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Perception of Productive Teacher Major in Mechanical and Automotive Engineering to the Teaching Factory Implementation at Vocational High School in South Sulawesi, Indonesia

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Abstract:
This study aims to find out the description of teachers' perceptions of productive field in mechanical and automotive engineering to the readiness of teaching factory implementation at SMK in South Sulawesi. The research method used is survey research. The total population of 606 teachers of mechanical engineering and engineering techniques scattered in 24 regencies / cities in South Sulawesi. Sampling using proportional random sampling technique with the number of respondents are 252 people. Data analysis technique used in this research is quantitative descriptive analysis technique and confirmatory factor analysis (CFA). Statistical analysis is used to obtain answers from the objectives proposed in this study. The result of the research shows that from the nine indicators of readiness to apply teaching factory, the first indicator of the curriculum has the highest achievement score of 84.1%, followed by infrastructure and facilities, operational management, entrepreneurship, finance and investment, real products, cooperation, human resources and goods and services, which has the lowest score achievement rate of 65.1% from the average achievement for the nine indicators is 75.17%. Therefore, the level of achievement for each indicator of readiness to apply teaching factory still needs to be improved.

Keywords: *teaching factory, productive teacher, mechanical engineering, automotive engineering*

1. Introduction

Vocational Vision as stipulated in the strategic plan of the Directorate of Vocational High School Education of the Ministry of Education and Culture that can produce graduates who have entrepreneurial spirit, ready to work, smart, competitive, and have national identity, and able to develop local advantage and able to compete in global market can achieved. To achieve this vision, mission is formulated to increase the expansion and equitable access to quality SMK for all levels of society; improving the quality of vocational schools by applying discipline, noble character, environmental insight, and ICT-centered contextualized learning; empowering SMK in creating graduates with an entrepreneurial spirit with a number of competency skills by developing industry cooperation and relevant business communities in the form of "teaching industry".

The roadmap document of SMK 2010-2014 has targeted that by the end of 2014 there will be 70% of SMK having business learning units in the form of teaching industry or teaching factory. To accelerate the formation of teaching factory in vocational education in Indonesia, the government in this case five ministries namely the Ministry of Industry; Ministry of Education and Culture; Ministry of Research, Technology and Higher Education; Ministry of Manpower; and the Ministry of State-Owned Enterprises in October 2016 developed a memorandum of understanding No. 668 / M-IND / 11/2016; 125 / XI / NK / 2016; 17 / M / NK / 2016; 5 / NK / MCN / XI / 2016; and MOU-04 / MBU / 11/2016 on the development of vocational education and competency-based vocations that link and match with industry. In article 3 regarding the duties and responsibilities of point 1.c. explained that the industry is encouraged to provide workshops as teaching factories of education and vocational and industrial vocations and facilitate field work and / or industrial apprenticeship for students, students and teachers / vocational and vocational education unit. Item 5.c. of this understanding also explains that State-Owner Enterprises are encouraged to provide support in the development of teaching factories and infrastructure for vocational education and industrial vocations. In addition to the above five ministries, previously in 2011 the Ministry of Maritime Affairs and Fisheries has also declared the importance of applying teaching factory teaching strategies to improve the competence of graduates in the School of Medium Fisheries Enterprises which includes teaching factory management;

mechanism of learning activities at teaching factory; and monitoring and evaluation) and reporting. This is stated in the Decree of the Head of Marine and Fisheries Resources Development Agency Number 97 / BPSDMKP / 2011 dated December 19, 2011.

Several studies have been conducted such as in Surakarta and Bengkulu stated that teaching approach through teaching factory can improve students' competence in SMK (Siswanto, 2011; Sampurni, 2012, and Paidi, 2013). In addition to domestic research, several studies in several EU countries such as Germany, Canada, Italy and Greece also show that the application of teaching factory or learning factory can improve the competence of faculty and learners. Through this teaching factory teaching can be applied a new learning model where learners can deepen their knowledge and apply it in the form of real practice (Rentzos et al., 2014; Abele et al., 2015; Wagner et al., 2014; Enke et.al ., 2016, Chrissolouris et.al. 2016 and Lanza et.al., 2015). The implementation of teaching factory is also believed to be able to overcome the gap between education and industry (Rentzos et.al., 2015). Increased competencies include technology and methods of learning, social and communication, personality and activities and the orientation of implementation of learning outcomes (Iris et.al., 2016). The implementation of these learning outcomes is gained through the ability to apply knowledge in solving practical problems in the industry (Dominik et.al., 2014). The role of teachers themselves in the learning process is as a consultant or moderator of the learning process and guide learners in learning activities (Lanza et.al., 2016). The facts encountered in the field, especially in SMK technology groups such as Mechanical Engineering and Automotive Engineering courses in South Sulawesi, experiencing difficulties in the implementation of teaching factory. The implementation of teaching factory has been running in several vocational schools located in Makassar city, Parepare city and Palopo city namely SMK 5 Makassar, SMK 2 Parepare and SMK 2 Palopo which in its activities also still encounter obstacle in production and marketing of product, existing workshops have not optimally support the implementation of teaching factory. So it is necessary to conduct a comprehensive assessment of the readiness of teaching factory application seen from the perception of productive teachers.

2. Method

The approach used in this research is quantitative approach with non-experimental design because the researcher did not give treatment to the research subject (Bordens & Abbott, 2008: 216). When viewed from the type including survey research because the data studied is the sample data taken from the population and research using questionnaires as collectors of data from respondents in the form of teachers' perceptions of the preparation of teaching factory implementation (Mitchell & Jolley, 2007: 208). The population in this research is productive teachers of SMK in Mechanical Engineering and Automotive Engineering in South Sulawesi, spread over 24 regencies / cities that have followed the 2015 UKG as many as 606 people. Productive Teachers Mechanical Engineering and Automotive Engineering is a teacher on the package of expertise in Mechanical Engineering, Welding Engineering, Light Vehicle Engineering, and Motorcycle Engineering. Of the population, samples were taken that represented the distribution of SMK to the district / city. The sampling technique is very important in behavioral research, and aims to make the findings of economical and accurate research. A good sample is representative or random to provide maximum information about generalization of research data (Singh, 2006: 81). Determination of teacher sample size using random number table from Issac and Michael (1984: 193) with error rate $\alpha = 5\%$, so from population number 606 obtained sample used is 252 Teachers. The sampling technique used is combined sampling, because the sampling technique used involves more than one method or combined sampling, i.e. cluster sampling, proportional random sampling, and stratified random sampling. Cluster sampling is used to view sample spreads in each district / city and on each skill pack. The sample size of each district / city is distributed using proportional random sampling technique. The research instrument was developed to obtain data from teaching factory preparedness variables, consisting of nine sub variables namely operational management, human resources, curriculum, infrastructure and facilities, finance and investment, cooperation, real product based learning process, entrepreneurship, and goods and services. This study is a survey by using questionnaires or questionnaires as a means of collecting data. Before the instrument is used to retrieve the data, firstly done the validity and reliability of research instruments by conducting instrument test on 30 teachers. Data were collected by self-administered questionnaires in the presence of the researcher, in which respondents would answer questions or revelations in questionnaires in the presence of researchers without the help of researchers (Cohen, 2007: 344). The presence of researchers on questionnaires aims to help respondents to explain the questions that are less clear. In addition, it is usually also done to ensure a good response rate and ensure that all questions are completed properly and correctly. The main advantage of the questionnaire is that it allows broad reach at minimal cost, wider geographical coverage by large sample selection and more representative (Singh, 2006: 108). Data analysis technique used in this research is quantitative descriptive analysis technique. Descriptive analysis is used to interpret the data from variables that represent answers to research questions. Further analysis is by using Confirmatory Factor Analysis (CFA) analysis to get the idea that the readiness of teaching factory can be explained from the construct of nine indicators of teaching factory readiness in SMK Mechanical Engineering and Automotive Engineering in South Sulawesi.

3. Result and Discussion

The variable data of readiness to apply teaching factory was revealed by questionnaire consisting of 59 points in Likert scale (1-4), then the minimum score determined for the readiness to apply teaching factory is 59, the maximum score is 236 so that the criterion average ($\bar{X}_k$) equal to 147.5 and standard deviation criterion (σ_k) is equal to 29,5.

The result data showed that the minimum score of the readiness variable applied teaching factory was 121, the maximum score was 236, the score was 193,96, the median was 194, the mode was 167, and the standard deviation 26,16. Furthermore, by using the average value of criteria ($\bar{X}_k = 147{,}5$) and standard deviation criteria ($\sigma_k = 29{,}5$), it can be compiled classification of the total score of readiness variable to apply teaching factory in five categories namely very low, low, medium, high, and very high.

Average score of research results ($\bar{X}$= 193.96) when compared with these criteria, then generally respondents perceive readiness in applying teaching factory is in very high category. A total of 0.79% respondents perceive readiness to apply teaching factory is in the low category, 9,13% in medium category, and 38,49% in high category, 51,59 in very high category and no respondent perceptible to readiness to apply teaching factory in very low category.

Descriptive analysis also aims to see the achievement of the variable score of readiness to apply teaching factory by comparing the total score achieved with the highest expected total score. Total score of readiness variable applied teaching factory obtained is 48779, while the highest total score expected is 63504. Therefore, the achievement of total score of readiness variable applied teaching factory reaches 75,17% from total expected highest score.

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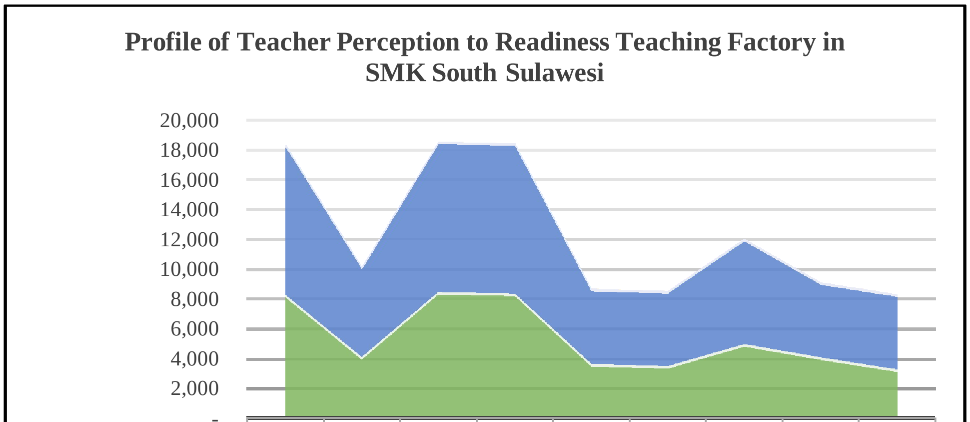
Readiness to apply teaching factory is observed from nine indicators, namely: (1) operational management (TF1); (2) human resources (TF2); (3) curriculum (TF3); (4) infrastructure and facilities (TF4); (5) finance and investment (TF5); (6) cooperation (TF6); (7) real product-based learning process (TF7); (8) entrepreneurship (TF8), and (9) goods and services (TF9). Description of data of these indicators is presented in the following figure.

Based on the drawings, it can be concluded that from the nine readiness indicators to apply teaching factory, the first indicator of the curriculum (TF3) has the highest achievement score of 84.1% and the ninth indicator of goods and services (TF9) has the lowest score achievement level of 65, 1% of the average achievement for the four indicators is 75.17%. Therefore, the level of achievement for each indicator of readiness to apply teaching factory still needs to be improved.



	TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	TF9
Percentage Score	82.31%	68.04%	84.08%	83.09%	72.52%	69.58%	70.63%	81.15%	65.10%
Criteria Score	10,080	6,048	10,080	10,080	5,040	5,040	7,056	5,040	5,040
Achievement Score	8,297	4,115	8,475	8,375	3,655	3,507	4,984	4,090	3,281

Figure 1: Teacher Perception to Readiness Teaching Factory

The readiness to apply teaching factory of SMK teachers in mechanical engineering and automotive (TF) in this research is hypothesized to be built by nine observed varians (manifest), namely (1) operational management (TF1); (2) human resources (TF2); (3) curriculum (TF3); (4) infrastructure and facilities (TF4); (5) finance and investment (TF5); (6) cooperation (TF6); (7) real product-based learning process (TF7); (8) entrepreneurship (TF8), and (9) goods and services (TF9).

To test whether the manifest variable is a valid and reliable indicator in explaining construct of readiness variable applying teacher factory of SMK teacher in mechanical engineering and automotive (TF), used CFA. The results of the analysis in the form of standardized solution are presented in Figures 2 and 3.

The summary of the results of the analysis and interpretation of the validity and reliability of teacher factory vocational teacher readiness variables in the field of mechanical engineering and automotive are presented in Table 1. The results of CFA analysis in Table 4:24 show that the charge factor or standardized loading factor (λ) of each observed variable is in the range of 0.56 to 4.67 and the t-values are respectively from 5.89 to 19, 72. The factor load value meets the acceptance criteria is $\lambda \geq 0{,}50$. Similarly, the t-value also meets the acceptance criteria because the value is ≥ 1.96.

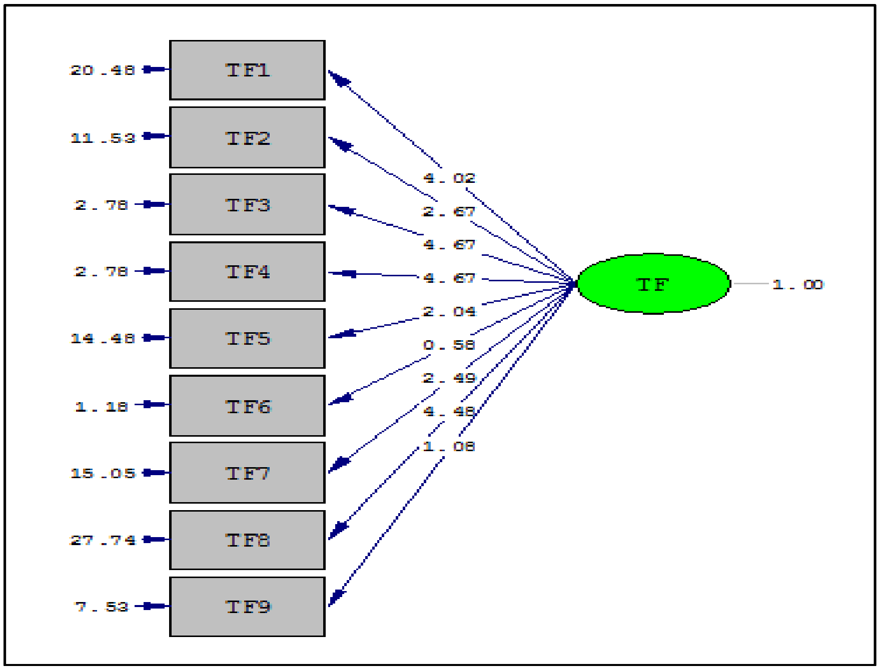


Figure 2: CFA result ofTeaching Factory (Lambda, λ)

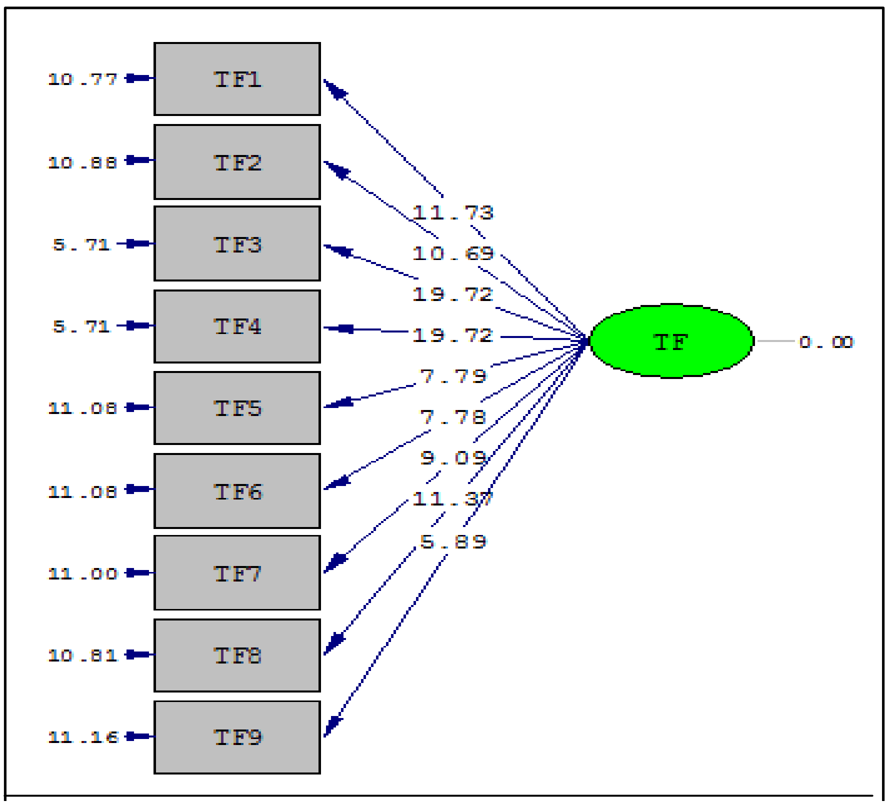


Figure 3: CFA result ofTeaching Factory ***(t-value)***

Based on the analysis result, it is concluded that the nine manifest variables, namely 1) operational management (TF1); (2) human resources (TF2); (3) curriculum (TF3); (4) infrastructure and facilities (TF4); (5) finance and investment (TF5); (6) cooperation (TF6); (7) real product-based learning process (TF7); (8) entrepreneurship (TF8), and (9) goods and services (TF9) are valid variables in explaining construct of variable of readiness variable applying teaching factory of vocational teacher in mechanical engineering and automotive.

Meanwhile, the result of latent variable reliability calculation of factory readiness (TF) shows construct reliability of 0.907. It means that its reliability value meets the acceptance criteria because it is bigger than 0.70 so it can be concluded that the reliability of the measurement model from the latent variable of the readiness variable applying the teaching factory of the vocational teachers of the field of mechanical engineering and automotive is good.

Latent Variable → *Manifest* Variable	Validity		*Error* (δ)	Construct Reliability	Remark
	Lambda (λ)	*t-value*			
TF →				0.907	Reliable
TF 1	4,02	11,73	20,48		Valid
TF 2	2,67	10,69	11,52		Valid
TF 3	4,67	19,72	2,78		Valid
TF 4	4,57	19,72	2,78		Valid
TF 5	2,04	7,79	14,48		Valid
TF6	0,56	7,78	1,18		Valid
TF 7	2,49	9,09	15,05		Valid
TF 8	4,48	11,37	27,14		Valid
TF 9	1,08	5,89	7,53		Valid

Table 1: Summary of CFA Analysis to ReadinessTeaching Factory

CFA analysis for teaching factory readiness showed that from the nine observed variables contributed to the value of loading varied factors to explain teaching factory preparedness. The biggest contribution of the results of the analysis is given by entrepreneurial variables which means that to run the concept of teaching factory in vocational school is needed ability to entrepreneurship. This is in line with the current SMK curriculum spectrum by incorporating creative product and entrepreneurship courses as one of the competency subjects of C3. The next important variables are curriculum, infrastructure and learning facilities, human resources, real learning based on DU / DI, shelter and investment, product in the form of goods and services as well as cooperation between schools with institutions in accordance with existing skills programs in SMK.

4. Conclusion

The readiness of teaching factory shows that teachers' perceptions of the readiness of teaching factory implementation can be represented by the nine observed variables. The results of CFA analysis contribute to the loading values of varied factors. The biggest contribution of the results of the analysis is given by entrepreneurial variables which means that to run the concept of teaching factory in vocational school is needed ability to entrepreneurship. The results of this observation correspond to the current SMK curriculum spectrum that adds creative and entrepreneurial product subjects as one of C3's competency skills subjects. Other variables also play an important role in supporting the readiness of teaching factory implementation in SMK, which can be mentioned, among others, curriculum, infrastructure and learning facilities, human resources, real learning based on DU / DI, finance and investment, and services and cooperation between schools with institutions that are in accordance with existing skills programs in SMK.

To optimize the implementation of good teaching factory in SMK, it is recommended that each SMK in determining the group of expertise in the school is that can be synergized and in accordance with the needs of the partner industry in the organization of teaching factory so that all existing skills programs can contribute actively in the organization of teaching factory in school.

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