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Analysis Workshop Management, Time Management and Problem Solving Ability to Automotive Electrical Competence

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Abstract

In the 21st century, the industrial revolution 4.0 occurred where required to change aspects of human life. Therefore, the quality of human resources must also be carried out increase. The quality of human resources can be seen in terms of their competence at work. In this study, we want to identify the factors that influence competence, especially in the automotive electrical. The data analysis of this research is using SEM analysis to see the direct and indirect effect on competence. The results showed that workshop management had a significant effect on the ability to solve problems, while time management did not directly affect the ability to solve problems and competence. Partially, workshop management and problem solving ability have a significant direct influence on competence. Competence is influenced indirectly by workshop management through the ability to solve problems. In contrast to time management which does not affect competence indirectly through problem solving ability. Therefore, in order to improve student competence, it is necessary to do improvement of problem solving ability and improvement of workshop management quality.

Keywords: *Competence, Workshop Management, Problem-Solving Ability, Time Management, SEM Analysis.*

Introduction

Advances in science and technology are increasingly fast in the 21st century which is marked by the industrial revolution 4.0 where all elements sued to change all aspects of human life (Ali et al., 2020). The existence of the Industrial Revolution 4.0 and the impact of technological disruption is certainly very influential in education World. Education is fundamental in the formation process the character of each individual, so that education is expected to be able to optimize students to become human beings who have full competence. Increased competence can lead a person to the world of association, which can be done in the business world, industry, social environment, management and technology media (Bingham & Conner, 2010).

To answer the challenges of the 21st century, the key to the success of vocational, professional and sustainable education, is determined by three aspects, namely teachers, curriculum, and learning (Nurtanto et al., 2020). The main goal of TVET is to produce graduates who are ready to enter the world of work and industry, are required to be able to produce graduates who have competence (Nurjanah & Ana, 2022). In Indonesia, vocational education is undergoing a curriculum transition which was originally based on the 2013 curriculum to become an independent learning curriculum.

Educational institutions produce graduates who are not ready to work causing a lot unemployment, this is a fact that is currently happening in Indonesia (Daryono et al., 2023). We must take concrete and comprehensive steps to solve these problems so as to produce graduates who are ready to use, competent in accordance with the field of work, competitive and have a high selling value so that they can compete in the global era (Squire, 2020).

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Students attending vocational schools tend to learn more functional and social competencies such as technical skills and job-appropriate. Competence is an integrated set of knowledge, skills, and attitudes that acquire its meaning in the context (job) or task in which the competency is used (Misbah et al., 2020). Höglund distinguish between 'competence' and 'qualification'. The difference is that 'competence' is something that an individual possesses temporarily qualification is something close _ related to work tasks (Backa & Wihersaari, 2014). Granberg defines competence as a formal qualification for a task or job position. According to Granberg there are several types of competence. One of them is formal competence. As a rule formal competence is connected to the education that has been carried out by the individual (Backa & Wihersaari, 2014). Competence is defined as self-efficacy for a task, or the degree to which an individual believes they can complete a task successfully (Deci & Ryan, 2008).

Many things are done by teachers to improve the competence of students, one of which is by increasing the ability to solve problems. This ability can be applied, one of which is a problem -based learning model. PBL was first adopted in teaching medicine at McMaster University, Canada, by Barrows and Tamblyn (Engle, 1981). Barrows and Tamblyn's first two basic postulates are that learning through problem solving is much more effective than learn a large amount of usable knowledge and, secondly, that problem solving skills are more important for doctors than memory skills (Engle, 1981).

In Andis's research showed that the use of PBL in large classrooms without tutors (thus avoiding additional costs) led to a statistically significant improvement in students' general problem solving skills (Klegeris et al., 2013). Hosseinzadeh teaches PBL in electrical power systems engineering and has concerns over the breadth of content to be discussed without compromising content subject - specific technicalities (Hosseinzadeh & Hesamzadeh, 2012). Problem -based learning is a constructive learning paradigm, in which learners selecting and changing information, constructing ideas, and making decisions based on their current or past knowledge (Yoo & Park, 2015).

In general, researchers into problem solving usually define the term problem as a task or question that an individual or group of individuals does not immediately know how to answer (Haavold & Sriraman, 2022). However, this definition says very little about how teach individuals to become better problem solvers (Haavold & Sriraman, 2022). Accordingly, several problem-solving models have been developed to describe and explain the factors and processes involved in problem solving — most have been drawn to rely heavily on Pólya 's famous four - stage problem-solving model. Hesse et al, gave the definition of problem solving is an activity in which a student perceives the difference between the current state and the desired goal state, recognizes that this difference has no clear or routine solution, and then tries to act based on certain situations to achieve that goal state. This is accompanied by a number of mental and behavioral processes which may not always occur sequentially but may proceed in parallel" (Guaman-Quintanilla et al., 2023).

Troubleshooting is defined as the process of eliminating the gap between states desired and existing thoughts. There are several features included in troubleshooting such as, finding problems, describing problems, creating a number of alternative solutions, evaluate alternative solutions and choose option best (Zhang et al., 2023). based learning case expose students to appropriate responses in phase first and second learning and approach teaching, thus enabling them to succeed recognize, analyze, and solve communication problems (Allchin, 2013; Jonassen & Hernandez-Serrano, 2002).

The ability to solve problems is influenced by several factors, namely internal and external factors. Internal factors are factors that come from individuals, for example motivation, interest, self/time management, etc. While external factors are conditions that are influenced outside the individual, for example the environment, infrastructure, etc. The research discussed in this article is an internal factor, namely student time management in carrying out activities, especially in learning. While external factors are facilities and infrastructure, but more focused on workshop management when carrying out practicum.

Based Learning, working in groups is the biggest time consumer though distributed relatively homogeneous. In addition, students spend too a lot of time in almost all activities, which causes common overloads to be handled properly (Ruiz-Gallardo et al., 2016). Is known that time management is a technology to increase efficiency in the use of time for task performance. Time management presupposes

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conscious control over the amount of time spent on certain types of work, thereby increasing efficiency and product quality of activities (Kirillov et al., 2015). A number of studies have identified the positive impact of time management. Time management skills have been shown to have a positive impact on student learning and student outcomes (Kirillov et al., 2015) and (Krause & Coates, 2008). reported that the capacity to succeed managing their time is the foundation on which students develop Good study habits and strategies for success. In the research Adaman and Blair found students' understanding of time management behavior in contributing to students' academic performance (Adams & Blair, 2019).

Based on draft lifelong learning education, emerge workshop terms. The term workshop can be explained to improve skills and competencies in certain fields quickly. Furthermore, Ananda argues that the workshop is a learning activity of teaching and training to achieve a certain competence or level of work efficiency as the output of the workshop, and is expected to provide a fast, precise and appropriate response to the situation at hand (Mardos & Nadeak, 2021).

Therefore, management in the workshop is needed as an effort systematic and planned to optimize all components of the workshop to achieve the purpose of the workshop objectives effectively and efficiently. The management component itself consists of curriculum, human resources, facilities/infrastructure, and costs. Systematic and planned training management includes planning, implementation, supervision (control), and evaluation, especially those concerning organization, programs, resources, and financing. Meanwhile, the general purpose of holding workshops is to improve the results of professional workshops.

Practice has proven that the curriculum teaching model integrating workshop management with teaching can better realize the " integration of theory and practice ", which is conducive to improving the quality of vocational education and teaching in China. The construction of a curriculum teaching model that integrates workshop management with teaching can be divided into three stage: "stage preparation", "process stage" and "stage assessment" (Yang, 2020). The results of the study explain that there is an influence of workshop management on the skills of students of SMK Negeri 3 Toraja Utara (Mardos & Nadeak, 2021). Based on the above background, this research analyzes workshop management, time management and problem solving skills on the competence of expertise, especially in automotive electrical competence. The formulation of the problem discussed in this article is.

- How is the direct influence of workshop management on automotive electrical competence
- How does time management directly affect automotive electrical competence
- How does the ability to solve problems directly affect automotive electrical competence
- How is the indirect influence of workshop management on automotive electrical competence through the problem solving ability
- What is the indirect effect of time management on automotive electrical competence through the problem solving ability.

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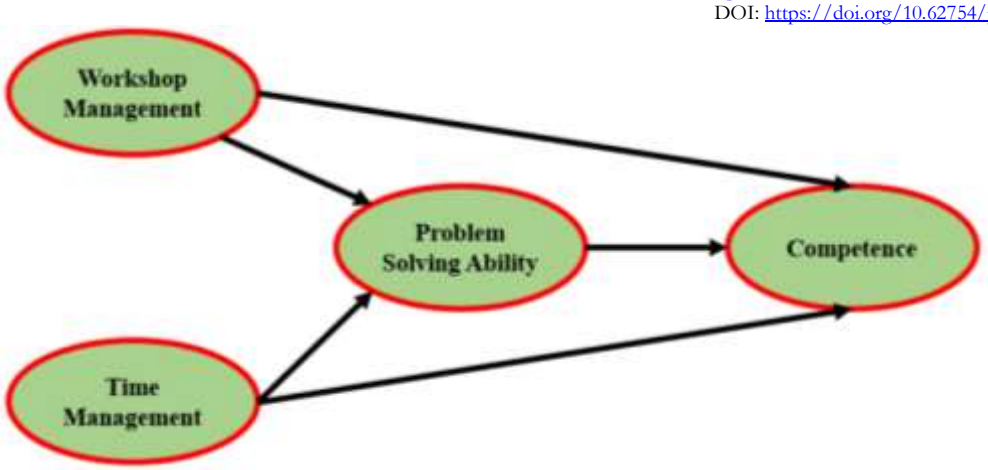

Figure 1. Skeleton Conceptual

Research Method

Design

This research design examines the factors that influence automotive electrical competence. Where the researcher examines workshop management, time management and problem solving skills in undergraduate students of Mechanical Engineering Education, State University of Surabaya. This study aims to obtain information on the influence of workshop management, time management and problem solving ability on automotive electrical competence. Research using approach quantitative ex post facto survey method (Crain, 2015).

Population and Sample

Where the population in this study is mechanical engineering education students who have taken automotive electrical practice Classes of 2021 and 2022. The samples taken were 64 students of mechanical engineering education class 2021 and 2022 who had participated in automotive electrical practice activities.

Research Instruments

Collecting data or information is a procedure and prerequisite in solving research problems constructs that are tested, then the data collection instruments are arranged in the form of questionnaires and tests. Questionnaires are used to obtain data on workshop management and time management, while tests are used to collect data on problem solving abilities and automotive electrical competence (Proctor, 2010).

Instruments used arranged in advance according to the rules the preparation of the instrument, namely: construct validity, content validity, advance validity and continued with item validity to see the validity and reliability of the instrument to be used. The description of the instruments for each construct can be seen in the table below.

Table 1. Instrument Grid

No	Construct	Indicator	Instrument
1	Competence	1. Cognitive 2. Psychomotor 3. Affective	Test
2	Problem solving ability	1. Understanding the problem 2. Planning problem solving 3. Doing planning problem solving	Test

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		4. Checking Troubleshooting Results Back	
3	Workshop management	1. planning 2. Organizing 3. Actuating 4. controlling	Questionnaire
4	Time management	1. Activities to do 2. Best activity conducted	Questionnaire

Data Analysis

In this study, before the data is analyzed, it must be done The classical assumption test first relates to the normality, heterosity, and multicollinearity tests, this aims to select the right testing technique according to the rules of analysis.

The analysis used is SEM (Structural Equation Modeling) which is suitable for multivariate statistical analysis. The use of SEM is so that the data can be analyzed if there is data that is not normally distributed. SEM data processing is built by measurement models and structural models. In SEM there are 3 activities simultan namely checking the validity and reliability of the instrument (confirmatory factor analysis), testing the relationship model between variables (path analysis), and getting a suitable model for prediction (structural model analysis and regression analysis). A complete model basically consists of a measurement model and a structural model or causal model. Measurement model done to produce evaluation regarding the validity and discriminant validity, while the structural model, namely the modeling that describes the hypothesized relationships.

This analysis is used to determine the effect of workshop management, time management and problem solving skills on automotive electrical competence. In testing the hypothesis of the constructs above, it will be analyzed how the direct and indirect effects of each construct will be analyzed. The analytical test tool used use ADANCO.

Results and Discussion

Factors that directly and indirectly affect automotive electrical competence analyzed using path analysis. The constructs studied include workshop management, time management, problem solving skills and automotive electrical competence. To get the value of the variables studied, each construct will first be grouped in the path sub structure and after the path sub structure results are obtained, a result diagram is made as a summary of the sub structure section. The path sub structure will be divided into 2 groups, namely lane 1 and 2 sub structure. The path 1 sub structure consists of time management constructs, workshop management, problem solving abilities to automotive electrical competence. The results of the first sub-structure path analysis can be seen in table 2. While the second sub-structure path analysis can be seen in table 3.

Table 2. First Path Structure Analysis

Effect	Original coefficient	Standard bootstrap results				
		Mean value	Standard error	t-value	p-value (2-sided)	p-value (1-sided)
Problem Solving Ability -> Competency	0.361	0.381	0.132	2,728	0.006	0.003

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Workshop Management -> Competency	0.289	0.287	0.134	2.163	0.031	0.015
Time Management -> Competency	0.024	0.048	0.186	0.126	0.899	0.450

Table 3. Coefficient Results of the Second Structure Path Analysis

Effect	Original coefficient	Standard bootstrap results				
		Mean value	Standard error	t-value	p-value (2-sided)	p-value (1-sided)
Workshop Management -> Problem Solving Ability	0.361	0.388	0.128	2.826	0.005	0.002
Time Management -> Problem Solving Ability	0.124	0.111	0.192	0.647	0.518	0.259

Workshop Management on Competence

According to the results of statistical tests using path analysis, a p value (1-sided) of 0.015 was obtained, this means that workshop management has a significant effect on automotive electrical competence. The average workshop management has a path coefficient (β) of 0.289 for automotive electrical competence. This shows that if the average number of workshop management increases and is not limited, it is estimated that the percentage of automotive electrical competence will increase by 0.289. The workshop management factor is a form of infrastructure. With adequate infrastructure, it will support practical activities. Good practice activities will increase the competences obtained by students.

Time Management on Competence

The results of statistical tests with path analysis obtained p value (1-side) 0.450, this means that time management has no significant effect on automotive electrical competence. The percentage of time management path coefficient (β) is 0.024 for automotive electrical competence. Time management has no effect on competence. Competence is not influenced by time management in the long run that competence is the ability to carry out activities both knowledge and skills psychomotor, which requires procedural.

Problem Solving Ability to Competence

According to the results of statistical tests using path analysis, a p value (1-sided) of 0.003 was obtained, this means that the ability to solve problems has a significant effect on automotive electrical competence. The average problem-solving ability has a path coefficient (β) of 0.361 for automotive electrical competence. This shows that if the average number of problem solving abilities increases and is not limited, it is estimated that the percentage of automotive electrical competence will increase by 0.361. Students who are able to solve problems mean that they have been able to apply the knowledge they have acquired. Even if students often solve different problems, they will get additional information, especially in conducting analysis and decision making decision.

Workshop Management on Problem Solving Ability

From the results of statistical tests with path analysis obtained p value (1-sided) 0.002. This means that the workshop management has a significant effect on the ability to solve problems. The percentage of workshop management has a path coefficient (β) of 0.361 on the ability to solve problems. This shows that if the percentage of workshop management increases, it is estimated that the ability to solve problems is 0.361. Workshop management has an influence on the ability to solve this problem because good workshop arrangement, for example easy placement of tools and materials affordable at the time of implementation

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practicum. The equipment used is also adequate so that when you find students' automotive electrical practice problems are not constrained by tools, so it will make it easier to solve problems that occur. In the practice area, materials are prepared in good and damaged conditions so that students can compare, so that students are able to analyze when given problems in automotive electrical practice

Time Management on Problem Solving Ability

According to the results of statistical tests with path analysis, a p value of 0.124 is obtained, in table 2. This means that the percentage of time management has no significant effect on automotive electrical competence. The percentage of time management path coefficient (β) is 0.124 to the ability to solve problems. The ability to solve problems has different levels of problems. Problem level seen not from the time but is how the solution to the problem can be found.

Based on the results of the path coefficients in table 2 and table 3, it can be described as a whole the causal effect between constructs in the form of a path diagram. The path that is created will show the value of each construct. The path mechanism between constructs can be seen in Figure 2. Figure 2 shows that the significance and path coefficients for the construct workshop management, time management, problem solving skills and automotive electrical competence.

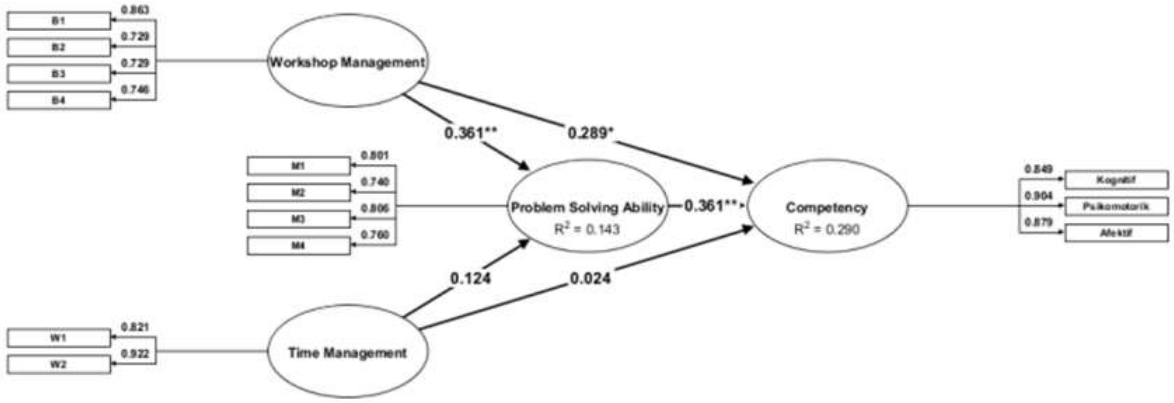

Figure 2. Path Analysis Diagram Results

Table 4. Coefficient Results of the Second Structure Path Analysis

Effect	Original coefficient	Standard bootstrap results				
		Mean value	Standard error	t-value	p-value (2-sided)	p-value (1-sided)
Workshop Management -> Competency	0.1301	0.1457	0.0705	1.8457	0.0652	0.0326
Time Management -> Competency	0.0449	0.0441	0.0757	0.5927	0.5535	0.2767

In Figure 2 we can see the direct effect on each construct while in table 4 we can assess the influence of the construct indirectly. Table 4 shows that the time management construct has an indirect effect on competence through the ability to solve problems. Table 4 also shows the data on the influence of workshop management on competence indirectly through the ability to solve problems.

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Table 4 above shows the indirect effect of each of the tested constructs. The description of the indirect effect of each construct through mediation is as follows.

The indirect effect between time management and competence is obtained by a value of 0.0449 with a p -value (1-sided) of 0.2767. If a p-value is above 0.05, it can be stated that time management has no effect on competence. automotive electrical engineering through problem solving skills.

Indirect influence between workshop management and automotive electrical competence obtained a value of 0.1301 with n p -value (1-sided) of 0.0326. If the p-value is below 0.05, it can be stated that workshop management has an effect on automotive electrical competence through the ability to solve problems.

Conclusion

The research findings indicate several key conclusions related to the tested hypotheses. Workshop management plays a significant and direct role in enhancing automotive electrical competence. The support provided by infrastructure and effective workshop management fosters practical activities, which in turn automatically improves competence. Conversely, time management does not have a measurable impact on automotive electrical competence. Additionally, problem-solving ability has a direct, positive, and significant effect on automotive electrical competence. When students engage in problem-solving, they apply their acquired knowledge to determine methods and make decisions, which, often unconsciously, leads to an improvement in their competence. Moreover, workshop management also positively influences competence indirectly, through the development of problem-solving skills. On the other hand, time management shows no significant effect on automotive electrical competence, either directly or through problem-solving ability.

Conflicts of Interest

The author(s) declare that there are no conflicts of interest regarding the publication of this paper.

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