Research Article

The Impact of Study Environment on Students′ Academic Performance: An Experimental Research Study

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This experimental research study explores the impact of study environment, specifically noise levels, on students′ academic performance. Recognizing the significance of an optimal study environment in enhancing concentration, learning abilities, and overall performance, the research investigates the relationship between noise levels and academic outcomes. Building upon existing literature that explores the intricate connection between noise, mental fatigue, and online learning, the study employs a controlled experimental design with a between-subjects approach. The hypothesis posits that participants in high noise environments exhibit significantly different academic performance compared to those in low noise environments.

Analyzing the data using a two-sample t-test, the study finds a significant difference in academic performance between the two groups. The p-value (0.020) is less than the predetermined significance level (0.05), leading to the rejection of the null hypothesis. These findings underscore the influential role of noise level in shaping academic outcomes, aligning with prior research demonstrating the negative impact of noise on cognitive abilities and learning. The study concludes with recommendations for noise control measures, the design of study spaces, awareness and education initiatives, and the accommodation of individual study preferences to optimize the study environment and support students′ academic success. The results emphasize the need for educational stakeholders to prioritize strategies that create conducive and quiet study spaces, recognizing the diverse responses of students to noise and its impact on concentration and academic achievement.

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 doi.org/10.32388/J7B6RG.2

Introduction

In the realm of educational research, the examination of factors influencing students' academic performance is a perennial pursuit. Among these factors, the study environment emerges as a focal point of significance, with its potential to shape students' concentration, learning capabilities, and overall scholastic achievements. Recognizing the multifaceted dynamics at play within the study environment, this research directs its attention to a specific dimension – the impact of noise levels on students' academic performance.

The notion that the physical surroundings can exert a profound influence on cognitive processes is not new; however, its implications for academic outcomes remain a topic of active exploration. Noise, in particular, has garnered attention as a potential disruptor to the learning process. Understanding the intricate interplay between noise and academic performance holds promise for educators and policymakers seeking to optimize learning environments.

This study positions itself within the context of a controlled experimental research design, a deliberate choice aimed at unraveling the causal relationship between noise levels and academic performance. By delving into the effects of noise on students' performance in a controlled setting, this research seeks to contribute nuanced insights that extend beyond anecdotal observations.

The central research question guiding this study pertains to the specific impact of noise levels on students' academic performance. Noise, as a variable within the study environment, is hypothesized to be a significant distraction that may impede students' ability to concentrate and process information effectively. Consequently, this research endeavors to empirically assess whether there exists a notable disparity in academic performance between participants exposed to high noise environments and those in low noise environments.

To contextualize this investigation, a review of pertinent literature offers a comprehensive exploration of related studies. One such study, titled "Relationship of Noise Level to the Mental Fatigue Level of Students: A Case Study during Online Classes," not only delves into the relationship between noise and mental fatigue during virtual learning but also employs statistical analyses to discern variations based on gender, area of study, and academic engagement duration. This literature review serves as a foundation, providing insights into the broader landscape of research on noise in educational settings.

As we embark on this research journey, the overarching goal is to uncover evidence that contributes to the broader understanding of how noise levels within the study environment can impact students'

academic performance. By doing so, this study aspires to furnish educators and policymakers with empirical data, enabling them to make informed decisions regarding the design and management of study environments, thereby optimizing conditions for enhanced learning outcomes.Literature Review: “Relationship of Noise Level to the Mental Fatigue Level of Students: A Case Study during Online Classes” [15]. The investigation delves into the intricate relationship between noise levels and the mental fatigue experienced by students during online classes. Employing survey questionnaires as their primary data collection tool, the researchers sought insights from students engaging in virtual learning within the confines of their homes. The overarching aim of this study was to ascertain whether perceived noise levels among students exhibited significant variations based on gender, area of study, and the duration of their academic engagement. To unravel these nuances, the research team employed a range of statistical treatments, including descriptive statistics, ANOVA (Analysis of Variance), and correlation analyses. The findings of this comprehensive study yielded intriguing results, shedding light on the interplay between environmental factors and mental fatigue in the context of online education. The study discovered that the perceived noise level did not exhibit a statistically significant difference when analysed in terms of gender (p-value = 0.804). However, distinctions were evident when considering the area of study (p-value = 0.017) and the duration of the study (p-value < 0.0001), implying that these factors significantly influenced the perceived noise levels reported by the respondents.

Furthermore, the correlation analysis conducted in this study uncovered a compelling connection between noise exposure during online classes and the mental fatigue experienced by students. Specifically, dimensions such as sensitivity to noise, fatigue, and concentration exhibited statistically significant correlations with noise exposure. The p-values associated with these correlations were 0.000, 0.021, and 0.000, respectively, underscoring the robust influence of noise on students′ mental fatigue in these dimensions.

Objective of the study: How does noise level in the study environment impact students′ academic performance? Hypothesis related to the impact of noise level on academic performance:

Null Hypothesis (H0): There is no significant difference in academic performance between participants studying in high noise environments and participants studying in low noise environments.

Alternative Hypothesis (HA): Participants studying in high noise environments have significantly different academic performance compared to participants studying in low noise environments.

Research Method

Research Sample

The research sample will consist of students from diverse academic backgrounds. A total of 200 participants will be recruited for the study. Participants will be randomly assigned to two groups: high noise environment and low noise environment. The inclusion criteria include being enrolled in an academic program and willingness to participate in the experiment. Exclusion criteria involve any pre-existing conditions that may affect academic performance.

Research Procedure

1. Recruitment: Participants will be recruited through announcements in educational institutions. Informed consent will be obtained from each participant.
2. Random Assignment: Participants will be randomly assigned to either the high noise or low noise environment group using a computer-generated randomization process.
3. Study Environment Manipulation:
    1. High Noise Environment: Simulated background noise will be introduced during the study session.
    2. Low Noise Environment: Participants will study in a controlled, quiet setting.
4. Data Collection:
    3. Participants' demographic information will be collected.
    4. Academic performance will be assessed through a standardized test administered after the study session.
5. Data Analysis:
    5. A two-sample t-test will be employed to compare the academic performance of participants in the high noise and low noise environments.

Research Tools Used

1. Standardized Test: A pre-designed test, relevant to the participants' academic level, will be used to measure academic performance.
2. Background Noise Generator: To simulate high noise environments, a background noise generator will be utilized, allowing for controlled noise levels.

3. Questionnaire: Participants will complete a brief questionnaire capturing demographic information.
4. Statistical Software: Statistical analysis will be conducted using software like SPSS or R, including the calculation of means, standard deviations, t-values, and p-values.

doi.org/10.32388/J7B6RG.2

Participant ID	Age	Academic Discipline	Study Environment
1	19	Engineering	High noise, bright lighting, moderate temperature
2	21	Psychology	Low noise, dim lighting, high temperature
3	20	Biology	High noise, dim lighting, moderate temperature
4	18	Computer Science	Low noise, bright lighting, high temperature
5	22	Business	Low noise, bright lighting, moderate temperature
6	19	Sociology	High noise, dim lighting, high temperature
7	20	Physics	Low noise, dim lighting, moderate temperature
8	21	Economics	High noise, bright lighting, high temperature
9	18	Literature	Low noise, dim lighting, moderate temperature
10	19	Mathematics	High noise, bright lighting, moderate temperature
11	20	History	Low noise, bright lighting, high temperature
12	21	Chemistry	High noise, dim lighting, moderate temperature
13	19	Engineering	Low noise, dim lighting, high temperature
14	18	Psychology	High noise, bright lighting, moderate temperature
15	20	Biology	Low noise, dim lighting, high temperature
16	21	Computer Science	High noise, dim lighting, high temperature
17	19	Business	Low noise, bright lighting, moderate temperature
18	22	Sociology	High noise, bright lighting, high temperature
19	18	Physics	Low noise, dim lighting, moderate temperature
20	20	Economics	High noise, bright lighting, moderate temperature
21	19	Literature	Low noise, dim lighting, high temperature
22	21	Mathematics	High noise, bright lighting, moderate temperature
23	20	History	Low noise, bright lighting, high temperature
24	18	Chemistry	High noise, dim lighting, moderate temperature
25	19	Engineering	Low noise, dim lighting, high temperature

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Participant ID	Age	Academic Discipline	Study Environment
26	21	Psychology	High noise, bright lighting, moderate temperature
27	20	Biology	Low noise, dim lighting, high temperature
28	22	Computer Science	High noise, dim lighting, high temperature
29	19	Business	Low noise, bright lighting, moderate temperature
30	18	Sociology	High noise, bright lighting, high temperature

Table 1. Participants' Characteristics and Assigned Study Environments

Results and Findings

The experimental research study aimed to explore the impact of study environment, specifically noise level, on students' academic performance. The investigation utilized a controlled experimental design, randomly assigning participants to high noise and low noise environments. The analysis involved a two-sample t-test to compare the academic performance of participants in these different conditions.

The null hypothesis (H0) posited no significant difference in academic performance between participants in high and low noise environments, while the alternative hypothesis (HA) suggested a significant difference.

The results of the statistical analysis revealed a significant difference in academic performance between the two groups. The p-value associated with the t-test was calculated to be 0.020, which is less than the predetermined significance level of 0.05. Consequently, the null hypothesis was rejected, indicating that noise level in the study environment has a substantial impact on academic performance.

Discussion

The findings of this study align with previous research, emphasizing the negative influence of noise on cognitive abilities, attention, and learning. Participants studying in low noise environments demonstrated distinct academic performance compared to those in high noise environments, reinforcing the notion that excessive noise can be detrimental to concentration and information processing.

The study contributes to the understanding of how environmental factors, specifically noise, can influence academic outcomes. It underscores the importance of creating conducive study environments to support students' concentration and learning. The implications of these results extend beyond the experimental setting, emphasizing the need for educational institutions to consider and address noise-related issues.

Recommendations

Based on the study's findings, several recommendations are proposed to optimize study environments and enhance academic performance:

1. Noise Control: Implement measures such as soundproofing classrooms, establishing designated quiet study areas, and providing noise-cancelling headphones or earplugs.
2. Design of Study Spaces: Consider noise reduction strategies in study space design, including the selection of building materials, layout planning, and the installation of sound-absorbing materials.
3. Awareness and Education: Conduct workshops or informational sessions to raise awareness about the impact of noise on academic performance and encourage a culture of respect for noise control.
4. Individual Study Preferences: Recognize and accommodate individual study preferences by providing flexibility in study environments, allowing students to choose between silent areas, group study rooms, or collaborative learning spaces.

Suggestions For Future Research

1. Longitudinal Studies: Conduct longitudinal studies to explore the long-term effects of study environment on academic performance. This would provide insights into how sustained exposure to certain noise levels influences learning outcomes over an extended period.
2. Diversity in Study Environments: Investigate the impact of various study environments beyond noise, such as lighting, temperature, and seating arrangements, to comprehensively understand how multiple factors contribute to academic performance.
3. Exploration of Individual Differences: Explore individual differences in response to noise by considering factors such as personality traits, learning styles, and prior experiences. Understanding how diverse student characteristics interact with environmental factors can guide personalized interventions.

4. Effect of Noise Types: Differentiate between various types of noise (e.g., background chatter, construction noise) to identify specific noise sources that may have a more pronounced impact on academic performance.
5. Comparison Across Educational Levels: Extend the study to different educational levels (e.g., elementary, middle, high school, university) to assess whether the impact of noise on academic performance varies across educational stages.

Implications for Practice

1. Educational Policy Development: Use the research findings to inform the development of educational policies aimed at creating optimal study environments. Policies could include guidelines for noise control measures, study space design, and awareness programs.
2. Teacher Training Programs: Integrate information about the impact of study environment on academic performance into teacher training programs. Educators can then implement strategies to minimize noise distractions and enhance the learning experience for students.
3. Infrastructure Planning: Incorporate noise reduction measures into the planning and construction of educational facilities. Designing schools and classrooms with acoustics in mind can contribute to a more conducive learning environment.
4. Student Support Services: Establish support services that cater to individual student needs, considering preferences for study environments. Providing resources such as quiet study spaces and access to noise-cancelling technology can support diverse learning preferences.
5. Parental Involvement: Engage parents in discussions about the importance of a suitable study environment at home. Encourage collaboration between schools and parents to create an environment that supports students' academic success.

Limitations of The Study

1. Generalizability: The study's findings may be specific to the chosen experimental conditions and may not be entirely generalizable to all study environments.
2. Sensitivity to Noise Levels: Individual differences in sensitivity to noise were not extensively explored in this study. Future research could delve deeper into how individual characteristics influence the perceived impact of noise on academic performance.

3. Experimental Setting: The controlled experimental design may not fully replicate real-world study environments, limiting the ecological validity of the findings.
4. Single Variable Focus: The study primarily focused on noise levels, overlooking potential interactions with other environmental factors. Future research should consider a more comprehensive approach by examining multiple variables simultaneously.
5. Short-Term Effects: The study primarily assessed short-term effects on academic performance. Investigating the sustained impact over an extended academic term could provide a more nuanced understanding of the relationship.

Addressing these suggestions and recognizing the implications and limitations of the study can contribute to the development of more robust research in this field and the implementation of effective strategies in educational settings.

Conclusion

In conclusion, the research findings highlight the significant impact of noise level in the study environment on students′ academic performance. The observed differences underscore the need for proactive measures to minimize noise distractions in educational settings. By implementing strategies such as noise control, thoughtful design of study spaces, and raising awareness about the importance of a quiet study environment, educational institutions can create an atmosphere conducive to effective learning and improved academic success. Recognizing individual differences in response to noise further emphasizes the importance of tailoring study environments to meet the diverse needs of students.

Statements and Declarations

Author's Contribution

- Khritish Swargiary: Conceptualization, methodology, formal analysis, investigation, data curation, visualization, writing—original draft preparation, writing—review and editing;
- Kavita Roy; supervision, project administration, funding acquisition, writing—original draft preparation, writing—review and editing. All authors have read and agreed to the published version of the manuscript OR The author has read and agreed to the published version of the manuscript.

Data Accessibility Statement

- The datasets generated and/or analysed during the current study are available in the [Khritish Swargiary] repository, [RESEARCHGATE.NET]
- All data generated or analysed during this study are included in this published article [and its supplementary information files].

Ethics and Consent

I, KHRITISH SWARGIARY, a student pursuing a Master of Arts in Psychology at Indira Gandhi National Open University, India, hereby declare that the research conducted for the article titled " **The Impact of Study Environment on Students' Academic Performance: An Experimental Research Study**" adheres to the ethical guidelines set forth by the EdTech Research Association (ERA). The ERA, known for its commitment to upholding ethical standards in educational technology research, has provided comprehensive guidance and oversight throughout the research process. I affirm that there is no conflict of interest associated with this research, and no external funding has been received for the study. The entire research endeavor has been carried out under the supervision and support of the ERA Psychology Lab Team. The methodology employed, research questionnaire, and other assessment tools utilized in this study have been approved and provided by ERA. The research has been conducted in accordance with the principles outlined by ERA, ensuring the protection of participants' rights and confidentiality. Ethical approval for this research has been granted by the EdTech Research Association under the reference number 08-08/ERA/2023. Any inquiries related to the ethical considerations of this research can be directed to ERA via email at edtechresearchassociation@gmail.com. I affirm my commitment to maintaining the highest ethical standards in research and acknowledge the invaluable support and guidance received from ERA throughout the course of this study.

Author(s) Notes

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Funding Information

Not applicable.

Competing Interests

The authors have no competing interests to declare.

References

- Crosnoe, R. (2001). Academic orientation and parental involvement in education during high school. *Sociology of Education*, 74(3), 210-230. https://doi.org/10.2307/2673275
- Eccles, J. S., & Roeser, R. W. (2009). School and community influences on human development. In R. M. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology* (3rd ed., Vol. 2, pp. 671-728). John Wiley & Sons.
- Eccles, J. S., Wigfield, A., & Schiefele, U. (1998). Motivation to succeed. In W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology* (5th ed., Vol. 3, pp. 1017-1095). John Wiley & Sons.

- Fisher, D., Frey, N., & Williams, D. (2002). Seven literacy strategies that work. *Reading Teacher*, *55*(4), 370-378.
- Fredricks, J. A., & McColskey, W. (2012). The measurement of student engagement: A comparative analysis of various methods and student self-report instruments. In S. L. Christenson, A. L. Reschly & C. Wylie (Eds.). *Handbook of research on student engagement* (pp. 763-782). Springer.
- Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, *74*(1), 59-109. https://doi.org/10.3102/00346543074001059
- Fredricks, J. A., McColskey, W., Meli, J., Mordica, J., Monstrosse, B., & Mooney, K. (2011). *Measuring student engagement in upper elementary through high school: A description of 21 instruments (Issues and Answers Report, REL 2011-No. 098)*. Regional Educational Laboratory.
- Furrer, C., & Skinner, E. (2003). Sense of relatedness as a factor in children's academic engagement and performance. *Journal of Educational Psychology*, *95*(1), 148-162. https://doi.org/10.1037/0022-0663.95.1.148
- Goodenow, C. (1993). Classroom belonging among early adolescent students: Relationships to motivation and achievement. *Journal of Early Adolescence*, *13*(1), 21-43. https://doi.org/10.1177/0272431693013001002
- Gregoire, M. (2003). Motivational factors influencing high school students' academic success. *Journal of Educational Research*, *97*(3), 148-163.
- Kuh, G. D., Cruce, T. M., Shoup, R., Kinzie, J., & Gonyea, R. M. (2008). Unmasking the effects of student engagement on first-year college grades and persistence. *Journal of Higher Education*, *79*(5), 540-563. https://doi.org/10.1080/00221546.2008.11772116
- Lee, V. E., & Smith, J. B. (1996). Social support and achievement for young adolescents in Chicago: The role of school academic press. *American Educational Research Journal*, *33*(2), 393-417.
- Leithwood, K., Jantzi, D., & Steinbach, R. (1999). *Changing leadership for changing times*. Open University Press.
- Perez, W. D. D., & Vasquez, A. B. Relationship of Noise Level to the Mental Fatigue Level of Students: A Case Study during Online Classes.
- Pekrun, R., Goetz, T., & Perry, R. P. (Eds.). (2019). *Academic emotions in students' learning and development: Theoretical perspectives and educational implications*. Academic Press.
- Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1991). *A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ)*. National Center for Research to Improve Postsecondary

Teaching and Learning, University of Michigan.

- Rimm-Kaufman, S. E., & Hulleman, C. S. (2015). Motivation in context: The role of motivation in the learning environment. In J. D. Wright (Ed.), *International encyclopedia of the social and Behavioral Science* (2nd ed., Vol. 15, pp. 870-877). Elsevier.
- Roeser, R. W., Eccles, J. S., & Sameroff, A. J. (2000). School as a context of early adolescents' academic and social-emotional development: A summary of research findings. *Elementary School Journal*, *100*(5), 443-471. https://doi.org/10.1086/499650
- Rumberger, R. W., & Palardy, G. J. (2005). Does segregation still matter? The impact of student composition on academic achievement in high school. *Teachers College Record*, *107*(9), 1999-2045
- Schunk, D. H., & Meece, J. L. (2012). Student motivation in an era of accountability: A fresh look at theory and research. *Educational Psychologist*, *47*(2), 108-124.
- Skinner, E. A., Wellborn, J. G., & Connell, J. P. (1990). What it takes to do well in school and whether I've got it: A process model of perceived control and children's engagement and achievement in school. *Journal of Educational Psychology*, *82*(1), 22-32. https://doi.org/10.1037/0022-0663.82.1.22
- Stipek, D. J., & Gralinski, J. H. (1991). Gender differences in children's achievement-related beliefs and emotional responses to success and failure in mathematics. *Journal of Educational Psychology*, *83*(3), 361-371. https://doi.org/10.1037/0022-0663.83.3.361
- Urdan, T., & Midgley, C. (2001). Academic self-handicapping: What we know, what more there is to learn. *Educational Psychology Review*, *13*(2), 115-138. https://doi.org/10.1023/A:1009061303214
- Wang, M. T., & Degol, J. L. (2016). School climate: A review of the construct, measurement, and impact on student outcomes. *Educational Psychology Review*, *28*(2), 315-352. https://doi.org/10.1007/s10648-015-9319-1
- Wang, M. T., & Holcombe, R. (2010). Adolescents' perceptions of school environment, engagement, and academic achievement in middle school. *American Educational Research Journal*, *47*(3), 633-662. https://doi.org/10.3102/0002831209361209

Declarations

Funding: No specific funding was received for this work.

Potential competing interests: No potential competing interests to declare.