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Assessing the School Environment: A Study of Physical Condition and Science Teachers' Perception in Multan

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Abstract

The study evaluates the physical school environment of public secondary schools in the District Multan, Pakistan, against World Health Organization (WHO) guidelines by the perception of science teachers. The science teachers are chosen due to their qualifications in chemistry and biology, and their understanding of chemical and biological reaction of physical school environment. Recognizing by science teacher, that a school's physical condition is a critical determinant of student health, enrollment, and academic performance, this research assesses ten basic indicators, including waters' quality, sanitation services, good hygiene practices, waste disposal, Conditions of building, and safety. Employing a mixed-methods convergent parallel design, data were collected from 158 schools via questionnaires for school heads and science teachers, supplemented by direct diary observations. While indicators like School security and waste disposal were relatively better, none met the international standard. The analysis also uncovered stark disparities, with urban schools demonstrating significantly better conditions than rural schools, and notable variations across different tehsils. The study also revealed that science teachers as respondents played a vital role as a critically, scientifically and significantly in study keeping in view their science subject knowledge. The study concludes that despite some progress, the physical infrastructure of schools in Multan falls considerably short of WHO standards, potentially hindering educational outcomes. It recommends the formal adoption of WHO guidelines, conducting comprehensive facility surveys, and implementing targeted programs to address the identified gaps, with a specific focus on improving water safety and sanitation, particularly in rural and female schools.

Keywords: Physical Environment, Public Schools, WHO, Pakistan, Science teacher

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Introduction

Education is very important for people's social and economic growth. Nevertheless, enforced by the prevailing area environmental condition.(GOP, 2009b). School is a place of learning. An excellent school climate is a fundamental factor in student attraction and retention. Today's children are tomorrow's adults, and the provision of a healthier and safer environment is their right. The most important task in the world is to safeguard the children's environment (WHO, 2002). Safe & healthy schools' environment impact crucial influence for shaping the next generation's health and education(WHO et al., 2003). Physical Schools' Environment comprises both the internal and external environment.

The physical school environment is influenced by factors including the school building and its surrounding area, biological agents and chemical agents that cause harm to the health of students, and physical environmental conditions like noise, temperature, and light (Marxand Wooley, 1998).The school's environmental characteristics, such as thermal comfort, aesthetic, acoustic, lighting, indoor and outdoor air quality, the school's overall constructed environment, and sanitation facilities, all have a part in influencing the performance of people working in school , as well as the entire educational activities. (Higgins et al., 2005).

The maintenance of a healthy physical school environment ensures that the physical infrastructure for education (buildings, school sites, equipment, and transportation) is of enough quality, it encounters the lowest criteria, and is supportive of learning and teaching(Maine, 2002).As policies to national development, the programs are being incorporated in all the member countries of the UN at an alarming rate and action plans laid down regarding education. Studies have shown that environmental factors in schools are key causes of disease, low enrolment, low educational achievement, absent rate, and rate of high dropout (.Bundy, 2011).The essential need of education system is to realized and addressing the challenges connecting with health of school personnel in the World Education Forum, Dakar 2000.(UNESCO, 2000). International collaborative agencies such as WHO, UNESCO, UNICEF, and the World Bank collaborated to help develop and implement school health initiatives, including physical environments for healthy, safe and sound learning environment. The first step was to create the FRESH (Focusing Resources on Effective School Health) framework, which would serve as benchmark for the enhancement of schools' health projects as well as policies, as well as a mechanism for monitoring and evaluating policy implementation.

The physical school environment has an overall impact on the entire educational process. Schools in rural areas frequently lack water, sanitation, and hands' washing facilities, have extremely low in quality and quantity. (WHO, 2009). Provision of water supply and sanitation facilities in schools is directly related to MDGs in terms of reaching universal primary education goals (WHO 2009). A good physical schools' environment improves student numbers in school, learning process, and retention of student in school. UNESCO sponsored an initiative around the world, including Pakistan, called "Safe and Supportive Environment in Schools" to enhance physical environmental conditions (UNESCO, 2010). WHO et al. (2013) described six criteria of the physical school environment:

WHO et al. (2013)described six parameters of Physical School Environment: -

i) To provide, use, and maintain the latrines of a sufficient number according to the needs of children.
ii) To provide, use, and maintain the safe drinking water system for students and management
iii) To provide, use, and maintain the hand washing facilities, including water and soap.
iv) Good quality building constructed and renovated study areas like classrooms and other areas (e.g., playgrounds and athletic facilities).
v) Removal of garbage from school premises.
vi) To protect the students from dangers like road traffic, animals, insects, fire, etc.

The Pakistan education policy 1998 did not produce the desired results for quality education and remained deficient in achieving the international goals like MDGs, Education For All (EFA), and other global challenges. It demanded the formulation of a new national education policy to meet the objectives of international agreements signed by Pakistan. Some isolated initiatives for improvement of quality education and learning environment were taken by different departments, but minimum standards and their measurement mechanism remained missing. The "National Education Policy 2009" was notified to fulfill the emerging global challenges and commitments with international donors and development partners providing funding support to Pakistan in the education sector for quality education (GOP, 2009b). To address all of these weaknesses, the National Education Policy 2009 was developed with objective number 13 in mind, allowing Pakistan to meet all of its commitments to accomplish the EFA and MDG goals.

The Global Competitiveness Index (GCI) found that performance of Pakistan's health department and education department is low as compared to other Asian countries. (GOP, 2007b). Pakistan's education system is the most undeveloped and poor in Asia.(Economist Intelligence Unit, 2007). Facility provision within schools was done at low rate. Government Of Pakistan (2005) recorded that during 2005-2006 there was60.2% schools with low drinking water facility and increasing to 63.9% during 2007-2008, and during 2005-6, the boundary walls was 50.8% and in 2007-08, 60%. These areas have continued to improve regularly since 2000-01.(GOP, 2005). According to the Government of Pakistan (2009b), the infrastructure of rural schools has very bad conditions as well as extremely inappropriate. Approximately for every 40 percent of the schools lack boundary walls, 36 percent lack drinking water facilities, 39 percent lack sanitation, 61 percent lack electricity facilities, and 6 percent lack buildings. The toilet distribution and ratio is not proper. There are schools with a limited number of shade trees and only three shade trees serve the students. Facilities provision between schools of rural and urban area is very varied. The Schools of rural area are less equipped than the urban. The rural area school of 63% have drinking water accessbut this opportunity of in urban area school is 90% of urban schools. On the same note, 88 percent of urban schools have a sanitation facility with 56 percent of rural schools. (GOP, 2009b).

Students in poorer countries perform worse as compare to prosperous countries, because of inadequate and bad physical classroom environments (Mwamwenda & Mwamwenda, 1987). Schools of rural areas often lack water, sanitation, and hand washing facilities, or have severely inadequate quality and quantity (WHO, 2009). Pakistan is a developing country, and its schools lack indispensable needs (GOP, 2005, 2009b). The National Education Policy (2009) aimed to improve the school environment by working with Health, Environment, and Population authorities at the national, province, district, and municipal levels (GOP, 2009b). In the last decade, Pakistan initiated nationwide efforts to improve physical school environmental conditions, developing "Education Sector Reforms Programmes" for the supply of missing facilities such as shelter, boundary walls, toilets, and so on, to improve the "physical school environment" (GOP, 2013).

WHO (2003) reported that 40% of the total burden of diseases falls on children due to environmental hazards, due to intake of contaminated drinking water, inappropriate sanitation facilities, such as lack of hygienic latrines and handwashing facilities, and traffic dangers. The children are more prone to environmental diseases than adults and therefore need a healthy school environment. Bundy (2011) reported that

environmental factors in schools are main cause of diseases, low student admission with attendance, low educational activities result, school absenteeism, and increased early dropout rates(Bundy, 2011).The physical school environment has an impact on education; therefore, a supportive and safe school environment is an important factor in improving educational achievement(World Bank, 2012). Baafi (2020) reported that the students in high school who had a conducive physical environment performed better than those where the physical environment was not conducive, and he established that the provision of adequate facilities in school provides positive physical school environmental conditions, which are considered suitable for better learning and educational performance. He further recommended that evaluation of the school's physical environment should be carried out regularly to improve the deficiencies for better educational performance of the students. All of this research complement the World Health Organization's aims for health-promoting schools. This study, which evaluates the physical environment of public secondary schools in the Multan area using WHO guidelines, is consistent with the WHO framework for Health Promoting Schools, and it may serve as a foundation for replication in other major cities in Pakistan. The purpose of this study is to assess the current physical environmental conditions of public secondary schools of Multan in light of recommendations and benchmarks of WHO.

Literature Review

WHO et al.(2003) has demonstrated the importance of provision and maintenance of a healthy "physical school environment" to save the health of students and staff. The children are more prone to environmental health hazards in the world. It is, therefore, essential for planners, educational policy makers, educators, school management, and community members to be educated about the typical environmental health hazards that may exist in schools. Cash (1993)described that a healthy school's environment is a first step towards a better future. He further narrated that it is a physical indicator of the message to the public regarding the importance of education. "We shape our buildings; therefore, our buildings shape us"(ERIC, 1991).

Hathaway (1991) reported that children learn from their schools about social issues of the community, and have faith that environmentally healthy schools play a key role in making the students good citizens. Coners (1982)reported that the learning and teaching in schools will remain effective till the fulfillment of typical minimum standards like the size of the school building, lighting, acoustics, and temperature. Taylor & Gousie(1988) pointed out that the "physical

school environment" and "learning experience" are essential parts of each other. Coners (1982) explored that improperly designed "physical school environment' influences the occupants and is likely to cause anxiety to the students and staff of the school. It was concluded that the feature of school environmental conditions influences the result of the students activities at a significant level.

Several researchers have examined the effect of physical environmental conditions, including seating arrangements, furniture, density of students, noise, privacy, acoustics, climate, temperature, quality of air, proper ventilation system, playgrounds, vandalism, color and lighting, attendance, achievements, and well-being of the students. Temperature, thermal control, and quality of air are the most significant parameters for the performance of students(Earthman, 2017; Higgins, 2005).

The improvement in the school environmental conditions can boost and maintain the health of students(UNICEF, 2009). Promotion and provision of a conducive environment where students experience safety is an integral aspect of schools. "Safe and Protective Schools" refer to such environmental conditions that save the students physically, emotionally, and psychologically. In a safe and sound school environment, children are considered safe from physical harm and injury(UNICEF, 2006). Better physical conditions, mental health, and communal welfare are key factors to increase learning performance. Better health and diet are basic requisites for efficient learning. High-quality health and food increase enrolment, minimize repetition and absenteeism, increase educational achievements, and attract more poor and most underprivileged children to the schools(UNICEF, 2009).

The results of six countries were found in a positive trend for the development of a safe school environment, and there is much space for improvement in the policy framework of the countries to ensure a comprehensive compliance with the World Bank's school–health policy framework(World Bank, 2012). The research has significantly evidenced that the health-related issues such as chronic diseases and hunger are major factors in absenteeism, admission, educational activities , and school drop out in early classes(Bundy, 2011).

The schools can address the health-related issues of students and can improve the educational performance of school children(Bundy, 2011; Jukes et al., 2008).Water scarcity and poor sanitation can lead to illness in children. The absence of safe and separate sanitation facilities in schools for girls has been proven to be a factor in girls in school, and addressing this issue has improved the attendance rates. Both physical and Psychosocial school environment influence education, and subsequently, a supportive and safe school environment is an essential

component to improve educational performance(World Bank, 2012). Certain standards and assessment methods for environmental design for typical types of built environment have been established, like office buildings, residential buildings, and hospitals. Educational buildings like schools also have a specialized category of built environment. Researchers have diverted their attention towards the evaluation and assessment of school facilities, and it has become an area of research interest(Zepatou et al., 2016).

School is the place of learning and teaching where children and staff spend a reasonable time. (Higgins et al., 2005). The environmental factors in schools have gained importance, and a number of practices and initiatives have been taken on a global level for environmental assessment of school functioning (Tilbury, 2004). The application of new strategies and technologies has led to the establishment of sustainable schools and green schools(Gough, 2011). The main objectives of such practices are to enhance the water and energy efficiency, air quality, minimization of litter or waste, recycling, improving the school grounds greenery, lighting, and acoustics, and to use nontoxic materials in school buildings (Olson & Kellum, 2003). The school's physical facilities provide a comfortable atmosphere for students to achieve higher academic achievements and are considered essential. The inappropriate facilities in schools are contributing to poor learning. The majority of the schools from primary to secondary level are facing classroom shortage, inadequate buildings, sanitation, and drinking water facilities, and safe drinking water in Punjab, Pakistan (Saeed and Wain, 2011).

The physical facilities, including electricity, toilets, potable water, boundary wall, playgrounds, libraries, and medical facilities, influence the educational achievements of students (Saeed and Wain, 2011). The educational planners and policy makers should improve the school atmosphere and physical environment of the school to meet the expectations of students, teachers, and school staff for an ideal educational environment (Aghamolaei et al., 2014). The educational environment is associated with educational achievements and is an important indicator of students' and teachers' behaviors (Soemantri et al., 2010).The schools ‘environment affects the early childhood education and care, and have a strong relationship between academic student results and school environment(Sahin et al., 2011).

The PSE impact on the students' health and academic achievements (Jamal et al., 2013). Our school system is a type of built environment and has a direct influence on the academic achievements of students (Earthman, 2004). The school buildings influence the educational

performances and outcomes of students (Earthman, 2017).The assessment of the school environment gives chances to fix concerns and move toward a healthier school environment in order to safeguard the health of children and staff and improve educational achievement (Lunenburg, 2011). Students' educational achievement is strongly affected by their school's environment (Usaini et al., 2015). The school environment comprises the school's location, school facilities such as portable safe water and sanitation, and climate, all of which have an impact on kids' academic progress.

Well-planned school environmental conditions gear up well educational outcomes and facilitate the political, social, and economic development of the country. There is a significant relationship between the physical school facilities and the scores of academic achievement of students(Dahie et al., 2017). The bad environmental situations were found to be liable for the low educational activities results of secondary schools students, in addition to other factors (Baidoo-anu, 2018).

Research Methodology

The reason for choosing a science teacher as environmental observer in this article is because the science teacher has compatibility and understanding with his subject and with the school environment and having the ability to improve the environment. The improved environment can have a better effect on children's learning.

The study is mixed in nature, having qualitative, quantitative, and descriptive analyses. It is a research design wherein the school is the unit of analysis for the physical environment. The study is a Convergent Parallel Design in mixed method research, where quantitative and qualitative data are collected in a single study, and then the results are integrated or merged for the determination of the overall conclusion (Petrosyan, 2018). Qualitative data were collected using three research instruments designed purposely for this research according to the WHO guidelines to assess the physical school environment.

Science teacher were selected as respondent keeping in view of their scientific knowledge about chemistry and biology as well as to assess the situation scientifically. The responses were scored, and their arithmetic mean was used to calculate the position of the physical school environment at the regional level as defined by the World Health Organization (WHO, 2009; WHO et al., 2013).

The following ten core indicators have been established to assess the PSE according to World Health Organization guidelines (WHO, 2009; WHO et al., 2013). Each core indicator is an internationally accepted indicator associated with the physical school environment:

- ***Core indicator 1:*** *Water quality*
- ***Core indicator 2:*** *Water quantity*
- ***Core indicator 3:*** *Water availability and approach*
- ***Core indicator 4:*** *Good hygiene activities*
- ***Core indicator 5:*** *Toilets with hand washing availability*
- ***Core indicator 6****: Control of insects carrying diseases*
- ***Core indicator 7:*** *Cleanness and garbage disposal*
- ***Core indicator 8:*** *Conditions of building*
- ***Core indicator 9:*** *School security*
- ***Core indicator 10:****Helping classroom conditions*

Data for basic information of schools were included in the questionnaire for heads of schools, which contained 15 questions, including the name and type of school, geographical location (urban, rural, and tehsil), number of enrolled students, number of toilets and wash basins, etc. Sub-indicators of the 10 core indicators were the same for the three key informants (WHO et al., 2013).

Cronbach's alpha (α) was employed to calculate the coefficient of reliability of questionnaires and checklists.

Table 1
Cronbach's alpha

Variable Indicators	Head Teacher		Science Teacher		Researcher Observations	
	n	α	n	α	n	α
Indicator 1	6	0.590	6	0.598	6	0.787
Indicator 2	5	0.721	5	0.793	5	0.872
Indicator 3	4	0.804	4	0.804	4	0.882
Indicator4	13	0.549	13	0.723	13	0.888
Indicator5	13	0.824	13	0.906	13	0.939
Indicator6	8	0.720	8	0.703	8	0.886
Indicator 7	13	0.831	13	0.831	13	0.941
Indicator8	10	0.727	10	0.755	10	0.800
Indicator 9	8	0.548	8	0.648	8	0.670
Indicator 10	10	0.789	10	0.789	10	0.853
Overall	90	0.939	90	0.946	90	0.974

A total of 158 public secondary schools of Multan were taken as sample(Gay et al., 2009). Tehsils-wise division of sample schools is given in Table2.

Table 2
Summary of the Tehsil-Wise Schools

Tehsil	f	%age
Multan city	51	32.90
Shuja bad	32	19.61
Multan Saddar	49	31.64
Jalalpur Pirwala	26	15.83
Total	158	100

The questionnaire for school head was prepared on Google Forms and emailed to all heads of high schools and the hard copies were distributed to teachers personally in the district of Multan with the permission of the District Education Officer (Secondary Education) Multan. The researchers visited each school and recorded diary observations using by checklist. The data received from each key informant was tabulated. The response rate was 100%. For sub-indicator there were given three responses' options (WHO et al., 2013) as under:

i) No work
ii) Yes, it is ok up to 50% work
iii) Yes, it is ok, more than 50% work

The responses of key informants about sub-indicators, scored according to the WHO et al. (2013) criteria given in Table 3.

Table 3
WHO scoring criteria for responses to the physical school environment

No work	Up to 50% work	More than 50% work
0 mark	1 mark	2 marks

Source: WHO et al. (2013)

All the responses of sub-indicators were scored according to Table 3 as prescribed in the WHO guidelines. The arithmetic means of scores of sub-indicators were computed for the scoring of each core indicator. The arithmetic means of scores of 10 core indicators exhibited the score of each school for its physical school environment. The arithmetic averages of scores for each core indicator in sample schools represented the core indicator's score at the district level. The arithmetic mean of 10 core indicators at the cluster or district level showed the score at the cluster or district level for the physical school environment, which were defined according to the WHO FRESH pillar policy development domain table 4 (WHO et al., 2013).

Table 4
Whos' FRESH criteria (P) for Indicator Development

not. Established	between emerging	emerging	between emerging-established	Established	WHO required score
p=0	0<P<1	p=1	1< p<2	p=2	p≥1.5

Source: WHO et al. (2013)

The mean scores of ten core indicators of all the schools were calculated according to given guidelines (WHO et al., 2013).The statistical analysis of the scores of core indicators was computed by following the procedure. First, the Calculation of the mean/average and standard deviation. Second, the Calculation of the Pearson coefficient of correlation was computed to find the relationship between 10 core indicators of three research tools. Then, t- t-test was applied for testing of equality between two groups. At the end, one-way ANOVA was used for descriptive analysis and testing of equality of means between more than two groups.

Results

Status of Core Indicators

The status of scores of all indicators of Physical SE based on mean marks of results at the district level is described according to WHO guidelines and is given in Table5.

Table 5
Status of Core Indicators of Physical School Environment

Indicators	scores	Status accordance of WHOs' guidelines
Indicator 1	0.55	Between Emerging
Indicator 2	1.14	Between Emerging & Established
Indicator 3	0.95	Between Emerging
Indicator 4	0.83	Between Emerging
Indicator 5	1.01	Between Emerging & Established
Indicator 6	1.04	Between Emerging & Established
Indicator 7	1.20	Between Emerging & Established
Indicator 8	1.11	Between Emerging & Established
Indicator 9	1.33	Between Emerging & Established
Indicator 10	0.95	Between emerging
District total marks	1.01	Between emerging-established
WHOs' required score	1.5	

Table 5 shows that the core indicators for water (quality, facilities and access), good hygiene activities, and helping classrooms' conditions in schools lie in the "between emerging" stage ($0 < 0.55 < 1$), ($0 < 0.95 < 1$), ($0 < 0.83 < 1$), and ($0 < 0.96 < 1$), respectively, and less than the WHOs' required marks. The indicators of quantity of water, toilets with hand washing availability, vector-borne disease control, cleaning and garbage disposal, schools' building situation with security system are lie the "between emerging and established" stage ($1 < 1.14 < 2$) and are below the WHOs' required marks. Figure-1 depicts a comparison of the mean scores of core indicators at the district level. The findings predict the drinking water quality indicator with a least marks and also showing the slow progress the improvement of drinking water quality in schools, as compare to water quantity, with a marks of 1.13, is on a more solid foundation. School security ranks best, with a score of 1.32, indicating development. The marks for basic needs e.g water (facilities and access), hygiene condition, and helping classroom settings are below the 1.0, suggesting that the position is "between emerging". The ratings for ten core indicators are lower than the WHO's target score of 1.5. The district's score for the physical school environment (1.01) is lower than the WHO recommendation.

Pearson Coefficient of Correlation

Pearson's coefficient of correlation was utilized to examine the linear relationship between the main variables (core indicators) of three research tools. The Pearson coefficient of correlation matrix (PCM) showing the relationship between the results of main variables (core indicators) of three research tools, i.e., responses of school heads (H), science teachers (T), and diary observations (D), is given in Table6.

The results (table 6) indicate that most responses of ten indicators of three respondents have significant positive correlations with each other such as T_1-H_1 ($r = 0.206$), T_3-H_3 ($r = 0.200$), T_6-H_6 ($r = 0.390$), T_7-H_7 ($r = 0.322$), D_1-T_1 ($r = 0.299$), D_2-T_2 ($r = 0.302$), D_3-T_3 ($r = 0.275$) and D_5-T_5 ($r = 0.233$), D_6-T_6 ($r = 0.382$), D_7-T_7 ($r = 0.385$), D_{10}-T_{10} ($r = 0.214$), D_1-H_1 ($r = 0.433$), D_2-H_2 ($r = 0.795$), D_3-H_3 ($r = 0.930$), D_4-H_4 ($r = 0.628$), D_5-H_5 ($r = 0.889$), D_6-H_6 ($r = 0.698$), D_7-H_7 ($r = 0.703$), D_8-H_8 ($r = 0.704$), D_9-H_9 ($r = 0.588$), D_{10}-H_{10} ($r = 0.917$) at the level of 0.01, while T_4-H_4 ($r = 0.165$), T_5-H_5 ($r = 0.183$), T_{10}-H_{10} ($r = 0.171$) at the level of 0.05 exhibited similar behaviors indicating that same source is responsible for Physical SE. The values further revealed the responses of schools' heads, science teachers and diary observations have strong relationships with each other.

Table 6

Pearson Coefficient of Correlation Matrix between Responses of Core Indicators of Three Research Tools

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
H.1	.20**	.									.43**									
H.2		.10										.79**								
H.3			.20**										.93**							
H.4				.16*										.62**						
H.5					.18*															
H.6						.39**										.69**				
H.7							.32**										.70**			
H.8								.00										.704**		
H.9									.13										.588**	
H.10										.17*										.917**
T.1											.29**									
T.2												.30**								
T.3													.27**							
T.4														0.079						
T.5																				
T.6																.382**				
T.7																	.385**			
T.8																		0.126		
T.9																			0.036	
T.10																				.214**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 7

Pearson Coefficient of Correlation between Core Indicators within Schools' Heads Responses

	Water quality	Water quantity	Water availability and approach	Good hygiene activities	Toilets with hand washing availability	Control of insects carrying diseases	Cleanliness and garbage disposal	Conditions of building	School security	Helping classroom conditions
Water qual	1	0.519**	0.670**	0.657**	0.447**	0.585**	0.511**	0.299**	0.327**	.402**
Water quant		1	0.773**	0.358**	0.688**	0.691**	0.731**	0.559**	0.548**	0.591**
Water approachability			1	.477**	0.708**	0.714**	0.718**	0.510**	0.442**	0.556**
Hygiene prom practices				1	0.371**	0.552**	0.438**	0.188**	0.302**	0.350**
Toilets , hand washing					1	0.770**	0.789**	0.601**	0.530**	0.621**
Control overvector borne diseases						1	0.854**	0.597**	0.572**	0.636**
Cleaning ,waste disposal system							1	0.658**	0.540**	0.639**
Building situation								1	0.584**	0.689**
School security									1	0.577**
Helping classroom conditions										1

**. At 0.01 level, significant correlation, (2-tailed).

*. At 0.05 level significant correlation, (2-tailed).

The Pearson correlation coefficient matrix (PCM) showing the relationship between the results of core indicators within the responses of school' heads is given in Table7. The values of Table-7 shows that all the main indicators in the physical school environment have highly significant positive correlations with each other at the 0.01 level, exhibiting similar behaviors. This suggests that any improvement in one core indicator will lead to improvements in other core indicators.

Table 8

Pearson Coefficient of Correlation Between Core Indicators within Science Teachers' Responses

	Water quality	Water quantity	Water availability and approach	Good hygiene activities	Toilets with hand washing availability	Control of insects carrying diseases	Cleanliness and garbage disposal	Conditions of building	School security	Helping classroom conditions
Water qualt	1	0.50**	0.49**	0.40**	0.34**	0.39**	0.45**	0.17*	0.18*	0.24**
Water quant		1	0.68**	0.21**	0.55**	0.50**	0.51**	0.41**	0.34**	0.56**
Water approachability			1	0.40**	0.63**	0.48**	0.56**	0.40**	0.30**	0.53**
Hygiene prom practices				1	0.33**	0.29**	0.30**	0.09	0.27**	0.27**
Toilets , hand washing					1	0.52**	0.58**	0.48**	0.30**	0.60**
Control over vector borne diseases						1	0.62**	0.47**	0.30**	0.49**
Cleaning ,waste disposal system							1	0.56**	0.25**	0.52**
Building situation								1	0.35**	0.49**
School security									1	0.53**
Helping classroom conditions										1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The Pearson coefficient of correlation matrix (PCM) showing the relationship between the results of core indicators within the responses of science teachers is presented in Table8. The values of Table-8 predict that all the indicators in the physical school environment have highly significant positive correlations with each other at the 0.01 level, exhibiting similar behaviors. This suggests that any improvement in one core indicator will lead to improvements in other core indicators.

Table 9

Pearson Coefficient of Correlation Between Core Indicators within Diary Observations' Responses

	Water quality	Water quantity	Water availability and approach	Good hygiene activities	Toilets with hand washing availability	Control of insects carrying diseases	Cleanliness and garbage disposal	Conditions of building	School security	Helping classroom conditions
Water quality	1	0.40**	0.52**	0.30**	0.316**	0.37**	0.472**	0.17*	0.24**	0.29**
Water quantity		1	0.61**	0.28**	0.55**	0.50**	0.49**	0.435**	0.33**	0.54**
Water approachability			1	0.40**	0.58**	0.49**	0.560**	0.40**	0.30**	0.53**
Hygiene prom practices				1	0.45**	0.33**	0.44**	0.22**	0.23**	0.33**
Toilets , hand washing					1	0.56**	0.57**	0.48**	0.29**	0.59**
Control over vector borne diseases						1	0.61**	0.47**	0.27**	0.48**
Cleaning ,waste disposal system							1	0.55**	0.25**	0.52**
Building situation									0.34**	0.51**
School security									1	0.53**
Helping classroom conditions										1

**. At 0.01 level, significant correlation, (2-tailed).
*. At 0.05 level significant correlation, (2-tailed).

Pearson coefficient of correlation was used to determine the linear relationship between the main variables (core indicators) within diary observations' responses. The Pearson coefficient of correlation matrix (PCM) showing the relationship between the results of core indicators within the responses of diary observations is given in Table9. The values of Table-9 shows that all the indicators in the physical school environment have highly significant positive correlations with each other at the 0.01 level, exhibiting similar behaviors. This suggests that any

improvement in one core indicator will lead to improvements in other core indicators.

t-Test Results

Grouping By Boys's and Girl's Schools

Table 10

Descriptive Statistics of Mean Scores of Responses of Schools' Heads, Teachers and Diary Observations for Boys' and Girls' Schools

	Category of school	n	Mean	Std. Deviation	Std. Error Mean
School heads	Boys'	105	1.02	0.32	0.03
	Girls	53	0.93	0.32	0.04
Science teachers	Boys'	105	1.01	0.22	0.02
	Girls	53	0.98	0.21	0.03
Diary observations	Boys'	105	1.04	0.18	0.02
	Girls	53	0.99	0.16	0.02

The Descriptive statistics of mean scores of responses of heads, science teachers, and diary observations are given in Table10. The results (Table 10) indicate that the mean scores based on responses of heads, teachers, and diary observations for boys' schools are closest, having values 1.02, 1.01, and 1.04, respectively. The mean scores based on responses of heads, teachers, and diary observations for girls' school are closest, having values 0.93, 0.98, and 0.99, respectively.

Table 11

The t-Test for Testing of Equality of Means Between Responses of Schools' Heads, Science Teachers, And Diary Observations for Boys' and Girls' Schools

	t	df	p-value	Mean Difference
School heads	1.897	186	0.059	0.09396
Science teachers	0.757	186	0.45	0.02558
Diary observations	1.512	186	0.132	0.04104

The t-test was applied for testing the equality of mean scores of schools' heads, teachers, and diary observations for boys' and girls' schools, and is presented in Table11. The results (Table11) indicate that the p-value for heads, teachers, and diary observations is more than the

level of significance (0.05), which indicates that the opinions of heads, teachers, and diary observations for boys' and girls' schools are statistically significant which indicates that the physical SE of boys' and girls' schools are similar.

Grouping By Urban and Rural Schools

Table 12

Descriptive Statistics of Mean Scores of Responses of Schools' Heads, Teachers, And Diary Observations for Urban and Rural Schools

	Area	n	mean	Std. Dev	Std. error mean
Schools' heads	Urban	73	1.0549	0.32490	0.03463
	Rural	85	0.5327	0.30617	0.03262
Science teachers	Urban	73	1.0734	0.19661	0.02096
	Rural	85	0.9324	0.21919	0.02192
Diary observation	Urban	73	1.0826	0.16215	0.01729
	Rural	85	0.9688	0.17423	0.01742

The Descriptive statistics of mean scores of responses of heads, science teachers and diary observations are given in table 12. The results (table 12) indicate that the mean scores based on responses of heads, science teachers and diary observations for urban schools are closest having values 1.05, 1.07 and 1.08 respectively. The mean scores based on responses of heads, science teachers and diary observations for rural schools are similar having values 0.53, 0.93 and 0.96 respectively. The mean scores of urban area school are higher than those of rural area schools. It revealed that the physical SE of urban area schools is in good condition than those of rural area schools in the opinions of three key informants. Moreover, the results of mean score of science teacher's data is greater than Head teacher showing the capability to response of science teacher towards the school environment.

Table 13

The T-Test for Testing Equality of Means Between Responses of Schools' Heads, Science Teachers and Diary Observations for Urban and Rural Schools

	t	df	P-value	Mean Difference
Schools' heads	2.61	185	0.01	0.1222
Science Teachers	4.618	185	0.00	0.14104
Diary observations	4.619	185	0.00	0.11388

The t-test was applied for testing the equality of mean scores of schools' heads, teachers and diary observations for urban and rural schools and presented in table 13. The results (table 13) indicate that the p-value for heads, teachers and diary observations is less than the level of significance (0.05) which indicated that the opinions of heads, teachers and diary observations for urban and rural schools are statistically significant. The results revealed that in the opinions of three key informants, the average physical SE of urban area schools is in good condition than rural area schools.

The result of science teacher is again significant than head teacher result showing more competency of science teacher in assessing the physical environment.

Results of Analysis of Variance (ANOVA)

One-Way ANOVA for Tehsil-Wise Mean Score

Table 14

Descriptive Statistics of Mean Scores of Responses of Schools' Heads, Teachers and Diary Observations for Four Tehsils

		n	Mean	Std. Deviation	Minimum	Maximum
School heads	Multan City	52	1.04	0.30304	0.34	1.85
	Shuja Abad	31	0.92	0.28725	0.43	1.77
	Multan Sadar	50	0.91	0.33442	0.31	1.84
	JPPW	25	0.87	0.37502	0.3	1.74
	Total	158	0.98	0.32522	0.3	1.85
Science teachers	Multan City	52	1.11	0.20353	0.56	1.63
	Shuja Abad	31	0.96	0.14471	0.77	1.43
	Multan Sadar	50	1.97	0.19972	0.58	1.54
	JPPW	25	0.79	0.21621	0.53	1.2
	Total	158	0.99	0.21999	0.53	1.63
Diary observations	Multan City	52	1.11	0.1639	0.67	1.49
	Shuja Abad	31	0.96	0.13449	0.79	1.35
	Multan Sadar	50	1.81	0.16554	0.65	1.44
	JPPW	25	0.77	0.20394	0.51	1.2
	Total	158	1.02	0.17762	0.65	1.49

One-way ANOVA was applied for the descriptive statistics of mean scores of responses of heads, science teachers, and diary observations for four tehsils and is presented in Table14. The results (Table14) indicate

that the mean scores for Multan city are similar, having values 1.04, 1.11, and 1.10, respectively, in the opinions of three key informants. The mean scores for Shujabad are similar, having values 0.92, 0.96, and 0.97, respectively, from the opinions three key informants. The mean scores of Multan Saddar are 0.91, 0.97, and 1.81, respectively. The mean scores of JPPW are 0.7, 0.79, and 0.87 for heads teacher, science teachers, and researcher diary observations, respectively. It revealed that the physical school environment at the top is of the Multan city, and at the bottom level is of JPPW.

The data result of science teacher is significantly higher than the school head in each tehsil due to scientific knowledge and perceiving the situation scientifically.

Table 15

ANOVA For Testing Equality of Means Between Responses of Schools' Heads, Science Teachers, and Diary Observations for Four Tehsils

		Sum of Squares	df	Mean Square	F	p-value
School heads	Between Groups	0.710	3	0.237	2.283	0.081
	Within Groups	19.069	184	0.104		
	Total	19.779	187			
Science teachers	Between Groups	2.013	3	0.671	17.544	0.000
	Within Groups	7.037	184	0.038		
	Total	9.050	187			
Diary observation	Between Groups	1.104	3	0.368	14.125	0.000
	Within Groups	4.795	184	0.026		
	Total	5.900	187			

One-way ANOVA for testing the equality of the mean scores of four tehsils was applied, and the results are shown in Table15. We tested the opinions of heads, teachers, and dairy observations with respect to the schools located in Multan city, Shujabad, Multan Sadar, and JPPW. As the p-value for teachers (0.00) and dairy observations (0.00) are less than our level of significance 0.05, which indicates that the opinions of the science teachers and dairy observations for Multan city, Shujabad, Multan Saddar, and JPPW are statistically significant (different). For both science teacher and diary observations, the results of Multan city are closer to the WHO criteria. While the p-value of heads (0.081) for each of the tahsils is more than 0.05, which shows that the opinions of the heads of schools in four tahsils are statistically non-significant (similar). The results of the t-test indicate that the physical SE of Multan city is in good condition than that of other tehsils in the opinions of science

teachers and diary observations, which validated the results of descriptive analysis for four tehsils.

ANOVA for Mean Score of District Level Observations

Table 16

Descriptive Statistics of Mean Scores of Responses of Schools' Heads, Science Teachers, and Diary Observations at the District Level

	n	Mean	St Dev
School head	158	0.99	0.3252
Science teachers	158	1.02	0.1776
Diary observations	158	1.02	0.1776

One-way ANOVA was applied for the descriptive statistics of mean scores of responses of heads, science teachers, and diary observations at the district level, and is presented in Table16. The results (Table16) indicate that the mean scores based on responses of heads, teachers, and diary observations at the district level are similar (non-significant), having values 0.99, 102, and 1.02, respectively. It revealed that the opinions of three key informants yielded similar results about the physical SE at the district.

The above data also showing that Science teacher result is more non-significant than school head.

Table 17

ANOVA For Testing of Equality of Means Between Responses of Schools' Heads, Science Teachers, and Diary Observations at District Level

Source	DF	SS	MS	F	p-value
Factor	2	0.1045	0.0523	0.8400	0.4300
Error	561	34.7292	0.0619		
Total	563	34.8337			

One-way ANOVA for testing the equality of the mean scores of heads, teachers, and dairy observation was applied, and the results presented in Table17 indicate that the p-value (0.43) is more than our level of significance (0.05), which revealed that the overall opinions of the three key informants are statistically non-significant (similar). The result of the one-way ANOVA has validated the results of the descriptive analysis of three key informants.

Conclusion

The findings of this study lead to the conclusion that the physical environment of high schools in the district is in a transitional phase, having moved from the initial "emerging" stage to "between emerging and established." However, this progress remains below the WHO's desirable level. While all ten core indicators of a physical school environment are present to some degree, none meet the international standard. Particularly critical is the state of water quality, which is at the most preliminary stage and is the lowest-performing indicator. Other essential facilities, such as toilets, handwashing stations, and Helping classroom conditions, also fall significantly short. The analysis also reveals disparities, with urban schools generally faring better than rural schools, and notable variations exist across different tehsils.

A deeper look into specific facilities reveals severe deficiencies. The district faces a critical shortage of 3,234 toilets, with the situation in girls' schools being especially dire, as not even one meets the WHO criteria. Similarly, there is a deficit of 1,062 handwash basins, and soap for handwashing is absent in nearly half of the schools. Furthermore, most schools do not conduct any water quality analysis or treatment, such as chlorination, and the mandatory safe distance between water sources and toilets is largely not maintained. These conditions highlight a substantial gap between the existing infrastructure and the standards required for a healthy and conducive learning environment.

The analysis also concludes that science teacher have deep observation and critically review the thing scientifically. Keeping in view the knowledge of chemistry and biology they related it to the current scenario for healthy learning environment. School head results showed differently than science teacher for physical environment because heads observe the thing in managerial point of view while science teacher’s observation related to healthy learning environment. The research itself recorded the diary observation which is also close match to the science teacher result. The science teachers’ views were surprisingly different from School Head and closely matching with researcher views showed here dealing the environmentally scientifically.

To address these challenges, a multi-tiered approach is recommended. At the national and provincial levels, there is an urgent need to formally adopt and notify the WHO guidelines for the physical school environment as the official standard. This should be coupled with the creation of dedicated environment cells within education departments to oversee planning, implementation, and monitoring. Comprehensive surveys must be conducted to identify specific deficiencies in each

school, leading to targeted programs for providing missing facilities, particularly focusing on water treatment, toilet construction, and ensuring an adequate supply of handwashing amenities.

For effective implementation and sustainability, action is also required at the district and school level. This includes allocating specialized support staff, such as masons and plumbers, for clusters of schools to ensure timely maintenance. Community involvement through Parent Teacher Associations and School Management Committees should be strengthened to foster local ownership. Finally, training and informative materials must be provided to school heads and teachers to keep them updated on the goals and practices related to maintaining an optimal physical school environment. Through this coordinated effort, the schools can progress towards the established stage, ultimately enhancing student enrollment, retention, and educational performance.

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