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The Impact of Self-Directed Learning on Student Motivation and Creativity in Electronics Education: A Correlational Study

Riki Wahyudi[1*], Sartika Anori[1], Hendra Hidayat[1], Dedy Irfan[1], Erik Pezo[2], Xiaohan Feng[3]

[1] Faculty of Engineering, Universitas Negeri Padang, Padang, **Indonesia**
[2] Pontificia Universidad Católica del Perú (PUCP), Lima, **Peru**
[3] Department of Information Sciences and Arts, Toyo University, Kawagoe, **Japan**

✉ *Corresponding Author: rikiw472@gmail.com

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ABSTRACT

The implementation of 21st-century education demands significant shifts in learning approaches, particularly in vocational high schools, where practical skills and creativity are paramount. This study investigates the impact of the Self-Directed Learning (SDL) model on students' motivation and creativity in the subject of electronic circuit applications at SMK Negeri 1 Batipuh. Using a descriptive correlational research design, data were collected from 34 students through validated and reliable questionnaires. The findings reveal that SDL contributes 46.9% to enhancing learning motivation and 39.69% to fostering creativity, indicating its significant influence on both variables. SDL empowers students to take greater control of their learning processes, thereby promoting intrinsic motivation and creative problem-solving abilities. These results align with previous research emphasizing the role of independent learning in improving academic performance and preparing students for the demands of the workforce. The practical implications of this study highlight the importance of optimizing SDL implementation in vocational education, particularly in technical subjects, to develop students' independence and creativity—skills essential for success in the digital era and professional environments. This study contributes to the advancement of effective learning models in vocational education, offering valuable insights for educators and policymakers to enhance the quality of teaching and learning.

Keywords: Self-Directed Learning; Motivation; Creativity; Electronics Subject; Correlational Analysis

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1. INTRODUCTION

The demands of 21st-century education necessitate a fundamental reorientation of learning methodologies across various educational institutions, including vocational high schools [1]. The shift from traditional teacher-centered paradigms to student-centered learning models is central to this transformation, with Self-Directed Learning (SDL) emerging as a prominent approach. SDL empowers students to take ownership of their educational journey by defining their objectives, selecting methodologies, and independently evaluating their progress, fostering autonomy and lifelong learning skills [2].

In Indonesia, the 2013 Curriculum underscores the importance of active and independent learning, particularly in disciplines requiring technical proficiency and creative problem-solving, such as Audio-Video Engineering (AVE). However, observations at SMK Negeri 1 Batipuh reveal a significant reliance on teacher-led instruction. This dependency has resulted in passive student behavior and limited engagement in the learning process [3]. Data further indicate that 62.5% of students required remedial sessions to meet the Minimum Competency Criteria (KKM), highlighting a critical gap in cultivating self-directed learning capabilities.

The integration of advancements in information technology and educational innovation offers promising opportunities to address these challenges. Learning models such as SDL, which emphasize active student participation, have been identified as effective in enhancing motivation and creativity [4]. SDL provides students with the autonomy to plan, implement, and evaluate their learning processes, leading to greater intrinsic motivation and the development of creative problem-solving skills [5]. These attributes are particularly relevant in vocational education, where technical expertise and innovative thinking are paramount, as exemplified in subjects like electronic circuit applications [6].

This study seeks to address two key questions: (1) Can the implementation of SDL enhance students' motivation to learn and understand the application of electronic circuits? (2) Can SDL foster creativity in resolving technical challenges? The primary objective of this research is to evaluate the correlational impact of SDL on improving students' motivation and creativity. By providing empirical evidence, this study aims to contribute to enhancing the quality of vocational education and inform broader adaptations of SDL within Indonesia's vocational education system.

2. METHODS

This study employed a descriptive correlational research design, which aims to describe and interpret phenomena in their natural context without manipulating variables. Often classified as non-experimental, this methodology is appropriate for investigating relationships among variables while maintaining the integrity of the natural setting [7].

Descriptive correlational research is particularly suited for exploring the extent and nature of relationships between variables within a defined population. The objective of this study was to examine the impact of the Self-Directed Learning (SDL) model on two critical aspects of student learning: motivation and creativity. Specifically, this research aimed to assess the extent to which SDL influences the development of these attributes in the context of the Electronic Circuit Applications course at SMK Negeri 1 Batipuh [8].

This study adopted a quantitative approach to analyze the relationships between the SDL model (independent variable) and the students' learning motivation and creativity (dependent variables). Through this approach, the

study sought to quantify the degree of correlation between the variables and evaluate the predictive strength of SDL in enhancing motivation and creativity.

2.1. Research Variables

The independent variables in this study are learning motivation (X_1) and learning creativity (X_2), while the dependent variable is the Self-Directed Learning model (Y) applied in the XII TAV class for the subject of Electronic Circuit Applications at SMK Negeri 1 Batipuh (Figure 1).

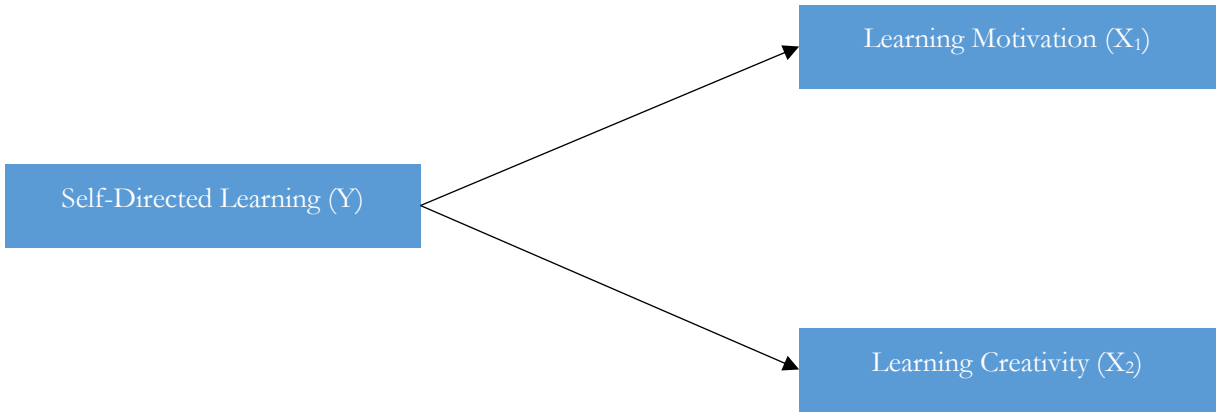

Figure 1. Model of variables relationships

2.2. Population and Sample

The population is a general area comprising objects or subjects with specific qualities and characteristics determined by the researcher for study and conclusion drawing. The population in this study consists of all 50 students from Grade XII at SMK Negeri 1 Batipuh (Table 1).

Table 1. Research Population

No	Class	Total Students
1	XII TAV 1	25
2	XII TAV 2	25
Total		50

The sample is a subset of the population that shares its characteristics. The sampling technique in this study utilizes the Taro Yamane formula (1) as follows:

$$n = \frac{N}{N.d^2 + 1} \quad (1)$$

Explanation:

n = Sample size
N = Total population
d^2 = Precision level (set at 10%)

$$n = \frac{50}{50.0{,}1^2 + 1} = 34$$

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If the calculation using the Taro Yamane formula results in students, this study's sample size is 34 students. The details of the research sample are presented in Table 2.

Table 2. Research Sample

No	Class	Total Sample
1	XII TAV 1	17
2	XII TAV 2	17
Total		34

2.3. Data Collection Instruments

The research instruments consist of tools for measuring the variables under study. This research's primary data collection tool is a questionnaire constructed based on the Likert scale model. The Likert scale is considered the most appropriate model to assess students' learning motivation and creativity.

Table 3. Likert Scale

Statement	Response Score	
	Positive	Negative
Always	5	1
Often	4	2
Sometimes	3	3
Rarely	2	4
Never	1	5

2.3.1. Instrument Validation

Instrument validity demonstrates the extent to which a measurement tool accurately measures the intended variable (an instrument is valid if it successfully measures the phenomenon in question). To test the validity of the questionnaire, the Product-Moment Correlation formula (2) is employed as follows:

$$R_{calculated} = \frac{n(\sum XY)-(\sum x).(\sum Y)}{\sqrt{\{n.(\sum x^2)-(\sum x^2)\}.\{n.(\sum Y^2)-(\sum Y^2)\}}} \quad (2)$$

Explanation:
$R_{calculated}$ = Correlation coefficient
N = Number of respondents
$\sum X$ = Score of the variable (respondents' answer)
$\sum Y$ = Total score of the variable (respondents' answer)

Based on the trial, a validity analysis was performed using Microsoft Excel 2013. While Microsoft Excel is commonly utilized for data processing and basic analysis, more specialized statistical software such as SPSS or other statistical programs is generally used for more complex validity tests.

The validity analysis process typically involves several steps, such as item correlation tests, construct validity tests, etc. Ensure that detailed findings and results from the validity analysis are included using Microsoft Excel. If specific steps or formulas were used during the analysis, they should also be included to provide a more comprehensive overview.

2.2.2. Reliability Test

The purpose of reliability measurement is to determine the degree of reliability of the instrument after testing [10]. An instrument is considered reliable if it consistently measures the same phenomenon at different times and produces the same results.

2.4. Data Analysis

The data analysis process in this study involves the preparation, tabulation, and application of data in line with the research approach. The data obtained from the research are initially raw and lack significant meaning. Therefore, to provide a meaningful depiction of the issues under investigation, the data must first be processed to guide further analysis.

Data analysis aims to achieve the research objectives, including data description, analysis requirement tests, and hypothesis testing. The data analysis in this study is performed using SPSS software version 26. The techniques employed in this process involve the following steps [11] [12]:

a) Mean represents the arithmetic average or a value that summarizes a data set. It is denoted as $\bar{x}$ and calculated as:

$$\bar{x} = \frac{\sum xi}{n} \quad (3)$$

Explanation:

X_i = Sum of each data point

n = Total number of data points

b) Mode is the value that appears most frequently in the dataset.

c) The median represents the middle value of a dataset sorted in ascending order. It is calculated as:

$$Me = \frac{1}{2}(n) \quad (4)$$

d) Standard deviation indicates the degree of variation within a dataset or the standard amount by which individual data points deviate from the mean. The formula (5) for standard deviation is:

$$S = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}} \quad (5)$$

Explanation:

S = Standard deviation

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$\sum x$ = Total sum of respondents' answers for each question

N = Sample size

e) Achievement Level of Respondents

To determine the achievement level for each variable, the following formula (6) is used:

$$\text{Achievement Level} = \frac{Average\ Score}{Maximum\ Ideal\ Score} \times 100\% \quad (6)$$

2.5. Analysis Prerequisite Tests

Testing the prerequisites of the analysis is a crucial step before conducting data analysis using SPSS. The following are the general steps undertaken in testing data analysis prerequisites with SPSS:

2.5.1. Normality Test

The normality test, such as the Kolmogorov-Smirnov (K-S) test, determines whether the data originate from a normally distributed population. A significance level (α) is applied as a criterion for accepting or rejecting the null hypothesis. The standard significance level is typically α = 0.05. If the significance value from the normality test is greater than α (e.g., $p > 0.05$), the null hypothesis cannot be rejected, and the data are considered to originate from a normally distributed population. Conversely, if the significance value is ≤ 0.05, the null hypothesis is rejected, and it is concluded that the data are not normally distributed [13].

2.5.2. Homogeneity Test

The homogeneity test determines whether the variance among several populations is equal. This test employs a homogeneity of variance test, which is a fundamental assumption in the analysis of variance (ANOVA) [14]. If the significance value is greater than 0.05 (p>0.05), it is concluded that the variances among two or more data groups are equal. This test is typically performed using standard statistical software like SPSS.

2.5.3. Linearity Test

The linearity test aims to determine whether a significant linear or nonlinear relationship exists between two variables [15]. This test is conducted at a significance level of α=0.05. If the significance value from the linearity test is less than α (e.g., p<0.05), it indicates a significant linear relationship between the two variables.

2.5.4. Multicollinearity Test

The multicollinearity test is performed to determine whether there is a correlation among independent variables in a regression model. If correlation exists, it indicates the presence of multicollinearity, which needs to be addressed [16]. This test uses the Variance Inflation Factor (VIF) as a diagnostic measure. If the VIF value is less than 5 (VIF<5), it can be concluded that there is no multicollinearity issue. conversely, a VIF value greater than 5 (VIF>5) indicates that the variable correlates with other independent variables in the regression model.

2.5.5. Hypothesis Testing

Hypothesis testing is conducted using analytical techniques processed with SPSS as follows:

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a) First and Second Hypothesis Testing

Instrument validity refers to the extent to which a measurement accurately captures the intended objective (a valid measurement successfully measures the phenomenon in question). To test the validity of the questionnaire, the formula used for validity testing with the Product-Moment Correlation technique is:

$$r_{calculated} = \frac{n(\sum XY) - (\sum X).(\sum Y)}{\sqrt{(n.(\sum X^2) - (\sum x^2).(n.(\sum Y^2) - (\sum Y^2)}} \quad (7)$$

Explanation:

$R_{calculated}$ = Correlation coefficient
n = Number of respondents
∑X = Score of the variable (respondents' answers)
∑Y = Total score of the variable (respondents' answers)

The hypothesis is tested to determine the strength and significance of the relationship between variables. If the calculated correlation coefficient ($r$calculated) exceeds the critical value ($r$table) at a given significance level (α, typically 0.05), the null hypothesis is rejected, and it is concluded that a significant relationship exists between the variables.

b) Determinant Analysis

Determinant analysis determines the extent to which the independent variables influence the dependent variable. The magnitude of this influence is measured using the coefficient of determination formula (8):

$$KP = r^2 \times 100\% \quad (8)$$

Explanation:

KP = Coefficient of determination
r = Correlation coefficient

3. RESULTS

3.1. Data Analysis

3.1.1. Learning Motivation (X1)

The data for the learning motivation variable were collected using a questionnaire consisting of 40 validated and reliable items. The questionnaire was administered to 34 students. The statistical analysis for the learning motivation variable is presented in Table 4.

Table 4. Statistical Results of Learning Motivation

Descriptive Data	
Mean	157.61
Standard Error	3.55
Median	160.5
Mode	163
Standard Deviation	20.75
Sample Variance	430.72
Kurtosis	-0.78
Skewness	-0.19

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Range	80
Minimum	112
Maximum	192
Sum	5359
Count	34

As shown in Table 4, the learning motivation variable was measured using data from 34 students. The results indicate a mean score of 157.61, a median score of 160.5, and a mode of 163. The standard deviation was 20.75, with a variance of 430.72. The range representing the difference between the highest and lowest scores was 80, with a minimum score of 112 and a maximum score of 192. The total score for all responses was 5359, providing a comprehensive overview of the distribution and variability of the learning motivation data.

3.1.2. Learning Creativity (X_2)

The data for the learning creativity variable were collected using a questionnaire consisting of 30 validated and reliable items. This questionnaire was distributed to 34 students for completion. The statistical results for the creativity variable are presented in Table 5.

Table 5. Statistical Results of Learning Creativity

Descriptive Data	
Mean	117.85
Standard Error	1.008
Median	120.5
Mode	108
Standard Deviation	11.71
Sample Variance	137.22
Kurtosis	-0.94
Skewness	-0.20
Range	42
Minimum	97
Maximum	139
Sum	4007
Count	34

Based on Table 5, the creativity variable was measured using data from 34 students. The results indicate a mean score of 117.85, a median score of 120.5, and a mode of 108. The standard deviation was 11.71, with a variance of 137.11. The range, representing the difference between the highest and lowest scores, was 42, with a minimum score of 97 and a maximum score of 139. The total score for all responses was 4007.

3.1.3. Self-Directed Learning (Y)

As shown in Table 6, the Self-Directed Learning variable was measured using data from 34 students. The statistical results indicate a mean score of 194.20, a median score of 194, and a mode of 192. The standard deviation was 18.11, with a variance of 328.28. The range between the highest and lowest scores was 65, with a minimum score of 163 and a maximum score of 228. The total score for all responses was 6603.

Table 6. Hasil perhitungan statistik *self directed learning*

Descritpive Data	
Mean	194.20
Standard Error	3.10
Median	194
Mode	192
Standard Deviation	18.11
Sample Variance	328.28
Kurtosis	-1.03
Skewness	0.014
Range	65
Minimum	163
Maximum	228
Sum	6603
Count	34

3.2. Analysis Prerequisite Tests

3.2.1. Normality Test

Based on Table 7, the significance scores for the variables are as follows: the significance score for the learning motivation variable (X_1) is 0.200, for the creativity variable (X_2) is 0.200, and for the Self-Directed Learning variable (Y) is 0.200. The significance level (α) used is 0.05. Since the significance values for all variables are greater than 0.05, it can be concluded that the data for all variables are normally distributed.

Table 7. Normality Test Results for YX_1, X_2 and Y

		Learning Motivation	Learning Creativity	Self-Directed Learning
N		34	34	34
Normal Parameters [a,b]	Mean	157.62	117.85	194.21
	Std. Deviation	20.754	11.714	18.119
Most Extreme Differences	Absolute	.082	.109	.091
	Positive	.082	.102	.091
	Negative	-.079	-109	-.069
Test Statistic		.082	.109	.091
Asymp. Sig. (2-tailed)		.200[c,d]	.200[c,d]	.200[c,d]

3.2.2. Homogeneity Test

Table 8 and 9, show that the significance value for X_1 is 0.180, and for X_2 is 0.284. Since the significance values for X_1 and X_2 are greater than the alpha level (α=0.05), it can be concluded that the data distributions originate from homogeneous groups.

Table 8. Homogeneity Test for Learning Motivation (X_1)

		Levene Statistic	df1	df2	Sig.
Learning Motivation	Based on Mean	2.102	5	7	.180
	Based on Median	2.021	5	7	.192
	Based on the Median and with adjusted df	2.021	5	2.000	.363
	Based on trimmed mean	2.097	5	7	.181

Table 9. Homogeneity Test for Learning Creativity (X2)

		Levene Statistic	df1	df2	Sig.
Learning Creativity	Based on Mean	1.461	6	10	.284
	Based on Median	.680	6	10	.670
	Based on the Median and with adjusted df	.680	6	5.555	.675
	Based on trimmed mean	1.399	6	10	.304

3.2.3. Linearity Test

From Table 10 and 11, the linear significance for Y to X_1 is 0.709, and for Y to X_2 is 0.458. Both values are greater than the alpha level (α=0.05). Therefore, it can be concluded that there is a linear relationship between the Self-Directed Learning variable and learning motivation, as well as between Self-Directed Learning and learning creativity.

Table 10. Linearity Test of Y to X1

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Self-Directed Learning * Learning Motivation	Between Groups	(Combined)	9299.892	26	357.688	1.633	.260
		Linearity	5086.208	1	5086.208	23.215	.002
		Deviation Linearity	4213.684	25	168.547	.769	.709
	Within Groups		1533.667	7	219.095		
	Total		10833.559	33			

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Table 11. Linearity Test of Y to X2

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Self-Directed Learning * Learning Creativity	Between Groups	(Combined)	8715.725	22	396.169	2.058	.108
		Linearity	4304.626	1	4304.626	22.358	.001
		Deviation Linearity	4411.100	21	210.052	1.091	.458
	Within Groups		2117.833	11	192.530		
	Total		10833.559	33			

3.2.4. Multicollinearity Test

Based on Table 12, the Variance Inflation Factor (VIF) value for both independent variables—learning motivation and learning creativity—is 1.332. Since the VIF value is less than 5, it can be concluded that there is no multicollinearity issue in the regression model. This result ensures that the independent variables are not excessively correlated, confirming the validity of the regression analysis assumptions.

Table 12. Multicollinearity Test

Model		*Collinearity Statistics*	
		B	*Tolerance*
1	Learning Motivation	.751	1.332
	Learning Creativity	.751	1.332

3.3. Hypothesis Testing

3.3.1. First Hypothesis

The Self-Directed Learning model significantly influences the learning motivation of Grade XII TAV students at SMKN 1 Batipuh. Based on this, the following hypotheses are formulated:

H_O = There is no significant influence of the Self-Directed Learning model on the learning motivation of Grade XII TAV students at SMKN 1 Batipuh.

H_a = There is a significant influence of the Self-Directed Learning model on the learning motivation of Grade XII TAV students at SMKN 1 Batipuh.

Decision Criteria:

- Accept H_0 : If the significance probability > Alpha (0.05)
- Accept H_a : If the significance probability < Alpha (0.05)

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Table 13. Correlation Between Self-Directed Learning (Y) and Learning Motivation (X_1).

		Learning Motivation	Self Directed Learning
Learning Motivation	*Person Correlation*	1	.685**
	Sig. (2-tailed)		.000
	N	34	34
Self Directed Learning	*Person Correlation*	.685**	1
	Sig. (2-tailed)	.000	
	N	34	34

Based on the simple correlation analysis in Table 13, there is a correlation of 0.685 between the Self-Directed Learning model and learning motivation. This indicates that the Self-Directed Learning model influences learning motivation.

Subsequently, a significance test is conducted to determine the meaningfulness of the correlation or the significance of the relationship between the two variables. A t-test is utilized to test the significance of the correlation (Table 14).

Table 14. T-Test Analysis for Y (Self-Directed Learning) and X_1 (Learning Motivation)

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	99.921	17.866		5.593	.000
	Learning Motivation	.598	.112	.685	5.322	.000

The t-test analysis results in Table 14 indicate that $t$calculated = 5.322 and $t$table = 1.693, with df=n−k. Since $t$calculated = 5.322 > $t$table = 1.693 or the significance value is less than alpha (0.000<0.05), the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted. This means that the Self-Directed Learning model (Y) has a significant influence on learning motivation (X_1). A determinant analysis is conducted to determine the magnitude of this influence.

Based on Table 15, the r^2 (R) value is 0.685, indicating that the influence of the Self-Directed Learning model on learning motivation can be determined through the coefficient of determination (KP):

$$KP = (0.685)^2 \times 100\% = 46.9\%$$

This means that the Self-Directed Learning model contributes 46.9% to the variation in learning motivation, while other variables influence the remaining 53.1%.

Table 15. Determinant Analysis Results for Y (Self-Directed Learning) on X_1 (Learning Motivation)

Model	R	R Square	Adjust R Square	Std. Error of the Estimate
1	.685[a]	.469	.453	13.402

3.3.2. Second Hypothesis

The Self-Directed Learning model significantly influences the creativity of Grade XII TAV students at SMKN 1 Batipuh. Based on this, the following hypotheses are formulated:

H_0 = There is no significant influence of the Self-Directed Learning model on the creativity of Grade XII TAV students at SMKN 1 Batipuh.

H_a = There is a significant influence of the Self-Directed Learning model on the creativity of Grade XII TAV students at SMKN 1 Batipuh.

Decision Criteria:

- Accept H_0: If the significance probability > Alpha (0.05)
- Accept H_a: If the significance probability < Alpha (0.05)

Table 16. Correlation Between Self-Directed Learning (Y) and Learning Creativity (X_2)

		Learning Creativity	Self Directed Learning
Learning Creativity	*Person Correlation*	1	.630**
	Sig. (2-tailed)		.000
	N	34	34
Self Directed Learning	*Person Correlation*	.630**	1
	Sig. (2-tailed)	.000	
	N	34	34

From Table 16, the correlation analysis shows a Pearson correlation value of 0.630 between the Self-Directed Learning model (Y) and creativity (X_2). This indicates a strong positive correlation, suggesting that as the implementation of Self-Directed Learning improves, students' creativity also increases. The significance level for the correlation is 0.000, which is less than α=0.05. This confirms that the correlation is statistically significant. A t-test is applied to evaluate the significance of the correlation.

Table 17. T-Test Analysis for Y (Self-Directed Learning) and X_2 (Learning Creativity)

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	79.300	25.136		3.155	.003
	Learning Creativity	.975	.112	.630	4.593	.000

The t-test analysis results in Table 17 indicate that $t$calculated = 4.593 and $t$table = 1.693, with df=n−k. Since $t$calculated = 4.593 > $t$table = 1.693 or the significance is less than alpha (0.000<0.05), the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted. This means that the Self-Directed Learning model (Y) has a significant influence on creativity (X_2). To determine the magnitude of this influence, a determinant analysis is conducted.

Table 18. Determinant Analysis Results for Y (Self-Directed Learning) on X_2 (Learning Creativity)

Model	R	R Square	Adjust R Square	Std. Error of the Estimate
1	.630[a]	.397	.379	14.284

Based on Table 18, the r^2 (R) value is 0.630, indicating that the influence of the Self-Directed Learning model on creativity can be determined using the coefficient of determination (KP):

$$KP = (0.630)^2 \times 100\% = 39.69\%$$

This result shows that the Self-Directed Learning model contributes 39.69% to the variation in creativity, while other variables influence the remaining 60.31%.

4. DISCUSSION

The findings of this study reveal that the Self-Directed Learning (SDL) model has a significant influence on both learning motivation and creativity, underscoring its relevance in vocational education. These results align with prior research emphasizing the importance of fostering independent learning to enhance students' self-reliance and adaptability, particularly in technical and skills-based disciplines.

4.1 Impact of SDL on Learning Motivation

The analysis demonstrated that SDL contributes 46.9% to students' learning motivation, indicating a strong positive influence. This supports theoretical assertions that SDL empowers students by granting them autonomy over their learning processes, thereby enhancing intrinsic motivation. Geng et al. [6] highlighted that technology-enhanced learning environments supporting SDL significantly improve student engagement and motivation, particularly when students have opportunities to set goals and self-monitor progress.

These findings are consistent with Setyowati [3], who found a strong correlation between independent learning and improved academic performance among vocational high school students. The SDL model effectively aligns with the objectives of the 2013 Curriculum, which emphasizes active, student-centered learning. By encouraging students to take an active role in their education, SDL not only meets curriculum goals but also addresses critical challenges, such as passivity and disengagement observed in traditional teacher-centered learning environments.

4.2 Impact of SDL on Learning Creativity

SDL also showed a notable contribution of 39.69% to students' creativity, highlighting its importance in vocational education contexts. Creativity is an essential skill for vocational students, especially in technical subjects such as electronics, where problem-solving and innovation are integral. This aligns with Almomani et al. [11], who noted that independent learning environments foster creativity, particularly during remote learning contexts like those experienced during the COVID-19 pandemic.

Students who are encouraged to engage in self-directed learning are afforded the freedom to explore creative solutions to complex problems, which is critical for vocational success. SDL provides a framework for developing creative thinking skills by enabling students to experiment, innovate, and learn from their experiences without excessive reliance on direct instruction.

4.3 Broader Implications of SDL

Beyond its impact on motivation and creativity, SDL supports the holistic development of students, cultivating independent and responsible character traits. Oishi [4] emphasized that SDL equips students with essential skills for higher education and professional settings, such as self-regulation, adaptability, and accountability. These competencies are particularly critical in preparing students to navigate the dynamic demands of the 21st-century workforce.

The relevance of SDL extends beyond vocational education, offering a framework adaptable to broader educational contexts where student autonomy and active engagement are priorities. Its implementation not only improves learning outcomes but also aligns with global educational trends emphasizing lifelong learning and self-reliance.

4.4 Recommendations

The findings of this study suggest that SDL should be more widely adopted and optimized within vocational high schools to address both cognitive and non-cognitive learning goals. Teachers and policymakers are encouraged to incorporate SDL strategies into curricula, leveraging technology and innovative instructional practices to foster active, creative, and motivated learners.

5. CONCLUSION

Based on the findings of this study, it can be concluded that implementing the Self-Directed Learning (SDL) model significantly influences students' motivation and creativity in electronic circuit applications at SMK Negeri 1 Batipuh. The data analysis revealed that SDL contributes 46.9% to enhancing learning motivation and 39.69% to improving students' creativity.

The application of SDL has proven effective in encouraging students to become more independent and creative in the learning process, particularly in subjects requiring a high level of technical understanding, such as electronics. This aligns with previous studies indicating that learning models emphasizing student autonomy significantly enhance learning outcomes, particularly motivation and creativity.

The implementation of the SDL model in vocational high schools can be further optimized to help students prepare for the demands of the workforce, which increasingly require independence and creative thinking skills. This model is also highly relevant to the needs of digital-era learning, where easy access to information and technology supports students in learning independently and interactively.

This study contributes to the development of improved learning models at the vocational education level, particularly in subjects requiring technical skills such as electronics. It is hoped that the results of this research will serve as a reference for teachers and policymakers in enhancing the quality of vocational education through more autonomous learning models.

DECLARATIONS

Author's Contributions

Riki Wahyudi: Conceptualization, Methodology, Software, Writing - Original Draft, Writing - Review & Editing. **Sartika Anori:** Data curation, Writing - Original Draft. **Hendra Hidayat:** Supervision, Validation. **Dedy Irfan:** Supervision. **Erik Pezo:** Writing - Review & Editing. **Xiaohan Feng**: Writing - Review & Editing. All authors have read and approved the final version of this manuscript.

Competing Interests

The authors declare no competing interests.

REFERENCES

[1] A. Rahman, S. A. Munandar, A. Fitriani, Y. Karlina, and Yumriani, "Pengertian Pendidikan, Ilmu Pendidikan dan Unsur-Unsur Pendidikan," *Al Urwatul Wutsqa Kaji. Pendidik. Islam*, vol. 2, no. 1, pp. 1–8, 2022. [Online]. Available: https://journal.unismuh.ac.id/index.php/alurwatul/article/view/7757

[2] UUD RI No. 20 Tahun 2003, "Presiden republik indonesia," *Peratur. Pemerintah Republik Indones. Nomor 26 Tahun 1985 Tentang Jalan*, no. 1, pp. 1–5, 2003.

[3] W. W. Setyowati, "Optimalisasi Prestasi Belajar Melalui Sikap Kemandirian Belajar Siswa Smk Jurusan Multimedia," *J. Pendidik. Teknol. dan Kejuru.*, vol. 17, no. 1, p. 105, 2020, doi: 10.23887/jptk-undiksha.v17i1.23018.

[4] I. R. V. Oishi, "Pentingnya Belajar Mandiri Bagi Peserta Didik Di Perguruan Tinggi," *J. IKRA-ITH Hum.*, vol. 4, no. 2, pp. 50–55, 2020. [Online]. Available: https://journals.upi-yai.ac.id/index.php/ikraith-humaniora/article/download/555/407/

[5] S. Julaeha and M. Erihadiana, "Model Pembelajaran dan Implementasi Pendidikan HAM Dalam Perspektif Pendidikan Islam dan Nasional," *Reslaj Relig. Educ. Soc. Laa Roiba J.*, vol. 3, no. 3, pp. 133–144, 2021, doi: 10.47467/reslaj.v4i2.449.

[6] G. S., K. M. Y. Law, and B. Niu, "Investigating self-directed learning and technology readiness in blending learning environment," *Int. J. Educ. Technol. High Educ.*, vol. 16, p. 17, 2019. 10.1186/s41239-019-0147.

[7] Õ. Uus, K. Mettis, and T. Väljataga, "Self-directed learning: A case study of school students scientific knowledge construction outdoors," *Cogent Education*, vol. 9, no. 1, 2022, doi: 10.1080/2331186X.2022.2074342.

[8] I. Agustian, H. E. Saputra, and A. Imanda, "Pengaruh Sistem Informasi Manajamen Terhadap Peningkatan Kualitas Pelayanan Di Pt. Jasaraharja Putra Cabang Bengkulu," *Prof. J. Komun. dan Adm. Publik*, vol. 6, no. 1, pp. 42–60, 2019, doi: 10.37676/professional.v6i1.837.

[9] D. Taluke, R. S. M. Lakat, A. Sembel, E. Mangrove, and M. Bahwa, "Analisis Preferensi Masyarakat Dalam Pengelolaan Ekosistem Mangrove Di Pesisir Pantai Kecamatan Loloda Kabupaten Halmahera Barat," *Spasial*, vol. 6, no. 2, pp. 531–540, 2019, doi: 10.35793/sp.v6i2.25357.

[10] M. M. Sanaky, "Analisis Faktor-Faktor Keterlambatan Pada Proyek Pembangunan Gedung Asrama Man 1 Tulehu Maluku Tengah," *J. Simetrik*, vol. 11, no. 1, pp. 432–439, 2021, doi: 10.31959/js.v11i1.615.

[11] L. M. Almomani, N. Halalsheh, H. Al-Dreabi, L. Al-Hyari, and R. Al-Quraan, "Self-directed learning skills and motivation during distance learning in the COVID-19 pandemic (case study: The University of Jordan)," *Heliyon*, vol. 9, no. 9, p. e20018, 2023, doi: 10.1016/j.heliyon.2023.e20018.

[12] L. M. Cronin-Golomb and P. J. Bauer, "Self-motivated and directed learning across the lifespan," *Acta Psychologica*, vol. 232, p. 103816, 2023, doi: 10.1016/j.actpsy.2022.103816.

[13] K. A. Puspita and F. Tirtoni, "Pengaruh Model Pembelajaran Blended Learning terhadap Hasil Belajar Siswa Sekolah Dasar", *lectura*, vol. 14, no. 1, pp. 85-98, Feb. 2023, doi: 10.31849/lectura.v14i1.12031.

[14] A. Aprizan, S. Subhanadri, and N. Avana, "Pengaruh Pembelajaran Daring terhadap Motivasi Belajar Mahasiswa PGSD STKIP Muhammadiyah Muara Bungo," *J. Basicedu*, vol. 5, no. 5, pp. 3445–3459, 2021, doi: [Online]. 10.31004/basicedu.v5i5.1325.

[15] A. Rahmayani, J. Siswanto, and M. A. Budiman, "Pengaruh Model Pembelajaran Discovery Learning dengan Menggunakan Mediavideo Terhadap Hasil Belajar", *j. ilm. sekol. dasar*, vol. 3, no. 2, pp. 246–253, Jun. 2019, doi: 10.23887/jisd.v3i2.18055.

[16] E. Yaldi *et al.*, "Penerapan Uji Multikolinieritas Dalam Penelitian Manajemen Sumber Daya Manusia," *J. Ilm. Manaj. dan Kewirausahaan*, vol. 1, no. 2, pp. 94–102, 2022, doi: 10.33998/jumanage.2022.1.2.89.