sarella, G., Khambete, A. K., & Shrikant, R. B. 2015. Fuzzy MCDM Approach for Air Quality Assessment. International Journal for Innovative Research in Science & Technology, 1, 59-55.
- Dalal A. Alqiawi & Sawsan M. Ezzeldin 2015 A Suggested Model for Developing and Assessing Competence of Prospective Teachers in Faculties of Education. World Journal of Education, Vol. 5, No. 6.
- Dursun, M., & Karsak, E. E. 2010. A fuzzy MCDM Approach for Personnel Selection. Expert Systems with Applications, 37(6), 4324-4330.
- Ekawati, R., Kohar, A. W., & Hartono, S. (2017). Experts' notion and students' responses on context-based mathematics problem. Journal of Engineering Science and Technology (JESTEC), 53-64.
- Garg, H., Agarwal, N., & Choubey, A. 2015. Entropy Based Multi-criteria Decision Making Method under Fuzzy Environment and Unknown Attribute Weights. Global Journal of Technology & Optimization, 6, 1-4.
- Gerspacher, N. 2012. Preparing Advisers for Capacity-Building Missions . Washington, DC: United States Institute of Peace.
- Hill, T., & Westbrook, R. 1997. SWOT Analysis: It's Time for a Product Recall. Long Range Planning , 30(1), 46-52.
- Junior, S. G., de-Melo, J. B., & Meza, L. D. 2014. Sequential Use of Ordinal Multicriteria Methods to Obtain a Ranking for the 2012 Summer Olympic Games. WSEAS Transactions on Systems , 13, 223-230.
- Koster, B., Brekelmans, M., Korthagen, F. A. J., & Wubbels, T. 2005. Quality requirements for teacher educators. Teaching and Teacher Education, 21(2), 157- 176.



- Lanier, J. E., with Little, J. W. 1986. Research on teacher education. In M. C. Wittrock (Ed.), Handbook for research on teaching (pp. 527-569). New York: Macmillan
- Learned, A., Christensen, C., Andrews, R., & Guth, D. 1965. Business policy: Text and cases . Irwin.
- Liang, G. S. 1999. Fuzzy MCDM based on Ideal and Anti-ideal Concepts . European Journal of Operational Research, 112, 682-691.
- Lumaksono, H. 2014. Implementation of SWOT-FAHP Method To Determine The Best Strategy on Development of Traditional Shipyard in Sumenep. Academic Research International, 5(5), 56-67.
- Malik, S. A., Al-Khatani, N. S., & Naushad, M. 2013. Integrating AHP, SWOT and QSPM in Strategic Planning an Application to College of Bussiness Administration in Saudi Arabia. Proceedings of the International Symposium on the Analytic Hierarchy Process.
- Pahrudin, Trisno Martono, Wiedy Murtini 2016. The Effect of Pedagogic competency, Personality, Professional and Social Competency Teacher to Study Achievement of Economic Lesson in State Senior High School of East Lombok District Academic Year 2015/2016. Proceeding The 2nd International conference On Teacher Training and Education Sebelas Maret University, Vol 2, Number 1.
- Prawoto, B. P., Hartono, S., & Fardah, D. K. (2018, November). Prospective teachers' difficulties in second order linear differential equation: a case of constructing methods in solving a non-homogeneous problem. In Journal of Physics: Conference Series (Vol. 1108, No. 1, p. 012002). IOP Publishing.
- Shahbandarzadeh, H., & Haghghat, F. 2010. Evaluation of the Strategies of Target Market Selection on the Basis of IFE and EFE Matrixes using Linmap Technique (A case study of Bushehr Province). Iranian Journal of Management Studies, 3(3), 41-58.
- Siswono, T. Y. E., Kohar, A. W., Rosyidi, A. H., & Hartono, S. (2018, January). Searching for authentic context in designing PISA-like mathematics problem: From indoor to outdoor field experience. In Journal of Physics: Conference Series (Vol. 953, No. 1, p. 012197). IOP Publishing.
- Siswono, T. Y. E., Hartono, S., & Kohar, A. W. (2018). Effectiveness of project based learning in statistics for lower secondary schools. Eurasian Journal of Educational Research, 18(75), 197-212.



- Siswono, T. Y. E., Kohar, A. W., & Hartono, S. (2019, October). Beliefs, knowledge, teaching practice: three factors affecting the quality of teacher's mathematical problem-solving. In *Journal of Physics: Conference Series* (Vol. 1317, No. 1, p. 012127). IOP Publishing.
- Suharyo, O. S., Manfaat, D., & Armono, H. D. 2017. Establishing the Location of Naval Base Using Fuzzy MCDM and Covering Technique Methods : A Case Study. *International Journal of Quantitative Management*, 23(1).
- Toklu, M. C. 2017. Determination of Customer Loyalty Levels by Using Fuzzy MCDM Approaches. *the 3rd International Conference on Computational and Experimental Science and Engineering*, 132(3), 650-654.
- Wheelen, T., & Hunger, J. 1995. *Strategic Management and Business Policy* . Reading: Addison-Wesley.
- Yuksel, I., & Dagdeviren, M. 2007. Using the Analytic Network Process (ANP) in a SWOT Analysis – A Case Study for a Textile Firm. *Information Sciences*, 177, 3364–3382.
- Zadeh, L. A. 1965. *Fuzzy Sets, Information And Control* (8 ed.).