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Developing learning and training within industry model to improve work readiness of vocational high school students

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ABSTRACT

Unemployment is still a national priority that needs to be addressed. In 2022, vocational high schools in Indonesia had the highest open unemployment rate. The highest open unemployment rate is a result of vocational high school students' insufficient work readiness. Therefore, this research aims to develop a learning and training within industry (LTWI) model, and to evaluate the model's efficacy in increasing vocational high school students' work readiness. The research employed a research and development (R&D) design by Richey and Klein with the phases of needs analysis, internal validation, and external validation. There were 12 teachers and 89 students from the automotive engineering department at Muhammadiyah 1 Pakem Vocational High School and 1 Puring Vocational High School, as well as six instructors from the automotive industry: GAS Auto Service, Automotive Jogjakarta Center (OJC), Bengkel Barokah, and RND Auto Service, participated in the research. Data collection strategies adopted were interviews, questionnaires, and performance tests. The data were descriptively evaluated, and the conclusions were drawn using a categorization formula. With an average score of 3.43, the LTWI model can be used to learn very well. With an average final score of 3.32, the efficacy of the LTWI learning model falls into the category of "very good". The LTWI model can be applied effectively to learning in vocational high schools since it has a positive influence on students' work readiness.

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1. INTRODUCTION

Vocational high school (VHS) is an education level designed to generate a skilled and productive workforce [1]–[3]. The VHS offers a competency-based learning structure with work accomplishments [4], [5]. It is envisaged that VHS would contribute to the government's objective of lowering the unemployment rate. In actuality, however, VHS continue to have the highest unemployment rate in 2022, which is 9.42% [6]. In addition, many graduates of VHS work outside their disciplines. Graduates of VHS reported working outside the department due to a lack of work readiness acquired at VHS [7]–[10].

Work readiness is the most essential aspect that students must possess in order to work effectively [11], [12]. Work readiness consists of the industry-required competencies. Graduating from a VHS with a high level of job preparation will influence self-confidence at work, the capacity to get a career, and high levels of

production [13], [14]. In VHS, work readiness can be developed in phases through preparation, implementation, and evaluation of learning. Good learning in a VHS is linked and collaborative with the requirements of the industrial world. The industrial world serves as a reference since they can employ graduates of VHS [15]–[19].

By implementing learning models, VHS has attempted to improve and increase the quality of learning. Industry-oriented learning models, including project-based learning, problem-based learning, and problem-solving, are presently frequently employed and used at VHS [19], [20]. However, contemporary learning models continue to have limitations, most notably the lack of industry participation in learning and training. The present approach continues to be teacher-oriented, and is completely implemented in schools [21]–[23]. Good VHS learning is learning that is conducted using industrial replicas, competences based on industry standards, and taught by industrial instructors with knowledge in their respective professions [24]–[26].

To increase VHS students' work readiness, a learning model based on the concept of learning and training in industry or learning and training within industry (LTWI) was established. LTWI is a development of the training within industry (TWI) learning model, which has been applied to the industrial training model. The United States Department of War launched TWI with the purpose of preparing armament specialists for the second world war. TWI is a model for the rapid and consistent training of entry-level professionals in the workplace. TWI develops relationships high integrity, cooperation, and responsibility. Beginner employees will soon acquire the abilities required for industrial employment. In addition, the TWI develops beginner employees in leadership qualities [27]. TWI model consists of several phases, namely: i) Phase of preparation includes preparation activities and the creation of teaching resources; ii) Phase of demonstration includes activities in which industrial trainers demonstrate and exemplify the phases of work based on worksheets; iii) Phase of imitation includes the student application activities based on worksheet steps and trainer demonstrations in the workplace; iv) Phase of practice includes independent student repetitions of the imitation phase; v) Phase of evaluation includes activities designed to evaluate the students' achievement [28], [29].

The current TWI model has limitations, namely: i) The TWI model contains weaknesses, particularly those connected to the integration of VHS curriculum and industrial world demands [30], [31]; ii) The TWI approach does not involve industry in the preparation, implementation, and evaluation phases of learning. It affects the inefficient learning process; iii) The TWI model conducts only industry-based activities, hence influencing the amount of support for technical high schools; and iv) The TWI model focuses on enhanced components of students' skills [32], [33]. The LTWI model is an expansion of the TWI model that addresses the limitations of the TWI model. Several properties of the LTWI model are projected to improve the TWI model, namely: i) LTWI is consists of school and industry-integrated learning components; ii) LTWI focuses not only on skill development, but also on knowledge competency and attitudes, so that VHS students may become productive employees with character; iii) Contains work instructions that are standardized using industry expertise and school-approved.

2. RESEARCH METHOD

2.1. Research design

Figure 1 illustrates the phases of LTWI learning model development. The development of the learning model used Richey and Klein's research and development (R&D) design. The research and development (R&D) phases consist of needs analysis, internal validation, and external validation.

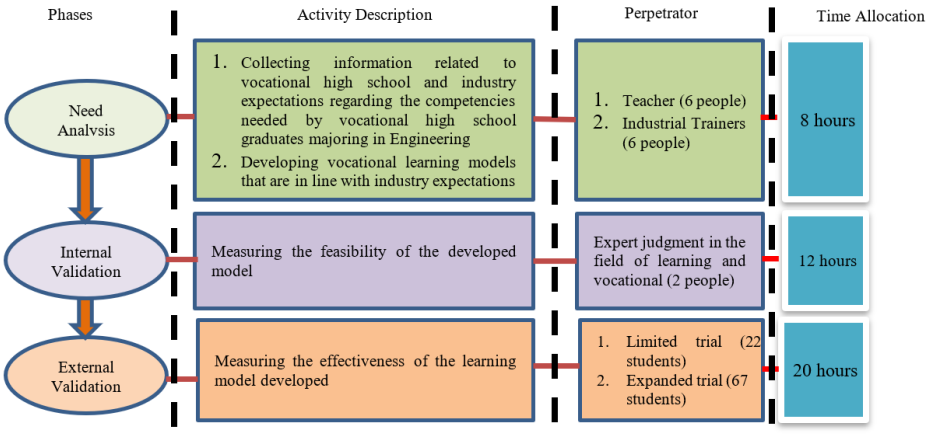

Figure 1. Phases of learning model development [34]

2.2. Research subject

The subjects of this study were automotive engineering teachers and students at Muhammadiyah 1 Pakem Vocational High School, and automotive industry instructors in the Special Region of Yogyakarta and Central Java, Indonesia. The number of research subjects was 44 teachers, 145 automotive engineering students, and 10 industries. The sampling technique used was purposive sampling technique. The sampling technique produced research samples at each stage of the research. The needs analysis stage used six teachers and six industry instructors. The internal validation stage used two learning and vocational experts. The external validation stage used 22 students for the limited trial, and 67 students for the extended trial.

2.3. Research instrument

In this investigation, both non-test and test-type instruments are utilized. Utilized non-testing instruments include interview lists and questionnaires. While the test instrument employed is the performance test (practice). Before they are used, the designed research instruments and models are conducted to content validation testing to ensure their practicability. The content validity of a research instrument demonstrated its capacity to reveal or accurately reflect all the material to be measured [35]. Two experts in vocational learning serve to content validation assessors. In addition, the questionnaire instruments and practical performance assessments are tested for reliability using the Cronbach alpha (α) test, with consistent results.

A grid of interview questions is utilized in focus group discussion (FGD) activities in order to collect information throughout the phase of requirements analysis. The interview question grid includes: i) the quality of current VHS graduates; ii) the learning model that has been used so far; iii) competencies needed by VHS graduates; and iv) the learning model is expected to improve the work readiness of VHS students and expected model phases [36]. The next instrument that is not a test is a questionnaire for internal validation that attempted to evaluate the model's feasibility, and offered feedback on the learning model that had been created. The questionnaire grid includes: i) according to government goals; ii) suitable for industrial purposes; iii) includes aspects of competence required by schools and industry; iv) easy to prepare infrastructure and learning tools; v) easy to apply; and vi) easy to measure the success of learning [37].

The next stage is external validation. External validation includes the implementation of the model that has been made with limited trials and expanded trials. The practical test assessment instrument was developed by teachers and industry by adapting the Work-Based Learning Models Based on Work Readiness (WBL-WoRe) research instrument [10]. The practical exam test instrument grid is shown in Table 1. To evaluate the effectiveness of the LTWI model, a practical exam test was used. To produce conclusions from the questionnaire instrument and practical exam test, the instrument results were categorized with the formula/criteria in Table 2.

Table 1. Practical exam test instrument grid [10]

Performance test aspects	
Attitude	Creativity
	Communication
	Integrity
Knowledge	Understanding of components and how they work
Skills	Completion of work with time efficiency
Occupational safety and health (K3)	Application of occupational health and safety

Table 2. Categorization of questionnaires and practical performance tests [38]

Formula	Score	Category
X≥ x +1.SBx	X ≥ 3.00	Very good
x + SBx > x ≥ x	3.00 > X ≥ 2.50	Well
x > x ≥ x - 1.SBx	2.50 > X ≥ 2.00	Enough
X < x – 1.SBx	X< 2.00	Not enough

X=final score, SBx=standard deviation, *x*=average score, *x*=(1/2) (max. score – min. score), SBx=(1/6) (max. score – min. score), Ideal Max score=∑item x the highest score, Ideal Min Score=∑item x the lowest score

3. RESULTS AND DISCUSSION

3.1. Needs analysis

The requires analysis phase is the initial phase in developing LTWI learning model. The needs analysis phase aims to gather information regarding the condition of VHS graduates, the competencies requires and the learning model of VHS that are in line with industry expectations/needs. The requirements analysis phase contains interviews with FGD activities. FGD participants consisted of six teachers and six industrial

practitioners. The FGD results are displayed in Table 3. A description of conceptual LWTI competence and learning is displayed in Table 4 and Figure 2.

Table 3. Results of needs analysis phases

No	Indicator	Results
1	The quality of current VHS graduates	The industry concludes that graduates of this 4-year VHS experience a decline in work ethic and skills and less responsive and lazy to gain new knowledge
2	The learning model that has been used so far	The learning model that has been used so far has implemented product and competency-based learning. The weakness of the learning model so far is the participation of the industry in the learning phases.
3	Competencies needed by VHS graduates	The competencies needed for VHS graduates today include attitudes, knowledge, skills and work safety competencies.
4	The learning model is expected to increase the work readiness of VHS students	The expected learning model is a learning model that can adopt school and industry goals.
5	Expected model phases	The phases that are expected to be implemented include: Material preparation phase and learning objectives and infrastructure, The phase of understanding student worksheets, The exemplary phase of the industrial instructor, The phase of practicing worksheets and directions from industrial instructors, Learning evaluation phase/performance test and Follow-up phase

Table 4. Competency aspects needed by industry and vocational high schools

	Performance test aspects	Description
Attitude	Creativity	Ability to solve problems and get the right solution
	Communication	The ability to establish cooperation and good social relations
	Integrity	Consistency in work
Knowledge	Understanding of components and how they work	Knowledge of the field of work and its characteristics
Skills	Completion of work with time efficiency	Complete the job correctly and in the time required
Occupational Safety and Health (K3)	Application of Occupational safety and health	Carry out occupational safety and health procedures at work according to safety procedures

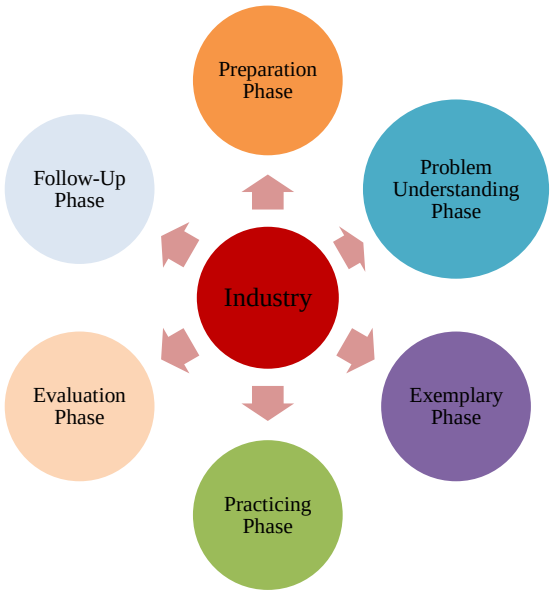

Figure 2. Phases of the conceptual LWTI learning model

3.2. Internal validation

The internal validation phase aims to obtain feasibility and input from experts for the development of learning models to background expertise in the field of vocational learning with qualifications, namely: active as academics and practitioners in vocational education institutions for at least 10 years and have produced scientific work in the field of developing vocational models. From the results of internal validation, it can be

concluded that the feasibility of the LTWI learning model is in the very high category with an average score of 3.43. Internal validation experts provide input regarding the LTWI model, including: i) the LTWI model must be prepared in detail and optimally, especially during the preparation phase; ii) Infrastructure facilities are prepared so that they can be implemented sustainably; iii) The teacher monitoring process needs to be carried out at the phases of learning. The results of the LTWI learning model after expert input (hypothetical) are displayed in Table 5 and Figure 3.

Table 5. Phases of the LTWI learning model

Phases	Activity description	Perpetrator
Preparation phase	Industrial instructors and teachers meet to agree on learning objectives and learning infrastructure.	Industry instructors and teachers
Problem understanding phase	Students understand student worksheets and find solutions to problem solving.	Industry instructor
Exemplary phase	Industrial instructors demonstrate/exemplify student worksheet steps.	Industry instructor
Practicing phase	Students apply student worksheets. Industry instructors provide mentoring and monitoring.	Industry instructor
Evaluation phase	Students are tested for work readiness with a practical performance test	Industry instructor
Follow-up phase	Industrial instructors and teachers jointly evaluate the learning process and make notes of improvement for the implementation of the next model.	Industry instructors and teachers

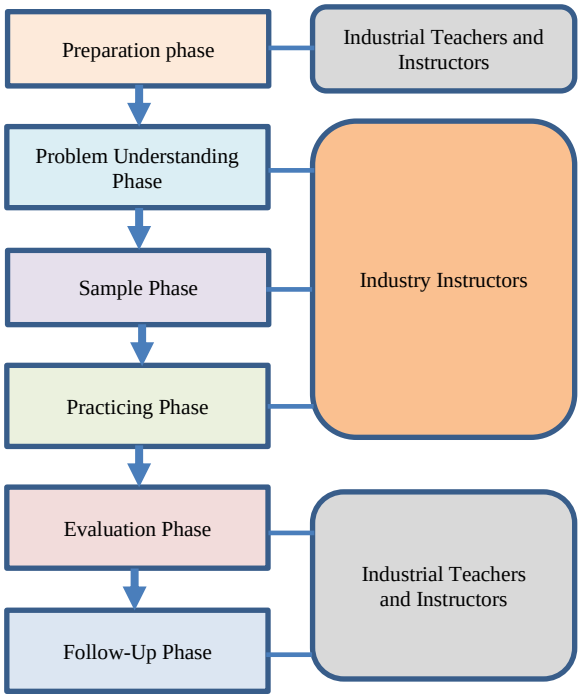

Figure 3. Phases of the hypothetical LWTI learning model

3.3. External validation

The external validation phase is carried out at the end of the development phase of the LTWI learning model. The external validation phase aims to test the effectiveness of the LTWI model in increasing the work readiness students. To find out the comparison of the increase in practice exam results, before limited trials and expanded trials, a pretest was carried out. The pretest was carried out at Muhammadiyah 1 Pakem VHS with a total of 25 students with the competency of removing the nozzle. Limited trials were implemented at Muhammadiyah 1 Pakem VHS with a total of 22 students. The work competency used is the dismantling of injection pumps. While the tryout was expanded to use the subjects of Muhammadiyah 1 Pakem VHS students and Puring 1 State VHS, a total of 67 students with competency expertise in injection system maintenance. The results of the pretest, limited trial and extended trial are displayed in Figure 4.

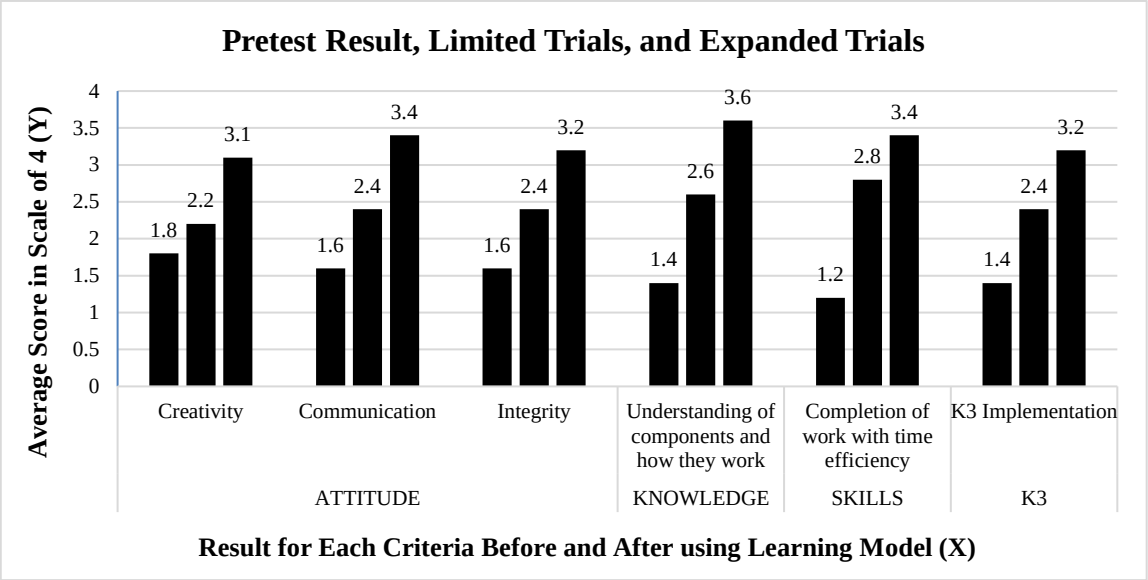

Figure 4. Pretest results, limited trials and expanded trials

3.4. Discussion

The LTWI learning model is a learning model developed from the TWI learning model. The LTWI model has main characteristics, namely learning with industry-based competency standards, completeness in achieving learning competencies and being fully trained by the industry. Learning on an industrial basis will optimize student work readiness and shape the character of VHS students according to industry expectations [7], [38]. Learning provided by industrial instructors will provide knowledge based on work experience and have a positive impact on the motivation and learning outcomes of VHS students [39]–[41].

The LTWI learning model has excellent effectiveness in increasing the work readiness of VHS students. Improved work readiness can be seen from the increase in the average score of the competency aspects of attitudes, knowledge, skills and occupational safety and health. Aspects of attitude competence consist of a creative attitude, communication and integrity. The attitude of creativity is students' ability to solve problems and get the right solution. The application of the LTWI learning model can improve creative attitudes very well. Industry-oriented learning models will encourage students to know real problems in the industry and get the right solutions from solving problems. The process of solving work issues will form creative competence gradually [39]–[41].

Communication attitude competence is the ability of students to establish cooperation and good social relations with other people. Applying the LTWI model properly will build a learning system as if working in an industry that prioritizes work communication in getting work done [39]–[41]. The next competency attitude is an attitude of integrity. Attitude of integrity is student consistency in work or seriousness in studying and working. The LTWI learning model forms an attitude of integrity very well because the LTWI learning model has the main characteristics of learning and practicing with industry. An attitude of integrity will be formed with industry-oriented learning patterns that demand complete and complete work. The industry-oriented learning model will create a spirit of consistency in work because work in industry must be completed and completely solve problems [42]–[44].

The LTWI learning model forms knowledge about the field of work gradually. Industry-oriented learning models with real work patterns will encourage students to collect new information and knowledge according to various problems [45]–[47]. Skill competence is the ability of students to complete the work correctly and according to the time needed. The LTWI learning model demands completion of work according to industry standards, that is, effective in work and time. The work is not only finished but must be correct, complete and have the right time to do it [48], [49]. Competency aspects of implementing K3 which contain student abilities carry out K3 procedures at work according to safety procedures. The LTWI learning model shapes understanding and the importance of application K3 very well. The industrial-oriented learning model will be faced with activities related to machines and have high job risks. This will form the ability and awareness of students to apply K3 procedures properly [50]–[53].

4. CONCLUSION

This research produced a LTWI learning model that can be applied very well to VHS learning. The LTWI learning model is a model that was developed from the TWI learning model by adding several phases and treatments that focus on the involvement of teachers and industry in learning. The LTWI model which was applied in two trials very well increased work readiness which consisted of aspects of attitude competence, knowledge, skills and occupational safety and health (K3). At the phase of implementing the LTWI learning model two weaknesses were found, namely, it required a pre-application phase of the model which contained the selection of industries that collaborated and supported the goals of VHS. Second, the readiness of infrastructure facilities in VHS must be gradually improved according to industry criteria. The hope is that after the development of the LTWI learning model, the development of models that involve more industries will be continued for collaboration. The LTWI learning model is not only applied to VHS students but teachers need to try to implement it in order to increase the quality of teaching according to industry criteria.

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