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# Classroom Management and Deep Learning: How Facility Design and Student Organization Shape Collaborative Behavior

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**Abstract:**

This study aims to analyse the contributions of these two dimensions to the development of students' collaborative behaviour and the achievement of deep learning. This study used a quantitative, cross-sectional survey design with 287 elementary school teachers. Data were collected using a 40-item Likert-scale questionnaire and analysed using Pearson's correlation, multiple linear regression, and Baron and Kenny's mediation analysis. The results showed that students' collaborative behaviour was the strongest predictor of deep learning ($\beta = 0.42$, $p < 0.001$) and acted as a significant mediator between the classroom management dimensions and learning outcomes. Environmental and instructional classroom management had a direct influence on deep learning, which was further strengthened through the mediation of collaborative behaviour. The novelty of this study lies in the development of an integrative mediation model that combines environmental and instructional classroom management with collaborative behaviour as the main mechanism for bridging classroom management practices and deep learning. The implications of this research emphasise the need for teachers to design classes that encourage collaboration through group work, directed discussions, and shared responsibility to support meaningful, in-depth learning.

**Keywords:** *Classroom Management, Collaborative Behavior, Deep Learning, Facility Design*

**Abstrak:**

Penelitian ini bertujuan untuk menganalisis kontribusi kedua dimensi tersebut terhadap pembentukan perilaku kolaboratif siswa dan pencapaian pembelajaran mendalam. Penelitian ini menggunakan pendekatan kuantitatif dengan desain survei cross-sectional terhadap 287 guru sekolah dasar. Data dikumpulkan melalui kuesioner skala Likert berjumlah 40 item dan dianalisis menggunakan korelasi Pearson, regresi linier berganda, serta analisis mediasi berdasarkan pendekatan Baron dan Kenny. Hasil penelitian menunjukkan bahwa perilaku kolaboratif siswa merupakan prediktor terkuat terhadap pembelajaran mendalam ($\beta = 0.42$, $p < 0.001$) serta berperan sebagai mediator signifikan antara dimensi manajemen kelas dan hasil belajar. Manajemen kelas berbasis lingkungan dan instruksional memiliki pengaruh langsung terhadap pembelajaran mendalam, yang menjadi lebih kuat melalui mediasi perilaku kolaboratif. Kebaruan penelitian ini terletak pada pengembangan model mediasi integratif yang menggabungkan manajemen kelas berbasis lingkungan dan instruksional dengan perilaku kolaboratif sebagai mekanisme utama dalam menjembatani praktik manajemen kelas dan pembelajaran mendalam. Implikasi penelitian ini menekankan perlunya guru merancang kelas yang mendorong kolaborasi melalui kerja kelompok, diskusi terarah, dan tanggung jawab bersama untuk mendukung pembelajaran mendalam yang bermakna.

**Kunci:** *Manajemen Kelas, Perilaku Kolaboratif, Pembelajaran Mendalam, Desain Fasilitas*

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## INTRODUCTION

The transformation of education in the 21st century has intensified the demand for learning approaches that promote higher-order cognitive competencies, including critical thinking, collaboration, creativity, and communication (Xia & Qi, 2023). However, despite these policy-level expectations, classroom practices in many contexts remain dominated by traditional management approaches that prioritize behavioural control, time regulation, and activity supervision rather than fostering meaningful learning processes. This misalignment has become a critical issue, as it limits the effectiveness of deep learning, which requires not only cognitive engagement but also supportive social and environmental conditions (Yan et al., 2022).

A major problem lies in how classroom management is still narrowly implemented. In many schools, particularly in developing regions, classroom environments are often characterised by rigid seating arrangements, limited spatial flexibility, and teacher-centred organisation of students (Zainuddin, 2023). Such conditions restrict opportunities for interaction, dialogue, and collaborative knowledge construction, which are essential for deep learning (Kutz et al., 2023). Although classroom management is widely acknowledged as a key element of the learning ecosystem, it is still largely treated as a reactive mechanism for controlling student behaviour rather than as a proactive strategy for designing learning environments that facilitate higher-order thinking (Donkin & Kynn, 2021).

Recent studies suggest that effective classroom management is not only about controlling students but also about how teachers intentionally design and orchestrate learning environments that enable social interaction, dialogue, and meaningful collaboration (Kim et al., 2022). However, empirical research that systematically integrates environmental aspects of classroom management (such as physical facility design) and instructional aspects (such as student organization strategies) remains limited (Reinius et al., 2021). In particular, little attention has been given to how these dimensions jointly influence collaborative behaviour as a mediating mechanism toward deep learning outcomes. This gap indicates the need for a more integrative and theoretically grounded approach to understanding classroom management in relation to 21st-century learning demands.

The main problem underlying this study lies in the gap between educational policies that encourage integrating collaborative skills into the curriculum and the reality of classroom management practices, which remain traditional. Many teachers have not yet fully utilized the potential of classroom design and grouping strategies as integral parts of collaborative pedagogy (Mentzer et al., 2023). This limits students' opportunities to build collective understanding, exchange perspectives, and develop social skills essential for deep learning (Eickholt et al., 2021).

Furthermore, various innovations in active learning—such as project-based, problem-based, and collaborative inquiry—are widely recognized for their potential to promote teamwork and higher-order thinking. However, their effectiveness depends heavily on how classroom management is enacted in practice. In many cases, these pedagogical approaches do not receive adequate support from classroom management structures, particularly in terms of spatial design and student organization (Wolf et al., 2022). As a result, collaborative activities are often implemented only at a surface level, without generating meaningful interaction or deep cognitive engagement. This indicates that classroom management is not merely a supporting component but a determining factor in the success of collaborative learning. Without well-designed environmental and instructional management, active learning interventions risk failing to achieve their intended deep learning outcomes due to structural and organisational constraints within the classroom.

The urgency of this research becomes even more apparent when linked to the educational situation in East Java, particularly in Sumenep Regency. Based on data from the 2022 East Java Education Profile released by the Provincial Education Office, the achievement of student collaborative competency indicators in several regencies/cities, including Sumenep, is relatively low. The Student Collaborative Participation Index, developed locally, indicates that only 38% of elementary schools in Sumenep regularly implement group-based learning (Hardiansyah et al., 2024). Additionally, the results of the learning quality evaluation conducted by the Sumenep Education Office (2022) indicate that 62% of classrooms at the elementary school level still use conventional designs (single-row layout), without flexibility for student grouping (Hardiansyah & Zainuddin, 2022).

Furthermore, the results of monitoring and evaluation conducted by the Ministry of Education, Culture, Research, and Technology's Research and Development Agency (2022) revealed that teachers in rural areas, such as Sumenep, face challenges in developing adaptive, collaboration-oriented classroom management strategies (Hardiansyah, 2022). Most teachers have not received training in learning space management as part of pedagogical strategies. In this context, research on the relationship between classroom management (particularly facility design and student organization) and collaborative behaviour is highly relevant and urgent, providing a scientific basis for policy-making and teacher capacity development.

This study was designed to address the following research questions: RQ1: How does classroom management—particularly through environmental dimensions (physical facility design) and instructional dimensions (student organization strategies)—influence the formation of student collaborative behaviour? RQ2: Which classroom management dimensions have the most significant impact on the dynamics of student collaboration? RQ3: To what extent does student collaborative behaviour mediate the relationship between classroom management and deep learning outcomes? In line with these questions, this study aims to empirically examine the role of environmental and instructional classroom

management in shaping student collaborative behaviour, to identify the most influential classroom management dimensions in fostering meaningful and collaborative learning interactions, and to provide both theoretical and practical foundations for developing classroom management frameworks that are aligned with the principles of 21st-century learning and deep learning outcomes.

Research on classroom management has long been a focus in educational literature. Research by Razzaq et al. (2023) introduced the principle of "withitness" as a key element of effective classroom management, which was further developed by McKay & Sridharan (2024) within the framework of the order and clarity of the teaching structure. However, this approach tends to emphasise behavioural control and discipline rather than integrating aspects of space design and social strategies into management. Meanwhile, studies on collaborative learning have shown significant benefits for improving learning motivation (Peng, Jin, et al., 2022), metacognitive skills (Zheng et al., 2023), and conceptual understanding (Yang et al., 2023). Research such as that conducted by Xie et al. (2023) also confirms that the structure of teacher-designed interactions, both physical and social, greatly influences meaningful collaboration.

In learning environment design, (Geitz et al., 2024)studies indicate that physical classroom conditions such as natural lighting, furniture flexibility, and wall colours can improve academic performance by up to 16%. On the other hand, Woolner & Cardellino 2022) highlight that social structures in the classroom, particularly student grouping, significantly influence the formation of collaborative norms and prosocial behaviour. However, the separation between classroom management literature, space design, and student collaboration remains highly evident. Most previous studies have explored these aspects partially, and few have integrated all three into a comprehensive conceptual framework. Therefore, an integrative approach is needed to bridge classroom management theory, collaborative pedagogy, and learning environment design.

This gap is further evident in studies conducted in developing regions, where structural and pedagogical limitations often constrain classroom management practices, yet remain underexplored in empirical research. Therefore, this study specifically addresses this gap by examining how environmental and instructional classroom management dimensions are linked to deep learning through the mediation of student collaborative behaviour. By doing so, the study contributes a more focused and empirically grounded model that connects classroom management practices with collaborative processes and learning outcomes.

Furthermore, this research provides empirical justification for re-examining how teachers are prepared to design classrooms, not merely as behaviour managers but as learning designers who intentionally structure environmental and instructional conditions to foster meaningful social interaction and higher-order thinking. The originality of this study lies in its integrative perspective, which combines environmental classroom management (facility design) and instructional classroom management (student organization strategies) within a mediated framework, positioning student collaborative behaviour as the key mechanism linking classroom management practices to deep learning outcomes.

## RESEARCH METHODS

This study employed a quantitative, cross-sectional survey design to examine relationships among classroom management dimensions, student collaborative behaviour, and deep learning outcomes. Specifically, the study was based on a mediation model in which environmental classroom management (classroom facility design) and instructional classroom management (student organisation strategies) function as independent variables, student collaborative behaviour acts as a mediating variable, and deep learning achievement serves as the dependent variable. This design enables the analysis of both direct and indirect relationships among variables without experimental manipulation.

The study population consisted of elementary school teachers actively teaching in Sumenep Regency, East Java, Indonesia. Sumenep Regency was selected as the research setting because it represents a mixed rural–semi-urban educational context in which 21st-century competency-based curricula are being implemented, yet challenges in classroom management and collaborative learning practices persist. The sample was determined using purposive sampling, targeting teachers who met specific criteria: (1) having at least two years of teaching experience, (2) having implemented group-based or collaborative learning activities, and (3) being willing to participate voluntarily. The sampling frame was based on a list of public and private elementary schools obtained from the local education authority, ensuring representation across different school types and geographical areas within the regency. The final sample comprised 287 teachers from multiple schools across urban and rural sub-districts. Although probability sampling is generally recommended for regression and mediation analysis, purposive sampling was considered appropriate in this study to ensure that respondents had relevant experience with collaborative classroom practices. The sample size (n = 287) exceeds the commonly recommended minimum threshold for multivariate analysis, thereby supporting the robustness of the statistical procedures employed.

Data were collected using a structured questionnaire comprising 40 items across four main constructs: environmental classroom management (classroom physical facility design), instructional classroom management (student organisation strategies), student collaborative behaviour, and deep learning. The instrument was developed by adapting and integrating established constructs from prior studies on classroom environment design, collaborative learning, and deep learning frameworks (e.g., Burgess et al., 2020; Woolner & Cardellino, 2022; Zheng et al., 2023) and was further contextualised for the primary education setting.

Each construct was measured using 10 items formulated as reflective indicators capturing teachers' practices and observations of student behaviour in classroom settings. Responses were recorded on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The collaborative behaviour items were adapted from prior research on student interaction and knowledge-sharing practices. At the same time, the deep learning construct was operationalised based on theoretical dimensions of higher-order thinking, conceptual understanding, and knowledge application. To ensure content validity, the instrument underwent

expert validation involving three specialists in educational management and learning sciences, who evaluated the relevance, clarity, and representativeness of each item. Revisions were made based on their feedback before the instrument was administered. This process ensured that the instrument adequately captured the theoretical dimensions of each construct and was appropriate for the research context.

**Table 1. Research Questionnaire Instrument**

| Aspect Measured | Indicators |
|---|---|
| Classroom Physical Design | The seating arrangement facilitates student interaction, the classroom is spacious enough for group activities, and the lighting supports concentration. |
| Student Organization Strategy | The teacher groups students for collaborative tasks, groups change periodically, each student has a role in the group. |
| Student Collaborative Behavior | Students help each other with assignments, Students discuss actively, Students respect their peers' opinions |
| Deep Learning Achievements | Students understand concepts deeply, Students apply material to real life, Students solve complex problems |

Before conducting the main analysis, the questionnaire's validity was assessed using Pearson's item-total correlations in statistical software. This procedure was conducted to ensure that each item consistently measured its intended construct and aligned with the overall scale. An item was considered valid if the item-total correlation coefficient exceeded 0.30. The results indicated that all items met this criterion, with correlation coefficients ranging from 0.37 to 0.81, confirming the instrument's adequacy for further analysis.

After the data were declared valid, data analysis was conducted through two main stages: descriptive and inferential. Descriptive analysis described teachers' perceptions of each research variable, including frequency, mean, and standard deviation. Furthermore, hypothesis testing was conducted using Pearson's correlation and multiple linear regression analyses to answer the research questions and test relationships among variables. This hypothesis testing was chosen because it is appropriate for identifying significant relationships between independent variables (physical facility design and student organisation strategies) and dependent variables (collaborative behaviour formation and deep learning). If an important relationship is found, conclusions can be drawn regarding the relative contribution of each aspect of classroom management to learning outcomes. Specifically, the analysis model uses a mediation approach to test whether collaborative behaviour mediates between classroom management and deep learning outcomes.

## RESULTS AND DISCUSSION

### Results

This study presents empirical findings based on teachers' perceptions and experiences in implementing classroom management to support collaborative and deep learning. The results are organised into four main findings to reflect the relationships among the variables examined clearly. Result 1: Classroom

management dimensions—environmental (facility design) and instructional (student organisation)—are positively perceived and widely implemented. Result 2: Student collaborative behaviour is strongly established in classroom practices. Result 3: Deep learning outcomes are present but relatively less consistent compared to collaborative behaviour. Result 4: Classroom management influences deep learning both directly and indirectly through student collaborative behaviour as a mediating mechanism.

**Table 2. Survey Results Summary**

| Aspect Measured | Mean | SD | % Strongly Disagree | % Disagree | % Neutral | % Agree | % Strongly Agree | Total |
|---|---|---|---|---|---|---|---|---|
| Classroom Physical Design | 4.12 | 0.56 | 1.2% | 3.5% | 12.6% | 57.8% | 24.9% | 287 |
| Student Organization Strategy | 4.05 | 0.61 | 0.7% | 4.9% | 13.9% | 56.2% | 24.3% | 287 |
| Student Collaborative Behavior | 4.18 | 0.49 | 0.5% | 2.1% | 9.4% | 60.8% | 27.2% | 287 |
| Deep Learning Achievement | 4.02 | 0.58 | 1.1% | 5.6% | 15.2% | 54.9% | 23.2% | 287 |

Table 2 presents the descriptive analysis from the combined survey, providing a comprehensive overview of teachers' perceptions regarding four core aspects of classroom management and student learning: classroom physical design, student organisation strategy, student collaborative behaviour, and deep learning achievement. Based on responses from 287 elementary school teachers in Sumenep, the findings offer valuable insights into how these variables manifest in actual teaching practices and the extent to which they support collaborative, deep learning environments.

Firstly, the Classroom Physical Design aspect scored a mean of 4.12 with a standard deviation of 0.56, indicating a relatively high and consistent level of agreement among teachers. This suggests that classroom settings in many schools have been arranged to support student interaction and collaborative learning. This perception is reinforced by 82.7% of teachers selected either Agree (57.8%) or Strongly Agree (24.9%), while only a marginal 4.7% expressed disagreement. The relatively small standard deviation indicates low variability in responses, further validating this perception's overall consistency.

The second aspect, Student Organisation Strategy, received a mean score of 4.05 and a standard deviation of 0.61, suggesting slightly more variability in teacher responses. Despite this, 80.5% of teachers agreed or strongly agreed that student grouping and task assignments were strategically implemented to foster collaboration. Only 5.6% disagreed, and 13.9% remained neutral. These results demonstrate that while organisational strategies are generally present, there may still be inconsistencies in their systematic implementation across classrooms, as well as variation in teacher competence and autonomy in managing group

dynamics.

The highest-rated aspect was Student Collaborative Behaviour, with a mean of 4.18 and the lowest standard deviation of 0.49. These figures indicate strong agreement and uniformity in respondents' perceptions. An overwhelming 88% of teachers observed that their students often engage in collaborative behaviour during learning activities, with 60.8% agreeing and 27.2% strongly agreeing. The low percentages of disagreement (2.6%) and neutrality (9.4%) indicate that a collaborative learning culture is not only present but also widely recognised as effective. This suggests that regardless of how classroom environments and organisational strategies are arranged, students are developing habits of cooperation, mutual assistance, and shared responsibility—hallmarks of 21st-century learning.

In contrast, the Deep Learning Achievement dimension had the lowest mean score of 4.02 and a standard deviation of 0.58. Although still relatively high, this score suggests that deep learning outcomes—such as conceptual understanding, critical thinking, and the ability to transfer knowledge to new contexts—are not as consistently perceived as having been achieved as the other aspects. While 78.1% of teachers reported agreement or strong agreement, 15.2% reported neutrality, and 6.7% expressed some disagreement. This gap might suggest that although collaborative behaviour is observable, it does not always translate directly into deep, conceptual learning, possibly due to limitations in instructional design, time constraints, or assessment practices that fail to capture higher-order thinking outcomes.

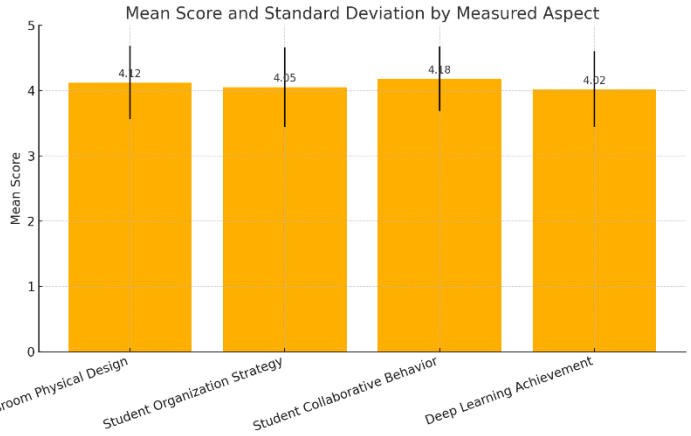


**Figure 1. Bar Chart of Mean Scores and Standard Deviations for Key Classroom Variables**

Figure 1 shows that the measured aspects have high average scores, all above four on a Likert scale of 1–5. However, the pattern of scores shows that the behavioural dimension—particularly Student Collaborative Behaviour—received the highest level of teacher appreciation, followed by the structural and strategic aspects. This provides an initial indication that changes in student social interaction are more visible and easier to observe than those in deep cognitive achievement. In this context, collaboration emerges not only as a result of good classroom management but also as a form of learning culture that students have begun to internalise.

Teachers have successfully organised space and student groups, but have not yet fully bridged this structure into a learning process that explores critical, reflective, and transformative thinking in students. Thus, these results do not merely capture the level of success in classroom management implementation, but also indicate that classroom management needs to be designed to regulate and guide. It is not enough to arrange seating and divide groups; teachers must also develop learning scenarios that challenge students to think, formulate, evaluate, and transfer ideas in depth. Thus, bar charts provide a quantitative picture and reveal a latent narrative: classroom management practices and student interaction patterns are not yet fully integrated with higher-order learning objectives. These findings can serve as a foundation for developing interventions that train teachers to link physical design and social strategies to deep cognitive outcomes—a synergy among spatial architecture, group dynamics, and pedagogical instruction.

**Table 3. Pearson Correlation Analysis**

| Independent Variable | Dependent Variable | Correlation Coefficient (r) | Significance (p-value) |
|---|---|---|---|
| Classroom Physical Design | Deep Learning Achievement | 0.42 | 0.0 |
| Student Organization Strategy | Deep Learning Achievement | 0.39 | 0.001 |
| Student Collaborative Behavior | Deep Learning Achievement | 0.61 | 0.0 |

Table 3 shows the correlation analysis results, which indicate that all independent variables correlate positively and significantly with deep learning achievement. Student Collaborative Behaviour showed the highest coefficient, with $r = 0.61$ ($p < 0.001$), indicating a strong and significant correlation with deep learning outcomes. Meanwhile, Classroom Physical Design and Student Organisation Strategy also showed moderate positive correlations, with $r = 0.42$ and $r = 0.39$, respectively, both highly significant ($p < 0.01$). These results indicate that the better classroom management teachers implement, the greater the tendency for students to achieve meaningful, reflective learning.

**Table 4. Multiple Linear Regression Analysis**

| Predictor | Unstandardized Coeff. (B) | Standardized Coeff. (Beta) | t-value | p-value |
|---|---|---|---|---|
| Classroom Physical Design | 0.21 | 0.19 | 3.42 | 0.001 |
| Student Organization Strategy | 0.18 | 0.16 | 2.98 | 0.003 |
| Student Collaborative Behavior | 0.36 | 0.42 | 5.86 | 0.0 |

Table 4 shows that a multiple regression analysis was conducted to examine the relative contribution of each predictor to deep learning (Table 4). The results

indicate that all three variables—Classroom Physical Design, Student Organisation Strategy, and Student Collaborative Behaviour—significantly predict deep learning outcomes. Among these, Student Collaborative Behaviour shows the strongest effect ($\beta = 0.42$, $B = 0.36$, $t = 5.86$, $p < 0.001$), followed by Classroom Physical Design ($\beta = 0.19$, $p < 0.01$) and Student Organisation Strategy ($\beta = 0.16$, $p < 0.01$). These findings suggest that while both environmental and instructional dimensions of classroom management contribute to learning outcomes, their relative influence differs in magnitude.

The results further indicate that student collaborative behaviour plays a more central role in explaining deep learning compared to structural classroom management factors. This implies that the effectiveness of classroom design and student organisation strategies is closely linked to their ability to facilitate meaningful student interaction. In this context, classroom management does not directly determine deep learning outcomes; rather, it operates through interactional processes that enable students to engage in shared understanding, reflection, and knowledge application.

**Table 5. Mediation Analysis (Baron & Kenny Steps)**

| Step | Coefficient (B) | Significance (p-value) | Description |
|---|---|---|---|
| IV → DV (Without mediator) | 0.41 | 0.000 | Direct relationship is significant |
| IV → Mediator | 0.44 | 0.000 | IV significantly affects the mediator |
| Mediator → DV (controlling IV) | 0.53 | 0.000 | Mediator significantly affects the DV |
| IV → DV (controlling mediator) | 0.19 | 0.022 | IV → DV relationship decreases (partial mediation) |

To determine whether Student Collaborative Behaviour mediates the relationship between classroom management and deep learning, Baron & Kenny's four-step approach was used. The results of the analysis show a significant direct relationship between Classroom Physical Design and Deep Learning Achievement ($B = 0.41$, $p < 0.001$). Classroom design significantly affects Student Collaborative Behaviour ($B = 0.44$, $p < 0.001$). Student Collaborative Behaviour also significantly affects Deep Learning Achievement ($B = 0.53$, $p < 0.001$), even when controlled for classroom design. The correlation between classroom design and learning decreased significantly when the mediator was included in the model ($B = 0.19$, $p = 0.022$), indicating partial mediation. Thus, these results provide empirical evidence that student collaboration acts as an intermediary mechanism that bridges the influence of classroom management on deep learning achievement.

## Discussion

The findings of this study demonstrate that classroom management, when examined through selected environmental and instructional dimensions, plays a significant role in supporting deep learning outcomes. In particular, student collaborative behaviour emerges as the strongest predictor, indicating that social

interaction is not merely a complementary aspect of learning but a central mechanism through which higher-order cognitive processes are developed. This suggests that deep learning is more likely to occur when students actively engage in dialogue, shared problem-solving, and collective meaning-making.

The results further indicate that both environmental classroom management (classroom facility design) and instructional classroom management (student organisation strategies) contribute to deep learning both directly and indirectly. However, their influence becomes substantially stronger when mediated by student collaborative behaviour. This finding highlights that classroom management is not limited to organising space or grouping students but functions as a design process that creates opportunities for interaction. Without meaningful interaction, classroom structures may support activity but fail to promote deeper cognitive engagement.

An important finding of this study is the gap between the high level of collaborative behaviour and the relatively lower level of deep learning achievement. This suggests that collaboration alone does not automatically lead to cognitive depth. In many cases, students may work together without engaging in critical thinking, reflection, or knowledge application. Therefore, collaboration must be intentionally structured through pedagogical strategies such as scaffolding, guided inquiry, and cognitively demanding tasks to ensure meaningful learning.

It is also important to acknowledge that classroom management is inherently multidimensional, encompassing behavioural, instructional, environmental, temporal, and engagement-related dimensions. However, this study deliberately focuses on environmental and instructional classroom management as the most relevant dimensions for understanding collaborative learning processes. This focused approach allows for a more precise analysis of how classroom management contributes to deep learning through interactional mechanisms, rather than attempting to generalise across all dimensions of the construct.

From a theoretical perspective, this study contributes to the classroom management literature by shifting its emphasis from a predominantly behaviour-oriented approach to a learning-centred framework. Classroom management is conceptualised not only as a mechanism for maintaining order but also as a process of designing learning environments and structuring student interaction to support cognitive engagement. By linking environmental and instructional classroom management with collaborative behaviour as a mediating mechanism, this study provides a more specific explanation of how classroom management influences learning outcomes.

From a practical perspective, the findings suggest that improving deep learning requires more than implementing collaborative activities at a surface level. Teachers need to intentionally design classroom environments and student organisation strategies that promote meaningful interaction and engagement. This includes arranging flexible learning spaces, organising students to encourage participation, and designing learning tasks that require critical thinking and knowledge application.

At the institutional level, the findings indicate that classroom management should be supported not only through behavioural policies but also through structural and instructional resources. Schools need to provide environments that allow flexibility in classroom layout and support collaborative learning practices. In addition, teacher professional development should emphasise the integration of classroom design, student organisation, and pedagogical strategies as interconnected components of effective teaching.

Overall, the findings of this study indicate that the effectiveness of classroom management in promoting deep learning depends on how selected and contextually relevant dimensions are intentionally designed to facilitate meaningful interaction and cognitive engagement. When classroom structures are aligned with collaborative processes, they create conditions that enable students to think critically, construct knowledge, and apply their understanding in meaningful ways.

## CONCLUSION

This study demonstrates that classroom management, when focused on environmental (facility design) and instructional (student organisation) dimensions, plays a significant role in supporting deep learning outcomes by mediating student collaborative behaviour. The most important finding of this research is that collaborative behaviour serves as the central mechanism that transforms classroom structures into meaningful learning processes. While classroom design and organisation provide necessary conditions, they do not automatically lead to deep learning unless they are intentionally designed to foster interaction, dialogue, and shared understanding. This highlights a key lesson: effective classroom management is not merely about organising space or controlling activities, but about designing interactional conditions that enable students to engage in higher-order thinking.

Scientifically, this study contributes to the literature by offering a more focused and integrative perspective on classroom management, positioning environmental and instructional dimensions within a mediated model that explains their relationship with deep learning outcomes. However, this study is limited by its cross-sectional design, reliance on teacher self-report data, and its focus on selected dimensions of classroom management within a specific regional context. These limitations suggest opportunities for future research to employ longitudinal or experimental designs, incorporate multiple data sources, and expand the scope of classroom management variables to provide a more comprehensive understanding of how classroom practices influence collaborative learning and cognitive development across diverse educational settings.

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