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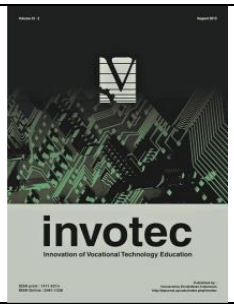

Interactive learning: Designing inventory e-module interactive for logistics vocational school

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ABSTRACT

One of the awareness that has arisen in Indonesia in response to the challenges of Industry 4.0 is the awareness to be able to meet domestic logistics needs through improving and strengthening the national logistics system. This is mandated through the Center of Excellence, where Logistics is one of the areas of expertise included as a target for the Indonesian government. The socialization and demands of Industry and the World of Work (IDUKA) continue to develop and change so the Vocational High School (SMK)'s ability to fulfill them needs to be improved. The purpose of this research is to compile SMK E-modules that need to be aligned with the needs of IDUKA, especially in the field of logistics. This study used a mixed methods approach by conducting interviews (qualitative) and using questionnaires (quantitative) and studies using secondary data in the form of the SMK Logistics curriculum. The output of this research is in the form of the results of graduate training needed by IDUKA in the form of scientific articles published in indexed international journals for the dissemination of results at international scientific seminars, IPRs, and E-modules.

1. Introduction

The Indonesian logistics sector envisioned its system to be locally integrated, and globally connected for national competitiveness and social welfare. It is contained in the Peraturan Presiden (The Presidential Decree) Republik Indonesia No. 26 Tahun 2012, displaying the great attention to the development of the national logistics system within The National Logistics System Development Blueprint. The National Logistics System Development Blueprint discusses the development and problems of national logistics; expected conditions and challenges; strategies and programs; road map and action plan; and follow-up.

Education institute leads the provision of human resources (HR) as well as its improvement qualities. Higher education in this context shares a responsibility to produce capable human resources according to the industry's general inquiry, specifically in the logistics industry. Statistics from Kementrian Pendidikan dan Budaya (Kemendikbud) have shown that the quantity of logistic engineering and management in secondary education is still small with only 27 vocational (public and private) schools. Logistics is one of the mandates in the Center of Excellent (CoE) program where it is necessary to accelerate the preparation of HR who have competence in logistics due to

the optimal increase in the logistics industry in Indonesia. This presents both an opportunity and a difficulty in training personnel migrating from operational or technical jobs to managerial ones in the logistics sector. [Figure 1] depicts more information on the spread of vocational school mapping in the fields of logistics management and engineering knowledge.

Provinsi	Nama SMK	Kompetensi	Distinct Count of NPSN
Prov. Banten	SMK INSAN MANDIRI AL-KHAIRI	Teknik Logistik	1
	SMKS YAPINKTEK	Teknik Logistik	1
Prov. D.I. Yogyakarta	SMKN 1 TEMPEL	Teknik Logistik	1
	SMKS MUHAMMADIYAH 2 TEMPEL	Teknik Logistik	1
Prov. Jawa Barat	SMK AL-ISLAM PACET	Teknik Logistik	1
	SMK LOGISTIK SUMEDANG	Teknik Logistik	1
	SMK NEGERI 1 LURAGUNG	Teknik Logistik	1
	SMK NEGERI 4 DEPOK	Teknik Logistik	1
	SMK NEGERI 6 KUNINGAN	Teknik Logistik	1
	SMK TEKNOLOGI	Teknik Logistik	1
	SMKN 1 GARUT	Manajemen Logistik	1
	SMKN 11 BANDUNG	Manajemen Logistik	1
	SMKN 11 BEKASI	Manajemen Logistik	1
	SMKN 3 BANDUNG	Manajemen Logistik	1
	SMKS DARMA BAKTI	Teknik Logistik	1
	SMKS PUI GEGESIK	Teknik Logistik	1
	SMKS TARUNA TERPADU 2	Manajemen Logistik	1
Prov. Jawa Timur	SMK PRODUKTIF AL ISLAM	Teknik Logistik	1
	SMKN 4 MALANG	Teknik Logistik	1
	SMKS MUHAMMADIYAH 1 TAMAN	Teknik Logistik	1
Prov. Kepulauan Riau	SMK NEGERI 1 TANJUNGPINANG	Manajemen Logistik	1
	SMK NEGERI 4 BATAM	Teknik Logistik	1
	SMKS MAARIF NU KOTA BATAM	Teknik Logistik	1
Prov. Lampung	SMK AVIASI BRANTI	Teknik Logistik	1
Prov. Papua	SMKS YPK 1 BIAK	Teknik Logistik	1
	SMKS YPK KOTARAJA	Manajemen Logistik	1
Prov. Riau	SMK DIRGANTARA RIAU	Manajemen Logistik	1
Grand Total			27

Figure 1. Distribution Mapping of SMK Management/Logistics Engineering in Indonesia. Source: Socialization of Occupancy Map in Logistics and Supply Chain, Coordinating Ministry of the Republic of Indonesia 2022

The list of vocational schools in [Figure 1] confirms the opportunity and difficulty of providing adequate HR. It is indicated that preparing graduates who are competent and needed by the Industry and the World of Work (IDUKA) Logistics is indeed achievable. However, the ability to successfully pair graduates with the industry's inquiry is challenging. To fit with IDUKA's rapidly developing logistics market, preparedness should begin with competency mapping. This entails optimizing Graduate Learning Outcomes (CPL) to keep up with IDUKA Logistics' rapid and significant developments. As part of our instructional media enhancement initiatives, we generate instructional materials in a variety of formats, including print, audio, audio-visual, and interactive resources.

The use of learning modules has shifted from physical to digital copies with additional interactive features such as visual and audio-visual media included. Interactive E-module has some distinct characteristics such as (1) self-paced; allowing a suitable learning speed based on student's preferences, (2) Self-instruction; providing self-learning materials, (3) Independent; offering all related learning materials, and (4) Modular/chunking; split and discussed in smaller sizes (Chaeruman, 2014). These characteristics allowed non and experienced students to gather information and confidence (Cloonan et al., 2020) due to its flexible online and offline learning nature (Danirmala, 2020; Dankbaar et al, 2017; Erna, M., dan Anwar, L. 2021; Fadieny, N., dan Fauzi, A, 2021).

Research done by McNamara et al. (2020) stated that interactive E-modules immensely improved critical thinking and independent learning. Visual media learning materials spanning over only 15 minutes and mixed learning tools approach (video clip, games, social media platform, direct instructions) are what we define as E-learning modules. Therefore, the researcher plans to research the preparation of interactive E-modules for Logistics Engineering Vocational Schools that are aligned and by the curriculum and current conditions in the logistics industry.

2. Method

The descriptive research technique and qualitative methodology are used in this study. It will last 8 months, beginning in March and ending in October 2023. Interviews and Focus Group Discussions (FGD) are the key data collection methods. These methodologies seek empirical

insights into the abilities required by IDUKA while evaluating CPLs. The focus group sessions include a select group of three varied stakeholders chosen for their skills and experience in logistics and learning development. A distinguished logistics ex-practitioner and instructors from two vocational schools are among the participants. Meetings are videotaped, and field notes are taken to capture both verbal and nonverbal indications, which helps to shape the interactive E-learning program. The incorporation of insights from the FGD sessions, this module matches with curriculum and industry demands.

Figure 2. FGD Documentation

3. Results and Discussion

The interactive E-learning module is highly dependent on the inquiries of both the curriculum and the industry. The previously held FGD presents crucial information, with the ex-practitioner providing the specifically requested skills and the instructors relaying the current learning values to be taught in the E-module. The discussion was strategically limited to only inventory control and management proved to not only maintain a focused approach to the module's design but also prevent groupthink, foster individuality, and ensure a more productive and meaningful discussion (William Boateng, 2012; Shanzida Farhana, 2010). This approach intends to give learners a complete and in-depth grasp of inventory-related difficulties and solutions, hence improving their readiness for the logistics industry's demands. [Table 1] shows the required learning materials from both perspectives.

Table 1. Required Learning Materials for the Interactive E-learning

Number	Logistic Competencies	
	Logistic Engineering Curriculum	**Industry's Inquiry**
1	Apply determination and calculate reorder point system	Basic concepts and definitions of inventory control
2	Understand the meaning and follow inventory policy	The importance of inventory
3	Analyze the importance and present the amount of inventory of safety stock	Inventory costs
4	Analyze and present the results of the inventory turnover analysis	Inventory function
5	Apply procedures in and present the administration of inventory administration	Types of inventories
6	Evaluate and manage records in inventory control	Inventory risks and issues
7	Analyze and present economic lot size calculations using the EOQ method	Procurement costs
8	Analyze and present inventory capacity design using ABC method	Inventory management
9	Apply and present inventory stock-taking results	Inventory handling and storing

Both industrial expectations and academic curriculum demonstrate strong compatibility with the required learning materials. These instructional materials are primarily focused on the crucial

topic of inventory control and management, going thoroughly into issues such as inventory forecasting and value assignment. However, the industry's requirements, relayed by the vast experience of previous practitioners, go beyond the boundaries of the prescribed curriculum.

The industry's insistence on practical factors that are not covered by the standard academic framework. The e-learning module must include not only academic knowledge but also tangible, real-world applications. To address this, the curriculum includes extensive case studies as a significant aspect. These case studies serve as illustrative tools, addressing a wide range of difficulties and dangers related to inventory control and management. This image is expected to help learners obtain a full knowledge of how to tackle complicated inventory-related challenges efficiently (Muhammad Marsudi, 2019; Darya Plinere & Arkady Borisov, 2015).

Furthermore, the industry's perspective emphasizes the importance of cost considerations in inventory control and procurement. Logistics engineers, who are frequently at the forefront of decision-making, are also in charge of cost control. As a result, the learning materials should explicitly include cost-related issues, providing learners with the necessary information and abilities to make cost-effective inventory selections. This all-encompassing strategy ensures that the e-learning module not only meets academic criteria but also equips future professionals to excel in their industry responsibilities.

We took note of both the industry and curriculum inquiries, with an emphasis on an inclusive E-module structure design of learning materials to extend the prescribed curriculum. The value of industry conformance education was incorporated into the design while not limiting to any development of the curricula’s required materials. The finalized design structure is composed in chunks with alleviated difficulty that corresponds to the inventory control and management process shown in [Table 2] is encapsulated in this as the cover of the E-module shown in [Figure 3].

Table 2. Finalized Interactive E-learning Module Structure

Number	Chapter	Sections
1	Inventory Control Basic Concepts	The importance of inventory control The concept of inventory control The correlation of micro and macro-Inventory control
2	Flow Of Inventory Planning and Control	
3	Inventory costs	Average cost method Cost structure
4	Inventory Management Methods: ABC, MRP, EOQ, Model P, Model Q, JIT	
5-6	Functions, Types, and Planning of Supply Management	Health Sector Clustering Food Sector Clustering Manufacturing Sector Clustering Textile Sector Clustering Service Sector Clustering
7	Inventory control issues	
8	Reports	Document formats SOP template Video tutorials

Figure 3. The Initial Cover of the Interactive E-learning Module

The E-module starts with the basic concepts of inventory control and management. It underlines the importance of inventory control in terms of operational and service improvement which leads to micro and macro effects, followed by an introduction of operational techniques terms used in inventory control. The operational techniques are then laid out in sequences of inventory planning and control inventory cost flow. These strategies are provided systematically, encompassing the complexities of inventory planning and control, as well as the rigorous monitoring of inventory cost flow. Furthermore, it complements this theoretical knowledge with practical illustrations, providing a tangible glimpse into the real-world implementation of inventory control strategies, and providing learners with both theoretical insights and practical insight necessary for better adaptation in a real-world scenario.

Additionally, the module also serves as learning materials outside the curriculum containing inventory costs concerning the cases it correlates. The cases were adapted from inventory management books that represent industry-accurate issues which were then scaled down to match the learning level of vocational learners. Other cases of inventory control and management practices and issues in multiple industry clusters are also included in the module. It was designed as an accurate representation of specific industries, including outside of logistics, as a means of a flexible learning reference. This is due to the nature of logistics present in every industry regardless of whether it is in manufacturing or service provider one.

Industries such as health and textile were determined to be the most difficult part to develop as learning materials due to limited open resources serve as references. It is believed that logistic practices in such industry contain sensitive information which if taken in as learning materials without an aggregate threatens the competitive advantage of the source information providers (companies). Thus, an effort was made to contact companies within the industry that are willing to have a joint stake in the development of the module. However, the current process of data collecting is still naught as companies are still hesitating, or toning down their data to match learners' capabilities is arduous.

Lastly, good logistics and inventory management are dependent on meticulously preparing logistics inventory documentation and implementing critical tools such as the Kanban system and standardized Standard Operating Procedure (SOP) templates. The logistics inventory document format serves as the foundation for streamlined record-keeping and transparent communication between departments (Gemachis Debala et al, 2023). Organizations provide consistent and error-free data handling by using standardized formats, which supports the efficiency of logistics operations.

Furthermore, the Kanban system provides a dynamic approach to inventory replenishment, allowing for real-time monitoring and just-in-time replenishment (Erik Hofmann & Marco Rüsch, 2017). This methodology not only lowers transportation costs but also improves supply chain coordination, ensuring that items flow smoothly from suppliers to consumers. SOP templates, on the other hand, give a systematic framework for documenting procedures, encouraging adherence to best practices, and eliminating errors and safety risks. The combination of these parts, as the final piece of our entire learning material for the E-module, fortifies logistics and inventory management, maximizing efficiency, and enhancing the overall efficacy of the supply chain.

The finished learning materials are presented not only in text, but also in illustrations, videos, and audio media to comply with the intended interactive learning system. Illustration is in the form of either drawings or diagrams that represent highly contextualized operational aspects in each chapter (Nikolas Flemotomos et al., 2021). These drawings serve as waypoints for navigation, providing a visual roadmap through the maze of logistics and inventory management, promoting a greater grasp of the subject. As for practice sets

Economic Order Quantity (EOQ), Just in Time (JIT), and ABC are among the seven practice sets included in the E-module. These three strategies are basic, calculative inventory control procedures. Companies frequently utilize EOQ to find the most cost-effective procurement quantity, whereas JIT is a procurement approach focused on minimizing lead times. ABC, on the other hand, is a value assignment mechanism used to determine priority levels for objects to be stored or delivered. These practice sets are smoothly incorporated into the E-module and can be accessed directly via the links given. These links take viewers to the Logistics Instructor's YouTube channel, where they can participate in practical exercises using Crossword Labs.

Tahun	Produksi	Kebutuhan			Biaya Pemesanan	Biaya Penyimpanan
		Jumlah	Harga/lembar	Total		
2015	333	666	Rp112.000,00	Rp74.592.000,00	Rp50.000,00	Rp5.240,00
2016	311	622	Rp112.000,00	Rp69.664.000,00	Rp50.000,00	Rp5.740,00
2017	325	650	Rp112.000,00	Rp72.800.000,00	Rp50.000,00	Rp5.840,00
2018	300	600	Rp112.000,00	Rp67.200.000,00	Rp50.000,00	Rp5.840,00

Tahun	EOQ (Q^*)	Biaya Pemesanan	Biaya Penyimpanan	Total Biaya	I (frekuensi pembelian yang diperlukan)	Pembulatan I
2015						
2016						
2017						
2018						

Tahun	EOQ (Q^*)	Biaya Pemesanan	Biaya Penyimpanan	Total Biaya	I (frekuensi pembelian yang diperlukan)	Pembulatan I

Perusahaan X merupakan perusahaan multinasional yang bergerak pada bidang manufaktur yang memproduksi meja lipat. Setiap produksi meja lipat membutuhkan bahan baku kayu 2 lembar. Perusahaan X ingin melakukan pengadaan bahan baku dengan melakukan perencanaan *purchasing* dengan rincian seperti pada tabel 1 berikut:

Tabel 1. Pemakaian bahan baku, harga per unit, total biaya pemakaian dan biaya pemesanan tahun 2015-2018

Tahun	Produksi	Kebutuhan			Biaya Pemesanan	Biaya Penyimpanan
		Jumlah	Harga/lembar	Total		
2015	333	666	Rp112,000.00	Rp74,592,000.00	Rp50,000.00	Rp5,240.00
2016	311	622	Rp112,000.00	Rp69,664,000.00	Rp50,000.00	Rp5,740.00
2017	325	650	Rp112,000.00	Rp72,800,000.00	Rp50,000.00	Rp5,840.00
2018	300	600	Rp112,000.00	Rp67,200,000.00	Rp50,000.00	Rp5,840.00

Figure 4. The EOQ Practice Set with Case Study

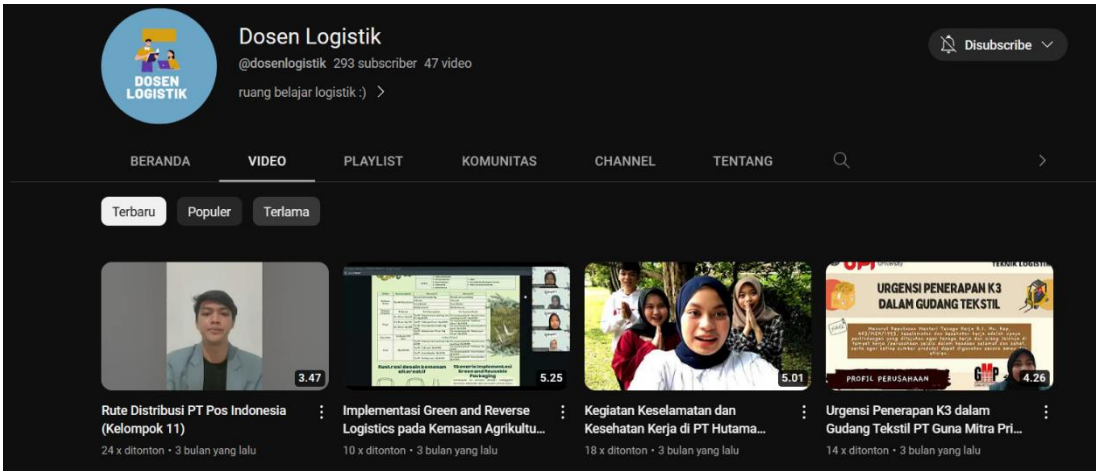

Figure 5.Figure 4. The Youtube Channel Respositoring Logistic Related Case Study and Real Observation videos (Bottom)

Furthermore, by adding video and audio media components that seamlessly complement the educational texts, the E-module enhances the learning experience. These multimedia tools

supplement the learning materials in the study, providing a holistic approach to information acquisition (Nadia Ghounane, 2020). The video content has been intelligently separated into discrete pieces, each of which has been thoughtfully connected with the sequential advancement of inventory control and management protocols within a warehouse, as stipulated by the given SOP. These videos, which consist of two independent segments, have been deliberately created to assist a thorough grasp of the subject matter.

The first section includes a lesson that expertly takes students through the efficient use of record-keeping papers. This hands-on demonstration teaches learners how to keep thorough inventory records, which is a vital component of good logistics practice. The second section digs into material handling protocols, illuminating best practices and safety precautions involved in the physical movement and inventory management inside a warehouse environment. This comprehensive video method not only improves comprehension but also develops practical skills necessary for real-world applications.

Simultaneously, the incorporation of audio resources enriches the learning experience. Learners can access aural content that reinforces key topics, enhancing engagement and comprehension. This seamless integration of video and audio components within the E-module demonstrates the company's dedication to providing a thorough and immersive educational experience in the field of inventory control and management.

4. Conclusion

The interactive E-learning module serves as a vital link between the academic curriculum and the logistics and inventory management industry's demands. It offers a holistic education by smoothly combining academic underpinnings with practical applications via a wide range of multimedia tools. This module provides learners with the aptitude and knowledge required to excel in the ever-changing sphere of logistics and inventory management by adeptly addressing the requirements of both the academic curriculum and the dynamic industry landscape, engaging seasoned professionals, and underpinned by a firm commitment to best practices. It is a testimonial to a comprehensive and forward-thinking approach to education in this dynamic profession.

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