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The Effect of Classroom Environment on Early Childhood Behavior and Discipline at Raudhatul Athfal Masyithoh Butuh Using Partial Least Squares Structural Equation Modeling

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Abstract

The classroom environment is a microenvironmental factor presumed to influence the formation of behavior and discipline in early childhood; however, previous studies have generally examined these effects separately and have not used an approach capable of testing them simultaneously within a single model. This study aims to analyze the effect of the classroom environment on early childhood behavior and discipline at Raudhatul Athfal (RA; an Islamic kindergarten) Masyithoh Butuh. Data on 54 children from five classes were collected using a 5-point Likert-scale questionnaire completed by classroom teachers as raters and were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS version 4.1.1.8 with 5,000 bootstrap subsamples. Of the 24 initial indicators, 13 met the threshold criteria and were retained in the final model, and all constructs satisfied the criteria for convergent validity, discriminant validity, and reliability (outer loadings 0.711–0.916; AVE 0.590–0.689; composite reliability ρ_c 0.851–0.922; Cronbach's alpha 0.773–0.899; maximum HTMT 0.764). The classroom environment, represented in the final model by positive peer interaction, a warm and supportive classroom atmosphere, emotional security, and children's physical-emotional comfort, had a positive and significant effect on both child behavior (γ_1 = 0.489; $p < 0.001$; R^2 = 0.239) and child discipline (γ_2 = 0.561; $p < 0.001$; R^2 = 0.315), with effect sizes (f^2) of 0.314 (medium) and 0.460 (large), respectively; based on R^2, its contribution was classified as weak to approaching moderate. It can be concluded that a safe and comfortable socio-emotional classroom climate is substantially associated with positive behavior and discipline in early childhood. These findings are

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associational, as they are derived from cross-sectional data assessed by a single type of rater.

Keywords: Classroom Environment; Child Behavior; Child Discipline; PLS-SEM; Early Childhood.

INTRODUCTION

Early childhood education (ECE) is often referred to as the "golden age," a period in which children's behavior and discipline are most easily shaped because children are highly sensitive to the environments they encounter daily. Among the various environments that children encounter, the classroom occupies a special position: it is not merely a place of learning but a space of interaction that continuously shapes children's behavioral and disciplinary patterns. Through a literature-based theoretical review, Deng et al. (2024) proposed an eco-psychological framework that views the classroom as part of the child's psychological system rather than merely a physical setting and emphasized that the classroom is an active ecosystem offering *affordances*, that is, opportunities for children to interact, explore, and learn. This view is reinforced by Istifadah et al. (2026), who, through a multisite qualitative case study in two nature schools using the Miles, Huberman, and Saldaña interactive model of data analysis, formulated an Environment-Behavior model that maps the classroom into five interrelated dimensions: the physical environment, sensory stimulation, exploration, social interaction, and children's self-regulation. Similarly, Lesiani et al. (2026), using simple linear regression analysis on 16 children, showed that teachers' ability to arrange the physical classroom environment contributed substantially to early childhood learning interest, with a coefficient of determination (R^2) of 0.836.

Several recent studies have also confirmed the link between classroom environmental conditions and early childhood behavior and discipline. Puspitasari et al. (2023), for example, using correlation analysis, found that the school environment had a significant effect on the disciplined character of children aged 5–6 years (r = 0.525), contributing approximately 27.5% of the variance in disciplined behavior. Armin et al. (2024), through a descriptive qualitative study based on interviews with and observations of two classroom teachers, added that the consistent enforcement of classroom rules, together with parental involvement, was the dominant factor in successful child discipline at the ECE level. From a different perspective, Jazriyah (2023), using PLS-SEM-based path analysis, found that classroom management and children's level of independence jointly explained emotion management ability (R^2 = 0.728), with independence being a partially significant predictor, whereas Sune et al. (2025), through a descriptive qualitative study based on participant observation, semi-structured interviews, and documentation, showed that teachers

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act as disciplinary role models through their everyday classroom management practices. The physical aspect of space is equally important: Lisfa et al. (2026), through a review of the scientific literature and observation of indoor and outdoor learning environments, found that flexible spatial arrangements that integrate indoor and outdoor areas could enhance children's cooperation and social interaction, while Safitri et al. (2026), using Pearson product-moment correlation, found a strong positive relationship between school environmental cleanliness and children's learning comfort (r = 0.74), whereas the relationship between family social support and child discipline was very weak and nonsignificant (r = −0.14).

These studies have generally examined the effect of the classroom environment on a single aspect in isolation, whether disciplined character, emotion regulation, or social interaction, and have not used an approach capable of testing its effects on child behavior and discipline simultaneously within a single integrated model. Yudha and Noza (2023) applied PLS-SEM to analyze the factors of early childhood education facilities, and this method can test multiple relationships among variables simultaneously, even with relatively small sample sizes, making it suitable for ECE research. Hair et al. (2022) provide standard procedures for applying this method; however, its use to test the classroom environment as a simultaneous predictor of child behavior and discipline, particularly in Raudhatul Athfal (RA) institutions grounded in Islamic values, remains very rare. This gap underlies the present study, which was conducted at RA Masyithoh Butuh. This study aims to analyze the effect of the classroom environment on early childhood behavior and discipline at RA Masyithoh Butuh and to measure the magnitude of its contribution through the coefficient of determination (R^2).

METHOD

Data and Variables

This study used a quantitative approach with a cross-sectional design and was conducted at RA Masyithoh Butuh in September 2026, with 54 children observed across five classes: Group A (A1 and A2) for children aged 4–5 years and Group B (B1, B2, and B3) for children aged 5–6 years. Data on each child were reported by the classroom teacher as the rater through a questionnaire, given that young children are not yet able to complete research instruments independently. The questionnaire, which used a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), was completed on the basis of direct observation of each child during teaching and learning activities. The instrument was not subjected to a separate pilot study; its validity and reliability were established directly through the measurement model (outer model) in the PLS-

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SEM analysis using SmartPLS version 4.1.1.8 (Ringle et al., 2024).

This study used one exogenous variable (classroom environment) and two endogenous variables (child behavior and child discipline). The classroom environment was measured using 12 indicators covering three dimensions: the physical dimension (room arrangement and layout, lighting and air circulation, room cleanliness and aesthetics, and the availability of educational play equipment); the socio-emotional dimension (teacher responsiveness to children's emotions, positive peer interaction, a warm and supportive classroom atmosphere, children's emotional security, children's physical-emotional comfort, and positive teacher affirmation); and the routine dimension (consistency of daily routines and smoothness of transitions between activities). The indicators were coded X1–X12 in the order described above.

Child behavior was measured using six indicators, comprising three positive indicators (compliance with rules, politeness, and willingness to share and cooperate) and three reverse-scored negative indicators, namely verbal aggression, physical aggression, and violation of classroom rules. Child discipline was measured using six indicators: punctuality and readiness to participate in activities, orderliness during activity transitions, responsibility for tidying up materials, task completion, independence, and self-regulation. The child behavior indicators were coded Y1a–Y1f and the child discipline indicators Y2a–Y2f in the order described above; the scores of the negative indicators (Y1d–Y1f) were converted to positive scores using the formula 6 − original score before analysis.

ANALYTICAL METHOD

The analysis was conducted in two stages: evaluation of the measurement model (outer model) and evaluation of the structural model (inner model).

Measurement Model Evaluation

The measurement model (outer model) describes the relationships between latent constructs, which cannot be observed directly, and the indicators that measure them, while assessing how well these indicators represent the constructs (validity and reliability). All constructs in this study were specified as reflective measurement models (Mode A), in which the indicators are regarded as manifestations of the construct, such that changes in the construct are reflected in all of its indicators (Hair et al., 2022). For the exogenous construct ξ and the endogenous construct η_j, these relationships are expressed as follows:

$$x_i = \lambda_{x,i}\,\xi + \delta_i$$

$$y_{ij} = \lambda_{y,ij}\,\eta_j + \varepsilon_{ij}$$

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where x_i is the ith indicator of the exogenous construct ξ $(i = 1,2, \dots, p)$; y_{ij} is the ith indicator of the jth endogenous construct $(i = 1,2, \dots, q_j; j = 1,2)$; $\lambda_{x,i}$ and $\lambda_{y,ij}$ are the outer loadings; and δ_i and ε_{ij} are the indicator measurement errors. In the initial model, $p = 12$, $q_1 = 6$, and $q_2 = 6$ (Figure 1).

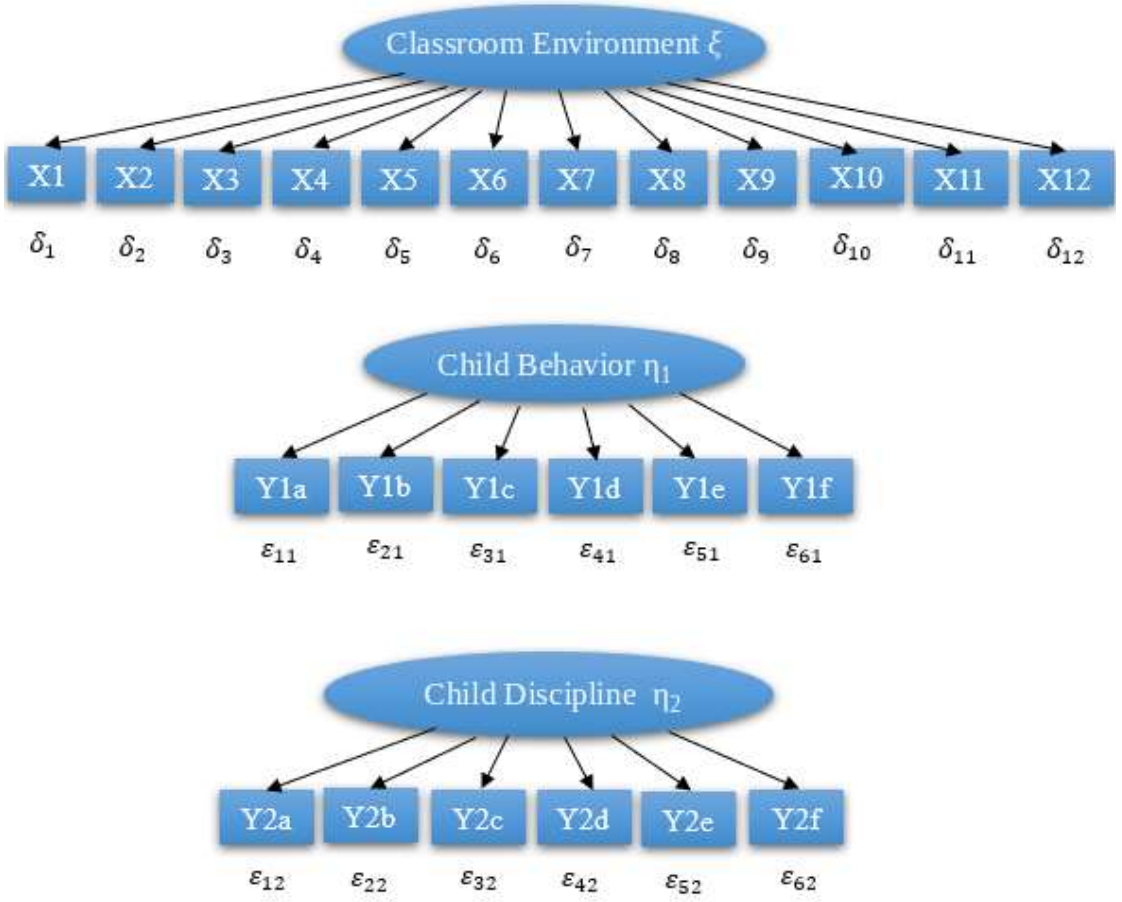


Figure 1. Initial Measurement Model

Construct scores are not observed directly but are estimated as weighted linear combinations of their standardized indicators:

$$\hat{\xi} = \sum_{i=1}^{p} w_{x,i}\, x_i, \qquad \hat{\eta}_j = \sum_{i=1}^{q_j} w_{y,ij}\, y_{ij}$$

where $\hat{\xi}$ and $\hat{\eta}_j$ are the construct scores, and $w_{x,i}$ and $w_{y,ij}$ are the outer weights. The weights are obtained through the iterative PLS algorithm using the path weighting scheme (the SmartPLS default setting) as follows: (1) the initial weights are set to one, and the construct scores are

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computed and then standardized; (2) the score of each construct is re-approximated from the scores of the constructs connected to it in the structural model (predictor constructs are weighted by regression coefficients and predicted constructs by correlations); (3) the outer weights are updated as the covariances between each indicator and this approximation (Mode A); and (4) steps (1)–(3) are repeated until the changes in the weights converge. The outer loadings are then calculated as the correlations between the indicators and their construct scores (Hair et al., 2022).

The measurement model was evaluated on three aspects: convergent validity, construct reliability, and discriminant validity. Convergent validity measures the extent to which the indicators designed to measure a construct are in fact highly correlated with that construct and share a large proportion of variance. Construct reliability measures internal consistency, that is, the extent to which the indicators within a construct are consistent with one another in measuring the same construct. Discriminant validity measures the extent to which a construct is empirically distinct from the other constructs in the model, that is, the extent to which the indicators of one construct are not too highly correlated with the indicators of other constructs. The formulas and criteria for each measure are presented below.

Convergent validity is assessed using the outer loading (λ_i), namely, the correlation between the score of the ith indicator and the score of the construct to which it belongs (the same applies to indicator y_{ij} and construct score $\hat{\eta}_j$):

$$\lambda_i = corr\left(x_i, \hat{\xi}\right)$$

where x_i is the score of the ith indicator and $\hat{\xi}$ is its construct score. An indicator adequately represents its construct if $\lambda_i \geq 0.70$ and it is statistically significant. The significance of the outer loadings was tested using the following bootstrapping procedure: (1) from the n = 54 observations, B = 5,000 subsamples of size 54 were drawn randomly with replacement (percentile bootstrap method with a fixed seed); (2) the model was re-estimated on each subsample to obtain $\hat{\lambda}_i^{(b)}$, b = 1, 2, …, B; (3) the standard error $\mathrm{SE}\left(\hat{\lambda}_i\right)$ was calculated as the standard deviation of these B values; and (4) the test statistic was computed as

$$t = \frac{\hat{\lambda}_i}{\mathrm{SE}\left(\hat{\lambda}_i\right)} \quad (1)$$

with the hypotheses H_0: $\lambda_i \leq 0$ versus H_1: $\lambda_i > 0$. H_0 is rejected if $p < 0.05$ (equivalent to $t >$ 1.65 at a significance level of α = 0.05 for a one-tailed test).

Convergent validity can also be assessed using the average variance extracted (AVE), namely, the mean of the squared loadings of all indicators within a construct:

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$$AVE=\frac{1}{m}\sum_{i=1}^{m}\lambda_i^2$$

where m is the number of indicators in the construct and λ_i is the outer loading of the ith indicator. A value of $\mathrm{AVE} \geq 0.50$ indicates that the construct, on average, explains more than 50% of the variance of its indicators (Hair et al., 2022).

Indicators that did not meet the outer loading threshold were considered for stepwise elimination, starting with the indicator with the lowest loading. Indicators with loadings of 0.40–0.70 were removed if their removal increased the AVE or composite reliability above the threshold, whereas indicators with loadings below 0.40 were always removed (Hair et al., 2022). The model was re-estimated after each removal until all remaining indicators met the threshold.

Construct reliability is assessed using composite reliability ρ_c:

$$\rho_c=\frac{(\sum_{i=1}^{m}\lambda_i)^2}{(\sum_{i=1}^{m}\lambda_i)^2+\sum_{i=1}^{m}(1-\lambda_i^2)}$$

where λ_i is the outer loading of the ith indicator and m is the number of indicators. A value of $\rho_c \geq 0.70$ indicates that the indicators within the construct are internally consistent when the differences in the loadings of the individual indicators are taken into account; hence, the construct is considered reliable (Hair et al., 2022).

Construct reliability can also be assessed using Cronbach's alpha (CA):

$$CA=\frac{m}{m-1}\left(1-\frac{\sum_{i=1}^{m}\sigma_i^2}{\sigma_t^2}\right)$$

where m is the number of indicators, σ_i^2 is the variance of the ith indicator, and σ_t^2 is the variance of the construct's total score. A value of $\mathrm{CA} \geq 0.70$ indicates that the indicators within the construct are consistent with one another under the assumption that all indicators carry equal weights; therefore, CA tends to represent the lower bound of construct reliability (Hair et al., 2022).

In addition, construct reliability can be measured using composite reliability ρ_A (Dijkstra–Henseler), a reliability measure whose value lies between Cronbach's alpha and composite reliability ρ_c, which is calculated as follows:

$$\rho_A=(\mathbf{w}'\mathbf{w})^2\,\frac{\mathbf{w}'(\mathbf{S}-\mathrm{diag}(\mathbf{S}))\mathbf{w}}{\mathbf{w}'(\mathbf{w}\mathbf{w}'-\mathrm{diag}(\mathbf{w}\mathbf{w}'))\mathbf{w}}$$

where $\mathbf{w}$ is the vector of the construct's outer weights and $\mathbf{S}$ is the covariance matrix of the construct's indicators. The vector $\mathbf{w}$ is obtained from the final outer weights of the PLS algorithm,

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normalized such that the variance of the construct score equals one ($\mathbf{w}'\mathbf{S}\mathbf{w} = 1$) (Dijkstra & Henseler, 2015). A value of $\rho_A \geq 0.70$ indicates that the construct is reliable (Hair et al., 2022).

Discriminant validity is assessed using the heterotrait-monotrait ratio (HTMT; Henseler et al., 2015), namely, the ratio of the mean of the correlations between indicators across constructs (heterotrait) to the geometric mean of the average correlations between indicators within each construct (monotrait). The HTMT between the ith and jth constructs is calculated as follows:

$$HTMT_{ij} = \frac{\frac{1}{K_i K_j}\sum_{g=1}^{K_i}\sum_{h=1}^{K_j} r_{ig,jh}}{\sqrt{\frac{2}{K_i(K_i\text{-}1)}\sum_{g<h} r_{ig,ih} \cdot \frac{2}{K_j(K_j\text{-}1)}\sum_{g<h} r_{jg,jh}}}$$

where K_i and K_j are the numbers of indicators in the ith and jth constructs, respectively, and $r_{ig,jh}$ is the correlation between the gth indicator of the ith construct and the hth indicator of the jth construct. A value of $\mathrm{HTMT} < 0.90$ indicates that the constructs in the model are empirically distinct (Hair et al., 2022).

Structural Model Evaluation

The structural model (inner model) describes the causal relationships among latent constructs according to the theoretical framework and is evaluated to assess the direction, strength, and significance of these relationships, as well as the model's ability to explain the endogenous constructs (Hair et al., 2022). This study has one exogenous construct (classroom environment, ξ) that influences two endogenous constructs (child behavior, η_1, and child discipline, η_2) through two direct paths. In matrix form, the structural model is written as follows:

$$\eta = \Gamma\,\xi + \zeta$$

where

$$\begin{pmatrix}\eta_1\\ \eta_2\end{pmatrix} = \begin{pmatrix}\gamma_1\\ \gamma_2\end{pmatrix}\xi + \begin{pmatrix}\zeta_1\\ \zeta_2\end{pmatrix}$$

The vector of endogenous constructs is $\boldsymbol{\eta} = (\eta_1, \eta_2)'$, with η_1 = child behavior and η_2 = child discipline; $\boldsymbol{\Gamma} = (\gamma_1, \gamma_2)'$ is the vector of path coefficients from ξ; and $\boldsymbol{\zeta} = (\zeta_1, \zeta_2)'$ is the vector of structural errors. The relationships among the variables are expressed in the following structural model.

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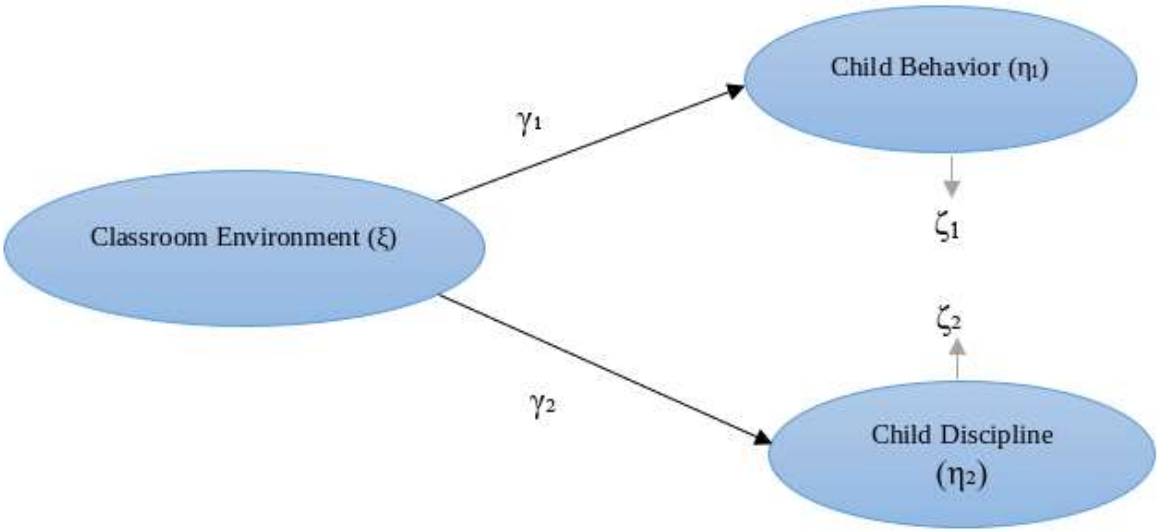


Figure 2. Structural Model

In Figure 2, the path coefficient γ_1 represents the effect of the classroom environment (ξ) on child behavior (η_1) and is tested through the hypotheses $H_0: \gamma_1 \leq 0$ and $H_1: \gamma_1 > 0$. Meanwhile, the path coefficient γ_2 represents the effect of the classroom environment (ξ) on child discipline (η_2) and is tested through the hypotheses $H_0: \gamma_2 \leq 0$ and $H_1: \gamma_2 > 0$.

The path coefficients were estimated using ordinary least squares (OLS) regression between construct scores. For standardized scores with a single predictor, γ_j equals the correlation between $\hat{\xi}$ and $\hat{\eta}_j$; hence, $R_j^2 = \gamma_j^2$:

$$\gamma_j = \frac{cov\left(\hat{\xi}, \hat{\eta}_j\right)}{var\left(\hat{\xi}\right)}$$

where $\mathrm{cov}\left(\hat{\xi}, \hat{\eta}_j\right)$ is the covariance and $\mathrm{var}\left(\hat{\xi}\right)$ is the variance of the construct score. The significance of the path coefficients was tested using the SmartPLS bootstrapping feature with 5,000 subsamples, the percentile bootstrap method, and a fixed seed at a 95% confidence level, with the following test statistic:

$$t = \frac{\hat{\gamma}_j}{SE\left(\hat{\gamma}_j\right)} \quad (2)$$

where $\hat{\gamma}_j$ is the estimated path coefficient and $\mathrm{SE}\left(\hat{\gamma}_j\right)$ is the bootstrap standard error. H_0 is rejected if $p < 0.05$ (equivalent to $t > 1.65$ at $\alpha = 0.05$).

Furthermore, the contribution of the classroom environment to each outcome variable was assessed using the coefficient of determination (R^2). The R^2 and adjusted R^2 values are

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formulated as follows:

$$R^2=1-\frac{SS_{res}}{SS_{tot}} \qquad \text{and} \qquad R^2_{adj}=1-\left(1-R^2\right)\frac{n-1}{n-k-1}$$

where SS_{res} is the residual sum of squares, SS_{tot} is the total sum of squares, n is the number of observations, and k is the number of predictors. The test of H_0: $R_j^2 = 0$ versus H_1: $R_j^2 > 0$ for each endogenous construct is performed using the F statistic:

$$F=\frac{R^2/k}{\left(1-R^2\right)/(n-k-1)} \tag{3}$$

H_0 is rejected if $F > F_{(0.05;\, k;\, n-k-1)}$ or $p < 0.05$.

In addition to the tests of the path coefficients and R^2, the effect size (f^2) can be used to measure how much an exogenous construct contributes to the R^2 of an endogenous construct when that construct is omitted from the model, which is formulated as follows:

$$f^2=\frac{R^2_{included}-R^2_{excluded}}{1-R^2_{included}} \tag{4}$$

where $R^2_{included}$ is the R^2 of the endogenous construct in the full model and $R^2_{excluded}$ is the R^2 when the exogenous construct is omitted. The effect size is considered small if $f^2 \leq 0.02$, medium if $0.02 < f^2 < 0.15$, and large if $f^2 > 0.35$ (Hair et al., 2022).

In a model with a single predictor, $R^2_{excluded} = 0$; thus, $f^2 = \frac{R^2}{(1-R^2)}$. Because the structural model has only one predictor, there is no collinearity among predictors (VIF = 1); therefore, a VIF test of the structural model is not required.

Stages of Analysis

The data analysis was conducted in the following stages:

1. Descriptive analysis, to describe the characteristics of the respondents and the proportion of scores for each research indicator;
2. Evaluation of the measurement model (outer model), including:
   a. convergent validity tests (outer loadings and AVE);
   b. construct reliability (composite reliability ρ_c and ρ_A, and Cronbach's alpha);
   c. discriminant validity (heterotrait-monotrait ratio, HTMT); and
   d. elimination of indicators that did not meet the thresholds;
3. Evaluation of the structural model (inner model), including:
   a. significance testing of the path coefficients through bootstrapping; and

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b. the coefficients of determination (R^2 and R^2_{adj}) with the F test, and the effect size (f^2).

RESULTS AND DISCUSSION

Descriptive Statistics

Figure 3 presents the score proportions of the 24 indicators in the initial model (n = 54); the scores of the negative indicators (Y1d–Y1f) were reversed so that higher scores indicate better conditions.

Most children obtained scores of 4–5 on almost all indicators, indicating that teachers' ratings tended to be high. The exceptions were X1, which had almost no scores of 5, and X2 and X4, which were bimodal. A score of 5 was highly dominant for Y1d–Y1f and Y2a (more than 80% of the children); thus, the between-child variation in these indicators was narrow.

Although PLS-SEM does not require normally distributed data, highly skewed distributions can inflate bootstrap standard errors; therefore, the significance tests for these indicators should be interpreted with caution (Hair et al., 2022).

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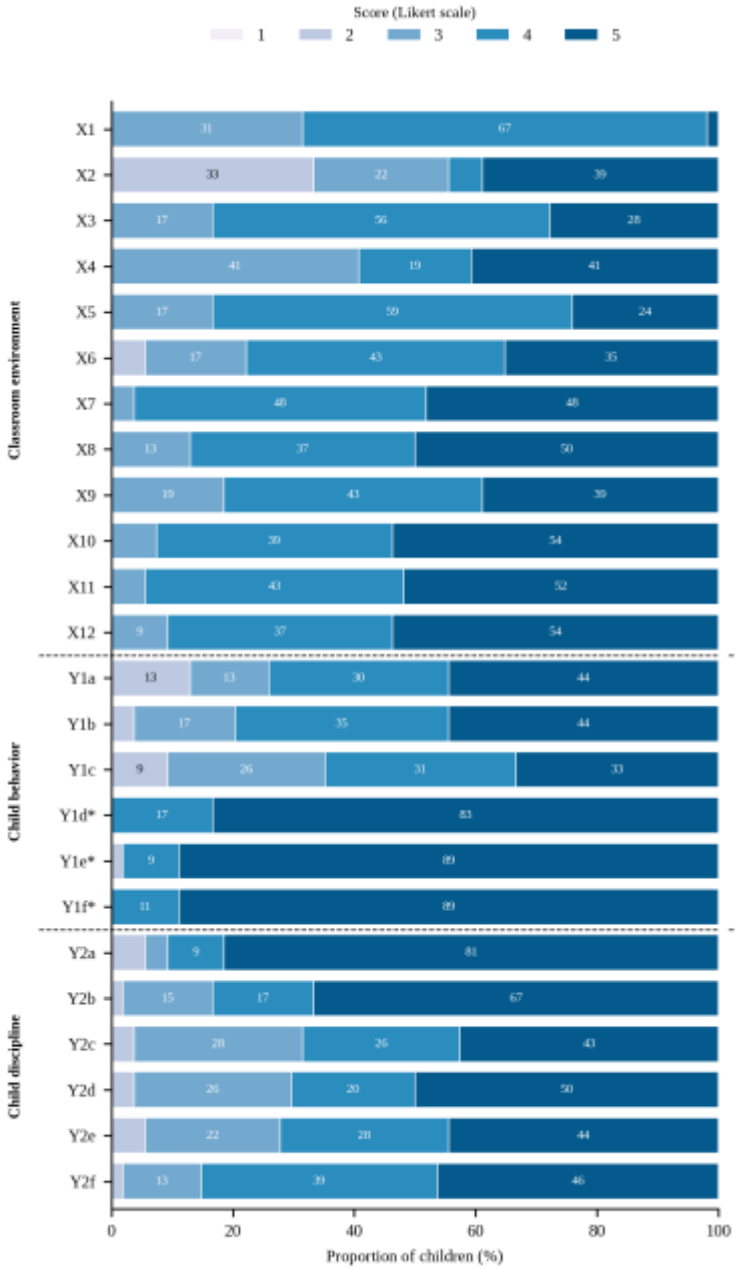


Figure 3. Score Distribution of the 24 Indicators in the Initial Model (*n* = 54)

Measurement Model Evaluation Results

Figure 4 presents the initial model with 24 indicators. The evaluation followed the sequence of convergent validity, construct reliability, and discriminant validity, followed by the

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elimination of indicators that did not meet the thresholds.

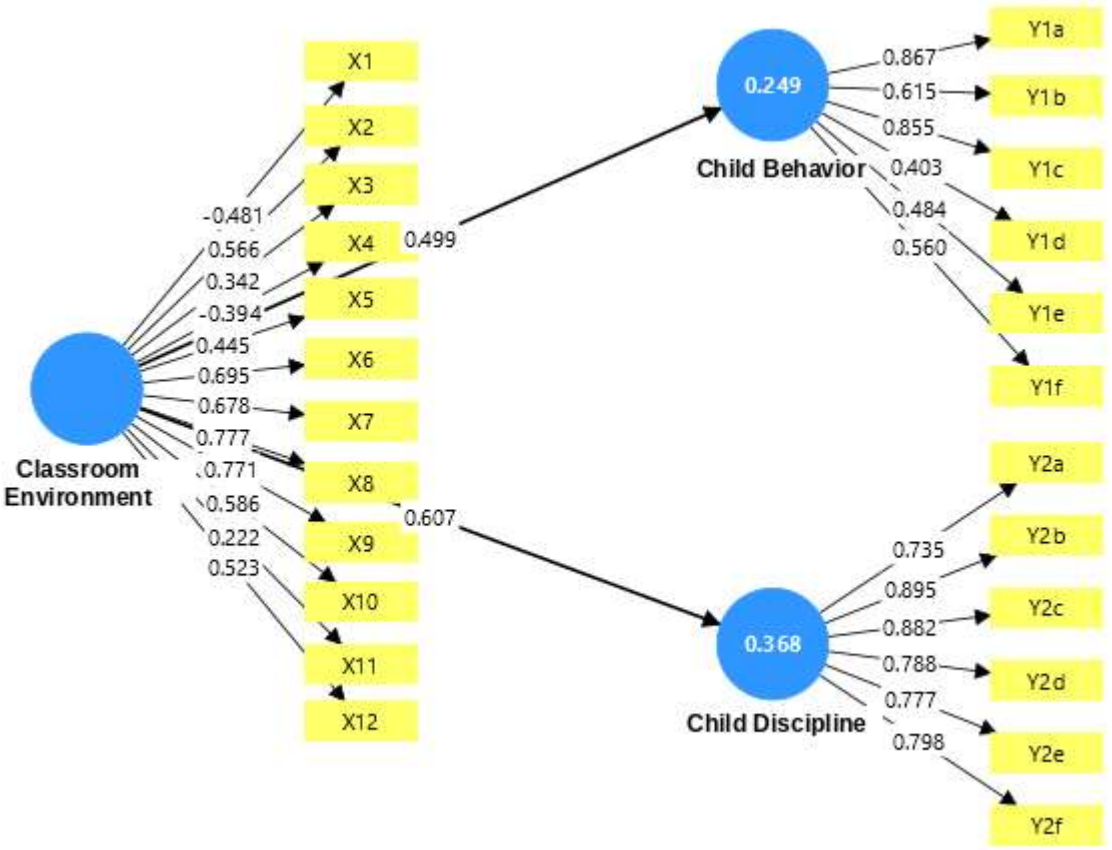


Figure 4. Initial PLS-SEM Estimation Model (24 Indicators)

Only 10 of the 24 indicators met the outer loading threshold of ≥ 0.70 (Table 1). The indicators with loadings < 0.40 that had to be removed were X1, X3, X4, and X11 (of which X1 and X4 were negatively signed), whereas the indicators with loadings of 0.40–0.70 that were considered for removal were X2, X5, X6, X7, X10, X12, Y1b, Y1d, Y1e, and Y1f.

Significance alone is insufficient to retain an indicator: X1 and X4 were significant but negatively signed and thus contradicted H_1: $\lambda > 0$; X11 was not significant; and several other significant indicators remained below 0.70. The *t* and *p* values for Y1e and Y1f were not available (n/a) because almost all children obtained a score of 5, so these indicators did not vary in some bootstrap subsamples.

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Table 1. Outer Loadings and Significance Tests of the Initial Model (24 Indicators)

Construct	Indicator	$\hat{\lambda}$	Bootstrap mean	$\mathrm{SE}(\hat{\lambda})$	*t*	*p*
Classroom environment (ξ)	X1	−0.481	−0.469	0.179	2.692	0.004
	X2	0.566	0.562	0.155	3.642	< 0.001
	X3	0.342	0.332	0.143	2.384	0.009
	X4	−0.394	−0.382	0.177	2.229	0.013
	X5	0.445	0.429	0.160	2.785	0.003
	X6	0.695	0.672	0.133	5.219	< 0.001
	X7	0.678	0.666	0.104	6.523	< 0.001
	X8	0.777	0.760	0.080	9.750	< 0.001
	X9	0.771	0.752	0.089	8.650	< 0.001
	X10	0.586	0.563	0.175	3.356	< 0.001
	X11	0.222	0.211	0.176	1.265	0.103
	X12	0.523	0.505	0.152	3.450	< 0.001
Child behavior (η_1)	Y1a	0.867	0.841	0.105	8.220	< 0.001
	Y1b	0.615	0.590	0.156	3.931	< 0.001
	Y1c	0.855	0.818	0.110	7.763	< 0.001
	Y1d	0.403	0.410	0.208	1.941	0.026
	Y1e	0.484	n/a	n/a	n/a	n/a
	Y1f	0.560	n/a	n/a	n/a	n/a
Child discipline (η_2)	Y2a	0.735	0.728	0.090	8.134	< 0.001
	Y2b	0.895	0.893	0.043	20.756	< 0.001
	Y2c	0.882	0.885	0.039	22.700	< 0.001
	Y2d	0.788	0.773	0.104	7.611	< 0.001
	Y2e	0.777	0.757	0.117	6.622	< 0.001
	Y2f	0.798	0.784	0.087	9.177	< 0.001

The AVE values of the classroom environment and child behavior constructs were below 0.50, indicating that these two constructs did not explain at least 50% of the variance of their indicators (Table 2). This suggests that convergent validity had not been achieved, presumably

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because of low-loading indicators; therefore, the less representative indicators needed to be eliminated.

The composite reliability of all three constructs met the criterion, but the CA of the classroom environment was below 0.70, indicating that its indicators were not yet internally consistent. The ρ_A value of the classroom environment exceeding its ρ_c deviates from the usual pattern, presumably because of the negative loadings of X1 and X4, which lowered ρ_c but did not lower the AVE. Accordingly, the reliability and AVE of the classroom environment in the initial model should be interpreted with caution.

Table 2. Construct Reliability and Convergent Validity of the Initial Model (24 Indicators)

Construct	CA	ρ_A	ρ_c	AVE
Classroom environment (ξ)	0.608	0.825	0.732	0.319
Child behavior (η_1)	0.710	0.794	0.807	0.428
Child discipline (η_2)	0.899	0.921	0.922	0.663

The discriminant validity of the initial model was established because all HTMT values were below 0.90, indicating that the three constructs were empirically distinct (Table 3).

Table 3. Discriminant Validity of the Initial Model Based on HTMT

Construct pair	HTMT
Classroom environment – Child behavior	0.575
Classroom environment – Child discipline	0.601
Child behavior – Child discipline	0.821

Although discriminant validity was established, the convergent validity and reliability of the classroom environment were not; therefore, stepwise indicator elimination was performed.

Indicator Elimination

Elimination was performed stepwise for each construct, starting with the construct with the lowest AVE (classroom environment, followed by child behavior) and the indicator with the lowest loading, with the model re-estimated at each step (Table 4). Child discipline required no elimination. After 11 steps, 13 indicators remained (Figure 5): X6–X9 for classroom environment, Y1a–Y1c for child behavior, and Y2a–Y2f for child discipline. Indicators X6, X7, and Y1b, which initially fell within the 0.40–0.70 range, were retained because their loadings increased above 0.70

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after the other indicators were eliminated (Table 5). Elimination improved measurement quality at the cost of relatively small decreases in R^2 and the path coefficients.

Table 4. Indicator Elimination Steps from the Initial Model (24 Indicators) to the Final Model (13 Indicators)

Step	Eliminated indicator	Loading when eliminated	Remaining indicators	R^2 (η_1)	R^2 (η_2)	$\hat{\gamma}_1$	$\hat{\gamma}_2$
0	(initial model)		24	0.249	0.368	0.499	0.607
1	X1	−0.481	23	0.258	0.377	0.508	0.614
2	X4	−0.365	22	0.260	0.385	0.510	0.620
3	X11	0.205	21	0.258	0.385	0.508	0.620
4	X3	0.318	20	0.254	0.383	0.504	0.619
5	X5	0.470	19	0.257	0.345	0.507	0.587
6	X12	0.541	18	0.232	0.315	0.482	0.561
7	X10	0.600	17	0.254	0.318	0.504	0.564
8	X2	0.627	16	0.269	0.310	0.518	0.557
9	Y1d	0.424	15	0.271	0.310	0.520	0.557
10	Y1e	0.552	14	0.263	0.310	0.513	0.557
11	Y1f	0.567	13	0.239	0.315	0.489	0.561

Evaluation of the Final Model (13 Indicators)

Figure 5 presents the estimation results of the final model with 13 indicators. All outer loadings exceeded 0.70 and were significant according to the *t* test in Equation (1) (Table 5), and the AVE values of all three constructs exceeded 0.50; thus, convergent validity was established (Table 6).

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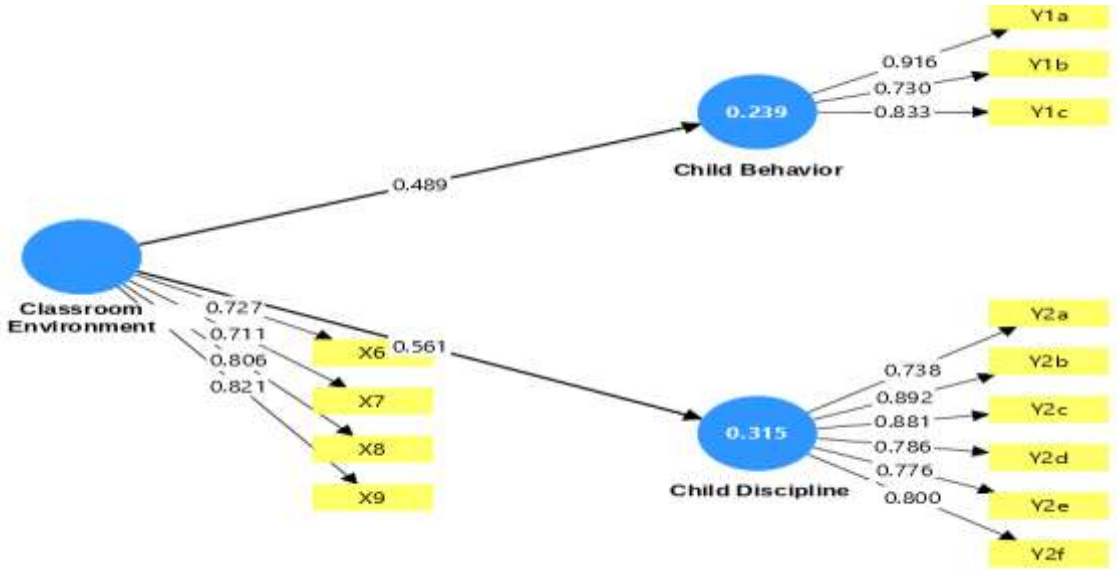


Figure 5. Final PLS-SEM Estimation Model (13 Indicators)

Table 5. Outer Loadings and Significance Tests of the Final Model (13 Indicators) Based on Bootstrapping with 5,000 Subsamples

Construct	Indicator	$\hat{\lambda}$	Bootstrap mean	$\mathrm{SE}(\hat{\lambda})$	*t*	*P*
Classroom environment (ξ)	X6	0.727	0.711	0.122	5.962	< 0.001
	X7	0.711	0.706	0.091	7.789	< 0.001
	X8	0.806	0.802	0.060	13.448	< 0.001
	X9	0.821	0.816	0.060	13.617	< 0.001
Child behavior (η_1)	Y1a	0.916	0.908	0.060	15.282	< 0.001
	Y1b	0.730	0.714	0.118	6.204	< 0.001
	Y1c	0.833	0.826	0.082	10.133	< 0.001
Child discipline (η_2)	Y2a	0.738	0.730	0.090	8.230	< 0.001
	Y2b	0.892	0.889	0.039	22.989	< 0.001
	Y2c	0.881	0.886	0.026	34.506	< 0.001
	Y2d	0.786	0.775	0.091	8.658	< 0.001
	Y2e	0.776	0.761	0.105	7.420	< 0.001
	Y2f	0.800	0.788	0.076	10.480	< 0.001

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Construct reliability was also established, as the ρ_c, ρ_A, and CA values of all constructs were above 0.70 (Table 6).

Table 6. Construct Reliability and Convergent Validity of the Final Model (13 Indicators)

Construct	CA	ρ_A	ρ_c	AVE
Classroom environment (ξ)	0.773	0.794	0.851	0.590
Child behavior (η_1)	0.775	0.820	0.868	0.689
Child discipline (η_2)	0.899	0.920	0.922	0.663

Discriminant validity was established, as all HTMT values were below 0.90 (Table 7). Hence, the final model met all measurement model criteria and was suitable for structural model evaluation.

Table 7. Discriminant Validity of the Final Model Based on HTMT

Construct pair	HTMT
Classroom environment – Child behavior	0.591
Classroom environment – Child discipline	0.619
Child behavior – Child discipline	0.764

Structural Model Evaluation Results

The estimated structural model is $\hat{\eta}_1$ = 0.489 $\hat{\xi}$ and $\hat{\eta}_2$ = 0.561 $\hat{\xi}$. On the basis of the test in Equation (2), the classroom environment had a positive and significant effect on both child behavior and child discipline because the *t* values exceeded 1.65 (Table 8); thus, H_0 was rejected for both paths, with a stronger effect on child discipline.

Table 8. Path Coefficients Based on Bootstrapping with 5,000 Subsamples

Path	$\hat{\gamma}$	Bootstrap mean	$\mathrm{SE}(\hat{\gamma})$	*t*	*p*
$\xi \rightarrow \eta_1$ (classroom environment → child behavior)	0.489	0.508	0.109	4.489	< 0.001
$\xi \rightarrow \eta_2$ (classroom environment → child discipline)	0.561	0.584	0.086	6.526	< 0.001

The contribution of the classroom environment was assessed using R^2, the *F* test (Equation (3)), and f^2 (Equation (4)). Both R^2 values were significant because the *F* values exceeded the

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critical value of 4.027 (Table 9). The classroom environment explained 23.9% of the variance in child behavior and 31.5% of the variance in child discipline. According to Hair et al. (2022), R^2 values of approximately 0.25, 0.50, and 0.75 are considered weak, moderate, and substantial, respectively; thus, the contribution was weak for child behavior and weak to approaching moderate for child discipline, whereas the effect sizes were medium and large, respectively. This difference is expected because, in a single-predictor model, f^2 is always larger than R^2; hence, the magnitude of the contribution is more appropriately interpreted from R^2.

Table 9. Coefficients of Determination, *F* Test, and Effect Sizes

Endogenous construct	R^2	R^2_{adj}	F	***p***	f^2	f^2 **category**
Child behavior (η_1)	0.239	0.225	16.35	< 0.001	0.314	Medium
Child discipline (η_2)	0.315	0.302	23.93	< 0.001	0.460	Large

DISCUSSION

The classroom environment was positively and significantly associated with child behavior and discipline at RA Masyithoh Butuh, with a stronger association for discipline. This finding is consistent with Puspitasari et al. (2023), who found an effect of the school environment on the disciplined character of children aged 5–6 years with a contribution of approximately 27.5%, which is in the same range as the 31.5% contribution found in this study, and with Wibisono et al. (2024), who regard classroom management as a means of building an inclusive, interactive, and disciplined learning environment.

The retained classroom environment indicators were all socio-emotional (positive peer interaction, a warm and supportive classroom atmosphere, emotional security, and physical-emotional comfort), whereas the physical, routine, and teacher responsiveness and affirmation indicators did not meet the thresholds. This relates to the data distribution: the X1 scores were nearly uniform, X2 and X4 were bimodal (Figure 3), and 13 children had identical score patterns on X1–X4, suggesting that the physical indicators were likely rated at the classroom level, resulting in narrow between-child variation. Therefore, the classroom environment in these data is more appropriately interpreted as the socio-emotional classroom climate. This differs from Deng et al. (2024) and Istifadah et al. (2026), who position the physical environment as an important dimension, and from Lisfa et al. (2026), who emphasize spatial arrangement, but it is consistent with Aslamiah et al. (2022), who regard classroom climate as a component of classroom

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management.

The child behavior construct retained only three positive indicators. The three reverse-scored negative indicators, namely, verbal aggression, physical aggression, and rule violation, were dropped because of their low loadings and their scores clustering at the highest value (Figure 3), which limited their ability to discriminate among children. Consequently, child behavior in the final model reflects prosocial behavior and compliance rather than problem behavior. In contrast, the discipline construct retained all six of its indicators, including self-regulation and independence, which align with the self-regulation dimension in the model of Istifadah et al. (2026).

Indicator elimination reduced the R^2 of child discipline from 0.368 to 0.315 (Table 4); thus, the final model is more valid but explains slightly less variance. The weak to approaching moderate R^2 values indicate that approximately 76.1% of the variance in behavior and 68.5% of the variance in discipline are explained by other factors, such as the teacher's role as a model (Sune et al., 2025), the consistency of classroom rules and parental involvement (Armin et al., 2024), and the fostering of discipline and morality by families and schools (Wantah & Wantah, 2023). The lower R^2 than those reported by Jazriyah (2023) and Lesiani et al. (2026) is reasonable because their predictors and outcomes differ, whereas this model has only one predictor. The association of the classroom environment with social interaction and comfort (X6 and X9) is consistent with Lisfa et al. (2026) and Safitri et al. (2026).

This study has several limitations. First, the data were cross-sectional and rated by a single type of rater (classroom teachers); hence, the results are associational rather than causal and may be influenced by teachers' subjective judgments, and the tendency toward high scores (Figure 3) also suggests possible rating bias. Second, the data came from a single institution with five classes, and children within the same class cannot be considered fully independent. Third, the sample size (n = 54) is small, although PLS-SEM can be used with small samples (Hair et al., 2022; Yudha & Noza, 2023). Fourth, the score distributions of several indicators were highly skewed toward the high categories (Figure 3), which may inflate the bootstrap standard errors (Hair et al., 2022). Therefore, these results cannot be generalized to other institutions.

CONCLUSION AND RECOMMENDATIONS

In the final model, the classroom environment was represented by socio-emotional indicators, namely, positive peer interaction, a warm and supportive classroom atmosphere, emotional security, and children's physical-emotional comfort, and it had a positive and significant

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effect on both child behavior (γ_1 = 0.489) and child discipline (γ_2 = 0.561) at RA Masyithoh Butuh; thus, the research hypotheses were supported. Its contribution was weak to approaching moderate (R^2 = 0.239 and 0.315), and other factors explained most of the variance in both child behavior and discipline. Because the initial model did not meet the convergent validity criterion, indicators were eliminated stepwise until the final model retained 13 of the 24 indicators with satisfactory validity and reliability. These findings are associational.

Teachers and RA administrators should maintain a warm, supportive, safe, and comfortable classroom atmosphere for children as part of classroom management. Future researchers are advised to (1) involve more than one institution and more children; (2) use more than one type of rater, such as teachers and parents; (3) refine the indicators of the physical and routine dimensions, as well as the negative behavior indicators that did not meet the thresholds; and (4) include additional variables, such as the role of teachers and parental involvement.

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