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Design of teaching factory based learning system in supply chain management at politeknik astra

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Abstract

The supply chain and production logistics processes are essential components of daily activities across various aspects of modern life and play a critical role in global development. A strong human resource base within an organization can enhance operational efficiency, strengthen collaboration with suppliers, and optimize the delivery of goods to customers. Skill enhancement is one avenue for improvement, particularly through education. The Teaching Factory (TEFA) is one of the learning methods that must be implemented in vocational education. TEFA concept is a field-based learning approach designed to bridge the competency gap between the knowledge imparted in schools and the needs of the industrial world. Teaching factory requires thorough preparation because all learning activities adapt and adopt quality standards and work procedures in the industry. This research will discuss how to design TEFA-based practical work. Based on the development of the TEFA-based learning design, the learning activities are conducted over a duration of 16 practical working days, involving 18 small groups divided into three areas: materials, production, and delivery. The module-based learning activities consist of completing 7 modules, while the TEFA activities involve 27 field activities which refers to the basic function of logistics competence and all of which are implemented in real production activities.

Keywords: education, human resources, supply chain, TEFA

1. Introduction

Supply Chain Management has long been one of the most productive research fields in management science (Martins et al., 2019). The supply chain and production logistics processes are integral parts of daily activities in various aspects of modern life and are crucial for global development (Garay-Rondero et al., 2019). An integrated and collaborative approach is key to achieving competitive advantage. By focusing on collaboration, integration, risk management, and technology utilization, companies can achieve competitive advantage and long-term success in their supply chains (Chatra et al., 2023). According to (APICS, 2017) supply chain performance as a strategic characteristic is used to prioritize and align supply chain performance with business strategies, including reliability, responsiveness, agility, cost, and asset management efficiency. By definition, responsiveness refers to the speed at which tasks are performed to deliver products to customers within supply chain operational activities.

Operational processes in production and logistics are essential activities for customer service and competitive advantage across many industries. These operational processes are typically

characterized by a high volume of manual labor, particularly in the areas of material handling and assembly. Although the automation of production and logistics systems offers many opportunities, many companies still rely on human labor in certain areas due to the flexibility and cognitive and motor skills that machines have not yet been able to replicate economically (Sgarbossa et al., 2020). Thus, skilled human factors remain essential in the industrial and supply chain sectors. A strong human resource base within an organization can enhance operational efficiency, strengthen collaboration with suppliers, and optimize the delivery of goods to customers (Jena et al., 2021).

Education is one of the key areas for skill improvement. The improvement of educational quality must be carried out continuously and sustainably. Vocational Higher Education is an education that focuses on fulfilling the latest specific work competencies for its graduates so that they can make a real contribution in solving problems faced by industry not only at the national level, but also in industrial developments abroad. To achieve this, it is necessary to develop and implement a curriculum aligned with the Higher Education National Standards (SN Dikti), which represent the mandatory minimum requirements for all academic programs. One of the learning methods that can be applied to support these achievements is the Teaching Factory (TEFA). TEFA is one of the learning methods that must be implemented in vocational education. TEFA is a field-based learning concept designed to bridge the competency gap between the knowledge provided in schools and the demands of the industrial world (Diwangkoro & Soenarto, 2020).

TEFA requires thorough preparation because all learning activities adapt and adopt quality standards and work procedures in the industry. Some of the competencies expected through this teaching factory's application include expertise in psychomotor, affective/attitude, and the ability to think critically and solve problems (Saputro et al., 2021). Real-world learning experiences help improve skills in analyzing complex situations and identifying practical solutions. The integration of theory-based education with case study approaches fosters stronger analytical and problem-solving capabilities among participants (Wu et al., 2023). The adaptation of human resources to key performance indicators (KPIs) in the supply chain is crucial in creating a resilient and flexible supply chain (Singh et al., 2019). Therefore, based on the aforementioned background, this research seeks to Designing a Teaching Factory (TEFA)-based practicum to develop a workforce ready to meet industry needs and enhance supply chain performance.

2. Methodology

This approach is based on observation, which involves collecting data by making direct efforts to observe the place or subject being studied (Joesyiana, 2018). This research aims to develop a TEFA model for the Logistics Planning and Control course within the Logistics Engineering Technology program at Politeknik Astra. The research process flow for the implementation of TEFA is presented in Figure 1.

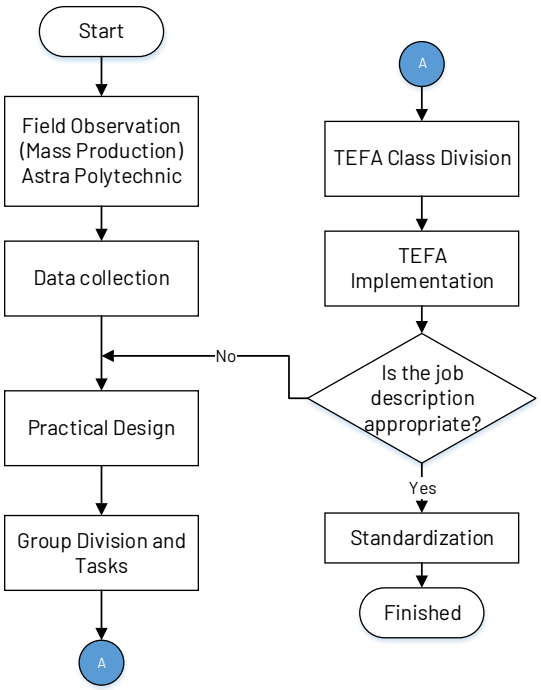

Figure 1. Research process flow

Based on Figure 1, this process consists of several stages as follows:

1. Begins with the observation stage in the field for mass production activities at Politeknik Astra. From this stage, the results are obtained on how the logistics process from incoming materials to products being sent to customers. This flow is shown in Figure 2 below:

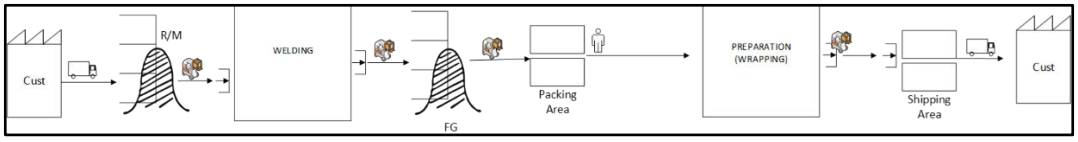

Figure 2. Material flow

2. In this stage, data is collected from module requirements including module requirements and the practicum schedule as shown in Figure 3.

Class	October																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Meet	10	11	12	13			14	15	16	1	2			theory							3	4	5	6	7			8	9	10	11
A	practical work						practical work			ractical wor											practical work							practical work			
Meet	theory						9	10	11	12	13			14	15	16	1	2			theory							3	4	5	6
B							practical work							practical work			ractical wor											practical work			

Figure 3. Sample practical schedule

By definition, a module is a learning material whose contents are relatively short and specific and are arranged to achieve learning objectives. Modules usually have a series of well-coordinated activities related to materials and media as well as evaluation (Lasmiyati & Harta, 2014).

3. In the design process, this practice is divided into 2 design parts, namely:
   a. Industry Needs Analysis
      In order to develop an effective and efficient National Logistics System (Sislognas), the government has mandated the implementation of Presidential Regulation No. 26 of 2012 concerning the Blueprint for National Logistics System Development. One of the mandates within Sislognas is the development of competent and professional

human resources in the logistics sector to support improvements in supply chain mechanisms for essential goods, as well as those oriented towards export. There are 78 fundamental functions in the logistics sector according to Decree of the Minister of Manpower of the Republic of Indonesia Number 170 of 2020. The following are 31 fundamental functions relevant to TEFA activities that must be possessed in the logistics field. The following can be seen in Figure 1.

Table 1. Basic competencies in logistics

The Main Purpose	Main Functions	Basic Functions
Ensuring the flow of goods from the point of origin to the point of destination through the integration of a series of activities, including procurement, logistics management, storage, and delivery	Logistics Support Activities	1. Participate in Environmental Care* 2. Lead a Team/Work Group* 3. Collect, Analyze Workplace Data and Information* 4. Implement and Monitor Occupational Health and Safety Procedures* 5. Apply Customer Service Skills* 6. Manage the Supply Chain* 7. Use Information Technology Equipment in the Workplace 8. Perform Cleaning Maintenance Activities 9. Implement Safe Work Practices in the Workplace 10. Collect and Analyze Information 11. Use Computer Devices** 12. Operate Computers/Hardware*** 13. Use a Web Browser**
	Storage	1. Refilling Stock* 2. Receiving and Storing Stock* 3. Moving Goods/Loads/Cargo Safely Using Manual Methods* 4. Following Safety Procedures When Handling Goods/Loads/Cargo 5. Moving Loads Using Manual Equipment* 6. Managing Systems to Manage Stock* 7. Monitoring Storage Facilities* 8. Completing Receipt and Expenditure Documentation* 9. Performing Inventory Counts* 10. Documenting Goods Data 11. Securing Goods/Loads/Cargo
	Delivery	1. Taking and Processing Orders* 2. Shipping Stock* 3. Packing Goods* 4. Managing Shipping Goods/Loads/Cargo * 5. Carrying Out Deliveries**** 6. Operating Global Positioning System (GPS)******

Information:

- * Minister of Manpower Decree Number 94 of 2019
- ** Minister of Manpower Decree Number 56 of 2018
- *** Minister of Manpower Decree Number 195 of 2017
- **** Minister of Manpower Decree Number 70 of 2016
- ***** Minister of Manpower Decree Number 354 of 2014
- ****** Minister of Manpower Decree Number 269 of 2014
- ******* Minister of Manpower Decree Number 182 of 2013

Based on these 31 basic functions, they will be used as a reference for activities in TEFA-based learning.

b. Development of Practical Scenarios

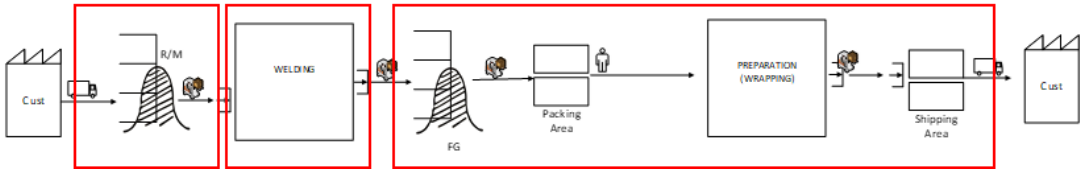

Figure 4. Material Flow

The Material Flow Process in Figure 4 is used as the basis for dividing groups and tasks according to the basic functions in the logistics field. The division is based on the flow of the material process from suppliers to products being delivered to customers. The following can be seen in Table 2.

Table 2. Jobdesk division based on material flow

Class	Section	Subsection		
		1	2	3
A	A	Material	Production	Delivery
	B	Material	Production	Delivery
	C	Material	Production	Delivery
B	A	Material	Production	Delivery
	B	Material	Production	Delivery
	C	Material	Production	Delivery

3. Result and Discussion

Based on the purpose of this study, from the results of the observation, students will carry out planning and control activities since the material arrives from the supplier until the goods are sent to the customer. For this reason, a schedule needs to be made so that learning activities are more structured. The practicum schedule as the basis for determining the duration of students carrying out TEFA activities. The duration of the practicum is 16 days. This schedule forms 6 small groups, each consisting of 10 students. Each group will take turns participating in activities throughout one semester. Based on the established schedule, the practical activities are designed into module activities for competencies in planning and field activities for management competencies. This practical activity creates 18 small groups as shown in Table 2. Each small group will engage in activities outlined.

In addition, the implementation of TEFA-based practicum is supported by module-based activities to improve understanding. The modules taught in this practicum consist of several modules, namely forecasting, aggregate planning, master production scheduling, material requirements planning, lot sizing, production scheduling, assembly line balancing.

Based on Table 1 related to basic competencies in logistics, 31 functions are taken which are related to activities that will be carried out according to the conditions, then the TEFA practical activities are described in the following Table 3.

Table 3. TEFA Activities based on basic functions in the logistics sector

No	Section	Activity
1	Material	1.1 Checking the arrival of materials from suppliers (quantity and specifications)
		1.2 Record any deviations between the delivery note and the actual
		1.3 Monitoring stock (inflows and outflows)

No	Section	Activity
		1.4 Preparing materials for production needs
		1.5 Update stock card
		1.6 Performing 5S activities
		1.7 Create daily reports on warehouse material stock
		1.8 Making improvements in the material warehouse area
		1.9 Conducting stock in and out analysis
2	Production	2.1 Recording the arrival of materials from the material warehouse
		2.2 Monitoring production results
		2.3 Conduct identification and recording of the amount of NG in the production area
		2.4 Preparing empty boxes for finished goods in the production area
		2.5 Analyze the difference between incoming and outgoing data
		2.6 Create production reports
		2.7 Coordinate with the PPIC team regarding daily planning
		2.8 Create stock reports at the end of the shift (material, WIP and finished products)
		2.9 Making improvements in the production area
3	Delivery	3.1 Conducting checks on incoming goods from production
		3.2 Perform calculations and visual checks of products before shipping
		3.3 Doing the packaging
		3.4 Ensure the actual quantity is the same as the delivery note
		3.5 Perform stock card updates
		3.6 Monitoring deliveries between plan and actual
		3.7 Create a delivery report
		3.8 Analyzing delivery timeliness
		3.9 Inserting Qty Labels on Finished Goods Boxes

So that the details of the activity will be the basis for TEFA activities that will be carried out by students during practicums in the field. Where the activity will be monitored with several activity agendas such as filling out the Logbook, Weekly reports, stock data reports, monitoring and all activities are included in the final assessment to measure its achievement. However, this study has not discussed how the assessment matrix will be carried out, so this can be an opportunity for further research to measure the achievement of this TEFA-based learning.

4. Conclusion

Based on the steps undertaken, it can be concluded that the TEFA-based learning design was developed over a 16-day work period, during which students are directly involved in production activities. This design includes seven modules, with activities divided into three main groups and further subdivided into 18 smaller groups. Each subgroup is tasked with executing 27 key assignments as part of the supply chain activities. Therefore, it is necessary to implement this program and measure its impact to determine how effectively it achieves the core competencies required by the Ministry of Manpower.

References

APICS. (2017). Supply Chain Operations Reference Model (Version 12).

Chatra, A., Stie, P., Kerinci, S. A., Syamil, A., Nusantara, B., & Fahmi, M. A. (2023). Manajemen Rantai Pasok (Efitra, Ed.; 1st ed.). PT. Sonpedia Publishing Indonesia.

Diwangkoro, E., & Soenarto, S. (2020). Development of teaching factory learning models in vocational schools. Journal of Physics: Conference Series, 1456(1). https://doi.org/10.1088/1742-6596/1456/1/012046

Foroughi, A. (2021). Supply chain workforce training: addressing the digital skills gap. Higher Education, Skills and Work-Based Learning, 11(3), 683–696. https://doi.org/10.1108/HESWBL-07-2020-0159

Garay-Rondero, C. L., Martinez-Flores, J. L., Smith, N. R., Caballero Morales, S. O., & Aldrette-Malacara, A. (2019). Digital supply chain model in Industry 4.0. Journal of Manufacturing Technology Management. https://doi.org/10.1108/JMTM-08-2018-0280

Joesyiana, K. (2018). Penerapan Metode Pembelajaran Observasi Lapangan (Outdor Study) Pada Mata Kuliah Manajemen Operasional (Survey Pada Mahasiswa Jurusan Manajemen Semester III Sekolah Tinggi Ilmu Ekonomi Beserta Persada Bunda). PeKA: Jurnal Pendidikan Ekonomi Akuntansi FKIP UIR, 6(2), hal 94. https://journal.uir.ac.id/index.php/Peka/article/view/2740

Lasmiyati, L., & Harta, I. (2014). Pengembangan Modul Pembelajaran untuk Meningkatkan Pemahaman Konsep dan Minat SMP. PYTHAGORAS Jurnal Pendidikan Matematika, 9(2), 161–174. https://doi.org/10.21831/pg.v9i2.9077

Martins, C. L., & Pato, M. V. (2019). Supply chain sustainability: A tertiary literature review. Journal of Cleaner Production, 225, 995–1016. https://doi.org/10.1016/j.jclepro.2019.03.250

Sgarbossa, F., Grosse, E. H., Neumann, W. P., Battini, D., & Glock, C. H. (2020). Human factors in production and logistics systems of the future. Annual Reviews in Control, 49, 295–305. https://doi.org/10.1016/j.arcontrol.2020.04.007

Singh, C. S., Soni, G., & Badhotiya, G. K. (2019). Performance indicators for supply chain resilience: review and conceptual framework. Journal of Industrial Engineering International, 15, 105–117. https://doi.org/10.1007/s40092-019-00322-2

Wu, F., Wang, T., Yin, D., Xu, X., Jin, C., Mu, N., & Tan, Q. (2023). Application of case-based learning in psychology teaching: a meta-analysis. BMC Medical Education, 23(1). https://doi.org/10.1186/s12909-023-04525-5