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Student Interactions and Self-directed Activities in School Libraries:

The design potentiality vs operational actuality

Ahmed Tarek Zaky Fouad;

School of Architecture and Environments, University of the West of England;

zaky.fouad@uwe.ac.uk

Kerstin Sailer;

Bartlett School of Architecture, UCL;

k.sailer@ucl.ac.uk

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ABSTRACT

School libraries contribute to student learning through accommodating the student self-directed activities (e.g. reading, studying, revising, drawing, etc) and interactions, all taking place during break-times. This research explores the design of school libraries through Space Syntax analysis of seven case studies, to define the library potentiality for learning practices relative to the library configuration (shallow or deep) in the school building; and relative to the library interior configuration shaped by furniture types and layouts. The research then presents the library operational actuality, i.e., the patterns of student interactions and self-directed activities, through fieldwork observations inside two (of the seven) schools. While the library configuration possibly shapes the potentiality of student encounters, interactions and activities, the actual operation diverts from this design, relative to changes in the student routes, supervision patterns and library regulations. Library A1 is a segregated relaxed quiet atmosphere which has less control from the librarian and discrete student interactions, while accommodating personalised experiences for regular visitors who target the library for focused intellectual activities, mainly independent reading. Contrarily, library B1 is a highly accessible vibrant activity-driven atmosphere with more diversified intellectual activities and less interactions, as influenced by the librarian who wants to maintain a disciplined environment, restricts interactions and controls which activities emerge, where students sit and their group formations. The research contributes to understanding the school spatial and managerial parameters which is beneficial to architects who design school buildings or school managements who run and set regulations in place.

KEYWORDS

Student Learning, Student Interactions, School Buildings, Library Design, Spatial Configuration.

1   INTRODUCTION

"Education is not preparation for life; education is life itself" (Dewey, 1916, p. 239). These words highlight the vitality of education for the younger generations. School buildings have an important role in this educational journey (Durán-Narucki, 2008) as the physical environment that hosts all the student learning activities (Daniel et al. 2019). Acknowledging learning as a social process beyond formal teaching events (Vygotsky, 1962), school libraries are rendered as vital hubs for student self-directed activities like intellectual reading, studying, revising, drawing, beside accommodating the student interactions. These activities are argued to be influenced by the configurational design of the building which potentially brings people together within more accessible spaces or taking them apart in more segregated spaces (Hillier 1996). This research focuses on investigating school libraries for their design potentiality and operational actuality, to be capable of promoting diverse student learning practices in the school day during break-times.

Acknowledging the importance of the school library, the main research question is: what is the role of the school library to afford the student learning practices of interactions and self-directed activities? This question unravels into two dimensions. The first explores the library design in terms of its configuration within the whole building and its interior configuration as shaped by furniture types and layouts; and the second focuses on the actual library operations shaped through managerial regulations and supervision. Both dimensions are hypothesised to influence the occurring student interactions and self-directed learning activities. Student interactions are recognised as verbal communications between students; Self-directed activities are learning practices initiated by students themselves (with autonomy) mostly during break-times, having less influence from their teachers (Hiemstra, 1994). The term 'afford' in the research question brings in the idea of affordances as possibilities for activities to happen in space which refer to the learning opportunities for students in the library.

2   THEORY

It is argued that there is an established relationship between the built environment and the social life of its inhabitants (Hillier 1996), as expressed in this study through the school building and its library space and the students. Student activities are possibly shaped by the school design (Kelly 1955), considering the potentiality of the spatial configuration to impact the patterns of copresence, movements and encounter, interactions and subsequent activities (Hiller and Hanson, 1984). Accordingly, studying the spatial configuration (in this context – for the school

building and its library) is the first dimension to explore the design potentiality as one aspect shaping learning practices in the school library, as stated in the research question.

Whilst recognising the influence of the spatial configuration, still, the building programme regulates the 'interfaces' between users, either through a strong programme with many social rules and control over events, or a weak programme with less rules, thus, allowing the spatial configuration to influence encounters, movements and interactions (Hillier & Penn, 1991). The building programme is manifested in the school (and its library) through the set of regulations that shape the types and distribution of student activities. The school building is expected to follow a strong programme. In that essence, if the research focuses on self-directed activities during break-times, i.e. activities initiated by students with minimal control from their teachers or management (Zimmerman, 2000), it is still acknowledged that there will be significant input from the management regulations and teacher supervision on activities (Fouad and Sailer, 2022). These are recognised as the second dimension of the research to formulate the actuality of library operations.

The focus on student interactions and self-directed activities is derived from the recognition of learning as a social process (Vygotsky, 1962) explained through constructivist learning ideas that the human mind constructs knowledge relative to perceptions and experience (Cooper, 1993). This could also manifest in the school building through learning communities of collaborative student interactions and exchange of knowledge to scaffold one another (Vygotsky, 1978), hence, enriching the student experiences (Schiro, 2013) relative to the aggregate of the whole group's knowledge rather than one individual (Vygotsky, 1978). Interactions are also strategic learning tools (Coles, 1995) that in many cases link to further forms of intellectual practices of reading and studying (Loyens et al., 2008).

The concept of affordances is the key linkage between the design potentiality and the actuality of activities taking place in the school building and its library, i.e. how spaces afford activities. Possible actions are performed by the users on the environment which affords those action (Gibson 1979). In the school library, the environment is shaped by the design, while the students are the user doing actions, i.e. their interactions and self-directed activities. The environment is portrayed as a 'rich landscape of affordances', such that the spatial design of the school building (and its library) exhibit possibilities or learning opportunities. Some of these possibilities could even trigger students to pursue certain activities, described as 'affordances that command to be acted upon' (Rietveld and Kiverstein, 2014).

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3   METHODS AND DATASETS

This research investigates the design potentiality of school libraries as shaped through the spatial configuration and furniture types and layouts, before moving on to explore the actuality of the library daily operations relative to managerial regulations and supervision, so that both dimensions shape the outcome patterns of student interactions and self-directed learning activities. For that scope, the study utilised mixed methods of quantitative and qualitative datasets which render a full picture of the design potentiality vs operational actuality of school libraries as explained in the next two sub-sections.

3.1   The Library Design Potentiality

The library design potentiality is studied through analysing the spatial configuration of seven secondary school buildings in the UK (A1, A2, B1, B2, B3, C1 and C2) each encompassing a library space, as designed by three different architects (A, B and C). The cases studies were chosen with the priority of increasing the diversity of school building typologies. The architects were also carefully selected for their high experience and expertise in school design. Figure 1 shows the seven school layouts of the floor-level where the library is, the specific location of the library in the plan, its entrance, its relation to the main circulation corridor and its degree of enclosure, i.e. how partitioned or open the space is relative to surrounding spaces.

Figure 1: The library as part of the school building in seven case studies.

The spatial configuration of the seven schools and their libraries is studied using the Space Syntax measure of Visual Mean Depth (VMD) – see figure 2. VMD calculates the average number of visual turns to reach one space from every other space in the school building, such that the higher number of turns (higher VMD) indicates a more segregated space – and lower VMD reflects a configurationally shallow space of ahigh accessibility. VMD is selected as a syntactic measure in this study (on buildings and internal spaces) because its numbers are relatable to a walking journey within a building (student walking in school) and allow for comparisons between different buildings (the seven case studies).

To run the Space Syntax analysis, this study has prepared the accessibility models (of the floor plans) for the seven case studies. Accessibility models are suitable in this context since they reflect the potential movement patterns and co-presence which relate more to understanding the library as a student destination for activities and understanding the student routes.
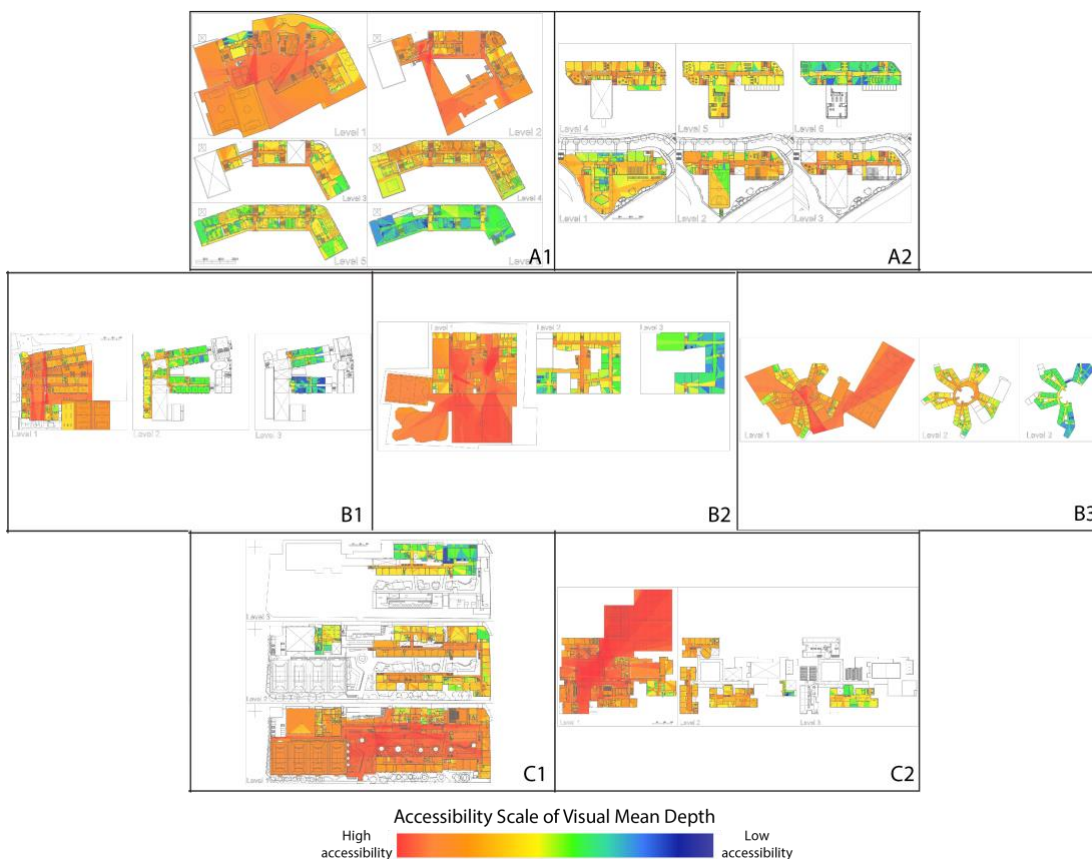
Figure 2: The Visual mean depth of the accessibility models of seven school buildings.

Further spatial analysis of the interior library space – excluding the surrounding spaces was run for the two libraries A1 and B1 which are selected for on-site observations (see next section). The same Space syntax measure (VMD) is obtained based on the visibility models which are defined through boundaries that block visibility, like tall partitions or bookshelves, but not furniture pieces below the eye level which allow visual connections. This is more suitable for analysing interior spaces after being mapped (by the researcher) with accurate furniture layouts during their school visits for fieldwork (see findings for more details).

Alongside the quantitative dataset of configurational analysis, the study conducts qualitative semi-structured interviews with the lead architect who is involved in the school design, from each of the three architecture firms. The interviews are designed to collect data about the main design decisions related to the whole school and the library space, as taken during the design process. Hence, it offers some explanations to why spaces were configured in that way, and how the design responded to the management and student needs.

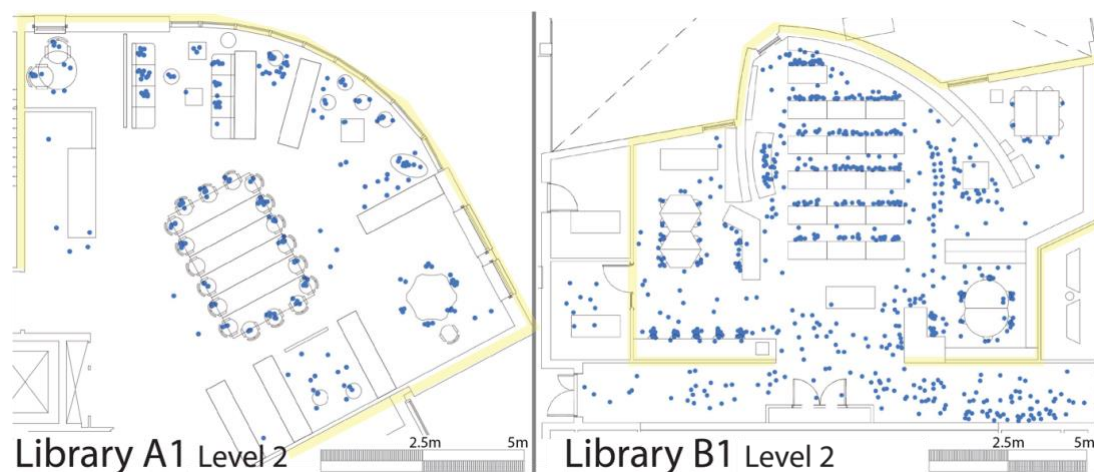## 3.2   The library operational actuality

Figure 3: An example of a snapshot showing the student distribution in both libraries.

The operational actuality of the school library is investigated through collecting quantitative observational data of the student learning practices which comprise interactions and self-directed activities, such as reading, studying and revising. For that, two school A1 and B1 (of the seven case studies) were selected, since they have different library design and different building typologies. Observations inside both schools were scheduled for the researcher to perform snapshots (sampled in figure 3) which is a method that records the different student activities happening within a defined space (UCL Space Syntax, 2024). A snapshot would include the location of all students in the space, the activities taking place (e.g. studying, reading, talking, etc.), the group formation (e.g. individual, a pair, a group of three, four, etc.) and the locomotion (e.g. sitting, standing or moving). Each snapshot also records the teacher supervision in space, in this case, mostly the librarian. Each of the two libraries is observed through repeated snapshots at different time periods of the lunch break, i.e. when students have the freedom to visit the library, interact or perform different self-directed activities. The snapshot dataset is complemented with gate-counts which is another observational method that records the number of students passing through specified gateways, in this study, the doorways of the school libraries.

Processing of the observational data is performed according to the method set by (Fouad and Sailer, 2022), to compile and geo-reference the snapshots and gate-counts onto the library floorplans using QGIS 3.6.3, maintaining the attributes of activity type, grouping and locomotion; and adding the spatial configurational analysis data (through a Spatial Join on QGIS 3.6.3). Further library actuality data includes qualitative semi-structured interviews with teachers and management staff members. These explain the school schedule and main regulations, especially the ones associated to break-times and the library spaces.

4   FINDINGS

Student Interactions and Self-directed Activities in School Libraries

4.1   The configurational design of school libraries
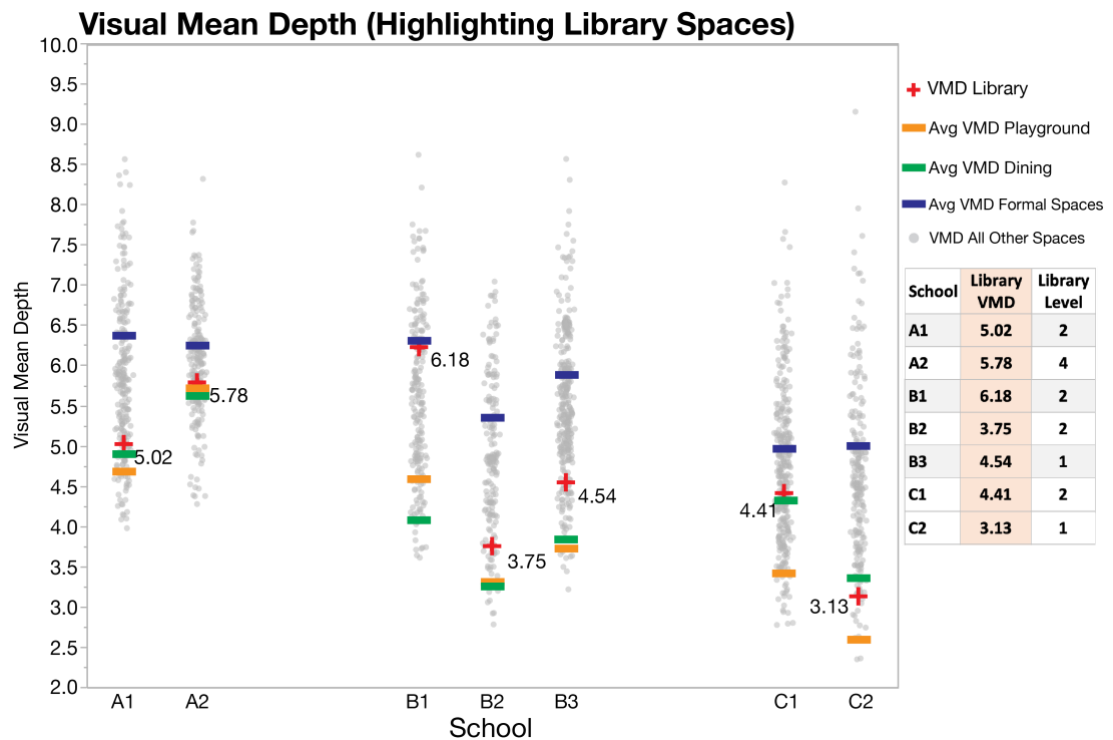

Figure 4: The configuration spectrum of the measure of VMD of the seven schools and their libraries.

The design of the seven schools portrays the prominence of the library space in terms of size and relationship to the surrounding corridors. The configurational analysis of the school buildings (accessibility models - VMD) shows that libraries are mostly within the mid-range of each school accessibility spectrum (marked red; figure 4), being deeper than other informal spaces like the playground and dining areas, but shallower (more accessible) than formal classes and studios. This configuration, i.e. being not among the shallowest spaces in the school, is impacted by the library allocation on upper levels in all the seven case studies except for school C2 which is on the ground level-1, hence, being the shallowest case study. Moreover, the library has a large area to accommodate for the co-presence of simultaneous large groups of students who visit during breaks; it is averaged as the fourth largest singular space in the school (after the playground, the main hall and the dining space).

Figure 5: Visual Mean depth of the two libraries A1 and B1 from analysing the visibility models.

Further configurational analysis using visibility models (to study the library interior; see methodology for details) reveals more design and configurational features of the two main case studies (library A1 and B1). Library A1 interior configuration is more diversified with quiet segregated pockets (lower VMD; purple dashed circles on figure 5) which potentially serve individuals (or pairs); and the highly visible large middle table or side sofas (higher VMD) which potentially serving collaborative activities. Contrarily, B1 interior exhibits equal configurational visibility, courtesy of its low-height southern and eastern partitions that expose the library space to the passers-by in the corridors. This configuration renders B1 library, potentially, as a busies and more vibrant space, whereas A1 library could possibly be the quieter space. Details on the actual operations are detailed in the two upcoming sections which shows how other managerial regulations and supervision impact the daily library student interactions and activities.

4.2   Student movements, encounters and interactions around the library

In library A1, the possibilities of student encounters around the library are reduced as a result of certain design decisions, but mainly due to the management circulation policies which diverts student routes away from the library. Despite being a mid-range accessible space (VMD=5.02), library A1 is cornered, off a secondary branch from the main student route, with no frontage over the main corridor – the entrance is recessed between a staircase and an elevator (figure 6). This reflected on the low student movements (count =24) at its main gate (Bx1), compared to library B1 (count=62). The management further reduces possibilities for student encounters or mixing at the library entrance by diverting their movements away. They close level-2 internal corridor (pink route in figure 6) for student-access, by terminating the south-east staircase (highlighted red on figure 6). They also close the surrounding gateways, including the second library entrance (Bx2). These changes are intended to inhibit the student circulation within the room adjacent to the library to provide teachers with privacy (upon assigning the space as an office due to shortage of teacher spaces as stated in the teacher interviews). This internal route and the second library

entrance (which are now closed) could have potentially compensated for the library isolation, since possible cross-library student movements could have maximised encounters inside the library. However, in operation, they are closed-down as reflected in the low count of gate Bx2 – a single incident of student crossing with a written teacher permission.
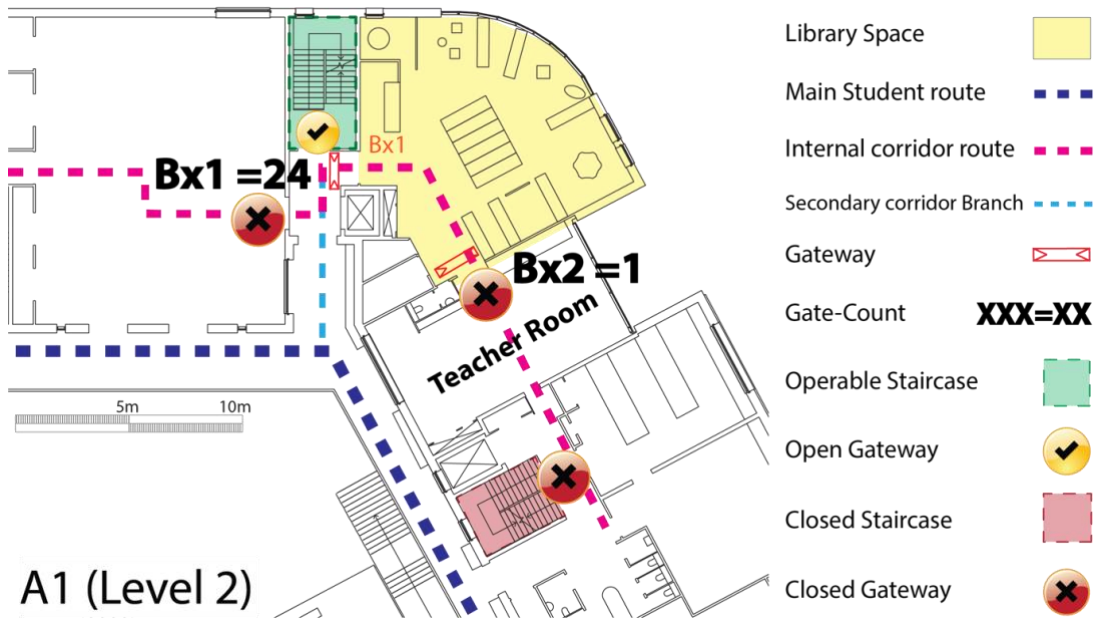

Figure 6: Library A1, its location, changes in routes and student movements around.

As for B1, the design has higher potentiality (than A1) to promote student encounters around the library. Despite the library's relative configurational segregation (VMD=6.18; highest in the seven case studies), the design centralises the library with frontage over three main corridors of which one route is highly important to connect both school wings (navy route; figure 7). This configuration attracts passer-by students towards the library space, maximises their encounters and possible interactions. Students developed a habit of walking by the library and stopping to see if their friends are inside. The library has a semi-open plan design, allowing students to see the library interior from the two east-side and entrance-side corridors whose boundaries have short partitions or short bookshelves (highlighted orange on figure 7).
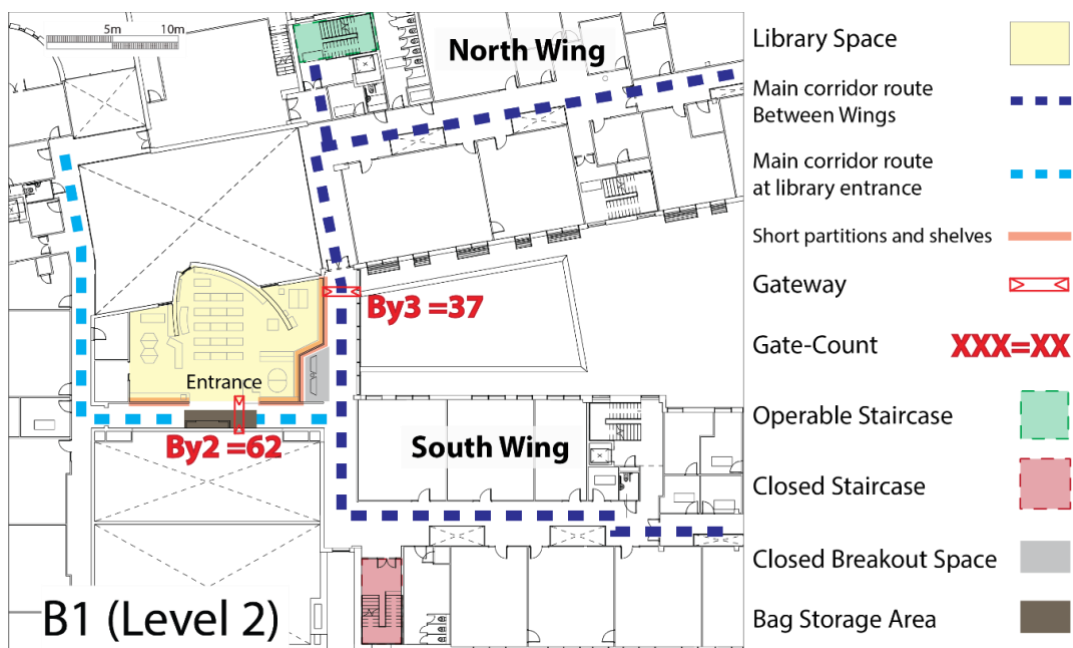
Figure 7: Library B1, its location, routes and student movements around.

Despite B1 management regulations being strict, they facilitate student mixing around the library. Wing corridors and staircases are locked shortly after students leave from classrooms to start their breaks, except for one staircase (marked green on figure 7) that connects students between level-1 dining area and level-2 library. This minimises the available open-access corridors (as student standing spots) to areas around the library which grow vibrant with encounters. Students interact at the bag storage area opposite the library entrance (marked brown on figure 7) which gets very vibrant (gate-count By2 of 62 on figure 7; higher than A1's count of 24). After the initial interactions, students walk into the library (if notified by the librarian); or leave to the dining area and come back later to pick up their bags. The management also closes-down the break-out space adjacent to the library (marked grey on figure 7) which further pushes students towards the library frontage to avoid loitering penalties. The corridor between both wings (left picture of figure 8) accommodates student movements and encounters (By3=37) less than the main library entrance (By2=62; pictured right of figure 8) but still higher than A1 library gates (count=24). These patterns reflect how the atmosphere around B1 library is more vibrant with mixing and encounters than A1.
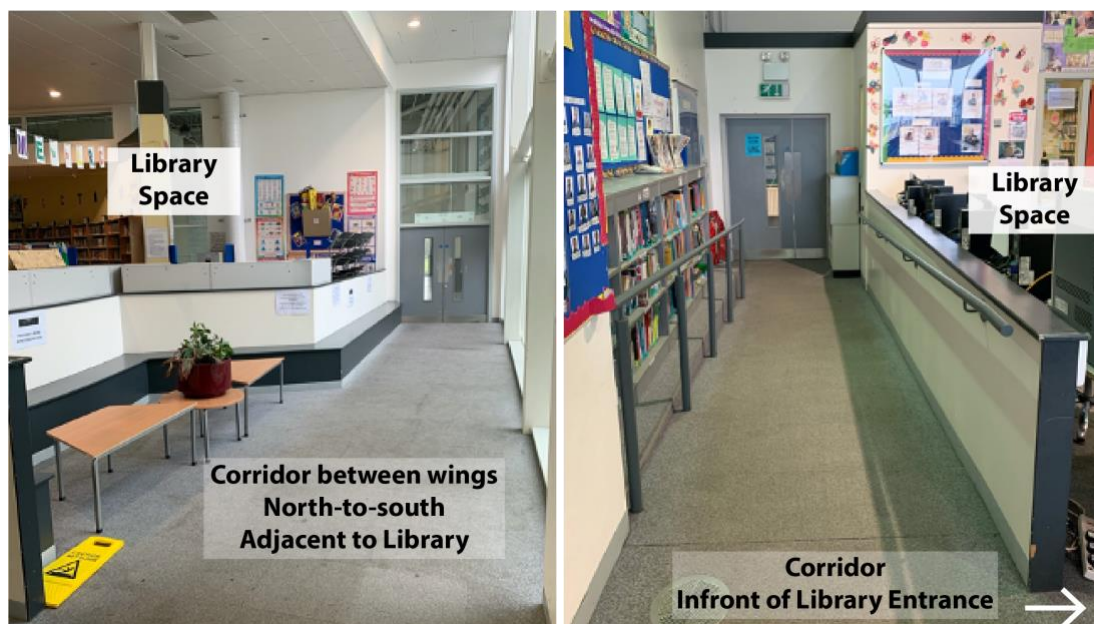
Figure 8: Adjacent corridors to B1 library.

4.3   The actuality of student self-directed activities

During lunch breaks (the prime time of library use), library B1 has more students than A1, yielding a busier atmosphere than A1's quieter library with less occupancies. The maximum recorded count of students at once in A1 library is 30 students, yielding a density of 0.27 student/m² (one student in 3.7 metres). This is lower than B1's record of 88 students at once which yields a density of 0.62 student/m² (one student in 1.61 metres). Higher B1 library occupancies are derived from the space being the only indoor destination open to students during breaks alongside the dining space which is more crowded. Contrarily, lower A1 occupancies result from the student dispersal over multiple indoor destinations, such as the internal corridors, open-studios and dining units. A1 library occupancy is mainly represented through a group of loyal library students who visit the space for similar activity patterns every lunch break. This group also exists in B1 but is diluted among higher frequencies of changeable students who visit the library to stay with friends, socialise or perform different activities according to the librarian input (as elaborated below).
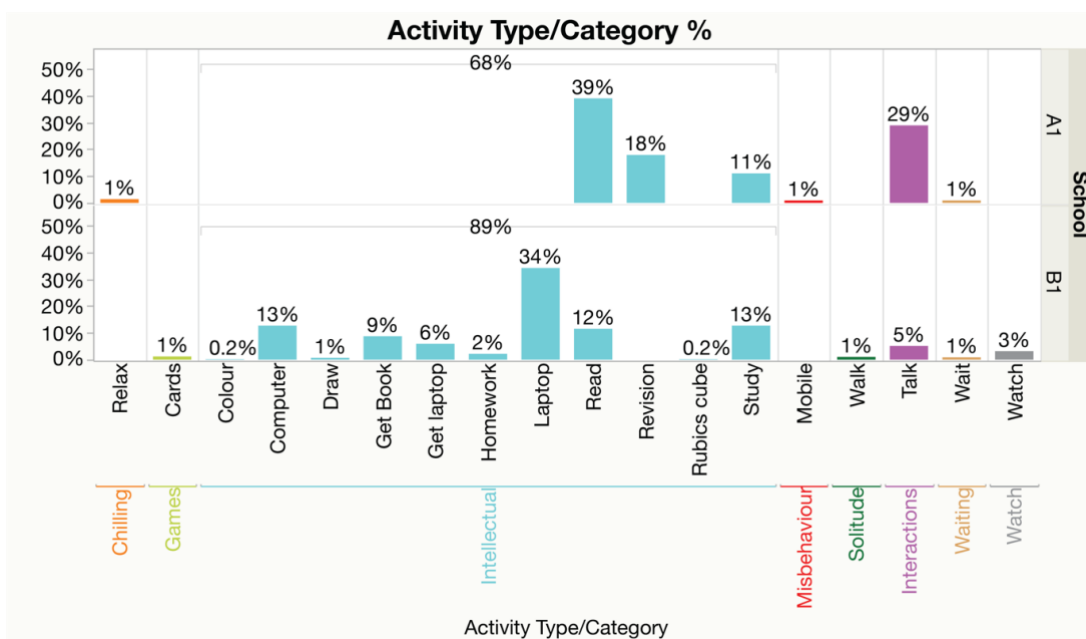
Figure 9: Activity types and percentages in library A1 and B1

There are variations in types and frequencies of activities between library A1 and B1. The high occupancies of B1 library possibly explains the higher variation and frequency of student self-directed activities especially the intellectual activities that compose 89% of total activities and formed of ten different types (cyan bars; figure 9). These patterns link to the efforts of B1 librarian who encourages student intellectual activities, walks around to check on students (unlike A1's static supervision), tells them what activities to do and restricts their excessive movements. The management also provides laptops, desktop PCs and assorted stationeries (papers, colouring books and pencils, etc). In contrast, A1 library is a more relaxed environment where students freely choose their activities with minimal influence from the librarian who supervises from their desk. This possibly explains the lower percentage (68%) and less variation of intellectual activities. Student in A1 library are mostly loyal visitors who spend their breaks reading (39%) as facilitated by the quiet atmosphere, unlike B1's vibrant atmosphere which does not encourage reading (only 12%). Further intellectual activities in A1 library include studying (11%) and revising (18%) as pursued by changeable students according to their needs (not the regular visitors). A1 free environment also allows for student interactions (29%) with minimal teacher interventions if students are not noisy. Contrarily, B1's stricter librarian inhibits most of interactions (only 5%) in favour of intellectual activities, and because the library space is already noisy due to high occupancies and porosity to the corridors.
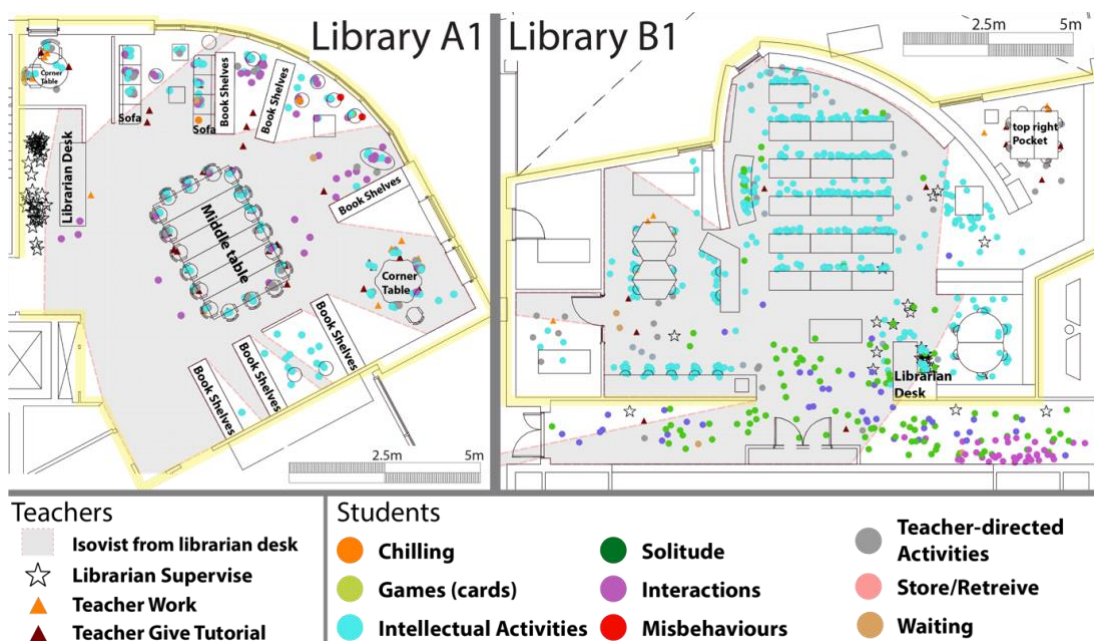
Figure 10: Self-directed activities distribution in Library A1 and B1

The configuration of the library interior also influences the types and distribution of student interactions and self-directed activities. Acknowledging the freedom granted to A1 students to move and choose activities, students occupy hidden pockets between shelves which demonstrate low visibility (previous visibility VMD analysis; figure 5). The spots are also not seen by the librarian as revealed through the librarian isovist (i.e. what the librarian see from their spot; grey area-fill on figure 10). However, B2 library is mostly exposed from the librarian desk except for the round table behind their desk and the top-right pocket which are closed for student use (unless accompanied by a teacher for tutorial or being part of a study group).

Student interactions in A1 (e.g. talking, discussing, gossiping) happen on the two opposite sofas if being less discrete but not noisy (mauve dots; figure 10); or at the peripheral pockets between bookshelves on bean bags if being more private conversations. These latter locations also accommodate some misbehaviours (e.g. using mobiles; red dots on figure 10), knowing they are not visible to the librarian. Patterns of student chilling of laying down individually or in groups (orange dots on figure 10) mimic the same locations of interactions, depending on the degree of privacy desired by students. In library B1, interactions happen outside the library (in the opposite corridor) then disintegrate beyond the library entrance due to the control of the librarian who also prevents students from laying down and chilling. According to the B1 librarian, to stay in the library, students must be doing some activities.

Intellectual activities (cyan dots; figure 10) have different patterns in library A1 than B1, being more related to student preferences in A1 but the librarian input in B1. Some A1 students choose

to isolate themselves in pockets to read silently while laying down on bean bags if those spaces are not occupied by interacting students. Most of A1's individual independent reading coexists alongside revising and studying at the middle table; or among small groups of friends (collaboratively) at the cornered round tables which are also shared with teachers.

Moreover, furniture impacts the type of activity and student posture. In library A1, for instance, the choice of formal upright sitting at the middle and corner tables is preferred by students for focused studying, unlike the relaxed sitting preferred on sofas and bean bags. In B1, colouring or drawing concentrate at one table chosen by the librarian, while another table is assigned for revision (behind the librarian desk). B1 central desks (arranged in row) are mostly occupied by individual students with laptops (provided by the school). Sometimes students sit in pairs or small groups (3-4) to work together on one laptop which is often dismantled by the librarian, if being noisy. Reading has no specific location in library B1 (unlike A1's middle table) but spreads all over the library, slightly concentrating towards the side tables away from the loud centre.

5   DISCUSSION

The school library, as analysed in the seven case studies, has high potentiality for student interactions and self-directed activities, influenced by the holistic configuration of the building. Despite not being highly accessible (compared to other informal spaces – the playground or the dining areas), the library space, as decided by the architect, is allocated along the main student route on upper floors (except A1 library at a branching corridor – earlier figure 6). Accordingly, students potentially pass by the library space along their daily circulation, increasing the potential student co-presence and interactions (Hillier, 1996) close by and in front of the library. Then, it is the role of the library design, being large and porous, to facilitates the transition of student streams from the corridor into the library. The porosity of the library design is achieved through an open-plan layout that blends into the main corridor (e.g. B1, B2 and B3), a closed-plan but having multiple access-points (e.g. A1), a glass frontage that exposes the inner activities (e.g. A2 and C2), or a combination of the above-listed features (e.g. C1).

Affordances are primarily shaped through the spatial design. The building configuration either segregates the library away from the student routes, thus, yielding less possibilities of student encounters (case of A1); or positions the library along busy routes, thus, triggering movement patterns around the library whose surrounding affords student encounters, mixing patterns and interactions (case of B1). The interior design and shelf-layout render a unified space (case of B1) where activities are equally visible and vibrant within a collaborative environment; or create a compartmented space (case of A1) for quiet and private activities with in-between pockets that

trigger student to sit individually, relax and read or sit in pairs (by moving furniture) to have discrete conversations. The latter case is what literature described as 'affordances that command to be acted upon' (Rietveld and Kiverstein, 2014) as space triggers certain activities over another. Furthermore, furniture typologies influence the student attitude through affording relaxed postures (e.g. A1 bean bags) or the formal upright sitting (e.g. B1 desk-chair combination). Furniture layout also shapes group formations which contributes to collaborative activities. The aforementioned parameters constitute the library affordances which shape possibilities for student short-period encounters or long-period occupancies, and the latter (long-period occupancies) renders the library as a popular destination.

While the spatial design outlines possibilities for student learning practices, the management operation schemes, supported by the librarian local input, maximise or reduce the affordances for student interactions and self-directed activities. For example, diversions in student routes minimise student encounters around and inside the library which render a quiet library atmosphere (case of A1); whereas closures of corridors and break-time destinations consolidate movements towards the library and maximise student mixing, thus, affording more interactions (case of B1). This links to Hillier and Penn (1991) discussion on building programmes being strong with many rules and limitations, or weak with less rules, hence, impacting copresence, encounters, interactions and subsequent activities. However, this link did not happen in the usual manner (of more rules, less activities) because B1 is the opposite scenario where regulations led to more student mixing and interactions.

Moreover, the librarian either allows student to sit freely, i.e. in different postures, group sizes and locations even hidden pockets (case of A1); or restricts interactions, controls student sitting patterns while influencing their activity choices through guidance or stationery (case of B1). The less controlled library environment allows student preferences to surface which impacts their interactions and self-directed activities. This applies to students who target the library on regular bases; or mostly other students who have changeable needs, i.e. different activities, to fulfil during breaks. This argument connects to Koch (2004) discussion on how a public library building promotes meetings and encounters between stranger groups. This is replicated in the school libraries where co-presence and encounters are guaranteed, not between strangers but friends or colleagues who see each other on daily basis, but the further development of interactions or other collaborative activities is dependent on the degree of control imposed on space (by the librarian and management regulations)

In the end, the affordances of school libraries to allow for the dissemination of knowledge, in terms of student interactions or self-directed activities, is relative to spatial and operational parameters. However, it is not a one-way system where configurational accessibility is always desirable (or the opposite scenario), but it is dependent on the context, the regulations in place and the degree of control. Configurational segregation could provide student privacy and promotes quieter interactions and self-directed activities, as seen in the segregated hidden spots inside library A1. In those locations, activities diversify while teacher supervision is nearby but not direct over the students. Moreover, segregated spaces do not always yield high control in this context of the school library. Control could be linked to shallow spaces that provide full teacher supervision, i.e. surveillance (Markus, 1993) as seen in library B1.

6   CONCLUSIONS

The potentiality of the school library is its capacity to accommodate long-period student occupancies to perform various self-directed activities and interactions, beside instant encounters and short interactions that happen around the library. These are primarily influenced by the library configuration as part of the holistic school building configuration; by the configuration of the interior spaces as shaped by the furniture layout; and by the types of furniture in space. The spatial affordances for activities in the library constitute this design potentiality, nevertheless, affordances, as possibilities or learning opportunities, translate into actuality through the management operation schemes, regulations, the librarian role and supervision, and the student preferences which filter out or maximise the possibilities for learning practices.

Intellectual activities in library A1 are more genuine, longer in duration and chosen by students (e.g. independent reading by regular visitors), unlike B1's activities which sometimes are alibis to stay in the library to socialise. A1 Students have the freedom to choose their activities, even if it is to interact (quietly) or sit in their favourite spots. B1 library, being dense in all activities, is highly controlled by the librarian who influences what activities occur, where students sit and also prevents interactions. While both libraries offer affordances that match the preferences of different student groups (seeking quietness or vibrancy), the difference is the teacher responses. They grant student freedom in the former example (A1) but restrain their interactions and push for a quieter atmosphere in the latter (B1), despite the spatial potentiality that afforded (commanded) the vibrant environment in the first place.

This study had certain limitations which could be improved in the future research plans. Firstly, the study could maximise the number of architects (three), the number of selected case studies

(seven) and the ones associated with fieldwork observations (two). Secondly, the study has only focused on school libraries in the UK. It could be interesting to investigate international school libraries to be compared to the current case studies. Thirdly, the study could attempt to revisit the two main cases studies for further longitudinal fieldwork across time, since school operations, regulations, design and furniture layout is always in continuous change.

Finally, it is crucial to highlight the research contribution, as an investigation of spatial and managerial parameters in schooling system. Accordingly, the findings are important for architects who are involved in the design of school buildings and their library space, to comprehend the implications of various design decisions. The findings could be also interesting, not only to the managements of both school A1 and B1 but all secondary schools, to understand the implications of their regulations on the student activities and how these could be related (or not) to the intended school design.

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