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THE IMPACT OF CRITICAL-CREATIVE THINKING AND SIMURELAY-BASED MOTIVATION ON MOTOR INSTALLATION LEARNING OUTCOMES

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Abstract
This study explored the correlation of critical thinking, creative thinking, and Simurelay-based learning motivation to the learning outcomes of students in class XI TITL at SMKN 7 Surabaya. The research used an ex post facto method with a correlational design. Participants were class XI students in the Electrical Power Installation Engineering program. Data were collected using questionnaires and tests, and analyzed with regression techniques using SPSS. The results showed that critical thinking significantly influenced knowledge (78.9%), attitude (70.2%), and skills (2.6%). Creative thinking contributed to knowledge (18.2%) and attitude (24%), but has limited effect on skills (3.6%). Learning motivation affected knowledge (19%), attitude (24.8%), and skills (5%). Combined, all three factors influenced learning outcomes: knowledge (98.3%), attitude (98.4%), and skills (8.9%). These findings underlined the importance of cognitive abilities and motivation in vocational education. The integration of critical and creative thinking with Simurelay-based learning enhanced engagement and achievement across cognitive, affective, and psychomotor domains. Such strategies were essential for improving technical learning performance.

Keywords: Creative thinking, critical thinking, electric motor installation, learning outcomes, motivation, simurelay.

Introduction

Education has long been recognized as a fundamental factor in shaping individual character and personality. It is important to understand that education is not solely derived from formal institutions such as schools and universities, but also encompasses informal and non-formal educational experiences that play a vital role, particularly during the formative years of children and adolescents (Tsauri, 2015). This perspective is aligned with the objectives articulated in Law Number 20 of 2003 on the National Education System, which emphasizes the development of learners' potential to become individuals who are devout, morally upright, knowledgeable, competent, creative, and independent, as well as responsible citizens who uphold democratic values (Depdiknas, 2004).

The rapid advancement of technology in recent years has significantly influenced the educational landscape. The integration of technology in instructional practices has transformed the roles of educators, teaching methodologies, and the nature of teacher-student interactions. Technological tools offer opportunities for personalized learning, diversified instructional strategies, and a student-

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centered learning approach, which collectively enhance the quality of the learning experience (Iskandar et al., n.d.). In vocational education, in particular, technological integration plays a critical role in aligning instruction with students' individual competencies and industry-relevant skills (Gunardi et al., 2023). Moreover, in the context of 21st-century education, key competencies such as effective oral and written communication and digital literacy have become essential. These skills enable learners to articulate ideas clearly and engage constructively with others (Ariyanti et al., 2018).

In addition to digital competence, the ability to think critically and creatively has emerged as a central element in effective learning. Critical thinking allows learners to assess the validity of evidence, recognize faulty reasoning, and construct well-founded arguments—skills that are particularly essential in academic settings (Zakiah & Lestari, 2019). Creative thinking, on the other hand, enables students to generate original ideas and apply them to problem-solving, decision-making, and goal attainment. Opportunities for creative expression in learning environments have been shown to increase student motivation and curiosity, fostering a more engaging and productive educational experience (Uloli, 2021).

Motivation to learn is another influential factor that significantly affects student academic performance. Empirical studies have established that learning motivation is closely linked to the intensity of student effort and, consequently, to learning outcomes (Mayasari et al., 2023).

However, preliminary observations at SMKN 7 Surabaya indicated that the prevailing learning process is characterized by its underdevelopment and a paucity of innovation. It has been demonstrated that students exhibit an absence of critical and creative thinking skills, particularly in the domain of electric motor installation. Consequently, the learning outcomes remain suboptimal. During the course of the Educational Field Experience Practice (PLP), researchers observed that the teaching strategies employed were predominantly conventional, with a paucity of effective utilization of educational technology. This finding suggests that the integration of technology into the teaching process has not resulted in a significant improvement in student learning outcomes. This finding aligns with the conclusions of Siyamoy Ghory and Hamayoon Ghafory's research, entitled "The Impact of Modern Technology in the Teaching and Learning Process," which asserts that modern technology possesses significant potential in enhancing the learning process. However, it is also noted that in the absence of adequate implementation strategies and sufficient support, the full benefits of technology may not be realized (Ghory & Ghafory, 2021).

This issue is of particular concern, given that vocational education must be practice-oriented and responsive to technological advances. The utilization of conventional pedagogical approaches has been identified as a significant impediment to the cultivation of essential 21st-century competencies, including critical and creative thinking. These competencies are deemed crucial for ensuring student preparedness for the demands of the contemporary workforce. This assertion is corroborated by Muchlas Samani's research, entitled "Learning Strategy to Develop Critical Thinking, Creativity, and Problem-Solving Skills for Vocational School Students," which underscores the necessity for innovative learning methodologies to facilitate the development of critical thinking, creativity, and problem-solving skills in vocational education (Samani et al., 2019). In response to this problem, the objective of this study is to examine the effect of critical thinking skills, creative thinking, and simulation-based motivation on student learning outcomes in the subject of electric motor installation. In order to address the limitations of traditional pedagogical methods, this study proposes the integration of Simurelay, a simulation-based learning medium that fosters a secure and pragmatic learning environment. This digital simulation enables students to engage in experiential learning

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without the risk of damaging physical equipment, aligning with the principles of digital learning media. These principles emphasize flexibility, accessibility, and efficiency.

The rationale for this research is further supported by a gap in the existing literature. While prior studies have explored critical thinking, creative thinking, or motivation individually, there is a paucity of research that examines the combined impact of these variables within the context of vocational education, particularly using simulation-based digital tools. This study is therefore very important and timely, as it aims to improve the quality of vocational teaching and contribute to empirical knowledge regarding technology-integrated learning strategies and 21st century skills development. With the formulation of the problem, namely to determine the correlation of critical thinking ability, creative thinking, and learning motivation both individually and simultaneously on student learning outcomes in the application of learning with Simurelay software in the Electrical Motor Installation Subject of Class XI Electrical Power Installation Engineering (TITL) at SMK Negeri 7 Surabaya, this study aims to provide practical insights and evidence-based recommendations to improve vocational education in Indonesia.

Literature Review

Definition of critical thinking

Critical thinking is defined as a reflective thinking process that focuses on deciding what to believe or do. This process includes the ability to access, analyze, and synthesize information. This ability can be taught, trained, and mastered. The skill set of critical thinking encompasses the following abilities: the analysis of arguments, the formulation of inferences through the use of inductive or deductive reasoning, the evaluation and assessment of situations, and the decision-making process and problem-solving (Zakiah & Lestari, 2019).

Critical thinking is a multifaceted concept that encompasses a range of cognitive skills, dispositions, and processes. Fundamentally, critical thinking involves the ability to analyze, evaluate, and synthesize information systematically and rationally. It demands that individuals interrogate assumptions, challenge biases, and meticulously examine evidence before arriving at conclusions or making decisions. It is important to note that critical thinking encompasses more than mere memorization or recall of facts. Instead, it is an active process of engaging with information, employing reasoning skills to understand complex issues, and solve problems effectively. A fundamental component of critical thinking is analysis, which entails the decomposition of information into its constituent elements and the subsequent examination of the relationships between these elements. This process enables individuals to identify patterns, relationships, and differences, thereby facilitating a more profound comprehension of the underlying issue or concept. Analysis is essential for the identification of latent assumptions, biases, or logical fallacies that might distort or obscure the truth (Redhana, 2024).

Creative thinking capability

The definition of creative thinking ability can be viewed from two aspects. From the cognitive aspect, creativity is defined as the ability to think in a fluent, flexible, original, and detailed manner. From the affective aspect, creativity is characterized by strong motivation, curiosity, interest in compound tasks, courage to face risks, resistance to discouragement, appreciation of beauty, humor,

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a desire to seek new experiences, respect for oneself and others, and so on. Within the educational context, creativity is synonymous with innovation. In business, creativity is often equated with entrepreneurship. In mathematics, creativity is often associated with problem solving. In music, creativity is manifested in performance or composition. However, a substantial number of scholars also define creativity as invention. The contemporary understanding of creativity encompasses not only the act of invention but also the process of thinking and acting (Lestari & Zakiah, 2019).

Creative thinking can be defined as the process of cultivating creative thinking. Creative beliefs have the capacity to define situations and measures, generate new types of environments, create careful explanations, or find ways to solve problems. Creative thinking can be conceptualized as the generation or suggestion of unique or alternative perspectives, the production of innovative designs, or new approaches to problems or artistic challenges (Uloli, 2021).

Motivation to learn

Motivation is defined as a psychological condition that encourages an individual to engage in a particular behavior or activity. The concept of learning motivation is further subdivided into two categories: intrinsic learning motivation and extrinsic learning motivation. Intrinsic learning motivation pertains to an individual's intrinsic motivation to achieve their personal goals or ideals. This intrinsic motivation stems from an individual's inherent desire to achieve their goals or ideals, which can be realized through the process of learning. In contrast, extrinsic learning motivation is influenced by external factors that motivate individuals to engage in learning. Examples of external factors that can influence learning motivation in students include the desire to obtain high grades and become class champions (Mayasari et al., 2023).

According to alternative sources, the concept of learning motivation is defined as the intrinsic or extrinsic energy that propels an individual to persist and demonstrate enthusiasm in their activities. This energy is attributed to the individual's own motivation, which is intrinsic, or to external factors, which are extrinsic. The strength of an individual's motivation exerts a significant influence on the quality of their behavior, both within the contexts of learning, working, and other aspects of life (Rachman, 2015).

Simurelay

This instance, the research tool employed to engineer and simulate a circuit utilizes the Simurelay application, an Android-based electric motor control circuit simulation software designed to facilitate the learning of students majoring in TITL. The software can be accessed via a smartphone through the Google Play Store, thereby enabling on-demand learning.

Learning outcomes

Student learning outcomes serve as a metric for evaluating the extent to which students have mastered the subject matter imparted by the instructor. Alternatively stated, learning outcomes represent the academic success of students, which is quantifiable through numerical values. These outcomes manifest in diverse forms, including semester exams, grade promotion exams, and daily assessments (Wirda et al., 2020).

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The scope of learning outcomes can be seen from three domains: the cognitive domain, the affective domain, and the psychomotor domain. The cognitive domain is subdivided into six levels of ability, namely: (1) knowledge, which is the level of ability that requires students to be able to recognize or know the existence of concepts, principles, facts, or terms without having to understand or be able to use them. The operational verbs that can be employed to demonstrate this level of understanding include: define, give, identify, name, list, match, mention, outline, state, and select; (2) Comprehension, defined as the level of ability that requires students to understand or comprehend the subject matter conveyed by the teacher and be able to utilize it independently. This ability is further delineated into three distinct components: translating, interpreting, and extrapolating. The operational verbs that can be employed include: change, maintain, distinguish, predict, explain, conclude, give examples, predict, and improve. The third level of cognitive ability is application, which requires students to use general ideas, procedures, or methods, principles, and theories in new and concrete situations. Operational verbs that can be used include: modify, calculate, demonstrate, express, perform thoroughly, perform, manipulate, connect, demonstrate, solve, and use; (3) Analysis, which is defined as the level of ability that requires students to decompose a certain situation or condition into its elements or components. This ability is further categorized into three distinct types: element analysis, relationship analysis, and analysis of organized principles. The operational verbs that can be employed include parsing, diagramming, separating, drawing conclusions, outlining, connecting, and detailing. The products resulting from this synthesis can manifest in the form of words, plans, or mechanisms. The following operational verbs can be used to classify, compile, combine, create, include, and modify: "memo," "plan," "compile," "generate," "recon," "organize," "revising," "conclude," and "tell."; (6) Evaluation, defined as the level of ability that requires learners to evaluate a situation, condition, statement, or concept based on specific criteria. The crux of this evaluation lies in the creation of conditions that facilitate the development of criteria or benchmarks by learners for the evaluation of various entities. The following operational verbs may be employed: assess, compare, contrast, criticize, differentiate, consider, support, interpret, and conjecture (Parsa, 2017).

The affective domain, defined as the internalization of attitudes conducive to personal growth, emerges when students become cognizant of the values they have been exposed to. This awareness fosters an attitude that becomes ingrained, shaping their values and influencing their behaviors. The affective domain is comprised of four levels of ability, namely: (1) receiving, which is the level of ability that requires learners to be sensitive to the existence of certain phenomena or stimuli. This sensitivity, in turn, is preceded by the realization of the ability to receive and pay attention. The following operational verbs can be used to demonstrate this level of ability: ask, choose, describe, follow, give, cling, answer, and use. (2) Responding is the level of ability that requires learners to demonstrate sensitivity to a phenomenon and the capacity to react accordingly. The emphasis is on learners' willingness to respond voluntarily, reading without being assigned. The following operational verbs may be employed: answering, helping, brainstorming, naming, showing, practicing, expressing, reading, reporting, writing, telling, and discussion. (3) valuing, which is the level of ability that requires learners to judge an object, phenomenon, or behavior consistently. Operational verbs used include: complete, explain, form, propose, take part, and choose; and (4) organization, which is the level of ability that requires learners to unite different values, solve problems, form a value system. Operational verbs that can be used include: change, arrange, combine, compare, maintain, generalize, and modify (Parsa, 2017).

The psychomotor domain encompasses the capacity of learners to engage in bodily movements or components thereof, ranging from rudimentary to intricate actions. The operational verbs

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employed must align with the designated skill groups, namely: (1) muscular or motor skills, encompassing: demonstrating movement, exhibiting results, jumping, moving, and displaying; (2) manipulations of materials or objects, including: repairing, arranging, cleaning, shifting, moving, and shaping; and (3) neuromuscular coordination, comprising: observing, applying, connecting, coupling, combining, installing, cutting, pulling, and using (Parsa, 2017).

Methodology

Research type and design

This study employs an ex post facto design, which aims to investigate the correlation between two or more variables, where the independent variables are not manipulated, either due to practical limitations or ethical considerations. In this approach, the researcher seeks to uncover the underlying factors that contribute to the occurrence of certain behaviors, symptoms, or phenomena that result from prior events or inherent characteristics of the independent variables (Fraenkel et al., 2012). Specifically, this study applieed a correlational quantitative design, which allowed the researcher to measure the strength and direction of relationships between variables. This design choice is relevant to the research problem, which was to examine how critical thinking ability, creative thinking ability, and learning motivation both individually and simultaneously correlate with learning outcomes.

By utilizing this design, the study aimed to generate empirical evidence regarding the extent to which the independent variables (critical thinking ability [X1], creative thinking ability [X2], and learning motivation [X3]) are associated with the dependent variable (learning outcomes in the electric motor installation subject [Y]). The alignment between the research design and objectives ensures the validity of the conclusions regarding the interrelationships among these constructs and their implications for instructional practices in vocational education.

Research site and participants

The term population refers to the entire subject of research, which may include living beings, objects, phenomena, test scores, or events that serve as sources of data representing specific characteristics within a study (Fadilla et al., 2022). The target population of this research consists of all students enrolled in the Class XI Electrical Power Installation Engineering (TITL) Program at SMK Negeri 7 Surabaya during the academic year. These students are considered appropriate subjects for the study as they are actively engaged in the electric motor installation subject, which is the primary context of investigation. The sample population is composed of students from three classes within the program, 34 students from Class XI TITL 1, 34 students from Class XI TITL 2, and 34 students from Class XI TITL 3, resulting in a total of 102 participants. The participants in this study share similar academic backgrounds, are at the same level of vocational education, and have all been exposed to conventional learning methods within the same institutional setting. These shared characteristics strengthen the internal consistency of the sample. The sampling method employed in this study is total sampling, a non-probability sampling technique in which all members of the defined population are included in the sample. This method is considered appropriate given the manageable size of the population and the research objective, which seeks to comprehensively assess the relationships between critical thinking, creative thinking, motivation, and learning outcomes across the entire group of relevant students. The use of total sampling ensures that the findings are generalizable to the full

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cohort of students in the program and enhances the credibility and accountability of the participant selection process.

Data collection and analysis

In this study, the researchers adopted a quantitative research design, utilizing statistical analysis to examine the relationships among critical thinking, creative thinking, learning motivation, and learning outcomes in the context of electric motor installation. The data collection was conducted through the use of structured instruments, namely questionnaires, tests, and observation sheets. Each instrument was developed to fulfill specific objectives: the test sheets assessed students' conceptual understanding and learning outcomes; the questionnaires measured students' levels of motivation, critical thinking, and creative thinking; and the observation sheets were used to record qualitative indicators related to student engagement and media effectiveness during the learning process. The development of these instruments followed a rigorous validation procedure to ensure their relevance, clarity, and reliability. Prior to deployment, the instruments were reviewed by subject-matter experts through an expert validation process, which applied a four-point Likert scale. The validation criteria ranged from "Highly Invalid" to "Highly Valid," based on the percentage of agreement among experts as presented in Table.

Table 1. *Expert validation assessment criteria*

Interval	Kriteria validitas
81,26% s.d 100%	Highly valid
62,6% s.d 81,25%	Valid
43,76% s.d 62,5%	Invalid
25% s.d 43,75%	Highly invalid

Conversely, to ascertain the impact of variables, whether concurrently or in part, researchers employ assistive software such as SPSS (Statistical Product and Service Solution). The SPSS version utilized in this study is SPSS 16.0. A series of steps is undertaken to determine the impact of variables, including the conduction of a pre-hypothesis test encompassing a normality test and a homogeneity test. Subsequent to this, the magnitude of the impact is ascertained through regression testing. The normality test is employed to ascertain the distribution of the data. The researchers utilize the Kolmogorov-Smirnov test with a 5% significance level to determine the normality of the data. A value of $sig\ 2\ tailed > 0.05$ indicates a normal distribution. Homogeneity testing, on the other hand, is employed to ascertain whether the data exhibits identical variants or if it is homogeneous. This homogeneity test utilizes the Levene test with a 5% significance level. In the event that $sig\ 2\ tailed > 0.05$, the data is declared to be homogeneous.In the event that the data is both normal and homogeneous, the researcher will proceed to test for an influence between one variable and another, as expressed in the following mathematical equation.

$$Y = a + b1 \times 1 + b2 \times 2 \ldots\ldots bn \times n \qquad \text{(equation 1)}$$

Description: Y = Dependent variable, a = Intercept or constant, b1 = Variable regression coefficient 1, b2 = Variable regression coefficient 2.

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Equation 1 illustrates the magnitude of the influence of independent variables, either partially or concurrently. The presence of variable influence can be ascertained by examining the significance value in the SPSS 16.0 software output, contingent upon the stipulated conditions.

a. If the significance value (Sig.) <0.05 then there is an influence of the independent variable on the dependent variable.
b. If the significance value (Sig.) > 0.05 then there is no influence of the independent variable on the dependent variable.

Results

Results of regression test

The results of this study answer the research questions by analyzing the effects of critical thinking, creative thinking, and learning motivation both individually and simultaneously on student learning outcomes across three domains: knowledge, attitude, and skills.

a. The present study seeks to examine the impact of critical thinking on learning outcomes. The regression test results show that critical thinking ability has a significant influence on all domains of learning outcomes, as for the output of SPSS software as follows.

Table 2. *Regression test results of critical thinking ability on learning outcomes*

Learning Outcomes	Knowledge	attitude	Skills
Sig. Critical Thinking	0.000	0.000	0.000
R Square	0.789	0.702	0.026

Specifically, critical thinking contributed 78.9% to knowledge outcomes, 70.2% to attitude outcomes, and 2.6% to skill outcomes, with all significance values at 0.000. This confirms that critical thinking plays a dominant role, particularly in the cognitive and affective aspects of student learning.\

b. The present study seeks to examine the impact of creative thinking on learning outcomes. The findings of the regression test demonstrate that creative thinking capacity exerts a substantial impact on learning outcomes within the knowledge and attitude domains. However, no such influence is observed in the skills domain. The following output from the SPSS software provides further elucidation on this matter.

Table 3. *Regression test results of the effect of creative thinking ability on learning outcomes*

Learning Outcomes	Knowledge	attitude	Skills
Sig. Creative Thinking	0.000	0.000	0.065
R Square	0.182	0.240	0.036

The analysis found that creative thinking ability significantly affects learning outcomes in the knowledge and attitude domains, with effect sizes of 18.2% and 24.0%, respectively. However, it does not significantly influence the skills domain, as indicated by a significance value of 0.065 and an R

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Square of only 3.6%. These results suggest that while creative thinking is essential in shaping students' understanding and attitudes, it is less impactful in directly developing their practical skills.

c. The present study seeks to examine the impact of learning motivation on learning outcomes. The regression test results showed that learning motivation has a significant influence on all domains of learning outcomes, as for the output of SPSS software as follows.

Table 4. *Regression test results of the effect of learning motivation on learning outcomes*

Learning Outcomes	Knowledge	Attitude	Skills
Sig. Learning Motivation	0.000	0.000	0.031
R Square	0.190	0.248	0.050

Learning motivation was proven to have a statistically significant impact on all three domains. The regression results indicated an influence of 19.0% on knowledge, 24.8% on attitude, and 5.0% on skills, all with significance values under 0.05. This highlights the important role of motivation in enhancing not only students' knowledge and attitudes but also their performance in skill-based tasks, albeit to a lesser degree.

d. This study aims to examine the impact of critical thinking skills, creative thinking, and learning motivation simultaneously on student learning outcomes.
The results of the study for the effect of critical thinking ability, creative thinking, and learning motivation simultaneously on student learning outcomes can be seen in the following table.

Table 1. *Multiple regression test results the effect of critical thinking ability, creative thinking, and learning motivation simultaneously on learning outcomes*

Learning Outcomes	Knowledge	Attitude	Skills
Sig. Regresi	0.000	0.000	0.038
R *Square*	0.983	0.984	0.089
Unstandardized B			
Constant	-42.890	-42.538	48.237
Critical Thinking	0.883	0.784	0.135
Creative Thinking	0.340	0.384	0.161
Learning Motivation	0.243	0.294	0.177

The regression test for simultaneous effects revealed that critical thinking, creative thinking, and learning motivation together significantly affect learning outcomes in all domains. The combined influence accounted for 98.3% of the variance in the knowledge domain, 98.4% in the attitude domain, and 8.9% in the skills domain. These findings underscore the powerful cumulative effect of these three variables, especially on cognitive and affective learning outcomes. The regression equations for each domain reinforce these conclusions and illustrate how each independent variable contributes positively to the learning outcome scores. Specifically, the regression equation for the knowledge domain is Y = -42.890 + 0.883(Critical Thinking) + 0.340(Creative Thinking) + 0.243(Learning Motivation), while the attitude domain is represented by Y = -42.538 + 0.784(Critical Thinking) + 0.384(Creative Thinking) + 0.294(Learning Motivation). For the skills domain, the equation is Y =

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48.237 + 0.135(Critical Thinking) + 0.161(Creative Thinking) + 0.177(Learning Motivation). From these equations, it is clear that critical thinking consistently shows the strongest influence across all domains, particularly in knowledge and attitude outcomes. Although the skills domain shows a smaller percentage of variance explained, the positive coefficients indicate that all three variables still play a meaningful role in shaping students' practical learning outcomes.

Discussion

The findings of this study indicated that critical thinking ability, creative thinking, and learning motivation are significantly correlated with student learning outcomes in the subject of Electric Motor Installation at SMK Negeri 7 Surabaya. Most notably, critical thinking ability exerts the greatest influence on the knowledge (78.9%) and attitude (70.2%) domains. This suggests that students with stronger critical thinking skills are more capable of comprehending theoretical content deeply and maintaining a constructive learning attitude. These results are consistent with the view of Ennis (2011), who emphasized that critical thinking is essential for analyzing information and forming reasoned judgments skills primarily associated with cognitive and affective learning outcomes. However, the effect of critical thinking on skills was relatively low (2.6%), indicating that while it fosters understanding and engagement, it is less directly related to the psychomotor competencies required in practical subjects.

Similarly, creative thinking ability was found to moderately influence knowledge (18.2%) and attitude (24%), but had no significant impact on skills (3.6%). These findings reinforce theories by Torrance (2002), which posit that creative thinking encourages idea generation and problem-solving in abstract or theoretical contexts but may not directly translate into practical performance without hands-on experience. This suggests that while students can devise innovative concepts, mastering technical execution still requires more practice-based methods.

In addition, learning motivation was shown to contribute positively to all three domains: knowledge (19%), attitude (24.8%), and skills (5%). These results align with self-determination theory (Deci & Ryan, 2000), which highlights motivation both intrinsic and extrinsic as a key driver of learner engagement and persistence. Motivated students are more likely to exert effort, stay focused, and embrace challenges, especially in tasks that demand cognitive processing and attitude development.

Furthermore, the combined regression analysis demonstrated that when critical thinking, creative thinking, and learning motivation are integrated, they significantly predict learning outcomes in the knowledge (98.3%) and attitude (98.4%) domains. This suggests a strong synergistic effect where the interplay of cognitive and affective factors enhances students' academic comprehension and disposition. However, their joint effect on the skills domain was only 8.9%, indicating that improving technical competencies requires more than just fostering thinking abilities and motivation. This supports findings from Kolb's Experiential Learning Theory, which highlights the importance of concrete experience and active experimentation in developing practical skills.

Therefore, while the Simurelay-based learning media used in this study has proven effective, especially in enhancing knowledge and attitudes, educators must maintain a balanced instructional approach. This includes integrating simulations with hands-on practice, contextual learning, and teacher-guided technical exercises to support the acquisition of motor skills effectively. These insights are crucial for developing instructional strategies that align with the demands of 21st-century learning, emphasizing not only cognitive and affective development but also technical and practical competence.

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Conclusion and Implications

Based on the initial research question namely, to examine the influence of critical thinking skills, creative thinking, and learning motivation, both individually and simultaneously, on student learning outcomes through the use of Simurelay software in the subject Electrical Motor Installation for Grade XI students of the Electrical Power Installation Engineering (TITL) program at SMK Negeri 7 Surabaya the study found that critical thinking, creative thinking, and learning motivation significantly affect student learning outcomes in the cognitive (knowledge), affective (attitudes), and psychomotor (skills) domains.

Among these factors, critical thinking was found to be the most influential in the cognitive and affective domains, contributing 78.9% to knowledge outcomes and 70.2% to attitudes. However, its effect on the psychomotor domain was minimal, with a contribution of only 2.6%, suggesting that while critical thinking enhances understanding and attitude formation, it is not a key factor in the development of technical skills.

Creative thinking also showed a substantial influence on knowledge (18.2%) and attitudes (24%), but had a limited impact on skills (3.6%). Meanwhile, learning motivation had a positive effect across all three domains, contributing 19% to knowledge, 24.8% to attitudes, and 5% to skills. These findings support the view that motivated students tend to be more engaged and persistent in diverse types of learning.

When analyzed simultaneously, critical thinking, creative thinking, and learning motivation demonstrated a strong combined effect on the cognitive (98.3%) and affective (98.4%) domains, but a significantly weaker impact on the psychomotor domain (8.9%).

These results suggest that cognitive and affective learning outcomes can be substantially improved through the enhancement of critical thinking, creativity, and learning motivation. However, the development of psychomotor skills requires more than just cognitive and motivational reinforcement.

In light of these findings, educators are encouraged to implement instructional strategies that foster critical thinking, such as problem-based learning, debates, and analytical tasks. To strengthen creative thinking, methods such as design projects, innovation-based assignments, and exploratory learning can be employed. Motivational aspects should be supported both intrinsically and extrinsically through recognition, encouragement, and the creation of an engaging classroom environment. To enhance skill acquisition, hands-on learning experiences, access to adequate tools and equipment, and practice-oriented instruction are essential.

Future research is recommended to explore additional factors that may influence learning outcomes in the psychomotor domain, such as the learning environment, availability of practice facilities, teacher feedback, and students' motor abilities. Investigating these variables may provide deeper insights into strategies for enhancing technical competencies in vocational education.

Disclosure statement

No potential conflict of interest was reported by the authors.

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