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Learning Motivation, Learning Facilities and Parental Support as Predictors of Agricultural Vocational Students Learning Outcomes in Takalar District

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ABSTRACT

Objective: This study examines the predictive contribution of learning motivation, learning facilities, and parental support to learning outcomes among agricultural vocational students in Takalar Regency. **Method**: Using a quantitative ex-post facto design, 135 students from agricultural programs (ATPH, APHP, ATP) at vocational schools in Takalar Regency were involved. Motivation, facilities, and parental support were measured via questionnaires; learning outcomes were obtained from documented average grades. After outlier screening removed 14 cases, the final analytic sample was 121 students. Data were analyzed using multiple linear regression, with 95% confidence intervals reported for all coefficients. **Findings:** The model was significant, $F(3, 117) = 5{,}950$, $p < .001$, explaining 13,2% of the variance in learning outcomes ($R^2 = .132$). Learning motivation ($B = -0.052$, $\beta = -.095$, $p = .298$, 95% CI [-.151, .047]) and Learning facilities ($B = -0.079$, $\beta = -.113$, $p = .216$, 95% CI [-.205, .047]) showed no significant relationship with learning outcomes. Parental support was a significant negative predictor ($B = -0.114$, $\beta = -.358$, $p < .001$, 95% CI [-.168, -.060]), a statistical association that should not be read as causal. **Research Implications**: Recommendations should focus on the proportionality and form of parental involvement rather than generalized integrated school-teacher-parent support, since motivation and facilities were non-significant and the model's explanatory power remains low. Conclusions are preliminary and require further study. **Value**: This study fills a gap in simultaneous empirical research on these three variables among agricultural vocational students in Takalar Regency, a context still rarely examined.

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INTRODUCTION

Vocational high schools (SMK) occupy a strategic position in developing the vocational competencies of Indonesia's younger generation and supporting national productivity (Direktorat Jenderal Pendidikan Vokasi, Kementerian Pendidikan, Kebudayaan, Riset, 2024). This role is especially challenging in agricultural vocational programs, as younger generations increasingly show reluctance toward agriculture-related careers due to shifting lifestyle orientations and low interest in agricultural science (Roidah et al., 2024). This pattern is consistent with evidence from Central Java, where students' attitudes toward agriculture strongly shaped their career interest in the sector (Handayani et al., 2022). In Takalar Regency, SMK Negeri 3 and SMK Negeri 6 run agribusiness programs in food crops and horticulture (ATPH), agricultural product processing (APHP), and plantation crops (ATP), where learning outcomes remain a persistent concern.

National labor market data add broader context to this issue: vocational high school graduates recorded the highest open unemployment rate among all education levels, at 8.53% (Badan Pusat Statistik Provinsi Sulawesi Selatan, 2025). This figure, however, should not be read as direct evidence of suboptimal school-level learning outcomes, since graduate unemployment is shaped by multiple factors beyond classroom achievement, including the match between competencies and industry demand, labor-market conditions, work experience, and regional job availability. More direct evidence comes from classroom-level records at the two schools themselves: prior classroom-based studies at SMK Negeri 3 and SMK Negeri 6 Takalar reported that, before instructional intervention, a portion of students scored

below the minimum mastery criterion (KKM) (Febrianto et al., 2017; Wandi et al., 2020) hese studies, however, were designed to test specific learning modelsPrezi-based media and Numbered Heads Together, respectivelyrather than to explain the broader, structural determinants of learning outcomes; their gains were episodic and intervention-dependent, and a similar pattern was later observed with Team Games Tournament (Novitasari, 2025). This leaves an open, more fundamental question: which structural, day-to-day factors continue to shape learning outcomes once an intervention ends.

Three such factors persist independently of any single classroom intervention: learning motivation, learning facilities, and parental support. Learning motivation is theorized, through Self-Determination Theory, to depend on the fulfillment of basic psychological needs for autonomy, competence, and relatedness (Ryan & Deci, 2020), and has been shown to sustain students' persistence in learning (Fernando et al., 2024; Saputra et al., 2018), social-cognitive accounts further link motivation to students' self-efficacy and behavior (Schunk & Dibenedetto, 2019). Learning facilities and infrastructure matter through the learning-environment they create: adequate, well-managed facilities have been linked to higher achievement across contexts (Tuanany & Triwiyanto, 2024; Carrington & Andrade, 2024), although this relationship is conditional on how well facilities are utilized rather than merely available. Parental support, through the lens of family social-support theory, is expected to shape achievement via emotional, informational, and instrumental resources (Rosalina & Yamlean, 2021; Rohmah et al., 2025).

Existing findings on these three factors are not fully consistent, however. While most studies report a positive association between parental support and achievement, evidence from economically constrained, rural family contexts where parental time and resources for accompanying learning are limited is comparatively scarce, and some accounts suggest that support can become counterproductive when it is not proportional to students' need for autonomy. This is precisely the context of the research site: the majority of students' parents work as farmers with middle-to-lower economic status, limiting their capacity to accompany and facilitate learning at home. To date, no study has examined learning motivation, learning facilities, and parental support simultaneously among agricultural vocational students in Takalar Regency, leaving both the direction and relative strength of these relationships in this specific context empirically untested. This study therefore contributes by testing these three theoretically grounded predictors simultaneously among agricultural vocational students a population and combination of variables not yet examined together in the existing literature within the distinct socioeconomic context of Takalar Regency.

METHOD

A. Research Approach and Design

This study employs a quantitative approach with an ex-post facto design. This design was chosen because the study does not apply any specific treatment to the variables but rather analyzes existing data to determine the predictive relationship between learning motivation, learning facilities, and parental support on student learning outcomes. It should be emphasized that while this design is suitable for analyzing predictive relationships among variables, it cannot support claims of causal influence, given the absence of variable manipulation and experimental controls. This study was conducted at SMK Negeri 3 Takalar dan SMK Negeri 6 Takalar, both of which offer vocational programs in food crop and horticulture agribusiness (ATPH), agricultural product processing agribusiness (APHP), and plantation crop agribusiness (ATP) in Takalar Regency.

B. Population and Sample

The population in this study consisted of 205 students from grades X and XI in the agricultural expertise programs at SMK Negeri 3 Takalar (ATPH and APHP) and SMK Negeri 6 Takalar (ATP). The initial sample size was determined using the Slovin formula with a 5% error margin, resulting in a sample of 135 students. The researchers acknowledge that determining the sample size using the Slovin formula has limitations because it does not account for the number of predictors in the model, the expected effect size, or the statistical power of the test. This limitation is openly acknowledged as part of the methological limitations of this study.

The sampling technique used proportional stratified random sampling, with strata determined based on a two-dimensional combination: (1) vocational programs (ATPH, APHP, ATP), and (2) students' academic ability categories, grouped into High, Medium, and Low based on standardized Z-scores of student learning outcomes. This two-dimensional stratification aims to ensure that the sample remains representative of the proportions of high-, medium-, and low-ability students in each vocational program, so that it is not dominated by any one ability group. The population and sample for each stratum are presented in Table 1, Table 2, and Table 3.

Table 1. Sample Distribution for the ATPH Expertise Program

Category	Population	Sample
High	4	3
Medium	53	35
Low	10	6
Total	**67**	**44**

Table 2. Sample Distribution for the APHP Expertise Program

Category	Population	Sample
High	11	7
Medium	78	52
Low	14	9
Total	**103**	**68**

Table 3. Sample Distribution for the ATP Expertise Program

Category	Population	Sample
High	0	0
Medium	33	22
Low	2	1
Total	**35**	**23**

The sample size for each stratum (combination of vocational program and ability category) was determined proportionally to the population in that stratum, using the formula $n_i = (N_i/N) \times n$, rounded to the nearest whole number. Respondents in each stratum were selected randomly by manual drawing from the list of students in each stratum.

C. Research Instruments

Learning motivation, learning facilities, and parental support were measured using a closed-ended questionnaire with a 5-point Likert scale (strongly agree = 5, agree = 4, undecided = 3, disagree = 2, and strongly disagree = 1). The indicators and the number of points for each question in the instruments for each variable are shown in Table 4.

The learning motivation instrument was adapted from (Putri, 2023), with modifications and adjustments to fit the context of this study. The learning facilities instrument framework was developed by the researcher based on the classification of educational facilities and infrastructure estabilished by (Kementerian Pendidikan, Kebudayaan, Riset, 2023), which distinguishes between educational resources (tools, equipment, and learning media) and educational infrastructure (supporting facilities such as classrooms, libraries, and laboratories). The parental support instrument was adapted from a study (Jeliani, 2018), with modifications and adjustments to fit the context of this study. Sample items for each variable are as follows: learning motivation "I study and learning tools provided by the school in the learning process"; parental support "My parents congratulate me on successes I achieve." All items under the learning motivation and learning facilities variables are favorable (positive) in nature and therefore do not require score reversal. The parental support instrument contains a combination of favorable and unfavorable (negative) items; therefore, the scores for the unfavorable items were reversed (reverse scoring) before further analysis.

Table 4. Research Instruments for Each Variable

Variables	Indicator	Data Collection Techniques	Data source	Number of Questions
Motivation to learn	Intrinsic motivation, extrinsic motivation, persistence, interest, and active involvement in learning.	a list of questions	Student	23
Facilities Learning	Learning media, practical tools, agricultural practice land, classrooms, laboratories, libraries, practice rooms, and internet access.	a list of questions	Student	18
Parental Support	Appreciative support, informational support, instrumental support, supervision, and collaborative support.	a list of questions	Student	34
Learning outcomes	Achievement in productive agriculture subjects based on report card grades.	Documentation	School documents	-

Before being used for research data collection, the instrument was first tested on 30 respondents to determine its level of validity and reliability. The test results are presented in Table 5.

Table 5. Results of Validity and Reliability Tests of Research Instruments

Variable	Initial Number of Items	Number of Valid Items	Range of Calculated *r*-Values	Cronbach's Alpha	Reliability Category
Learning Motivation (X1)	23	23 (All Items Valid)	0.415–0.898	0.965	All Items Reliable
Learning Facilities (X2)	18	18 (All Items Valid)	0.689–0.915	0.969	All Items Reliable
Parental Support (X3)	34	34 (All Items Valid)	0.380–0.633	0.902	All Items Reliable

Based on the results of the instrument trial in Table 5, a trial of 30 respondents (outside the main research sample), all items in the three research variables were declared valid because the total item correlation value (r-count) for each item was greater than the r-table (0.361) with a significance level below 0.05, so that no items needed to be dropped from the instrument. Crombach's alpha values for the three variables also showed a very high level of reliability, namely 0.965 for learning motivation, 0.969 for infrastructure, and 0.902 for parental support. Thus, the research instrument used was declared valid and reliable to measure the three variables in this study.

Learning outcomes were measured using the average student report card scores for the even semester of 2026. To ensure comparability of scores across vocational programs, teachers, classes, and schools given that the Minimum Passing Criteria (KKM) can vary by subject, class, and school, report card scores were standardized using a Z-score calculation with the KKM as the reference point, rather than using the class average as the reference in conventional Z-score calculations. This standardized Z-score was then used as the learning outcome variable (Y) in the regression analysis and also served as the basis for grouping students into ability categories (High, Medium, Low) used in the sample stratification stage, as described in Section B.

D. Procedures for Testing Classical Assumptions and Handling Outliers

Before hypothesis testing, classical assumption tests were conducted, including tests for normality, linearity, and multicollinearity. The normality test used the One-Sample Kolmogorov-Smirnov Test (residuals are considered normal if Asymp. Sig. > 0.05). The linearity test uses the Deviation from Linearity value (Sig. > 0.05 indicates a linear relationship). The multicollinearity test uses tolerance and VIF values.

The initial normality test on the simultaneous regression model (X1, X2, X3 → Y) with the initial sample (N = 135) yielded a Kolmogorov-Smirnov value of 0.163 with an Asymp. Sig. (2-tailed) of 0.000, which means the model's residuals are not normally distributed, as indicated by an asymmetric residual curve and a number of cases that deviate significantly toward either very high or very low residual values.

Outliers were handled using case-by-case diagnostics on the simultaneous regression model, with cases defined as outliers if they had standardized residuals greater than +3 or less than -3. This procedure is carried out iteratively: the regression model is run, cases with standardized residuals outside the ±3 range are identified and removed, the model is rerun using the remaining data, and this process is repeated until the residuals meet the normality criteria. These criteria are applied consistently based on the magnitude of the residual deviation from the model's predictions, not directly based on students' academic achievement status. The procedure resulted in the cumulative removal of 14 cases, yielding a final sample of 121 students who met the normality assumption.

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Further examinations showed that all 14 cases identified as outliers were from students with learning achievement scores below the Minimum Passing Score (KKM), specifically in the 60s range. However, the final sample (N = 121) still includes a number of students with scores below the KKM whose residuals fall within the normal range; thus, this procedure does not eliminate the group of low-performing students as a whole, but rather only those cases with the most extreme deviations from the relationship pattern predicted by the model.

To ensure methodological transparency, a sensitivity analysis was conducted by comparing the results of the simultaneous regression before and after outlier handling. The results of this comparison are presented in Table 6.

Table 6. Comparison of Simultaneous Regression Results

	Before Outlier (N=135)	**After Outlier (N=121)**
F	0,400	6.684
Sig.	0,453	0,000
Conclusion	Model is not significant	Model is significant

This comparison shows that the significance of the simultaneous relationship between learning motivation, learning facilities, and parental support on learning outcomes is quite sensitive to the presence of those 14 data points with extreme residuals. Therefore, the results of this study refer to the model after outlier handling (N=121), and this sensitivity is a limitation of the study that must be considered when interpreting the generalizability of the results.

A different pattern was found in the Mahalanobis Distance, which detects outliers based on a combination of predictor values (X1, X2, X3) without accounting for deviations from the Y values predicted by the model. Using the chi-square critical value for df = 3 (number of predictors), 5 cases exceeded the critical value at $p < 0.05$ ($X^2 = 7.815$; Mahalanobis Distance ranging from 8.12 to 24.30), 2 cases exceeded the critical value at $p < 0.01$ ($X^2 = 11.345$), and 1 case exceeded the critical value at $p < 0.001$ ($X^2 = 16.266$). All 5 of these cases had learning achievement scores in the range of 76–86, well above the passing score, and none overlapped with the 11 cases identified using Cook's Distance. A summary of the comparison of the three methods is presented in Table 6a.

Table 6a. Comparison of Outlier Detection Methods (N=135)

Method	**Criteria**	**Number of cases**	**Y Value Range**
Standardized Residual	> +3 atau < -3	14	Below KKM (60-an)
Cook's Distance	> 4/n (0,030)	11	49–65 (below KKM)
Mahalanobis Distance	$X^2(3) > 7{,}815$ ($p < 0{,}05$)	5	76–86 (above KKM)

This pattern is statistically understandable: Cook's Distance reflects the influence of a case on the regression model's coefficients and is essentially rooted in the magnitude of the residuals; thus, it is reasonable that the results align with the standardized residuals. Mahalanobis Distance, on the other hand, purely measures the distance of a combination of predictor values without considering how well those values are predicted by the model, thereby detecting a different type of outlier. The alignment between standardized residuals and Cook's Distance reinforces the conclusion that the 14 removed cases were outliers that influenced the learning outcome dimension (Y), while the lack of overlap with Mahalanobis Distance indicates that these cases were not outliers on the predictor dimension (X). Thus, the outlier handling procedure used in this study consistently targets cases that deviate from the relationship pattern predicted by the model, rather than merely cases with unusual combinations of scores.

Research Ethics, Respondent Consent, and Missing Data. This study obtained permission to proceed through a tiered approval process, starting with the graduate program, then the South Sulawesi Provincial Government, followed by the Takalar Regional Education Office (Region 7), and finally permission from the principals of each school to collect data on vocational programs and 10th- and 11th-grade students. Before completing the questionnaire, all respondents were given an explanation regarding the purpose of the study, the voluntary nature of their participation, and data confidentiality. Before randomizing the sample and distributing the questionnaires, the researcher first sought permission/consent from the students concerned; all selected students voluntarily agreed to complete the questionnaire without coercion. The collected data did not contain any personally identifiable information about the respondents (it was anonymous). There were no missing data or incomplete questionnaires during the data collection process.

E. Data Analysis Techniques

The data were analyzed using descriptive statistics (mean, median, mode, standard deviation, maximum, and minimum values) as well as multiple linear regression using IBM Statistics 25. Regression equation used:

$$Y = \alpha + \beta_1.X_1 + \beta_2.X_2 + \beta_3.X_3 + €$$

Information:

Y : Learning Outcome Variable
A : Constant
β_1 : Regression coefficient
β_2 : Regression coefficient

β_3 : Regression coefficient
X_1 : Learning Motivation variable
X_2 : Learning Facilities variable
X_3 : Parental Support variable
e : Error/residual

RESULTS

This study was conducted to determine the influence of learning motivation, infrastructure, and parental support on the learning outcomes of agricultural students at a vocational high school in Takalar Regency, both partially and simultaneously. Several statistical tests were conducted to ensure the feasibility of the statistical testing methods and to provide an objective basis for proving or drawing conclusions from the research statements.

1. Descriptive Analysis

Table 7. Descriptive Statistics of Research Variables

Variables	N	Minimum	Maximum	Average	Standard Deviation
Motivation Learning	135	63	115	91.14	10,90
Learning Facilities	135	50	90	71.12	8.43
Parental Support	135	80	170	117,54	19.08
Learning outcomes	135	49	92	79,90	9.22

Table 7, presents the results of the descriptive analysis of the four research variables with a sample size of 135 students for each variable. The learning motivation variable recorded the lowest score of 63 and the highest of 115, with an average of 91.14 and a standard deviation of 10.90. The facilities and infrastructure variable ranged from 50 to 90, with an average of 71.12 and a standard deviation of 8.43. The parental support variable had the widest range, namely 80-170, with an average of 117.54, and a standard deviation of 19.08. Meanwhile, the learning outcomes variable showed a minimum score of 49 and a maximum of 92, with an average of 79.90 and a standard deviation of 9.22. The frequency distribution of the independent and dependent variable data can be seen in Table 7.

Table 8. Frequency Distribution of Learning Motivation Categories, Facilities and Infrastructure, and Parental Support

Variables	Category				
	Very high	High	Currently	Low	Very Low
Motivation Learning	27	84	24	-	-
Facilities Learning	28	85	22	-	-
Parental Support	8	33	87	7	-

Based on Table 8, the frequency distribution shows that the majority of students are in the high category for learning motivation, with 84 students, followed by the very high category with 27 students and the medium category with 24 students; no students fell into the low or very low categories. A similar pattern occurs for facilities and infrastructure, where the high category dominates with 85 students, followed by the very high category with 28 students and the medium category with 22 students, again with no students in the low or very low categories. A different pattern emerges for parental support, which is dominated by the medium category with 87 students, followed by the high category with 33 students, the very high category with 8 students, and the low category with 7 students; no students fell into the very low category.

Tabel 9. Frequency Distribution of Learning Outcomes Mastery Based on KKM

Category (Mastery Status)	Score Rage	Frequency (f)	Persetase
Achieved Mastery	≥ 75	111	82,2%
Non achieved Mastery	< 75	24	17,8%
Total		**135**	**100%**

Based on Table 9, which shows the results of the analysis of student learning achievement using the minimum passing score (KKM) standard (≥ 75), it was found that the majority of students had met the achievement criteria. A total of 111 students (82.2%) were deemed to have met the criteria, while 24 students (17.8%) were deemed not to have met the criteria.

2. Normality Test

Table 10. Normality Test Before and After Outlier Handling

Testing Level	N	Kolmogorov-Smirnov statistics	Meaning	Information
Before Outlier Handling	135	0,163	<..001	Not Normally Distributed
After Handling Outlier Data	121	0,078	0,070	Normally Distributed

The initial normality test results indicated that the data were not normally distributed. Therefore, outlier handling was performed, and the number of valid samples used in the final analysis was 121 students. The normality test after outlier handling showed a significance value greater than 0.05, indicating that the residual data were normally distributed. A summary of the normality testing is presented in Table 10.

3. Linearity Test

Table 11. Linearity Test Results

Variable Relationship	Significant Deviation from Linearity	Information
Learning Motivation (X1) with Learning Outcomes (Y)	0.560	Linear
Infrastructure (X2) with Learning Outcomes (Y)	0,193	Linear
Parental Support (X3) with Learning Outcomes (Y)	0.733	Linear

Based on Table 11, the significance value of Deviation from Linearity for all independent variables is greater than 0.05. The significance value for learning motivation is 0.560, infrastructure is 0.193, and parental support is 0.733. These results indicate that learning motivation, infrastructure, and parental support have a linear relationship with student learning outcomes.

4. Multicollinearity Test

Table 12. Multicollinearity Test Results

Independent Variables	Tolerance	VIF	Information
Learning Motivation (X1)	0,987	1.013	There is no multicollinearity.
Sarana Prasarana (X2)	0.803	1.245	There is no multicollinearity.
Parental Support (X3)	0.800	1.250	There is no multicollinearity.

In Table 12. The multicollinearity test shows that all tolerance values are greater than 0.10 and all VIF values are below 10.00. The tolerance values of all independent variables are greater than 0.10, and the VIF values of all variables are below 10.00. Learning motivation has a tolerance of 0.987 and a VIF of 1.013; infrastructure has a tolerance of 0.803 and a VIF of 1.245; while parental support has a tolerance of 0.800 and a VIF of 1.250. These results indicate that the regression model does not experience symptoms of multicollinearity.

5. Heteroscedasticity Test

Table 13. Heteroscedasticity Test Results

Independent Variables	Mr. Glejser Test	Information
Learning Motivation (X1)	0.202	There is no heteroscedasticity
Sarana Prasarana (X2)	0,485	There is no heteroscedasticity
Parental Support (X3)	0,103	There is no heteroscedasticity.

Based on Table 13, the results of the heteroscedasticity test using the Glejser method show a significance value of 0.202 for learning motivation, 0.485 for infrastructure, and 0.103 for parental support. All significance values are greater than 0.05, indicating no signs of heteroscedasticity in the regression model. Based on the normality, linearity, multicollinearity, and heteroscedasticity tests, the research data has met the classical assumptions required for further regression analysis.

6. Hypothesis Test Results (T-Test)

Table 14. Summary of Multiple Regression Analysis (Partial t-Test Results)

Predictor	Unstandardized B	SE	Standardized Beta (β)	t	Sig.	R^2	95% CI [LL, UL]
Learning Motivation (X1)	-.052	.050	-.095	-1.046	.298	0,9%	[-.151, .047]
Facilities Learning (X2)	-.079	.054	-.113	-1.245	.216	1,3%	[-.205, .047]
Parental Support (X3)	-.114	.027	-.358	-4.184	<.001	12,8%	[-.168, -.060]

Table 14 presents a summary of the results of the partial tests (t-tests), which show the effect of each independent variable on learning outcomes, including the unstandardized coefficient (B), standard error (SE), standardized coefficient (Beta/β), t-values, significance (Sig.), R^2, and 95% confidence intervals (95% CI). Learning motivation (X1) showed a B coefficient of -0.052 with a standard error of 0.050, a standardized Beta coefficient of -0.095, a t-value of -1.046, and a significance level of .298 ($p > 0.05$). This variable contributes (R^2) 0,9% to learning outcomes, with a 95% confidence interval ranging from -0.182 to 0.015. Since this interval includes zero, the effect of learning motivation on learning outcomes is negative but not statistically significant. Learning facilities (X2) have a B coefficient of -0.079 with a standard error of 0.054, a beta coefficient of -0.113, a t-value of -1.245, and a significance level of 0.216 ($p > 0.05$). The contribution (R^2) of this variable to learning outcomes is 1.3%, with a 95% confidence interval ranging from -0.205 to 0.047. The fact that this interval also includes zero indicates that the effect of learning facilities on learning outcomes is negative but not statistically significant. Parental support (X3) showed a B coefficient of -0.114 with a standard error of 0.027, a beta coefficient of -0.358, a t-value of -4.184, and a significance level of $p < 0.001$. his variable contributed the largest R^2 value among the three predictors, namely 12.8%, with a 95% confidence interval ranging from -0.168 to -0.060 a range that does not include zero thereby indicating a negative and statistically significant effect. However, it cannot be concluded that there is a cause-and-effect relationship between the negative influence of parental support and academic achievement.

Overall, of the three independent variables tested, only parental support was found to have a significant effect on academic achievement, although the direction of the effect was opposite to what was theoretically expected (negative rather than positive). Both learning motivation and learning facilities showed a negative direction of influence, but neither was statistically significant because their 95% confidence intervals still included the value zero.

7. Hypothesis Test Results (F Test)

Table 14. Comparison of Simultaneous Regression Models (F-Test)

Proven Relationship	df	F	Significance	R^2	Information
Learning Motivation and Facilities > Learning Outcomes	(2, 118)	0.769	.466	1,3%	Not significant
Facilities Learning and Parental Support > Learning Outcomes	(2, 118)	8,871	<. .001	13,1%	Significant
Learning Motivation and Parental Support > Learning Outcomes	(2,118)	9,001	< .001	13,2%	Significant
Learning Motivation, Facilities and Infrastructure, and Parental Support > Learning Outcomes	(3, 117)	5,950	<. 001	13,2%	Significant

Table 14 presents the results of the F-test (simultaneous) for four combinations of independent variables on learning outcomes, including degrees of freedom (df), F-values, significance levels, and R^2 (the proportion of variance in learning outcomes explained by each model combination). The combination of learning motivation and facilities on learning outcomes yielded $F (2, 118) = 0.769$, with a significance level of 0.466 ($p > 0.05$) and an R^2 of 1.3%. Since the significance value is much greater than 0.05, this combination is deemed to have no significant simultaneous effect on learning outcomes, and the proportion of variance it explains is also the smallest among the four models. The combination of facilities and parental support yielded an F-value of $F (2, 118) = 8.871$, with a significance level of $p < 0.001$ and an R^2 of 13.1%. This combination was found to have a significant effect on learning outcomes. The combination of learning motivation and parental support yielded an F-value of $F (2, 118) = 9.001$, with a significance

level of $p < 0.001$ and an R^2 of 13.2%; thus, it was deemed significant in fact, the F-value for this combination was the highest among the four models tested. Finally, the combination of all three variables learning motivation, facilities, and parental support yielded an F-value of F (3, 117) = 5,950, with a significance level of $p < 0.001$. R The R^2 for this full model was the highest among the four combinations, at 13,2%, and was found to be significant. Overall, of the four combinations tested, only the combination of learning motivation and facilities was not significant and had the lowest R^2 (1.3%); the other three combinations all of which included the parental support variable showed a significant simultaneous effect on academic achievement. This pattern consistently indicates that adding the parental support variable to the model, in any combination, statistically increases the significance and the proportion of learning outcomes variance that can be explained, while combinations that do not include it (motivation and facilities alone) remain insignificant.

DISCUSSION

Learning Motivation and Learning Outcomes

The partial regression results indicate that learning motivation was not a statistically reliable predictor of learning outcomes, B = -.052, SE = .050, β = -.195, t (119) = -1.046, p = .298, 95% CI [-.151, .047]. Because the confidence interval spans zero, this finding does not support a conclusion of either a positive or a negative association between learning motivation and learning outcomes in this sample.

This null finding is consistent with other Indonesian studies, which likewise failed to detect a significant effect of learning motivation on learning outcomes (Widyanto & Wulaningrum, 2017; Setyawati & Listiadi, 2026). One plausible explanation is that self-reported motivation scores do not necessarily correspond to the actual learning behaviors students exhibit in the classroom or during independent study. From the standpoint of Self-Determination Theory Ryan & Deci, (2020) and social-cognitive accounts of motivation (Schunk & Dibenedetto, 2019), motivation is theorized to translate into achievement only when it is accompanied by adequate self-efficacy and by the fulfillment of underlying psychological needs. However, because this study did not directly measure self-efficacy, autonomy, or the intrinsic-extrinsic orientation of students' motivation, these mechanisms should be treated as plausible directions for future research rather than as confirmed explanations for the null result observed here

Facilities Learning and Learning Outcomes

Similarly, Learning facilities did not significantly predict learning outcomes, B = -.079, SE = .054, β = -.113, t(119) = -1.245, p = .216, 95% CI [-.205, .047]. As with learning motivation, the confidence interval crossing zero indicates insufficient statistical evidence for a reliable association between facility availability and learning outcomes in this sample. This result diverges from meta-analytic evidence generally linking adequate facilities to improved learning outcomes (Tuanany & Triwiyanto, 2024; Carrington & Andrade, 2024), but is consistent with prior Indonesian vocational-education research that likewise found no significant effect of facilities on achievement (Widyanto & Wulaningrum, 2017) One possible interpretation is that the mere availability of facilities does not guarantee their effective use in instruction; however, since this study did not measure facility utilization, teacher integration of instructional media, or facility maintenance quality, this remains a hypothesis for future investigation rather than a conclusion supported directly by the present data.

Parental Support and Learning Outcomes

In contrast to the two predictors above, parental support was a statistically reliable, negative predictor of learning outcomes, B = -.114, SE = .027, β = -.358, t(119) = -4.184, p < .001, 95% CI [-.168, -.060], a direction counter-intuitive relative to prior findings such as (Rosalina & Yamlean, 2021). This should not be read as evidence that parental support is, in a general or causal sense, detrimental to achievement.

Rather than concluding outright that parental support is detrimental to student learning outcomes, this negative direction is more appropriately read as a signal that the relationship between the two is not as straightforward as commonly assumed, with at least four alternative explanations worth considering based on the data pattern and evidence from comparable research.

Two methodological artifacts that could explain this direction were checked and ruled out. First, suppression: the zero-order correlation between parental support and learning outcomes (r = -.358, p < .001) and a simple regression of learning outcomes on parental support alone (B = -.114, β = -.358, p < .001, R^2 = .128) were, to three decimal places, identical to its coefficient in the full model, indicating the negative association is not an artifact of controlling for motivation and facilities. Second, scoring error: the reverse-scoring of unfavorable items in the parental support

instrument, a plausible artifact given evidence that involvement form affects the direction of its effect (Jiang et al., 2023), was confirmed to have been applied correctly during data entry.

With these two candidates excluded, the most plausible remaining explanations lie outside the regression specification itself: reverse or reciprocal causality, whereby lower-performing students may elicit greater parental support over time (Xiong et al., 2021), unmeasured socioeconomic confounding, given that family socioeconomic status shapes both the form of involvement families can provide and children's academic trajectories independently (Sengonul, 2022). and an unmeasured mediating mechanism such as school belonging, consistent with a comparable vocational-student sample in which parental emotional support showed no meaningful direct effect once such a mediator was modeled (Liu et al., 2022).

Taken together, parental support was negatively and reliably associated with learning outcomes in this sample, an association not attributable to statistical suppression or scoring error, but whose substantive mechanism cannot be determined from this cross-sectional design. This finding should not be read as a general claim that parental support undermines achievement; rather, consistent with Liu et al., (2022), it highlights the need for designs capable of testing mediating and confounding mechanisms before practical recommendations on parental involvement are drawn.

Overall Model

When tested simultaneously, the combination of learning motivation and learning facilities did not significantly predict learning outcomes, $F(2, 118) = 0.769$, $p = .466$, $R^2 = .013$ (1,3%). In contrast, the combinations that included parental support were significant: facilities and parental support, $F(2, 118) = 8.871$, $p < .001$, $R^2 = .131$ (13%); learning motivation and parental support, $F(2, 118) = 9.001$, $p < .001$, $R^2 = .132$ (13,2%); and the full model with all three predictors, $F(3, 117) = 5{,}950$, $p < .001$, $R^2 = .132$ (13,2%).

The full model's R^2 of .147 indicates that learning motivation, facilities, and parental support jointly accounted for only 13,2% of the variance in learning outcomes, leaving approximately 86.8% of the variance associated with factors outside this model. This limited explanatory power should be stated plainly rather than implied: the three predictors examined here are far from sufficient, on their own, to account for variation in learning outcomes among agricultural vocational students in this setting. Comparable regression-based studies using large-scale assessment data have similarly found that home- and school-related predictors, even when modeled jointly across several domains, explain a bounded share of achievement variance, with substantial remaining variance attributable to unmeasured instructional, cognitive, and contextual factors (Wei & Zhang, 2025). Plausible unmeasured contributors in the present context include students' prior academic ability, teacher competency and instructional strategies, class attendance, socioeconomic status, learning discipline, practical/industry experience, and broader school-level characteristics such as academic culture and grading practices.

Theoretical Implications

These findings contribute to the literature in two respects. First, they add to accumulating evidence that the relationships between learning motivation, facilities, and academic achievement are not uniformly positive across contexts, reinforcing the view that learning outcomes emerge from the interaction of multiple internal and external factors rather than from any single predictor in isolation (Kocak et al., 2021). Second, the negative association observed for parental support, considered alongside evidence that its effect on vocational students can be fully mediated by school belonging (Liu et al., 2022) and that its direction depends on its specific form and on the timing of measurement (Jiang et al., 2023; (Xiong et al., 2021), suggests that the assumption of a uniformly positive parental-support effect warrants closer theoretical and methodological scrutiny, particularly in cross-sectional survey designs where directionality and mediating mechanisms cannot be established.

Practical Implications

Practically, because learning motivation and facilities did not significantly predict learning outcomes in this sample, school-level interventions limited to raising motivation or expanding physical facilities alone are unlikely, by themselves, to meaningfully improve learning outcomes among agricultural vocational students in this setting. Given the low explanatory power of the full model, school administrators and policymakers should prioritize a broader set of interventions, potentially including improvements in instructional quality, teacher competency development, and structured practical/industry experience, alongside continued attention to facilities and student motivation. Because the mechanism underlying the negative association with parental support remains unclear, this study does not recommend any specific change to parental-involvement practices; instead, further research using longitudinal or mixed-methods designs, and where possible incorporating mediators such as school belonging (Liu et al., 2022) is recommended before translating this finding into practical guidance for parents or schools.

Limitations

Several limitations should be considered when interpreting these findings. First, the cross-sectional design precludes causal inference and cannot rule out reverse causality, which is particularly relevant to the negative parental support finding discussed above. Second, learning outcomes were measured using report-card averages rather than a standardized achievement test, which may be subject to variation in grading standards across teachers, subjects, and schools, although this study attempted to mitigate this by standardizing scores relative to each subject's minimum mastery criterion (KKM). Third, all three predictor variables were measured through student self-report, constituting a single perceptual data source; this raises the possibility of common method bias and precludes cross-validation against parent, teacher, or observational data. Fourth, the outlier-handling procedure removed 14 of 135 initial cases (final N = 121), which, despite the sensitivity analysis reported in the Method section indicating that the removed cases were concentrated among extreme residuals rather than low-performing students generally, may still affect the generalizability of the findings. Fifth, the study was limited to two schools within a single regency, restricting generalization to other agricultural vocational contexts or educational levels. Finally, the parental support and facilities instruments were researcher-developed or adapted and may not comprehensively capture all relevant dimensions of these constructs, particularly aspects of parenting style, student autonomy, and facility utilization that this discussion has identified as important for future measurement.

CONCLUSION

This study examined whether learning motivation, facilities and infrastructure, and parental support were associated with, and could predict, the learning outcomes of agricultural vocational students in Takalar Regency, both individually and in combination. After controlling for the other two predictors, learning motivation (β = -.095, p = .298) and Learning facilities (β = -.113, p = .216) were not statistically reliable predictors of learning outcomes, whereas parental support was a statistically reliable predictor, showing a negative association (β = -.358, p < .001). This negative direction should be interpreted with caution rather than as evidence of a causal or generally detrimental effect: supplementary analyses ruled out a statistical suppression effect and confirmed that the parental support instrument's reverse-scoring had been applied correctly, but the cross-sectional design used here cannot rule out reverse causality, unmeasured socioeconomic confounding, or unmeasured mediating mechanisms such as school belonging. The full model, combining all three predictors, was statistically significant, F(3, 117) = 5,950, p < .001, but explained only 13,2% of the variance in learning outcomes (R^2 = .132), indicating that the great majority of variation in learning outcomes among these students is associated with factors not captured by this study. These findings suggest that, in the context of agricultural vocational education in Takalar Regency, learning outcomes cannot be meaningfully improved through motivation-building or facility provision alone, and that any response to the parental support finding should focus on evaluating the quality and form of family support and on optimizing the use of existing facilities, alongside the development of more effective learning strategies, rather than on discouraging parental involvement. Given the model's limited explanatory power and the methodological constraints of a cross-sectional, self-report design based on a single-regency, two-school sample, future research is recommended to adopt longitudinal designs capable of establishing temporal precedence, draw on wider and more diverse school samples, employ standardized measures of learning outcomes, and control for additional student- and school-level characteristics before drawing firmer conclusions about the direction and mechanisms underlying these relationships.

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AUTHOR CONTRIBUTION STATEMENT

H contributed to the conceptualization, data collection and analysis, and manuscript writing. J and ML guided the research process, provided input and methodological guidance, and revised the manuscript. All authors approved the final manuscript.

AI DISCLOSURE STATEMENT

In this study, data collection was conducted using valid research instruments without the aid of AI. Data processing and statistical analysis were performed directly by the researcher using statistical software. The author used Claude during the preparation of this work to refine the language and format of the manuscript, and improve academic writing. After using the tool, the author thoroughly reviewed and edited the content as needed and takes full responsibility for the content of this publication.

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