



## **Development of an Integrated Industry-Based Learning Model to Improve Electric Vehicle Learning Tools Work Readiness of Vocational Students**

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### **ABSTRACT**

Vocational schools need to start addressing unemployment right away since it is a serious issue. Work readiness is prepared with the demands of the industrial world in mind. The objective of this study is to create and evaluate industry-based integrated learning models for EVL+i, or electric vehicle auxiliary, subjects. The research and development (R&D) design used was Richey and Klein's design. This research involved 34 students, 6 teachers from the automotive engineering department of SMK Muhammadiyah 2 Tempel, and 4 professionals from the automotive industry. Practical performance tests and interviews were used as data collection methods. Based on the research results, it can be said that the EVL+i model was successfully developed and implemented in three stages of research. The EVL+i model can improve 6 aspects of competence of automotive vocational students, namely aspects of integrity competence, cooperation, discipline, work area knowledge, work completeness and time efficiency. The six aspects of competence have increased from the category of less good to very good with an average score of 1.82 in the limited trial and 3.72 in the extended trial.

**Keywords:** Integrated Industry, Learning Model, Electric Vehicle Learning, Working Readiness

## **INTRODUCTION**

The high unemployment rate is still a major problem for vocational school students [1][2][3][4]. Data from the Central Statistics Agency for 2023 shows that vocational school graduates have the highest unemployment rate at 8.41%. The high unemployment rate occurs due to the low work readiness of vocational school students [5][6]. Industrial work competencies consist of attitudes, knowledge and skills to achieve optimal levels of productivity. Digitalization, automation and information communication are the focus of industrial progress [6][7].

Vocational high school (SMK) graduates are prepared to become competent and marketable human resources [8][9][11]. The rapid development of industry and the world of work has an impact on the competency achievements of vocational school students [12][13]. Indonesia is facing an energy transition era where vocational school graduates are prepared to have competency in electric vehicles and renewable energy. The energy transition era requires automation competence and technological digitalization to increase industrial productivity. The energy transition era will be a big challenge for vocational schools if work preparation is not properly anticipated [14][15][16].

Vocational School organizers have done their best to prepare for the energy transition era. Efforts and improvements in learning models, learning infrastructure and learning

innovations have gradually increased [17][18]. The process of developing a learning model is an improvement step that most vocational schools carry out. But numerous studies have found that without learning aids, the learning model employed in vocational schools will not be successful [19][20]. Not only that, learning aids must involve industry in their design and implementation. The hope is that industry becomes a collaborative team in preparing, planning, implementing and evaluating learning. The goal is only one, how the competence of vocational school graduates matches the needs and criteria of the industry [21][22][23].

According to research findings from Sudarsono (2022), using industry-based learning tools in a learning model can raise the caliber of graduates from vocational schools [24]. According to Heny Sulistyningrum (2020), using industry-based learning tools and models can increase group learning motivation and produce learning outcomes that adhere to international industry standards [25]. On the other hand, Redina Simbolon (2020) claimed that, when applied appropriately, a learning model based on industry-based learning tools can enhance the soft skills of students attending vocational schools [26].

The learning model created is an industry-based model, meaning that practitioners from the industry contribute to the various learning phases. In the meantime,

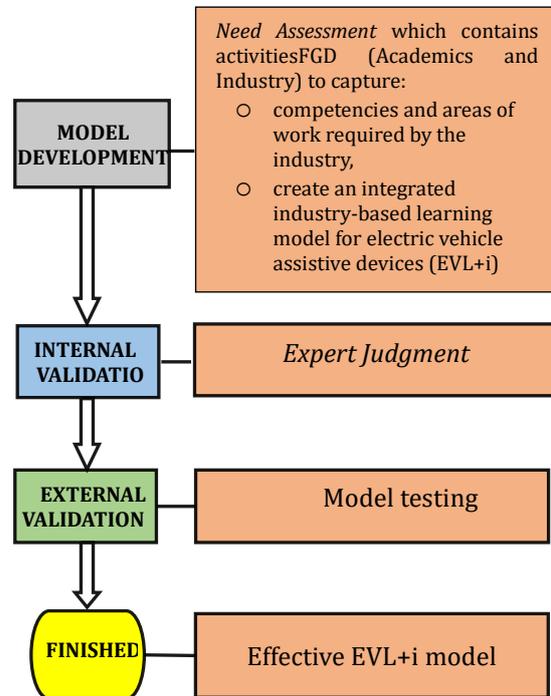
electric vehicle learning media (EVL) are instructional tools that are integrated with the learning model. EVL is a vehicle-based learning aid that serves as both a teaching tool and a performance assessment for students enrolled in vocational schools. EVL is seen as having the ability to bring together the needs of industry and education because it requires students to work on products, goods, and services that meet industry demands. It's also simple to use. If EVL is created with the demands and requirements of the industrial world in mind, it can raise the caliber of graduates from vocational schools. Furthermore, in order for the quality of graduates to meet the demands of the industrial world, the development of EVL must incorporate industry into the planning, execution, and assessment of learning.

## RESEARCH METHOD

The targets of this research are students, teachers and industrial practitioners. This research involved 34 students, 3 light vehicle engineering competency teachers at SMK Muhammadiyah 2 Tempel and electric car industry practitioners. The sampling technique used was purposive sampling. To test the effectiveness of the EVL+i model, it was tested in limited step with 5 students involved, and the trial was expanded with 34 students involved.

Model development, internal validation, and external validation are the three phases of

Richey and Klein's Research and Development model that are the subject of this study. The steps of the research are displayed in Figure 1.



**Figure 1.** Research step

The first step, known as model development, aims to create a conceptual model of the EVL+i model and formulate the competency aspects necessary to enhance students' work readiness. During the development step, an interviewing method developed with focus group discussion (FGD) activities was employed. Gathering expert opinions is the second step, or internal validation, before evaluating the hypothetical EVL+i model. The assessment of how well the EVL+i model is preparing students for the workforce is the third step, also referred to as external validation.

The technique of observing student performance is the data collection method

used to track the increase in work readiness of vocational school students. Learning media specialists and industry practitioners validate the tool prior to use. Furthermore, the internal validation data was analyzed descriptively, namely quantitatively, in accordance with the criteria achievement rubric which refers to the Likert scale in Table 1.

**Table 1.** Meaning of work readiness assessment

Assessment Norms	Score Range	Criteria
$X \geq \mu + 1. \beta$	$X \geq 3.00$	SB
$\mu + 1. \beta > X \geq \mu$	$3.00 > X \geq 2.50$	B
$\mu > X \geq \mu - 1. \beta$	$2.50 > X \geq 2.00$	K
$X < \mu - 1 \beta$	$X < 2.00$	Q

(Source: [27])

Notes:

Very Good (SB); Good (B); Not Good (K); Not Good (T)

Information:

$\mu$  : mean overall score of students in one class

$\beta$  : (maximum score + minimum score)

$\beta$  : standard deviation of overall score

$\beta$  :  $1/6$  (maximum score-minimum score)

## RESULT AND DISCUSSION

### 1. Development Step

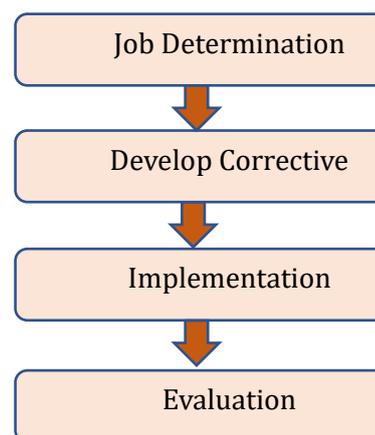
The development step seeks to create a conceptual model of the EVL+i model and formulate the competency aspects required to improve student work readiness. The competency aspects required by vocational school graduates consist of integrity, cooperation, discipline, knowledge of the field

of work, work completeness and time efficiency. Details can be seen in Table 2.

**Table 2.** Description of industrial competency aspects

Competency Aspects	Description
Integrity	Moral qualities that refer to honesty, truthfulness, and consistency in actions
Cooperation	The ability of individuals or groups to work together effectively to achieve common goals
Discipline	A person's ability to consistently comply with assigned rules, norms, and tasks
Job Field Knowledge	Deep understanding of job-related tasks, procedures, concepts, and principles
Job Completion	Ability to complete tasks or projects well, according to established standards
Time efficiency	Ability to use time wisely and effectively in completing tasks

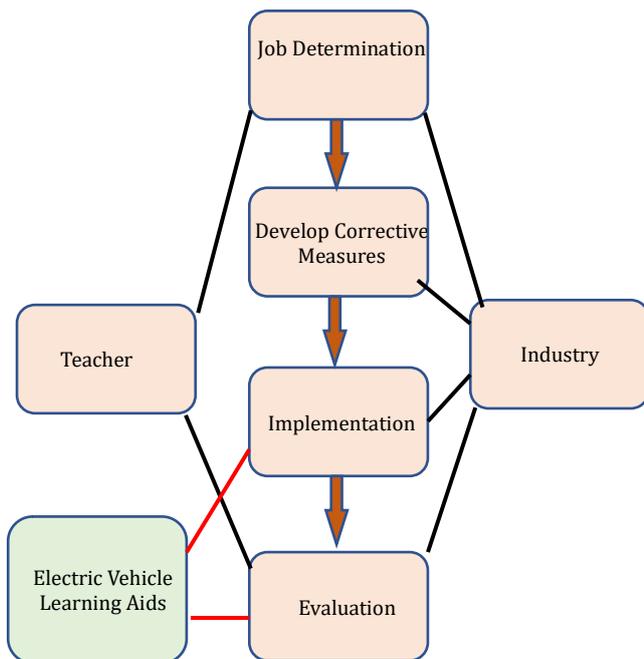
The integrated industry-based learning model for electric vehicle assistive devices (EVL+i) was produced from the FGD activities as follows.



**Figure 2.** Conceptual EVL+i model

## 2. Internal Validation Step

The purpose of the internal validation step is to solicit feedback from media specialists and experts in the electric vehicle industry regarding the suitability of electric vehicle models and tools.



**Figure 3.** EVL+i model used

The results of internal validation are as follows: (1) the model adds the role of industry at each learning step; (2) industry as a determinant of competency success; and (3) tools are made attractive with arrangements that take into account the level of work safety. The results of the EVL+i model used can be seen in Figure 3.

After being validated by experts, the work readiness assessment tool is put through a validity and reliability test. Experts tested reliability using the Cronbach's Alpha formula and validity using the Aiken's V coefficient.

The results about the validity and reliability of the work readiness instrument are shown in Tables 3 and 4.

**Table 3.** Content validity calculation results

Instrument Items	Validity
Integrity	Tall
Cooperation	Tall
Discipline	Tall
Job Field Knowledge	Tall
Job Completion	Tall
Time efficiency	Tall

The calculations above suggest that the work readiness assessment tool has a high degree of validity and reliability, which makes it a useful tool for obtaining information on students' readiness for the workforce.

**Table 4.** Reliability test

Cronbach's Alpha	N items
0.876	6

## 3. External Validation Step

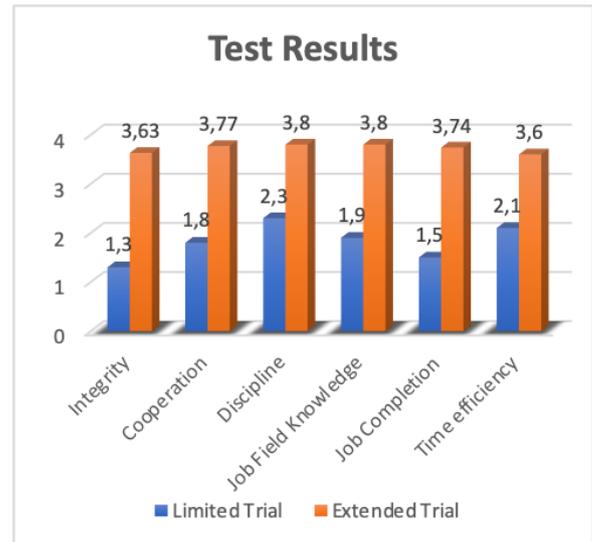
The purpose of this step is to assess how well the EVL+i model increases students' preparedness for the workforce. Model testing activities are included in the external validation step. Limited testing and expanded testing are the two phases that make up model testing. Ten students who were proficient in maintaining gasoline fuel systems conducted the short trial. Following a restricted testing phase, the researchers considered their findings and concluded that both students and industry practitioners could successfully apply the EVL+i model. The model's efficacy in fostering student work readiness yielded an

average score of 3.17 in the very good category. Table 5 and Figure 4 show the test results for each competency aspect 4.

**Table 5.** Test results of the EVL+i learner model

Competency Aspects	Average Score	
	Limited Trial	Expanded Testing
Integrity	1.3	3.63
Cooperation	1.8	3.77
Discipline	2.3	3.80
Job Field Knowledge	1.9	3.80
Job Completion	1.5	3.74
Time efficiency	2.1	3.60
Average Score	1.82	3.72

Students at Automotive Engineering Vocational School can become more prepared for the workforce in terms of attitudes, knowledge, and abilities by implementing an industry-based learning model integrated with electric vehicle learning aids (EVL+i). The design of the EVL+i learning model, which satisfies the requirements of vocational schools and the automotive industry, is the consequence of the findings of the focus group discussions (FGD) conducted during the development and validation phases. The unique features of the EVL+i learning model include its involvement of industrial practitioners during the learning phase and its support by learning materials that the industry requires. Planning, overseeing, and assessing learning is where industrial practitioners come into play.



**Figure 4.** Limited trial results

According to Sudarsono (2023), developing an integrated learning model of tools for the learning of Automotive Engineering Vocational School students can improve work competency and industry needs [9][28]. So far, the development of learning aids implemented in vocational schools does not involve industry and has not made collaborative efforts. According to Jacobs et al. (2022), Lawitta (2017), and Pardjono et al. (2019), learning aids have only been used by Automotive Vocational School students in compliance with school policies, with no input from the business community. Although learning will lead to competency, integrated competency's standardization and suitability for the industrial world are not ideal [29][30][31].

The study of industrial-based learning models combined with electric vehicle learning aids (EVL+i) will influence

modifications to the models and procedures of vocational education [32][4]. A shift from manual learning systems to collaborative learning will be necessary to implement the learning model. The short amount of time industrial practitioners has available to monitor and assess learning activities is a weakness in the EVL+i model. In order to create a more flexible control system, more development steps are therefore required. Additionally, there will be regulations governing the partner industries chosen in order to provide standardized competency references and more [32][4].

### CONCLUSION

The industry-based learning model integrated with electric vehicle learning aids (EVL+i) is designed to increase vocational school students' work readiness. The application of EVL+i twice produced data that there was an increase in the competency aspects of Integrity, Collaboration, Discipline, Job Field Knowledge, Work Completeness, and Time Efficiency increasing from low to very high categories.

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