Advances in Social Science, Education and Humanities Research, volume 299
5th UPI International Conference on Technical and Vocational Education and Training (ICTVET 2018)

# Developing the Teaching Factory Learning Model to Prepare the Students of Vocational High School in Facing Global Competitions

Sanggam Roy Inhard Manalu
Mechanical Engineering Education Study Program
Palangka Raya University
Palangka Raya, Indonesia
sanggamrim@yahoo.com

***Abstract*—There is a miss match between competencies obtained from Vocational High Schools and those required by the business and industrial world. To face global competition, ASEAN Economic Community free markets and Revolution Industry 4.0, Vocational High Schools should develop their learning models to achieve competencies which link and match with those required by the working world. One model to develop is the teaching factory learning model. The purpose of this research is to develop Teaching Factory learning model at Vocational High Schools. This study employs Research and Development (R&D). The research results in developing the teaching factory learning model show that the industrial atmosphere is well created at schools. The increase is tested for its significance using t-test that the result shows that p-score = <0.05 = *α*. It means that the increase is significant with the confidence level of 95%. Thus, the implementation of teaching factory learning method helps the students to reach their competences with the scores above 70. Those competencies encourage the students to confidently face the global competitions, ASEAN Economic Community free markets, and the Revolution Industry 4.0.**

***Keywords—teaching factory; vocational high schools; global competitions***

## I. INTRODUCTION

Nowadays the sophisticated-digital technology application in various sectors has been providing significant influence to increment of industrial competition at each nation in facing the dynamic global market. The Industry 4.0 is indeed offering the benefits, however it has the challenges which are encountered. The potential advantages of Industry 4.0 is regarding to the improvement of the flexibility rate in production and enhancement of customer service. Therefore, the education is required to prepare the human resources who have the capability and competency to occupy the Industry 4.0.

The education would be a media to present, shape, and improve the human resources. Through it, specifically in vocational education has been expected that the students having the competency as well directly implementing in job market areas.

Furthermore, there is still occurred the miss match between the studied subject in school and job demand or industry. It means that the course matters in learning model in vocational school is still not relevant in industry demand, thus needed the quality improvement, relevancy, and educational revitalization of vocational high school in producing the qualified human resource who are highly competitive. As the consequence, there is a establishment of link and match between learning in vocational school and the job/industry demand qualifications.

In simple concept of teaching factory, it is a development of the double education system, such as; the *Competence Based Training (CBT)*, and *Production Based Education and Training (PBET)* implemented by vocational schools. This is linked to the statement conveyed by Triatmoko, that vocational schools are still difficult to apply the education based on industrial production [1].

In 2000, Indonesia began to apply the concept of factory teaching in vocational schools through the development of production units. Then its concept has been developing in 2005 to be the development model of vocational school institution based on industry. In 2011, Supervisory Directorate of vocational school collaborated with federal government of German through the program of *Technical and Vocational Education and Training* (TVET) in developing the *Teaching Factory*. In previous phase, the concept of teaching factory adopted the learning method of dual system which is at long time has been implemented in education of *Technical and Vocational Education and Training* (TVET) in German and Switzerland. Moreover, dual system is a method integrating two principle environment in each student's activity, such as school area and industrial atmosphere. As the result, the students are not only gained the theoretical knowledge, but also capable to implement the practical activity based on industrial production which is similar to industrial atmosphere. This triggered the students obtained the skill, process, and altitude matching to the industrial standard then the educational competency will be proper to industrial requirement.

The relationship between the vocational education and job market in this context is to discover a solution or collaboration which is required in success the undergraduates of vocational

school appropriate to the qualification of industry demand, including the learning process in vocational education or specific case in learning process of vocational schools in Indonesia *(Sekolah Menengah Kejuruan)*. The issues frequently occurred in implementation process of learning is which teachers have been having the sufficient competency but occasionally it is unable to determine what is the model proper to the learning process for theory either practice.

The vocational schools are required to develop the path or learning model linking up with the circumstance of practice in vocational schools to the industrial areas, which is teaching the students relating to how is *learning by doing, hands on experience, and technopreneur*.

The model development of learning is directing on the merger of *Link and Match* between academic competency and industrial criteria that it is the model development of learning in *Teaching Factory*.

## II. Meaning of Teaching Factory

The Learning of teaching factory is a concept of learning in vocational schools based on industrial production/service product that refers to the standards and procedures in industry carrying out the atmosphere such as the industry area. This is according to the characteristics of vocational education as mentioned by Herminarto Sofyan, et al. namely: (1) preparing students to enter employment field; (2) based on "the demand market driven"; (3) mastery of the competencies needed by the job market; (4) student's success on "hands on" or work performance; (5) close relationship with the work world; (6) responsive and anticipatory to technological progress; (7) learning by doing and hands on experience; (8) requiring the investment cost and operational budget that are greater than general education [2].

The concept of teaching factory is combining the learning and a realistic work environment and presenting the relevant learning experiences. "Teaching factory concept as an approach that combines the learning and working environment from which realistic and relevant learning experiences arise" [3].

Lamancusa et al, revealed that the teaching factory concept was found because of three things, namely: (1) ordinary learning was not insufficient, (2) the benefits of students were obtained from practical experience directly and (3) the learning experience based on team work involving the students, teaching staff and industrial participation enriches the educational process and provides tangible benefits for all parties [4].

The paradigm of teaching factory learning is based on the aim of effectively integrating education, research and innovation activities into a single concept, involving industry and academics. The Learning of teaching factory focuses on the integration of industry and academics through approache to curriculum, teaching/training.

In the simple concept of teaching factory is the development of dual system education, namely Competence Based Training (CBT), and Production Based Education and Training (PBET) implemented by vocational schools. This is adjusted with the statement delivered by Triatmoko that vocational schools are still having difficulties in applying education based on industrial production [5]. Therefore, the term teaching factory was published in which requires schools to have a place for students to carry out the practical learning designed as such appear at work environment.

The Applying of the teaching factory model fully integrates the learning and work, in which there is not separated the place of delivery of theoretical matters and the place of practical courses. The organizational form of teaching factory shows the nature of the company that the teacher staff is a professional group in education area expected to be able to meet the needs of society for products and services in accordance with the vocational group.

## III. Research Method

This study employs the Research and Development (R&D) method by adopting the approaches stated by Plomp [6]. The step in the R & D research model are divided into five phases, including: (1) the initial investigation phase; (2) design phase; (3) realization/construction phase; (4) test, evaluation and revision phases; (5) field testing/implementation phase.

## IV. Result and Discussion

### *A. The Result of Initial Investigation Phase*

The results of the initial survey on seven parameters, namely management, workshop/laboratory, learning/training pattern, marketing/promotion, product-services, human resources, and industrial relations show that the average of the seven parameters is an average of 35.4; 47.5; 51.4; 38.5; 45, 48.5 and 51.7 (scale 0-100) still below 70 (expected conditions).

This condition also occurred in SMK 1 Pangkalan Kerinci, SMK 5 Banjarmasin, SMK 1 Palangka Raya, SMK 2 Palangka Raya, and SMK 5 Makassar.

TABLE I. RESULT OF INITIAL SURVEY IN FIVE SCHOOLS

| TEFA Parameter | SMKN 1 Pangkalan Kerinci | SMKN 5 Banjarmasin | SMKN 2 Palangka Raya (Accountancy) | SMKN 2 Palangka Raya (Office Administration) | SMKN 2 Palangka Raya (Marketing) | SMKN 1 Palangka Raya | SMKN 5 Makasar (Light Vehicle) | SMKN 5 Makasar (Refrigerator) | Average |
|---|---|---|---|---|---|---|---|---|---|
| 1. Management | 53,3 | 36,7 | 26,7 | 30,0 | 33,3 | 20,0 | 40,0 | 43,3 | 35,4 |
| 2. Workshopl - Lab | 44,0 | 48,0 | 44,0 | 44,0 | 44,0 | 48,0 | 40,0 | 68,0 | 47,5 |
| 3. Learning Model of Training | 91,4 | 42,9 | 34,3 | 42,9 | 42,9 | 48,6 | 60,0 | 48,6 | 51,4 |
| 4. Marketing and Promotion | 68,0 | 28,0 | 32,0 | 28,0 | 28,0 | 28,0 | 68,0 | 28,0 | 38,5 |
| 5. Product | 56,0 | 44,0 | 40,0 | 40,0 | 40,0 | 16,0 | 64,0 | 60,0 | 45,0 |
| 6. Human Resource | 92,0 | 36,0 | 40,0 | 40,0 | 36,0 | 32,0 | 60,0 | 52,0 | 48,5 |
| 7.Industrial Relation | 86,7 | 40,0 | 46,7 | 46,7 | 53,3 | 33,3 | 40,0 | 66,7 | 51,7 |
| Average | 70,2 | 39,4 | 37,7 | 38,8 | 39,6 | 32,3 | 53,1 | 52,4 | 45,4 |

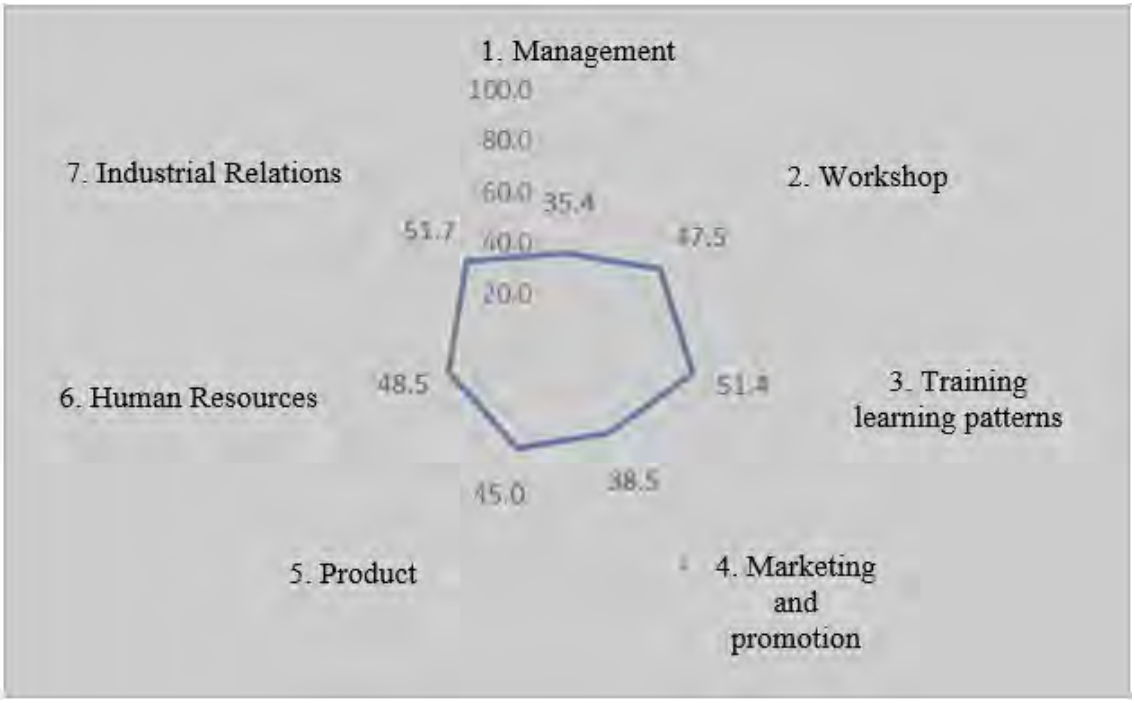


Fig. 1. Condition of seven paramaters in five schools.

There are seven parameters conducted at di SMKN 1 Pangkalan Kerinci, SMKN 5 Banjarmasin, SMKN 2 Palangka Raya (Accountancy), SMKN 2 Palangka Raya (Office Administration), SMKN 2 Palangka Raya (Marketing), SMKN 1 Palangka Raya, SMKN 5 Makassar (Light Vehicle Engineering), dan SMKN 5 Makassar (Refrigerator) respectively 70.2; 39.4; 37.7; 38.8; 39.6; 32.3; 53,1 and 52,4. Overall, the average of the seven parameters in all schools was 45.4. This condition occurs due to:

- The work culture that is applied has not been in accordance with the atmosphere of the industry, human resources who do not understand the culture and atmosphere of the industry, facilities and infrastructures that do not meet the standards of the industrial demand, cooperation with the business world is still insignificant, promotion or marketing of products produced by students is still unfacilitated, and the quality of the products produced is still low.
- There is not including the implementation manual book that is able to help vocational schools to present the industry atmosphere thus students are able to produce products or creation that are suitable to be commerce as well improving the entrepreneurial spirit of students.

### *B. Result of Implementation Phase*

On this phase there is the increment of learning in vocational schools

TABLE II. INCREMENT PERCENTAGE OF TEACHING FACTORY IN SMK

| TEFA Parameter | SMKN 1 Pangkalan Kerinci | SMKN 5 Banjarmasin | SMKN 2 Palangka Raya (Accountancy) | SMKN 2 Palangka Raya (Office Administration) | SMKN 2 Palangka Raya (Marketing) | SMKN 1 Palangka Raya | SMKN 5 Makasar (Light Vehicle) | SMKN 5 Makasar (Refrigerator) |
|---|---|---|---|---|---|---|---|---|
| 1. Management | 81 | 100 | 187,5 | 155,6 | 130,0 | 283 | 125,0 | 69,2 |
| 2. Workshopl - Lab | 100 | 42 | 72,7 | 72,7 | 72,7 | 67 | 130,0 | 29,4 |
| 3. Learning Model of Training | 0 | 93 | 116,7 | 73,3 | 73,3 | 35 | 66,7 | 35,3 |
| 4. Marketing dan Promotion | 24 | 129 | 150,0 | 185,7 | 185,7 | 143 | 35,3 | 185,7 |
| 5. Product | 21 | 55 | 90,0 | 80,0 | 90,0 | 300 | 56,3 | 33,3 |
| 6. Human Resource | 0 | 111 | 80,0 | 80,0 | 88,9 | 138 | 53,3 | 61,5 |
| 7. Industrial Relation | 15 | 67 | 57,1 | 42,9 | 50,0 | 80 | 150,0 | 30,0 |
| Average | **26** | 81 | 100,4 | 90,6 | 91,3 | 149,4 | 79,0 | 52,1 |

To investigate whether there is occurring the significant increment on testing and implementation. Its result uses Minitab 17 as such below:

*1) One-Sample T: Difference:*

Test of μ = 0 vs > 0, Variable N Mean StDev SE Mean 95% Lower Bound T P, Difference 25 7,478 3,145 0,629 6,401 11,89 0,000.

The results obtained p-value = 0 < α = 0.05. This means that there is an increment in significant value from the testing to implementation with a 95% of reliance level.

At the time of implementation, the average is 73.13. There was an increase of 11.39%. This was tested for its significance using the t-test, the result is $p - value =< 0{,}05 = \alpha$. This means that the increase is significant with a 95% of reliance level.

## V. CONCLUSION AND RECOMMENDATION

### A. Conclusion

The results of the development of the Teaching Factory implementation show that during the testing, the average score of students in producing chuck drill was at 65.66 (scale 0-100). At the time of implementation, the average is at about 73.13. There was an increase of 11.39%. The increase was tested for its significance using the t-test, the result was p-value = <0.05 = α. This means that the increase is significant with a 95% confidence level.

The results were evaluated based on the seven parameters of Teaching Factory implementation, namely (1) Management, (2) Workshop-Lab, (3) The Pattern of Learning Training, (4) Marketing and Promotion, (5) Products, (6) Human Resources, (7) Industrial Relations. Before implementation these, the average value of the seven parameters in five schools was respectively 35.4; 47.5; 51,4; 38.5; 45; 48.5 and 51.7. After it, the average is 90 '80.5; 78,6; 78.5; 75,5; 79 and 79.2. The value increase in the seven parameters is showing at 126%; 69%; 53%; 104%; 68%; 63%; and 53%.

Overall, the minimum and average values are 70.37 and 82.69 respectively. Thus, Teaching Factory learning addresses each student to competencies with grades above 70.

### B. Recommendation

- The implementation of Teaching Factory learning can improve the seven parameters (1) Management, (2) Workshop-Lab, (3) Pattern of Learning Training, (4) Marketing and Promotion, (5) Products, (6) Human Resources, (7) Industrial Relations. This is able to prepare students for global competition.
- In order to implement Teaching Factory in Vocational Schools, it is necessary to have a Teaching Factory implementation guide book to bridge the gap between industry and school.
- The central government needs to immediately implement the Regulation of the Minister of Industry No. 3 of 2017 and oversee its implementation in the Regions through increasing the application of Teaching Factory learning throughout vocational schools in Indonesia.
- Need to improve/replace/add out the conventional practice facilities.

## REFERENCES

[1] A. E. Sema, R. Pouraghabagher, P. McQuaid, and D. Waldrorf, "Teaching Factory," Proceedings of the 2001 American Society For Engineering Education Annual Conference & Exposition, San Luis Obispo, 3563, 2001.

[2] S. Herminarto, Pardijono, I.W. Djatmiko, and P. Sudira, "Paradigma Baru Pendidikan Vokasi," [Online] Retrieved from: dari http://staff.uny.ac.id/sites/default/files/pengabdian/prof-dr-herminarto-

sofyan-mpd/paradigma-baru-dan-guru-pendidikan-rev1.pdf, accesed 17 Januari 2017.

[3] Nayang Polytechnic, "Teaching Factory Concept," [Online] Retrieeved from: http://www.nyp.edu.sg/seg/innovative-teaching-n-learning/the-teaching-factory-concept, 2003, accesed 17 Januari 2017.

[4] J.S. Lamancusa, J.L. Zayas, A.L. Soyster, L. Morell, and J. Jorgensen, "2006 Bernard M. Gordon Prize Lecture*: The Learning Factory: Industry- Partnered Active Learning," Journal of engineering education, vol. 97, No. 1, pp. 5-11, 2008.

[5] S.J. Triatmoko, The ATMI story, rainbow of excellence. Surakarta: Atmipress, 2009.

[6] T. Plomp, Educational and Training system Design: Introduction University of Twente. Enschede, The Nederlands: Faculty of Education Science and Technology 1997.