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Physical Learning Environment and its Effect on Learners' Academic Performance in Cabiao Nueva Ecija

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Abstract

The academic performance of students is significantly influenced by the quality of the physical learning environment. Elements such as color, lighting, seating arrangement, temperature, and acoustics affect students' focus, motivation, and overall learning experience. While international studies have explored these factors, local research in the Philippine context often focuses on isolated variables, leaving a gap in comprehensive understanding. This study addressed that gap by examining the relationship between multiple physical classroom environment factors and the academic performance of Grade 4 learners in selected public elementary schools in Cabiao, Nueva Ecija. A quantitative descriptive research design was employed, involving 196 Grade 4 pupils during the academic year 2024–2025. A validated survey questionnaire measured students' perceptions of five physical environmental factors, while their academic performance was based on general average grades. Data were analyzed using weighted mean and Pearson correlation analysis. Results showed that lighting received the highest rating (mean = 4.16), while color had the lowest (mean = 3.21). Students' academic performance was rated "Very Satisfactory" (mean = 3.81). Seating arrangement ($r = -0.185$, $p = 0.009$), acoustics ($r = -0.166$, $p = 0.020$), and temperature ($r = -0.144$, $p = 0.044$) showed significant relationships with academic performance, while color ($r = -0.029$, $p = 0.683$) and lighting ($r = 0.096$, $p = 0.180$) did not.

The results suggested that while lighting and color showed no direct impact, the seating arrangement, acoustics, and temperature significantly influenced academic performance. Schools are encouraged to prioritize improvements in these areas to support more effective learning environments.

Article Info

Keywords:
Polytechnic University of the Philippines Cabiao Campus, Bachelor of Elementary Education, Color, Lighting, Seating Arrangement, Acoustic, Temperature, Academic Performance

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INTRODUCTION

The physical learning environment plays a vital role in shaping students' academic performance. Previous research has consistently shown that elements such as lighting, color, seating arrangement, temperature, and acoustics can shape learners' focus, motivation, and overall learning experience. International studies highlight these environmental features as influential to student academic performance; however, local Philippine literature remains limited, particularly in exploring multiple physical factors within a single study. This study addresses that gap by exploring the relationship between five key physical learning environment factors (lighting, color, seating arrangement, temperature, and acoustics) and the academic performance of Grade 4 pupils in selected public elementary schools in Cabiao, Nueva Ecija. Through a localized, data-driven analysis, the study aims to provide practical insights that school administrators and teachers can use to create more effective learning environments.

LITERATURE REVIEW

The physical learning environment has been previously considered as a significant predictor of academic performance of students, which affects concentration, motivation, and cognition. In both local and foreign literature, five aspects of the environment have constantly been shown in the studies to have quantifiable impacts on the learning experiences; these are color, lighting, seating arrangement, acoustics, and temperature.

Color influence the emotional and cognitive reactions of the students in the classroom. Research suggests that blue, green, and yellow are the cool colours that bring about calmness, concentration, and satisfaction, and the bright colours cause enthusiasm and interest (Baper et al., 2021; Sayo, 2019). On the other hand, dark colors may demotivate and cause negative attitudes toward the learning environment. Chang et al. (2018) also focused on the impact of color on the boosting of memory, whereas Al-Ayash et al. (2015) associated certain colors with physiological events, including heart rate change, which could affect attentiveness and reading ability.

Natural and artificial lighting has direct impact on visual comfort, cognitive performance and behavior. Enough daylight exposure can help to improve mood and alertness (Lekan-Kehinde and Asojo, 2021), whereas artificial light in the appropriate intensity range (250-500 lux) can make people more focused and reading more productive (Singh et al., 2020). The lighting conditions that are too dark or too bright may result in eye strain and fatigue (McDonald, 2023). The findings of the international research indicate that the quality of the lighting has a strong relationship with academic performance, although the local results are variable; Dumlao and Fajardo (2019) found no significant correlation, and Calamba et al. (2019) indicated the opposite.

Classroom seating has effects on visibility, participation and social interaction. Clusters, U-shaped design, and pod make use of flexible layouts and help facilitate collaboration as well as accommodate the needs of different instructors (Norazman et al., 2019; Gao et al., 2022). Proximity to the teacher, especially sitting in front rows, has been associated with higher engagement and performance (Byiringiro & Mount Kenya University, 2023; Shernoff et al., 2017). Poorly planned seating, particularly in the rear of the classroom, tends to reduce academic outcomes.

Acoustics influence students' ability to process auditory information and maintain concentration. Excessive noise—whether from external sources like traffic or internal factors such as ventilation—can cause stress, fatigue, and reduced comprehension (Bhandari et al., 2023; Swargiary, 2015). Effective noise control strategies, such as soundproofing and structured break times, improve participation and overall learning quality (Lapp, 2020; Dulay et al., 2022).

Temperature is one of the crucial factors in ensuring comfort and cognitive ability. Optimal thermal conditions promote attentiveness, while extremes—especially heat—can lead to lethargy, irritability, and diminished performance (Wargocki et al., 2019; Cantero et al., 2016). Research by Ali (2017) emphasizes the need for climate-appropriate regulation of classroom temperatures, integrating ventilation and shading solutions to support sustained engagement.

METHODOLOGY

Our research methodology is designed to clearly present the systematic process used in investigating the relationship between the physical learning environment and the academic performance of Grade 4 pupils in Cabiao, Nueva Ecija. The approach is structured into the following key phases:

1. Objective Definition

- The goal of this methodology is to assess the relationship between the physical learning environment and the academic performance of Grade 4 pupils in Cabiao, Nueva Ecija. It addresses the research gap on how multiple classroom factors—color, lighting, seating arrangement, acoustics, and temperature— influence learners' academic performance within a single study in the local context. The methodology highlights a quantitative-descriptive research design, the use of a validated questionnaire for data collection, and the application of statistical analysis to determine which physical environmental factors have significant effects on learners' academic performance.
- Measurable success is determined by establishing statistically significant relationships, through Pearson correlation analysis, between the physical learning environment factors—color, lighting, seating arrangement, acoustics, and temperature—and the academic performance of Grade 4 learners. Success is also indicated by the interpretation of weighted mean scores, which reflect the learners' overall level of agreement regarding the conduciveness of their classroom environment.

2. Scenario Development

Realistic use-case scenarios will be developed to reflect common challenges experienced by Grade 4 pupils in relation to their physical learning environment. These scenarios will address key factors identified in the study—color, lighting, seating arrangement, acoustics, and temperature—and demonstrate their impact on learners' focus and performance. For instance, a scenario may depict a classroom with dull or overly dark wall colors, prompting a discussion on how brighter, more stimulating colors could improve mood and engagement. While another could illustrate the shift from a traditional row seating layout to collaborative group pods to enhance participation. Additional situations may include managing distractions from external noise to maintain attention and implementing ventilation solutions during periods of discomfort due to heat.

3. Setup and Configuration

A total of 196 Grade 4 students were randomly selected through the fishbowl technique to have an equal chance of selection. A researcher-made questionnaire validated by educational research experts was used in collecting data. The instrument consisted of two sections: demographic profile and assessing of the physical learning environment in color, lighting, seating accommodation, acoustics, and temperature. Response was measured on a five-point Likert scale (1-Strongly Disagree to 5-Strongly Agree) and reliability was tested using JAMOVI software with Cronbach alpha values between 0.701 and 0.733 with different factors indicating good internal consistency. The study was permitted by Dr. Ronaldo A. Pozon, Nueva Ecija Division Superintendent, Dr. Noemi C. Sagcal, District Supervisor and all the school principals, who were involved and gave the permission to carry out the study. Ethical clearance was obtained from the University Research Ethics Committee, and permission from parents and school guarantee the safeguarding of student privacy and rights.

4. Step-by-Step Execution

- The session will begin with a brief explanation of the study's context, objectives, and relevance—highlighting the need to understand how classroom factors such as color, lighting, seating arrangement, acoustics, and temperature influence the academic performance of Grade 4 pupils in Cabiao, Nueva Ecija.
- This will be followed by a presentation of key findings, showing how each physical environmental factor was measured using the validated questionnaire, the statistical results obtained through weighted mean and Pearson correlation, and which factors were found to have significant effects on performance.

5. Data Collection

The primary data were derived from the accomplished questionnaires. On the other hand, secondary data consisting the learners' final grades, were obtained through letters of permission and used as the basis for assessing academic performance.

6. Evaluation and Iteration

The data analysis revealed significant correlations between three physical learning environment factors—seating arrangement ($r = –0.185$, $p = 0.009$), acoustics ($r = –0.166$, $p = 0.020$), and temperature ($r = –0.144$, $p = 0.044$)—and learners' academic performance, indicating that less favorable conditions in these areas were associated with lower academic performance. In contrast, color ($r = –0.029$, $p = 0.683$) and lighting ($r = 0.096$, $p = 0.180$) showed no significant relationship with academic performance. The results highlight the importance of optimizing classroom layouts, managing noise, and maintaining comfortable thermal conditions to support learning, while suggesting that color and lighting may influence engagement through other indirect or contextual factors.

7. Conclusion and Next Steps

The key takeaways from the study are that seating arrangement, acoustics, and temperature have a significant impact on learners' academic performance, with poor conditions in these areas linked to lower academic performance. Improving classroom layouts to enhance visibility and interaction, reducing noise for better focus, and maintaining comfortable thermal conditions can directly support better learning outcomes. While color and lighting showed no significant direct effect, they may still play a role in influencing mood, attention, and engagement, and can be optimized to create a more stimulating learning environment. For follow-up actions, teachers should incorporate bright and pale colors, optimize seating arrangements, reduce classroom noise, and maintain comfortable temperatures using fans, windows, and curtains. School administrators should ensure proper lighting maintenance, support optimal seating layouts, improve acoustic quality, and provide adequate cooling and ventilation. Future researchers should further investigate seating, acoustics, and temperature, and explore the indirect effects of color and lighting on mood and engagement.

RESULTS & DISCUSSION

The study yielded significant findings on the relationship between the physical learning environment and learners' academic performance. Data analysis revealed that seating arrangement ($r = –0.185$, $p = 0.009$), acoustics ($r = –0.166$, $p = 0.020$), and temperature ($r = –0.144$, $p = 0.044$) had significant correlations with academic performance, indicating that less favorable conditions in these areas were linked to lower learner academic performance. Color ($r = -0.029$, $p = 0.683$) and lighting ($r = 0.096$, $p = 0.180$) on the other hand had no significant relationship with performance, but they might still have an impact on engagement through mood and comfort. These results can be compared to those of Gao et al. (2022) and Bhandari et al. (2023) that focus on the strategic seating and the quality of acoustics in enhancing focus and participation and studies by Ali (2017), which show that thermal comfort influences focus. The findings also contrast with certain local reports, including Calamba et al. (2019) who showed that lighting has a significant relationship with performance and therefore that contextual variables can mediate this outcome. Comprehensively, the results confirm the hypothesis that some physical environment variables, especially seating, acoustics, and temperature have a direct effect on academic performance. These findings demonstrate the necessity of specific measures in the design of classrooms, noise regulation, and thermal control, as well as the possible indirect impact of colors and lighting. The findings of the study have solid grounds on practical interventions and future research on how to improve learning environment to achieve improved educational outcomes.

CONCLUSION

To sum up, the paper has identified the various aspects of the physical learning environment that have a significant influence on academic performance, including seating arrangement, acoustics, and temperature, and has shown the importance of these aspects in facilitating the achievement of learners. The research demonstrates the usefulness of these factors in teaching results and is in line with the objective of developing

more effective and supportive classrooms by providing evidence of their role in influencing focus, participation, and comfort.

RECOMMENDATIONS

This study suggests that teachers and school administrators should focus on the enhancement of seating, acoustics and temperature because these elements have a major impact on academic performance. To provide better learning environments, ideal sitting arrangements, soundproofing, and efficient cooling systems should be adopted. Although color and lighting do not appear to directly affect academic performance, their positive impression among learners indicates its continued application in a meaningful way to keep the classroom environment interesting. It is recommended that future studies be done in this area, especially the psychological and behavioral impacts of color and lighting on learning results.

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