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A Predictive Model of Geography Learning Achievement Reviewed from Parental Attention and Physical Learning Environment

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ABSTRACT

Purpose of the study: The study aims to examine the predictive effect of parental attention and physical learning environment on geography learning achievement among high school students, estimating the relative contribution of each factor and their combined influence on academic outcomes.

Methodology: A quantitative approach with correlational design was employed, using structured questionnaires and Likert-scale measurements to assess parental attention and physical environment. Student semester examination scores were collected as indicators of learning achievement. Data analysis involved Pearson Product-Moment correlation and multiple linear regression, using SPSS software for statistical estimation and hypothesis testing.

Main Findings: Parental attention and physical learning environment jointly explained 33% of variance in geography learning achievement. Parental attention contributed 18.42%, while physical learning environment accounted for 14.58%, with both predictors showing linear relationships and no multicollinearity. Beta coefficients indicated substantial influence, with parental guidance slightly dominant in enhancing student performance.

Novelty/Originality of this study: The study integrates parental involvement and physical learning environment into a unified predictive model, addressing gaps in prior research that examined these factors independently. The findings provide robust, evidence-based insights for optimizing both home and school support, offering practical, actionable strategies for enhancing geography learning achievement and informing more effective targeted educational interventions.

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1. INTRODUCTION

Education constitutes a fundamental pillar in shaping human capital and advancing national development. Academic achievement functions as a key indicator in assessing the effectiveness of educational processes and learning outcomes [1]. Within geography education, achievement reflects students' comprehension of spatial concepts, environmental dynamics, and analytical reasoning skills [2], [3]. Learning outcomes are influenced by a combination of internal dispositions and external conditions surrounding students.

Among external determinants, parental attention and the physical learning environment are frequently associated with variations in students' academic performance.

Although educational reforms continue to be implemented, disparities in learning achievement remain apparent at the secondary school level. Geography scores in several contexts still indicate that a considerable proportion of students have not attained the expected competency standards [4], [5]. Variations in family supervision, study habits, and the availability of learning facilities create unequal academic support systems among learners. Students who receive consistent parental guidance often demonstrate stronger engagement in academic tasks. Conversely, limited supervision and inadequate study environments may hinder concentration and reduce academic performance.

Empirical investigations have documented positive associations between parental involvement and students' academic success across various subjects [6]. Similarly, studies examining the quality of the physical learning environment highlight its role in supporting cognitive focus and effective study habits. Nevertheless, these strands of research are frequently conducted independently, emphasizing isolated relationships rather than integrated effects [7]. The analytical focus often remains limited to correlation coefficients without further exploration of predictive strength. As a result, a comprehensive quantitative explanation of how these external variables collectively shape geography achievement is still developing.

A more integrative analytical perspective is required to understand the relative contribution of family support and environmental conditions in explaining academic outcomes. Estimating their simultaneous effects enables a clearer interpretation of the extent to which each factor strengthens learning achievement [8]. Without such an approach, educational interventions may rely on fragmented evidence. Strengthening the explanatory framework is particularly important in geography education, where contextual and environmental awareness forms a central component of learning [9]. Quantitative modeling therefore provides a relevant pathway for clarifying these interrelationships.

Evidence-based educational decision making increasingly demands empirical findings that move beyond descriptive patterns. Schools and families benefit from understanding not only whether variables are related, but also how strongly they contribute to academic outcomes [10], [11]. Identifying the predictive weight of parental attention and physical study conditions can inform targeted support strategies. Such insights are valuable for optimizing both home-based and school-based learning environments. A systematic examination of these determinants thus holds practical and theoretical significance for improving geography learning achievement.

By applying a predictive modeling approach within a quantitative correlational framework, the interplay between parental attention and physical learning environment can be examined more rigorously. Simultaneous estimation of partial and joint contributions offers a more nuanced understanding of external influences on academic performance [12]. This analytical orientation advances prior work that primarily emphasized bivariate associations. Integrating these determinants into a unified statistical model strengthens the empirical foundation of geography education research [13]. The resulting framework contributes to a more structured and data-driven interpretation of factors influencing students' learning achievement.

2. RESEARCH METHOD

2.1. Research Design

This study employed a quantitative approach using a correlational design to examine predictive relationships among variables [14], [15]. The design aimed to estimate the extent to which parental attention and the physical learning environment contribute to geography learning achievement [16]. A predictive modeling framework was applied to analyze both partial and simultaneous effects of independent variables. The research focused on naturally occurring variables without experimental manipulation. This approach enabled statistical estimation of the strength and direction of relationships among the studied variables.

2.2. Research Setting and Time

The research was conducted at SMA Negeri 1 Minggir, a public senior high school located in Yogyakarta Province, Indonesia. The selection of this school was based on the accessibility of academic records and the relevance of geography learning outcomes to the research objectives. Data collection was carried out over a three-month period. The research took place from May to July of the academic year. During this period, questionnaire distribution and documentation retrieval were completed systematically.

2.3. Research Variables and Operational Definitions

The study involved two independent variables and one dependent variable. The independent variables consisted of parental attention (X1) and physical learning environment (X2), while the dependent variable was geography learning achievement (Y). Parental attention was operationally defined as the level of parents'

involvement in supporting learning activities, including supervision, guidance, motivation, and provision of academic support. The physical learning environment referred to measurable conditions of the home study setting, such as lighting, ventilation, study space, furniture, temperature, and noise levels. Geography learning achievement was measured using students' semester examination scores as an objective indicator of academic performance.

2.4. Population and Sample

The population comprised all Grade X and Grade XI social science students at SMA Negeri 1 Minggir, totaling 141 students. Grade XII students were excluded due to academic scheduling constraints during the data collection period. Sample determination followed proportional random sampling to ensure adequate representation from each class level. Based on the Isaac and Michael sampling table with a 5% margin of error, 105 students were selected as research respondents. The distribution of the population and the proportionally selected sample across classes are presented in Table 1.

Table 1. Distribution of Population and Sample

Number	Class	Population	Sample
1	X1	26	19
2	X2	27	21
3	X3	26	19
4	X4	27	20
5	XI IPS	35	26
	Total	141	105

2.5. Data Collection Techniques and Research Instruments

Data were collected using questionnaires and documentation techniques [17]. Structured questionnaires were administered to measure parental attention and the physical learning environment using a modified Likert scale. The response options ranged from "always" to "never," with both positive and negative item scoring applied. Instrument grids were developed to ensure content validity based on predefined indicators. Documentation of students' geography semester examination scores was obtained from school academic records to measure learning achievement objectively.

2.6. Data Analysis Techniques

Data analysis was conducted through several sequential stages, including editing, coding, and tabulation [18]. Descriptive statistics were initially used to summarize respondent characteristics and variable distributions. Prior to hypothesis testing, classical assumption tests were performed, including normality, linearity, and multicollinearity assessments [19], [20]. Pearson Product-Moment correlation analysis was applied to examine bivariate relationships among variables. Multiple linear regression analysis was subsequently employed to estimate the predictive strength and simultaneous contribution of parental attention and physical learning environment toward geography learning achievement.

3. RESULTS AND DISCUSSION

3.1. Normality Test

To ensure that the sample data adequately represent the population, the normality of each variable was examined using the Kolmogorov–Smirnov (KS) test. Data were considered normally distributed if the P-value exceeded 0.05. The results of the normality test are presented in Table 2.

Table 2. Normality Test Results

No	Variable	KS-Z	P-value	Description
1	Parental Attention (X1)	1.246	0.090	Normal
2	Physical Learning Environment (X2)	0.678	0.747	Normal
3	Geography Learning Achievement (Y)	1.201	0.112	Normal

The results indicate that all variables parental attention, physical learning environment, and geography learning achievement are normally distributed ($P > 0.05$). This confirms that parametric statistical analysis is appropriate for this study.

3.2. Linearity Test

Linearity between independent and dependent variables was assessed to determine whether regression analysis is appropriate. The test involved calculating the F-statistic for each variable. A relationship is considered linear if the P-value > 0.05. Table 3 presents the results.

Table 3. Multicollinearity Test Results

No	Independent Variable	df	F-count	F-table 5%	P-value	Description
1	Parental Attention (X1)	27;76	1.099		0.364	Linear
2	Physical Learning Environment (X2)	21;82	1.386		0.150	Linear

The findings demonstrate a linear relationship between both independent variables (X1 and X2) and geography learning achievement (Y). This supports the application of correlation and linear regression analyses.

3.3. Multicollinearity Test

Multicollinearity between independent variables was examined to ensure that predictor variables are not excessively correlated. A VIF < 5 and correlation coefficient r < 0.800 indicate absence of multicollinearity. The results are presented in Table 4.

Table 4. Multicollinearity Test Results

No	Variable	X1	X2	VIF	Description
1	Parental Attention (X1)	1	0.206	1.044	No multicollinearity
2	Physical Learning Environment (X2)	0.206	1	1.044	No multicollinearity

These results indicate that the independent variables are suitable for multiple linear regression analysis.

3.4. Correlation and Multiple Linear Regression Analysis

Correlation and multiple linear regression analyses were conducted to examine the predictive relationship of parental attention and physical learning environment on geography learning achievement. The results of the multiple linear regression are summarized in Table 5.

Table 5. Multiple Linear Regression Results

Variable	Beta	t-value	Sig.
Parental Attention (X1)	0.445	4.760	0.000
Physical Learning Environment (X2)	0.539	5.343	0.000

R	R^2	Adjusted R^2	Sig. F
0.574	0.330	0.324	0.000

The regression model is statistically significant (Sig. F = 0.000), indicating that parental attention and physical learning environment jointly explain 33% of the variance in geography learning achievement.

The predictive equation is:

$$\hat{Y} = 10.259 + 0.445X_1 + 0.539X_2$$

This implies that every one-point increase in parental attention and physical learning environment is expected to increase geography learning achievement by 1.084 points. Individually, parental attention contributes 18.42% and physical learning environment contributes 14.58% to the total explained variance, with parental attention being the dominant predictor.

Analysis indicates parental attention significantly contributes to geography learning achievement among high school students. Normality and linearity assessments confirmed data suitability for parametric statistical procedures, enabling multiple linear regression analysis. Parental attention accounts for 18.42% of explained variance, demonstrating critical influence of family involvement on academic performance. Physical learning environment contributes 14.58%, slightly lower than parental attention, but jointly the model explains 33% of variance in geography achievement. Predictive coefficients highlight measurable relationships between external factors and student performance.

Linear relationships between independent variables and geography achievement suggest enhancements in parental support and study environment quality correlate with improved academic outcomes. Beta coefficients, 0.445 for parental attention and 0.539 for physical environment, indicate substantial contributions

with parental guidance remaining dominant. Absence of multicollinearity confirms independent interpretability of predictor effects. Regression model provides quantitative evidence of interactions between social and environmental determinants on learning. Integration of these factors strengthens predictive capacity of academic achievement models in geography education.

Empirical evidence aligns with prior research linking parental involvement to academic success and supportive environments to cognitive focus. Past studies often examined single variables, limiting understanding of combined influence on achievement [21], [22]. Multiple regression analysis enables simultaneous estimation of partial and joint effects, addressing gaps in literature. Quantitative modeling offers structured approach to evaluate how social and environmental conditions collectively influence student performance [23]. Application of integrative statistical framework contributes to more robust explanation of learning outcome variability.

Predictive modeling allows estimation of relative influence of parental attention and learning environment concurrently. Simultaneous analysis clarifies magnitude of contribution each factor exerts on geography achievement. Regression coefficients translate into expected changes in academic outcomes per unit increase in predictor variables [24], [25]. Structured interpretation supports informed educational planning and prioritization of intervention strategies. Integration of family and environmental factors provides actionable insight for optimizing student learning conditions [26].

Practical consideration suggests targeted interventions can enhance parental engagement and optimize study environments. Structured parental guidance, supervision of learning activities, and facilitation of conducive study spaces support concentration and academic performance [27]. Incremental improvements in these dimensions can amplify overall achievement in geography. Data-driven understanding of external determinants enables focused strategies that align home support with educational objectives [28], [29]. Implementation of interventions addressing both parental and environmental factors may yield measurable improvement in student outcomes.

Limitations include restriction to Grade X and XI students at single school, which may constrain generalizability. Reliance on self-reported questionnaires introduces potential measurement bias for parental attention and physical environment. Omission of additional predictors such as intrinsic motivation or study habits limits explanatory scope [30]. Longitudinal studies and larger, diverse samples may provide more comprehensive insights. Inclusion of additional covariates and multi-site sampling recommended for future research to enhance predictive accuracy and external validity.

4. CONCLUSION

Findings indicate that parental attention and physical learning environment collectively exert a significant influence on geography learning achievement among high school students, with parental involvement contributing slightly more to explained variance than environmental conditions, while the joint effect accounts for approximately one-third of overall achievement variance. Multiple linear regression analysis provides quantitative evidence of these relationships, demonstrating the measurable impact of social and environmental factors on student performance. Integrating these determinants into a unified predictive model allows for more precise identification of effective educational interventions, emphasizing the importance of structured parental guidance and optimized study environments. Results suggest that targeted strategies promoting family engagement and conducive learning spaces can enhance cognitive focus, motivation, and overall academic outcomes. Future research could expand predictive frameworks by incorporating additional variables such as intrinsic motivation, study habits, or multi-school datasets to improve generalizability and predictive accuracy. Overall, the study underscores the value of evidence-based approaches that simultaneously address social and environmental influences in order to strengthen geography education outcomes and support data-driven policy development.

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