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Compare the Educational Environment and Prevalence of Myopia in Public and Private Schools

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ABSTRACT

Myopia is a major cause of worldwide avoidable blindness, and its prevalence is increasing rapidly. **Objectives:** To investigate the relationship between myopia and educational environmental characteristics in public and private sectors. **Methods:** A cross-sectional study was conducted from August to December 2024, implementing a stratified sampling technique. Two schools were chosen at random from each of the public and private school strata. From each grade level, students were then selected at random. Individuals with ocular problems or those who declined to participate were not included. 621 students between the ages of 8 and 15 took part. Ocular examination included refraction and visual acuity. A self-structured questionnaire was utilized to assess the home and school educational environment variables. SPSS version 26.0 was used for data analysis. **Results:** Among 621 students (mean age 13 ± 1.89 years), 46.53% were male and 53.46% were female. 387 students attend public schools, while 234 attend private. 33.8% myopia prevalence, with 10% having high, 33.33% having moderate and 56.66% having mild myopia. There were 109 myopes from private schools and 101 from public schools. 109 out of 234 students in private schools (46.58%) have myopia. A pleasant study area and the amount of time spent on homework are all factors linked to myopia in public and private school types. **Conclusions:** It was concluded that a notable difference was found in the public and private sectors' educational environments. More artificial lighting, fewer outside activities, and a stronger focus on digital learning resources like laptops and tablets are features associated with private schools.

INTRODUCTION

Refractive error, mainly myopia, is primarily the reason for around one-fifth of all blindness cases worldwide [1]. About 30% of people worldwide are affected by myopia, a serious and sometimes unrecognized public health issue that is defined as a spherical equivalent refraction of ≤ −0.50 diopters (D) [2]. It starts early in infancy, impairs vision and lasts the entirety of a person's life [3]. Myopia can have a significant socioeconomic impact, which varies depending on age, the severity and geographic location (e.g., urban versus rural settings). The prevalence of myopia is predicted to increase dramatically over the next few decades due to existing trends [4]. 50% of people worldwide are expected to develop myopia by 2050, with 10% having serious myopia [2]. High myopia is thought to be a disease caused by a complicated interaction between environmental and hereditary variables [5]. Studies have linked environmental factors, such as less outdoor exposure, overly near employment, and higher educational attainment, to changes in genetic risk [6-8]. Furthermore, there may be a connection between the development of myopia and iris colour [9]. The global burden of myopia-related vision impairment and blindness is predicted to increase significantly due to the strong correlation between myopia, particularly high myopia and sight-threatening consequences like retinal detachment, myopic maculopathy and glaucoma [10, 11]. Furthermore, a

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variety of factors, such as living environment [12], screen usage [13] and particular personality traits [14] have been connected to the prevalence of myopia. The relationship between myopia and education additionally attracted a great deal of interest. The evidence is currently limited and inconclusive, but some studies suggest that reducing the pressure to perform well in school may help lower the prevalence of myopia [15, 16]. Prior research has demonstrated a connection between myopia and level of education as well as educational level [17]. Additional aspects of the learning environment, however, have not gotten as much attention. So, it's very necessary to find successful school-based myopia prevention techniques.

Myopia is an increasingly prevalent public health issue among school-aged children, yet the influence of specific educational environmental factors remains insufficiently explored. While prior studies have linked myopia to general factors such as near work and reduced outdoor activity, there is a clear research gap in comparing how structured school environments particularly between public and private sectors, contribute to its prevalence. This study aims to assess the association between educational environment characteristics and myopia prevalence among students, with a comparative focus on public versus private schools to identify modifiable risk factors.

METHODS

The cross-sectional study was carried out in Faisalabad in 2024 between August and December. This study was carried out according to the Declaration of Helsinki's rules for biomedical research involving human subjects. A letter of ethical approval for this research (TUF/IRB/316/24) was issued by the University of Faisalabad, Ethical Institutional Review Board. The parents of the children provided their informed consent before they participated in the study. A stratified sampling procedure was used to guarantee the accurate representation of the children's sample. A sample size of 621 students was calculated with a 95% confidence interval, 80% power of the test and an expected percentage of prevalence of 33%. The population was separated into two strata, private and public, based on the kind of school. Two public and two private schools were selected at random from each stratum. After that, study participants were chosen at random from each grade level in each of these schools. People with ocular conditions such as strabismus, amblyopia, hyperopia, systemic diseases, ocular infections, and syndromes were excluded, as were those who chose not to participate. In each, 621 students between the ages of 8 and 15 were included in the study. An empirical method and a review of the literature were used to establish the sample size. Ocular examinations were conducted as follows: First, the children's visual acuity (VA) was assessed using the Snellen Chart. Pinhole visual acuity was also measured; individuals whose visual acuity decreased or remained unchanged were excluded from the experiment due to the possibility of pathology or amblyopia. Those whose pinhole visual acuity improved to 6/6 were considered to have uncorrected refractive error and underwent subjective refraction. If a child's visual acuity was less than 6/6 in either eye and their spherical equivalent refraction was greater than 0.5 diopter, they were classified as myopic. Conversely, children were classified as non-myopic if their visual acuity was 6/6 or better and their spherical equivalent refraction was 0.5 D or less. Demographic data, including age, gender and the prevalence of myopia and nonmyopia, was additionally gathered following the eye examination. A self-structured questionnaire was used for data collection. The type of school, the artificial and natural lighting in the classroom, outdoor activities and the usage of digital learning tools like computers and tablets are all aspects of the educational environment in both public and private schools. The participants' home study environment was investigated as well in the survey, including whether they have a specific area at home where they study or complete assignments. It also evaluated the comfort and ventilation of the study space at home, including the presence of a suitable table and chair. Additionally, the daily amount of time spent on non-educational digital devices. Statistical Package for the Social Sciences (SPSS) software version 26.0 was used to analyze the data. Frequency distribution and descriptive statistics were used for statistical analysis.

RESULTS

The demographic data of this study include age, gender and the distribution of myopic and non-myopic individuals. The mean age of the participants was 13 years with a standard deviation of 1.89. Of the 621 participants, 332 (53.46%) were female and 289 (46.53%) were male. In terms of refractive status, a total of 210 individuals were diagnosed with myopia, while 411 were non-myopic, indicating a 33.8% myopia prevalence in the study population. The degree of myopia was as follows: 21(10%) of the 210 myopic people had high myopia, 70 (33.33%) had moderate myopia, and 119 (56.66%) had mild myopia. Descriptive statistics and frequency distribution were applied to the demographic data (Figure 1).

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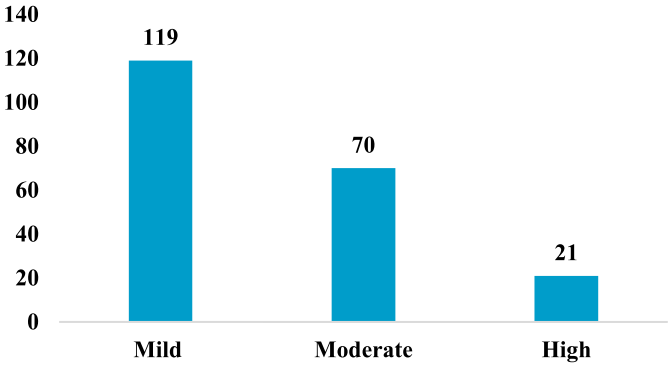

Figure 1: Frequency of Degree of Myopia

The educational environment in both public and private schools consists of components like the school type, classroom lighting (artificial and natural), outdoor activities and the use of digital learning aids like computers and tablets. Frequency followed by percentage calculations was used in a statistical analysis to evaluate these parameters. According to the participants' school type, 234 participants (37.68%) attend private schools, while 387 participants (62.31%) attend public schools (Figure 2).

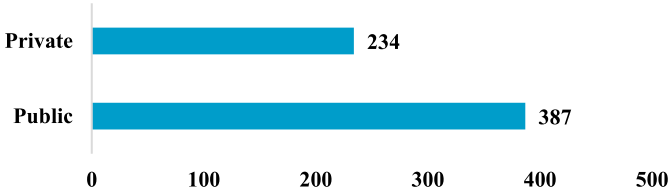

Figure 2: Frequency of School Type

Responses to the questionnaire about classroom lighting revealed significant variations between private and public schools. Regarding classrooms with adequate natural lighting, 231 public school respondents (59.61%) said "Yes," whereas 156 respondents (40.31%) said "No." Conversely, just 61 private school respondents (26.06%) selected "Yes," while 173 (73.94%) selected "No." Public schools revealed that 298 respondents (77.01%) lacked adequate artificial illumination, whereas 89 respondents (22.9%) had enough lighting for reading and writing. However, 189 replies (80.76%) indicated appropriate artificial illumination, compared to just 45 responses (19.23%) suggesting insufficient lighting, indicating a higher percentage of favourable responses in private institutions. Based on these findings, it has been discovered that private schools typically employ artificial lighting more effectively, using LEDs, bulbs and other contemporary lighting options. Public schools, on the other hand, frequently feature bigger, airier classrooms with wider windows that bring in more natural light (Table 1).

Table 1: Frequency of Classroom Lighting (Artificial and Natural)

Lighting Conditions		Private Schools	Public Schools
Adequate Natural Lighting	Yes	61 (26.06%)	231 (59.61%)
	No	173 (73.94%)	156 (40.31%)
Adequate Artificial Illumination	Yes	189 (80.76%)	89 (22.9%)
	No	45 (19.23%)	298 (77.01%)

There is a notable difference between public and private schools, according to survey data about outdoor physical activities or breaks during school hours. 180 participants (3–4 times a week) and 119 participants (greater than 30 minutes every day) in public schools reported routinely participating in outdoor activities. Comparatively, 91 private school participants participate in outdoor activities three to four times a week, compared to just 34 who do so for more than 30 minutes each day. Furthermore, 39 participants from public schools and 41 from private schools reported no outdoor activities at all, whilst 49 participants from public schools and 68 participants from private schools reported engaging in outdoor activities less frequently than once per week. According to these findings, private schools tend to engage in fewer outdoor activities than public schools, which may be owing to a lack of open areas or a preference for more digitalized learning environments (Figure 3).

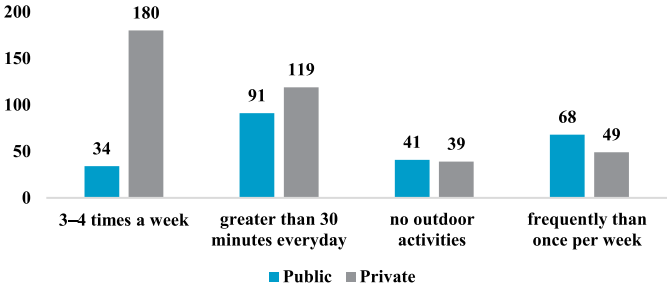

Figure 3: Frequency of Outdoor Physical Activities

Participants' daily usage of digital devices (such as computers and tablets) for learning differed between public and private institutions. 314 individuals (84.13%) from public institutions and 65 people (27.77%) from private institutions were among those who used digital devices for less than two hours a day. In contrast, 169 (72.22%) of participants who employed digital devices for more than two hours a day were from private institutions, while 73 (18.86%) were from public institutions. This suggests that private school learners are more likely than public school students to use digital devices for academic achievement (Table 2).

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Table 2: Frequency of Daily Usage of Digital Devices for Educational Purposes

Lighting Conditions		Private Schools	Public Schools
Usage of Digital Devices (Such as Computers and Tablets)	Less Than Two Hours a Day	65 (27.77%)	314 (84.13%)
	More Than Two Hours a Day	169 (72.22%)	73 (18.86%)

According to findings, students attending private schools had a greater number of myopic cases than students attending public schools. This difference may be attributed to several factors, including reduced outdoor activities, increased use of digital devices such as computers and tablets and greater exposure to artificial classroom lighting with limited natural light. Out of the 210 myopic individuals identified, 109 (51.90%) were from private schools, while 101 (48.09%) were from public schools. A total of 621 participants were screened in the study, with 234 attending private schools and 387 attending public schools. Notably, 109 out of the 234 private school students (46.58%) were found to be myopic. The possible influence of the home study environment on myopia has been evaluated. This addressed whether or not participants regularly study or do their schoolwork at home, if a dedicated study room was available and the study area's ergonomic comfort (e.g., suitable chair and table) and ventilation quality. The amount of time spent using digital devices for non-educational purposes each day was also noted because extended usage of screens and near work may accelerate the development of myopia. Participants were asked if they had a specific area at home for studying that was well-ventilated and comfortable, with a suitable table and chair. 161 students (41.60%) from public schools and 171 students (77.07%) from private schools responded that they have a dedicated study space at home. However, 63 students (26.92%) from private colleges and 226 students (58.39%) from public institutions reported that they lacked a pleasant, defined study area at home (Table 3).

Table 3: Frequency of Myopic Individuals and Dedicated Study Room at Home

Variables		Public	Private
Frequency of Myopic Individuals	Myopic	101 (48.09%)	109 (51.90%)
	Non-Myopic	286	125
Dedicated Study Room at Home	Yes	171 (77.07%)	161 (41.60%)
	No	226 (58.39%)	63 (26.92%)

The amount of time spent studying or completing homework at home each day was an additional inquiry introduced to the participants. Among students attending public schools, 131 (33.85%) reported studying for more than three hours a day, while 256 (66.14%) reported studying for less than three hours. Comparably, 161 students (68.80%) in private schools reported studying for fewer than three hours a day, while 73 students (31.19%) said they studied for more than three hours (Table 4).

Table 4: Amount of Time Spent Studying or Completing Homework at Home

Amount of Time Spent		Private	Public
Studying or Completing Homework at Home	>3 Hours/Day	73 (31.19%)	131 (33.85%)
	<3 Hours/Day	161 (68.80%)	256 (66.14%)

The duration of time that participants spent using digital devices at home for purposes other than studying was a question that was asked of respondents. Among children attending public schools, 267 (68.99%) reported using digital devices for more than four hours a day, while 123 (31.78%) reported using them for less than four hours. While 189 students (80.76%) reported using digital gadgets for more than four hours a day, 45 students (19.23%) in private universities reported using them for less than four hours. The findings show that teenagers generally spend a significant amount of time on screens, indicating a growing trend in the use of digital devices by those in this age group (Figure 4).

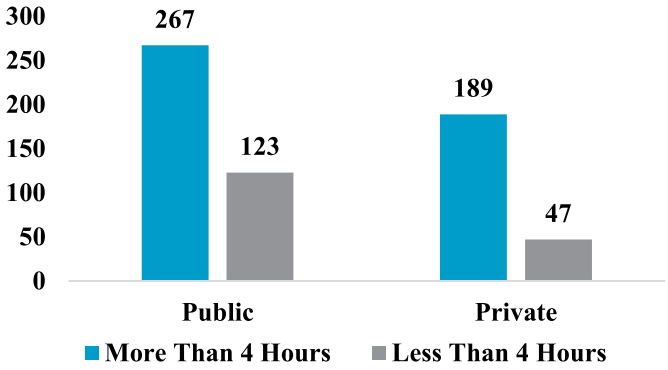

Figure 4: Frequency of Time Spent Using Digital Devices for Non-Educational Purposes

DISCUSSION

There were significant differences in the educational settings in the public and private sectors. Private schools tend to emphasize digital learning tools like computers and tablets, have more artificial lighting, and engage in fewer outside activities. On the other hand, public schools currently tend to provide more opportunities for outdoor play, rely less on technology, and use more natural light in their classrooms. Myopia has increased in prevalence as society has developed [18]. The development and progression of myopia are greatly impacted by outdoor activities, a lack of activity and excessive near work [19, 20]. By maximizing natural sunlight exposure, classroom design can significantly reduce myopia, according to a study by Wang *et al.*, [21]. Their study showed the advantages of architectural elements that increase daylighting, indicating that classrooms with sufficient

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illumination may lower the risk of myopia in school-age children. The study additionally determined that students in both private and public schools used digital devices for non-educational purposes for a considerable period. According to the study, a deeper comprehension of such behaviours may help us understand how myopia emerges. Reducing mobile phone use and overall screen time in schools is the main goal of current public health programs. Anti-addiction programs are a prime instance of a technology-based solution that supports these strategies. Healthcare providers have a crucial duty to evaluate children's screen-time patterns and offer evidence-based recommendations for treating and preventing myopia. Longitudinal studies that examine the combined effects of multiple environmental factors may help design more effective preventive strategies.

This study is limited by its cross-sectional design, which restricts causal inference, and reliance on self-reported questionnaire data that may introduce reporting bias. Additionally, the sample is confined to a single city, limiting generalizability. Future research should incorporate longitudinal designs, objective measures of environmental exposure (e.g., light intensity, screen time tracking), and larger multi-center samples. Interventional studies focusing on increasing outdoor activities and optimizing classroom lighting are also recommended to develop effective myopia prevention strategies

CONCLUSIONS

It was concluded that myopia is more likely to be caused by the private sector's educational environment than by the public sector's. This comprises fewer outdoor activities, artificial lighting in the classroom, and an excessive use of digital learning tools like computers and tablets. One of the contributing causes was the excessive amount of time spent daily using digital devices for non-educational purposes in both public and private settings, as prolonged screen time and close work may accelerate the development of myopia.

Authors' Contribution

Conceptualization: MJ
Methodology: MJ
Formal analysis: FA
Writing and Drafting: MJ, FR, SS, MMB, KMI
Review and Editing: MJ, FR, SS, MMB, KMI, FA

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

The authors declare no conflict of interest.

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