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How Do Spatial Architectural Features in a School Courtyard Influence Students' Dwell Time and Social Clustering Patterns?

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Abstract: ***This study explores how different design features in a school courtyard affect where students gather and how long they stay. The research focused on three main features: shade, seating arrangements, and airflow. To collect data, surveys, interviews, observations, and spatial mapping were used. A total of 31 students from different grade levels participated in the study. The results showed that shade was the most important feature influencing student behaviour. Around 71% of students said that shade encouraged them to stay longer in the courtyard. Open spaces, good airflow, and spending time with friends were also important factors. On the other hand, heat, direct sunlight, noise, and crowding often caused students to leave sooner. The study also found that students preferred gathering in specific locations, especially near the benches below the bridge. The spatial map confirmed that students tended to cluster in certain areas rather than spread out across the entire courtyard. Overall, the findings show that simple architectural features can have a strong impact on how students use outdoor spaces. Improving shade, seating, and comfort could help create a courtyard that better supports social interaction, relaxation, and student wellbeing.***

Keywords: School courtyard; Spatial architecture; Student behaviour; Dwell time; Social interaction; Environmental comfort

1. Introduction

The physical environment in educational institutions such as schools plays a very important role in shaping student behavior and social interaction. A study has shown a positive relationship between the physical environment and student interaction, highlighting the need to create more conducive learning environments (*Abdullah et al.)*. In educational settings, spaces aren't just transitional areas but also important social environments where students communicate, engage, and collaborate. As students spend a significant amount of their school day outside formal learning classrooms, the physical characteristics of these spaces may influence how they are used and experienced.

Prior research has established a link between courtyards and student wellbeing, satisfaction, and social interaction. Since social interaction has an impact on mental health, welfare, and the entire educational experience, it is a crucial part of student life *(Abdullah et al.)*. According to the same research, specific courtyard design elements can influence how students use these spaces. Higher levels of social connection can be encouraged by factors such as accessibility, spatial quality, comfortable surroundings, and opportunities for gathering. Moreover, Abdullah found that courtyard design can influence social interaction by creating spaces that support more communication, collaboration, and informal gatherings among students.

While existing studies suggest that courtyard design affects student satisfaction and social engagement, most of the research focuses on user perception rather than examining actual observable behavioral patterns *(Salameh et al.; Abdullah et al.)*. Consequently, there is limited understanding of how specific architectural features influence where students choose to spend their time of the day and how they organise themselves in the courtyard.

This study explores how spatial architectural features in a school courtyard influence students' dwell time and social clustering patterns. More attention is given to the role of features such as shade, seating orientation, and airflow, as these directly affect environmental comfort and spatial experience. With the help of observations, surveys, interviews, and spatial mapping, the research aims to examine how these architectural elements shape student behavior within a school courtyard setting.

2. Objectives

1) To identify the spatial architectural features present within the selected school courtyard.
2) To examine patterns of student dwell time in different courtyard locations.
3) To analyze how students cluster socially within the courtyard space.
4) To investigate the influence of shade, seating orientation, and airflow on student behavior.
5) To evaluate how courtyard design may support social interaction and effective use of outdoor educational spaces.

3. Literature Review

Importance of school courtyards

Courtyards have a long history in educational architecture, serving as transitional zones between the structured interiors of classrooms and the less regulated outdoor environment. (*Salameh et al.)* argue that courtyards serve a dual purpose. They act as passive ventilation strategies that reduce dependence on mechanical cooling, as well as providing students with spaces for informal interaction during breaks. This dual role makes them unusual among architectural features; they are simultaneously thermal infrastructure and social infrastructure.

The relevance of outdoor school spaces has grown as research on restorative environments has accumulated. Attention Restoration Theory *(Kaplan and Kaplan)* holds that natural or semi-natural environments allow the directed attention used in academic tasks to recover, and that settings with complexity and an appropriate degree of enclosure are most effective in this regard. Courtyards, particularly those with vegetation and varied spatial zones, tend to satisfy these criteria better than open concrete yards.

(Ranpise) also applies a similar logic to existing school courtyards in India, finding that enclosed semi-outdoor spaces with natural light and greenery are consistently rated more restorative by students than purely paved alternatives.

Student satisfaction and social interaction

Student satisfaction with the physical environment has been linked to academic engagement. However the direction of causation is not always clear. (*Salameh et al.)* found that students at schools with well-designed courtyards reported higher satisfaction with their overall school experience, and found that this specifically linked to the availability of comfortable seating, and shade in defined gathering zones. (*Abdullah et al.)* extended this to higher education, showing that courtyard accessibility and spatial quality were the strongest predictors of the frequency of social interaction; more so than the size of the space itself.

The theoretical background here draws partly on *Proxemics (Hall)*, which describes how people regulate social distance based on the nature of their interaction and the physical environment around them. In casual peer interaction, students tend to occupy what Hall calls the personal or social distance range **(roughly 0.5 – 3.5 metres)**. Architectural features that create enclosure, tend to support interaction at these distances by providing a defined social boundary. Conversely, wide open spaces without spatial definition often produce dispersed or transit-only behaviour.

Environmental comfort mediates this relationship. Thermal discomfort, from direct sun exposure or inadequate airflow, has been shown to reduce dwell time independently of social motivation. In tropical and subtropical climates, particularly, shade is not simply a comfort amenity but a precondition for outdoor space use. Seating orientation matters for a related but distinct reason: seating arranged to face other seating encourages conversation, while seating oriented outward or in rows tends to produce parallel rather than social occupation of space *(Gehl)*.

The gap in existing research, as both (*Salameh et al.)* and (*Abdullah et al.)* acknowledge, is that most findings rest on self-reported satisfaction rather than observed behaviour. Whether students say they value a courtyard and actually spend time there and how they arrange themselves when they do, are different questions.

Student satisfaction has been seen as one of the most important factors influencing educational achievement. Furthermore, courtyards can improve students' levels of socialization, mental wellbeing, physical wellbeing, and happiness, making them important components of educational environments *(Salameh et al.; Ranpise)*.

Among these spaces, courtyards have become a significant part of a school and campus design. Courtyards have been used as a passive architectural strategy that improve natural ventilation while also providing a functional environment *(Salameh et al.)*. Recent studies also suggest that well designed courtyards can contribute positively to student clustering patterns and dwell time.

4. Methodology

This study used a mixed-methods approach, combining both quantitative and qualitative data collection methods. Quantitative data was collected through observations and surveys to identify patterns in student behaviour, while qualitative data was collected through interviews to understand students' opinions and preferences regarding the courtyard environment.

The study focused on how architectural features such as shade, seating orientation, and airflow influenced students' dwell time and clustering patterns within a school courtyard.

Observations were conducted during morning and lunch breaks over multiple school days. During each observation session, student locations, group sizes, and estimated dwell times were recorded and plotted on a spatial map. This helped identify commonly used gathering areas and compare student behaviour across different parts of the courtyard.

Study Site

The research was conducted in the school courtyard. The courtyard was selected because it is a commonly used outdoor space where students gather during breaks, allowing observations of natural behaviour in a real school environment.

For the purpose of the study, the courtyard was divided into different zones based on the presence of shade, seating arrangements, and airflow conditions. This allowed comparisons to be made between areas with different architectural characteristics.

Figure 1: Photo of a school courtyard

5. Data Analysis

Quantitative Analysis
Observation and survey data were organized into tables and graphs.
The data was used to:

- Calculate average dwell times in different courtyard zones
- Compare student numbers across shaded and unshaded areas
- Identify common group sizes
- Examine relationships between architectural features and courtyard usage
- Bar charts and frequency tables were used to present the results.

Qualitative Analysis
Interview responses were reviewed and grouped according to recurring themes. Responses relating to comfort, shade, seating, airflow, and social interaction were compared to identify common patterns in student opinions.

Spatial Mapping
A map of the courtyard was created to show where students most frequently gathered. Observation data was plotted onto the map to identify areas with high and low levels of use.

This spatial analysis helped visualize how student gathering patterns related to specific architectural features within the courtyard.

Ethical Considerations
Participation in surveys and interviews was voluntary. Students were informed about the purpose of the study, and responses were recorded anonymously. No personal information was collected, and all data was used only for research purposes.

6. Findings

A total of 31 students participated in the survey. Respondents represented multiple grade levels, with the largest group being Grade 11 (D1) students (41.9%), followed by Grade 9 (M4) students (22.6%), Grade 8 (M3) students (16.1%), and Grades 7 (M2) and 12 (D2) students (9.7% each).

Courtyard Usage
The survey showed that the courtyard is frequently used by students. A majority of respondents (61.3%) reported using the courtyard daily, while 29.0% used it a few times a week. Only 9.7% reported using it rarely. Students also tend to spend significant amounts of time in the courtyard. More than half of respondents (51.6%) stated that they usually stay in the courtyard for more than 20 minutes. Another 25.8% reported spending between 10 and 20 minutes in the space, while smaller percentages reported shorter stays.

Social Gathering Patterns
Most students reported spending time in the courtyard with others rather than alone. The largest group of respondents (41.9%) usually spent time with one or two friends, while 29.0% spent time in small groups and 22.6% spent time in large groups. Only a small percentage of students reported spending time alone.

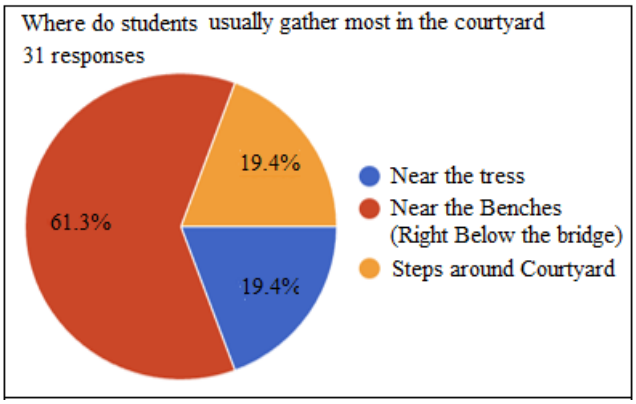
Students also showed clear preferences for particular gathering locations. When asked where students usually gather most, 61.3% selected the benches located below the bridge. In comparison, 19.4% selected the areas near the trees and 19.4% selected the steps around the courtyard.

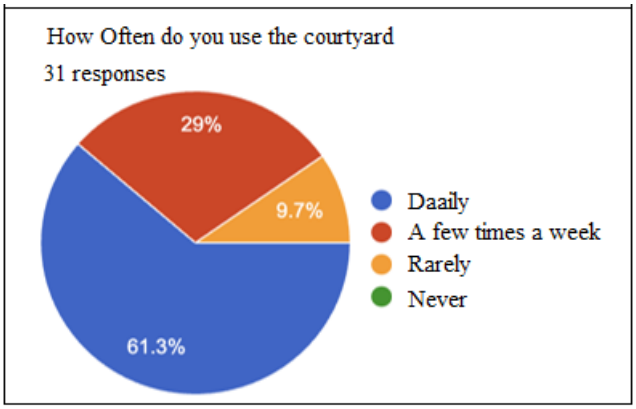
Factors That Encourage Longer Stays
Students identified several factors that encourage them to remain in the courtyard for longer periods. Shade was the most commonly selected factor, with 71.0% of respondents choosing it. Open space was selected by 67.7% of respondents, while 64.5% selected a quiet environment. The presence of friends was also important, with 61.3% of respondents identifying it as a factor that encourages them to stay longer. Good airflow was selected by 54.8% of students, while natural elements and plants were selected by 32.3%. Comfortable seating was selected by only 12.9% of respondents.

Factors That Cause Students to Leave
Students were also asked what usually causes them to leave the courtyard sooner. Crowding was the most commonly selected factor, with 77.4% of respondents identifying it as a reason for leaving. Heat and direct sunlight were selected by 71.0% of students, while noise was also selected by 71.0%. Lack of seating was selected by 51.6% of respondents. Poor ventilation (12.9%) and an uncomfortable layout (9.7%) were selected by comparatively fewer students.

Features That Encourage Social Interaction
When asked which courtyard feature most encourages social interaction, shade received the highest percentage of responses (38.7%). Open space was the second most selected feature (19.4%). Seating arrangements and greenery each received 16.1% of responses, while accessibility received the lowest percentage (9.7%).

Student Perceptions of the Courtyard
Responses to the rating-scale questions revealed mixed opinions about some courtyard features. Many students agreed that the courtyard felt spacious and open. Students also generally responded positively to statements regarding greenery, visual attractiveness, and ease of movement within the courtyard. However, responses regarding shaded areas and seating comfort were more varied. A noticeable number of students disagreed that the courtyard had enough shaded areas, while responses concerning seating comfort showed a large spread across different rating categories. The statement regarding seating arrangements encouraging conversation also produced mixed responses, suggesting that students had differing opinions about the effectiveness of the current seating layout.



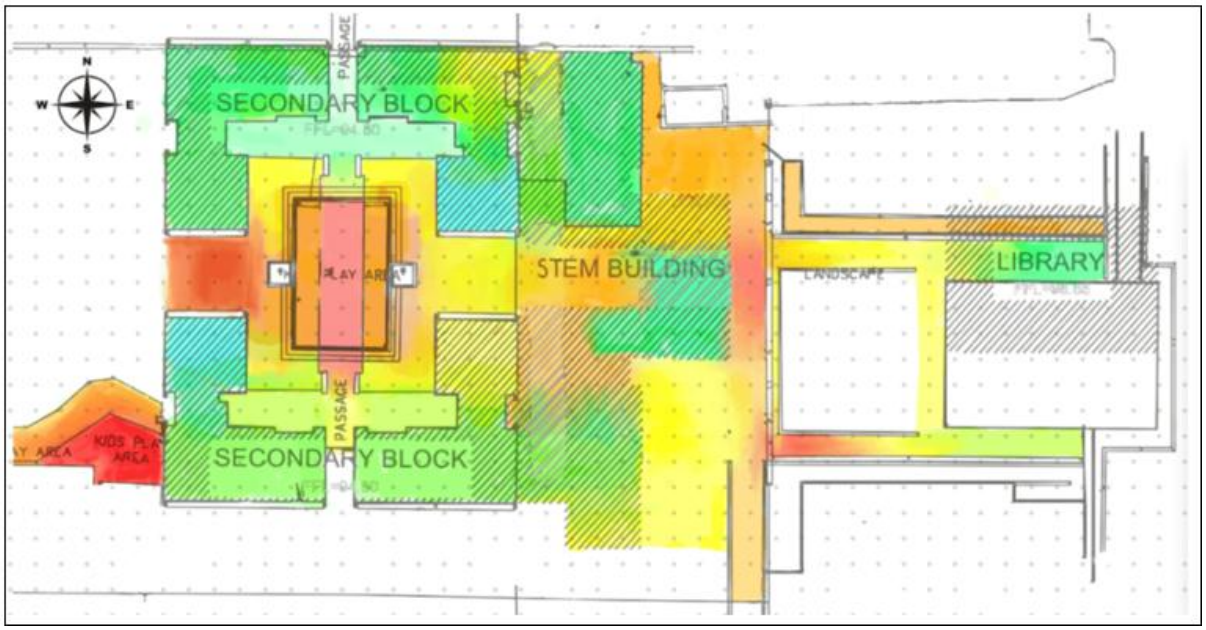


7. Interview Findings

Two short interviews were conducted with regular courtyard users to gain further insight into student preferences. The first student explained that they preferred spending time near the benches because this was where their friends usually gathered. They noted that shaded areas were more comfortable during warm weather and encouraged them to remain in the courtyard for longer periods. The second student stated that heat and noise often influenced their decision to leave the courtyard earlier than planned. They preferred locations with shade and natural airflow, describing these areas as more comfortable for relaxing and socializing.

Both interviews highlighted the importance of comfort and social interaction in shaping students' use of the courtyard. Shade, the presence of friends, and comfortable environmental conditions were repeatedly mentioned as factors that encouraged longer stays.

Spatial Map for Observation



The spatial map shows that students do not use all parts of the courtyard equally. The red areas represent the places where students gather the most. These locations are mainly around the central courtyard and seating areas, making them popular spots for socializing and spending time with friends. The orange and yellow areas show moderate use, while the green and blue areas are used less often. This pattern suggests that students prefer certain parts of the courtyard that are comfortable, easy to access, and suitable for group activities. The map supports the survey results, which showed that students tend to gather in specific locations rather than spreading out evenly across the courtyard.

Average Dwell Time

With 31 respondents:

The estimated average dwell time was calculated using the midpoint of each survey range. Based on these calculations, the average dwell time was approximately **18 minutes**.

Average dwell time:

(557.5)/31≈18 minutes

Based on the survey responses, the estimated average dwell time of students in the courtyard was approximately 18 minutes. More than half of the respondents (51.6%) reported spending over 20 minutes in the courtyard, suggesting that the space is used for extended periods rather than brief visits.

8. Analysis and Discussion

The survey results show that architectural features in the courtyard have a clear impact on how students use the space. Features such as shade, airflow, seating, and open space affect both how long students stay in the courtyard and where they choose to gather with friends.

Shade appeared to be the most important feature affecting dwell time. Around 71% of students said that shade makes them stay longer in the courtyard, while the same percentage said that heat and sunlight make them leave sooner. This suggests that students prefer comfortable areas that protect them from direct sunlight. The interview responses supported this finding, as both students mentioned that shaded areas were more pleasant and encouraged them to spend more time outside.

Open space was another important factor. About 68% of students reported that open areas encourage them to stay longer. Many students also agreed that the courtyard feels spacious and open. Open spaces allow students to move around easily, meet friends, and take part in different activities, making them more attractive places to spend time.

The results also show that the courtyard is mainly used as a social space. More than 90% of students said they spend time in the courtyard with friends or in groups rather than alone. In addition, 61.3% said that the presence of friends encourages them to stay longer. This suggests that social interaction is one of the main reasons students use the courtyard.

A clear pattern was seen in where students choose to gather. Most students (61.3%) said that students usually gather near the benches below the bridge. Far fewer students selected the areas near the trees or the steps around the courtyard. This suggests that certain parts of the courtyard are better suited for group activities. The benches provide seating and create a comfortable place for students to sit together and talk.

When students were asked which feature most encourages social interaction, shade received the highest number of responses (38.7%). This shows that comfort plays an important role in helping students interact with one another. Students are more likely to gather and spend time together in areas where they feel comfortable.

Airflow also influenced how students used the space. More than half of the respondents (54.8%) said that good airflow encourages them to stay longer. Although airflow was not as important as shade, it still contributed to making the courtyard more comfortable and enjoyable.

The survey also highlighted some weaknesses in the current courtyard design. Crowding was the most common reason students left the courtyard sooner, with 77.4% selecting this option. Heat, sunlight, and noise were also major reasons students chose to leave. In addition, more than half of the students said that a lack of seating reduced the amount of time they spent in the courtyard.

The interview findings supported the survey results. Both students said that comfort and social interaction were the main reasons they chose certain areas of the courtyard. They mentioned shade, airflow, and being close to friends as the most important factors influencing where they spent their time.

Overall, the results suggest that shade, airflow, and gathering spaces have a strong influence on student behaviour. Areas that are comfortable and allow students to interact with friends tend to attract more students and encourage longer stays. The findings show that even simple architectural features can affect how students use outdoor spaces and where social groups form within the courtyard.

9. Conclusion

This study examined how architectural features within a school courtyard influence student dwell time and social clustering patterns. The findings indicate that shade, airflow, and open spatial layouts play an important role in encouraging longer stays and supporting social interaction. Students showed a clear preference for shaded seating areas, particularly locations that facilitated group gathering. Environmental discomfort caused by heat, direct sunlight, noise, and crowding reduced courtyard use. The results demonstrate that relatively simple design improvements, including increased shade provision, enhanced seating, and improved comfort conditions, can positively influence how students use outdoor educational spaces. These findings may assist schools and designers in creating courtyards that better support student wellbeing and social engagement.

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