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The spatial and social organisation of teaching and learning:

The case of Hogwarts School of Witchcraft and Wizardry

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Abstract

Existing research on school buildings and how their layout informs the spatial and social organisation of teaching and learning is scarce with an evidence base that has been called incomplete and underdeveloped in a 2005 report commissioned by the UK Design Council. Only a small handful of studies have analysed school buildings in the tradition of Space Syntax. Hence this paper aims to close this gap by systematically reviewing literature and proposing a theoretical framework for the future study of school buildings. Rather than focusing on an empirical case and post-rationalising phenomena found in the field, important concepts of the Space Syntax study of buildings as well as pedagogical theories are brought together upfront in a single conceptual framework. Only then is this framework applied to prove its feasibility and value. As a dataset, a well-known example from popular culture has been chosen to allow the framework to be easily comprehensible and perspicuous: Hogwarts School of Witchcraft and Wizardry, the fictional secondary school of Harry Potter and his friends as featured in the novels by Joanne K Rowling and the associated movie series. Floor plans of Hogwarts are analysed using Visibility Graphs and the movie material has been systematically evaluated in order to distinguish types of learning (individual, peer and taught learning) and map episodes of learning onto functional areas of the floor plan.

Seven important dimensions are identified in the framework: 1) Accommodating different teaching styles; 2) Accommodating different processes of learning; 3) Strong or weak framing of the relationship between teacher and taught; 4) Movement economies; 5) The interfaces a building constructs; 6) The realisation of spatial and transpatial solidarities; and 7) Correspondence and non-correspondence models. The analysis of the Hogwarts narrative highlights the importance of social and public spaces for the accommodation of diverse learning processes: only 10% of learning in the movies occurred in classroom settings and the majority of peer learning took place in common rooms, dormitories and courtyards. It is also shown that peer learning tended to happen in more integrated spaces.

The paper concludes that the framework can be fruitfully applied and delivers interesting insights into the spatial and social organisation of teaching and learning inside school buildings in relation to pedagogy. It proposes to shift the focus of attention away from classroom conditions in the architectural debate and instead embrace the idea that learning is social and occurs in many different settings and places, which puts the idea of the school building as a whole in its interplay between spatial elements and their connections high up on the agenda.

Keywords

Teaching, learning, school, Hogwarts, spatial configuration, interaction.

1. Introduction

The spatial structure of school buildings and how a school layout impacts the social organisation of teaching and learning is an important topic. Children spend a significant amount of time in school buildings – in OECD countries the average time spent in compulsory instruction is 7475 hours (OECD, 2014). Schools are also the first building type children consciously experience outside of their home.

First and foremost, the role of schools is to educate children, but arguably, schools do not only have an academic role of transmitting knowledge; they are also an important place for children to learn about society, acceptable behaviours, group interactions and their own place in the world. Schools have therefore been described as important places for socialisation (Minuchin & Shapiro, 1983; Wentzel & Looney, 2007).

From a Space Syntax perspective, schools as a building type have not been studied in the same depth as other building types such as museums, offices or hospitals (for an overview of references see: Sailer, 2014). Thus, our knowledge on the relationship between spatial configuration and social processes in school buildings, such as teaching, learning, gaining knowledge, interacting, playing and socialising is rather limited as a whole, relying on a small handful of isolated studies.

This paper therefore aims at closing this gap and broadening our understanding of the spatial and social organisation of teaching and learning by reviewing existing literature and theories in order to develop a theoretical framework of studying school buildings.

In detail the paper is structured as follows: chapter 2 will briefly discuss theories of teaching and learning, while chapter 3 will give an overview of existing research on physical, spatial and design related factors in schools. Based on this, chapter 4 will propose a framework for investigating the spatial and social organisation of schools. Chapter 5 will introduce the case study of Hogwarts School of Witchcraft and Wizardry, known from popular culture as the school featuring in Harry Potter fiction and summarise data collection and methods, while chapter 6 will apply the developed theoretical framework to Hogwarts. A final chapter 7 will draw conclusions from the study and highlight a future research agenda for studying school buildings.

2. Theories of teaching and learning

Learning as a general process is defined in the dictionary¹ as “an activity or process of gaining knowledge or skill by studying, practicing, being taught or experiencing something”.

Looking back in history, our understanding of learning has shifted significantly over the last two centuries. Brown (2004) highlights that a commonly held view in the 19th century was to consider learning as a mental discipline that shaped the character, for example dull repetitive work would increase will-power. Traditional pedagogy saw children as ‘empty vessels to be filled’ focusing on the mastery of facts and disciplining of bodies. In his 1854 novel ‘Hard Times’, Charles Dickens describes the setting of a school and the view of pedagogy at that time: “The plain, monotonous vault of a school room... the little vessels then and there arranged in order, ready to have imperial gallons of facts poured into them until they were full to the brim.” (as cited in: Jones, 2005, p. 5)

It was only in the early 20th century with educators and thinkers like John Dewey, Jean Piaget and Lev Vygotsky that a more active role was assigned to children (Dewey, 1902; Vygotsky, 1978), finally giving rise to theories of constructivism, which today is a commonly accepted view of learning among others. Constructivism assumes that knowledge is individually constructed in the mind of a learner, building on preconceptions that were formed based on prior experiences in the world. Knowledge therefore cannot be transmitted, it has to be actively constructed (Jonassen, 1999). A strong focus is placed on the social construction of knowledge through interaction and peer learning (King, 2002) as well as self-regulated learning (Paris & Paris, 2001), i.e. learners actively controlling and monitoring their own learning progress. This shift towards a learner-centred view rather than a

¹ <http://www.merriam-webster.com/dictionary/learning> (Accessed: 23 January 2015)

teacher-centred view of education changes the role of the teacher significantly, which is to design learning activities and environments that enable pupils to learn by themselves.

The different approaches from learner-centred to teacher-centred were conceptualised by Jones (2005) as a question of aligning three factors: material to be learnt, teacher and learner. He argued that the traditional teacher-centred view closely aligns material and teacher, therefore turning the teacher into a gatekeeper to knowledge. If the learner is closely aligned with material, the role of the teacher turns into that of a midwife or facilitator, enabling the learner to discover and process material for themselves. In a third scenario, teacher and learner are closely aligned alongside each other like ‘fellow travellers’ exploring new knowledge together. Rather than thinking of the three modes as fixed concepts, Jones proposed that expert teachers adapt the learning alignment throughout a single session, shifting between different modes of instruction, enabling and exploring.

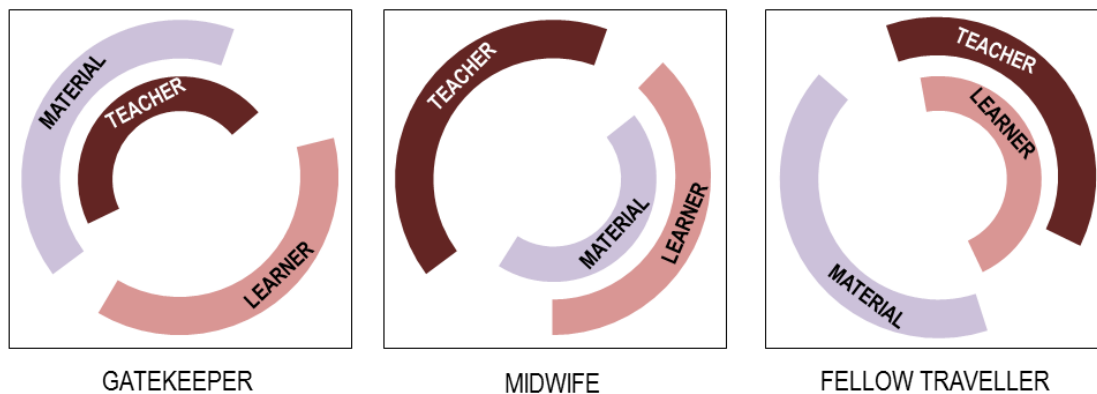


Figure 1: Three different approaches to align teacher, taught and material (redrawn based on Jones 2005).

What is implicit in all approaches towards teaching and learning is the question of power and control. Reframing the shift from a traditional teacher-centred view of education to a learner-centred view of education, one could argue that control of what is learnt and how it is learnt has moved away from the teacher to the learner.

A more systematic account of power and social control has been developed by the sociologist Basil Bernstein in analysing “how a society selects, classifies, distributes, transmits and evaluates (...) educational knowledge” (Bernstein, 1973, p. 227) Two different dimensions are proposed: classification, i.e. the degree of maintaining boundaries between contents in the curriculum, and framing, i.e. the degree of controlling boundaries in the transmission of educational knowledge, hence styles of pedagogy and relationships between teacher and taught. The difference between strong and weak framing is of particular relevance here. If framing is strong, this means the authority over what is taught remains with an individual teacher who determines what is right or wrong. The system resembles a mechanical solidarity (Durkheim, 1893) due to the low levels of interdependency between teachers. It results in a rather hierarchical organisational structure, highlighting differences between senior and junior teachers, as well as between teachers and pupils. Weak framing, in contrast, decreases the discretion of the individual teacher and requires coordination and homogeneity in pedagogy and evaluation, thus giving authority to an institution. It depicts a Durkheimian organic solidarity following the division of labour principle, where individuals rely on each other. It also means blurred boundaries and more equal relationships among staff, as well as weaker differences between pupils and teachers.

Bernstein makes the case that society is moving away from strong framing (and classification) towards blurred boundaries and more distributed and complex systems of power and control. This is strongly related to the skill sets needed in economic production: “It could be said that the nineteenth century required submissive and inflexible men, whereas the late twentieth century requires conforming but flexible men.” (Bernstein, 1973, p. 254)

In a similar vein to Bernstein, yet from the perspective of architecture, the operation of power and control in different institutions and their building types was discussed (Markus, 1993). Bringing together the analysis of spatial layouts of school buildings with an account of how the schools operated, he agrees with Bernstein that schools (and their buildings) reflect modes of economic production throughout time. This leads us to the question how teaching and learning are actually afforded in more detail by the spatial layout and design of schools, which will be discussed in the next chapter.

3. Spaces for teaching and learning – Existing research

Evidence on the impact of the physical school environment on teaching and learning behaviours is not very well established overall. Despite an extensive literature review drawing on over 200 references, a 2005 report commissioned by the Design Council (Higgins, Hall, Wall, Woolner, & McCaughey, 2005) criticised incomplete evidence and the “relative paucity of research on effective learning environments” (ibid, p. 3). While basic physical variables such as air quality, temperature and noise (especially in the case of poor standards) showed a relatively consistent impact on attainment, other aspects including lighting and colour appeared inconclusive. The spatial layout and structure of schools did not feature very prominently in the literature at all.

Still, some studies were able to prove a relationship between school layout and pupil attainment.

Studying 44 and 71 US primary schools, Tanner (2000, 2009) found that different design patterns (judged qualitatively), among them the configurationally relevant aspects of ‘pathways and clearly defined areas for freedom of movement’, but also patterns of ‘daylighting’ and ‘view’ predicted test scores of pupils. A UK study of 7 primary schools (Barrett, Zhang, Moffat, & Kobbacy, 2013) established that among other factors ‘choice’, ‘complexity’, ‘flexibility’ and ‘light’ had a positive effect on attainment and accounted for 25% of the learning progression of pupils. The dimension ‘connection’ had a negative effect. While the authors concede that particularly ‘connection’ needs further research, the operationalization of variables could be challenged. For instance, the parameter connection is defined by four factors, among them ‘corridor usage’. Corridor usage is rated higher if ‘the corridor is not used for storage or breakout purposes’. It is contestable whether a corridor limiting breakouts and as such co-presence, occupation and contact among pupils is indeed a positive element. Another study of over 500 new school buildings in the UK (Williams, Hong, Mumovic, & Taylor, 2014) found that 2 years prior to a new school building and one year after the design intervention, school performance increased significantly, only to deteriorate considerably again afterwards. The paper concludes that school buildings are only part of a larger complex of factors including staff input and management.

In addition to the above mentioned research, a small handful of studies have analysed the spatial configuration of schools in the tradition of Space Syntax. De Jong (1996) compared two different Swedish school buildings syntactically and discussed potentials and preconditions for space usage. In a study of 4 US secondary schools, Pasalar (2003, 2007) found that compact buildings simplified contact among pupils within a grade due to proximity and clustering of classrooms, whereas finger layouts showed higher levels of friendships among pupils of different grades, highlighting the potential for students to explore, learn and socialise as an effect of spatial accessibility of public areas and higher overall intelligibility of the layout. Similar results were found in a study of 76 primary schools in Japan (Kishimoto & Taguchi, 2014): layouts with high intelligibility showed more contact and interaction between students of different grades. Schools that were highly integrated as a whole were reported by teachers to allow less flexibility in adapting teaching styles. Schools with large open spaces, thus higher overall levels of connectivity were significantly easier to operate, according to teachers. The size of a school had a negative impact on pupil-teacher relations and contact among pupils. Further studies focused on design principles (Heitor, 2005), or the design briefing process (Heitor & Marques Pinto, 2012), yet did not consider the relationship between spatial configuration and behaviours.

To summarise, research has highlighted that the design and layout of school buildings can have a significant effect on learning performance and attainment, interaction among students and the

opportunities to accommodate different teaching styles, however, as a whole the evidence base must be considered rather patchy.

4. Towards a framework for the spatial and social organisation of schools

Based on these insights, a theoretical framework is now proposed to analyse the spatial and social organisation of schools. It unites pedagogical theories with concepts commonly used in Space Syntax and will focus on the potential of a school building to support important processes and activities in schools, such as teaching and learning, teacher's solidarity, pupil's solidarity, peer instruction and socialising.

Seven different dimensions were identified as important factors:

1. *Accommodating different teaching styles*

The most effective teachers switch between different teaching styles to guide pupils to learn by themselves, as argued by Jones (2005). Layout plays an important role, since Kishimoto & Taguchi (2014) highlighted how very integrated layouts were less favourable for teaching flexibility. Therefore a school building can be assessed against the criterion of how well a layout allows accommodating different teaching styles and enables the teacher to change between the roles of gatekeeper, midwife and fellow traveller.

2. *Accommodating different processes of learning*

Learning is a broad process and does not only encompass gain of information through the direct instruction of a teacher, but also means individual study and peer learning (as argued by King 2002). Therefore it can be asked in which locations of a school building the different processes of learning take place, how the spatial characteristics of a building shape the distribution of learning activities (integrated versus segregated areas) and how well the layout as a whole caters for the diversity of learning processes.

3. *Strong or weak framing of the relationship between teacher and taught*

According to Bernstein (1973), the relationship between teachers and pupils is expressed through the question of who controls what is taught. It could be argued that the layout of a building plays a role in this insofar as it mediates relationships (Hillier 1996). Thus, criteria to evaluate a school building would include visibility and openness of classrooms towards the corridors (to enable or hinder control of a teacher) as well as inter-visibility among pupils (to give control to pupils).

4. *Movement economies*

The term 'movement economies' has been coined by Hillier (1997) to focus on the power of movement to generate socioeconomic outcomes in cities. This can be applied to school buildings, since it could be argued that many aspects of the social dynamics of schools stem from movement flows. Schools are specifically interesting cases of movement economies, since movement does not only follow the configurational logic of the layout (as for instance shown by Pasalar, 2003), but also arises from organisational rules of the school and hence from strong programmes, as argued for other building types (Capille & Psarra, 2013; Hillier & Penn, 1991; Koch & Steen, 2012; Sailer et al., 2013) and. Therefore it will be of interest to analyse the movement systems of a school (Who moves between classes: all pupils, some pupils, teachers? Are there different possible paths in the circulation system? Hence what is the level of spatial choice?), and its effects on social outcomes.

5. *The interfaces a building constructs*

According to Hillier and Hanson (1984) any building enacts an ordering of user categories between inhabitants of a building (whose identity is inscribed into both building form and control systems, i.e. teachers), and visitors (who are controlled by the building, i.e. pupils). A building therefore is a mechanism of generating and constraining patterns of encounter and avoidance. This system of

ordering and control is called an interface (Hillier, Hanson, & Peponis, 1984). The main interfaces in a school are the relationships teacher-teacher, teacher-pupil, pupil-pupil. A school building can be investigated according to its spatial conditions for group identity and how relationships within user groups and across user groups are framed, controlled and managed by the building.

6. *The realisation of spatial and transpatial solidarities*

Two important mechanisms of creating and maintaining relationships have been suggested: spatial solidarities, based on proximity, and transpatial solidarities, based on kinship, affiliation, profession or interests (Hillier & Hanson, 1984; Sailer & Penn, 2009). In the context of a school building, one could ask to which degree the spatial layout affords the realisation of spatial and transpatial solidarities, particularly how solidarity among teachers and students is fostered.

7. *Correspondence and non-correspondence models*

Based on the distinction between spatial and transpatial relationships, Hillier and Hanson (1984) go on to define correspondence models, where encounters resulting from physical proximity are reinforced by transpatial solidarities, as opposed to non-correspondence models, which separate both mechanisms by allowing transpatial solidarities to overcome spatial boundaries. A correspondence model is characterised by local strength, exclusivity, hierarchies and pronounced boundary maintenance, whereas a non-correspondence system thrives on openness, equality, inclusivity and global strength. It can be assessed whether a building instigates an overlap of spatial and transpatial solidarities and hence whether the school functions as a coherent whole by bringing everyone in contact with everyone (non-correspondence), or is organised by separate groups maintaining their own strong identities (correspondence).

This framework will be applied to the case study of this paper, which will be introduced in the next section.

5. Case study, data and methods

Hogwarts School of Witchcraft and Wizardry, a fictional secondary school featuring in the Harry Potter² novel series written by Joanne K Rowling (1997, 1998, 1999, 2000, 2003, 2005, 2007) and the associated AOL Time Warner movie series will serve as case study. To treat books and movies as data sources necessarily implies following the narrative plot of the story rather than depicting a typical everyday experience of school life. Using such an extreme case, the paper will show how the proposed theoretical framework can provide a useful lens for the analysis of the social and spatial organisation of teaching and learning, even if the data clearly presents a bias caused by the needs of plot and narrative. Rather than discussing the ground truth of teaching and learning at Hogwarts, the paper aims at testing the framework.

Hogwarts³ is a nine storey boarding school attended by approximately 1000 pupils. Neither books nor movies draw a coherent picture of the spatial structure of Hogwarts; therefore, a set of floor plans reconstructed by the Harry Potter fan community will be used (see Figure 2).⁴ The floor plans will be evaluated by using Visibility Graph Analysis (VGA) (Turner, Doxa, O'Sullivan, & Penn, 2001) and depthmap software (Varoudis, 2012).

² The following abbreviations will be used: HP1 for 'Harry Potter and the Philosopher's Stone', HP2 for 'Harry Potter and the Chamber of Secrets' etc.

³ All school descriptions will be based on the Harry Potter Fan website:

http://harrypotter.wikia.com/wiki/Hogwarts_School_of_Witchcraft_and_Wizardry (Accessed: 25 January 2015)

⁴ Variations of the floor plans of Hogwarts exist across different online fan communities. This paper uses the plans provided by <http://hogwarts-castle.deviantart.com/art/Hogwarts-Ground-Floor-47140781>, which is spatially the most complete set (Accessed: 29 January 2015) and combines them with annotations made at <http://randwulf.com/hogwarts/Hogwarts.html> (Accessed: 29 January 2015)

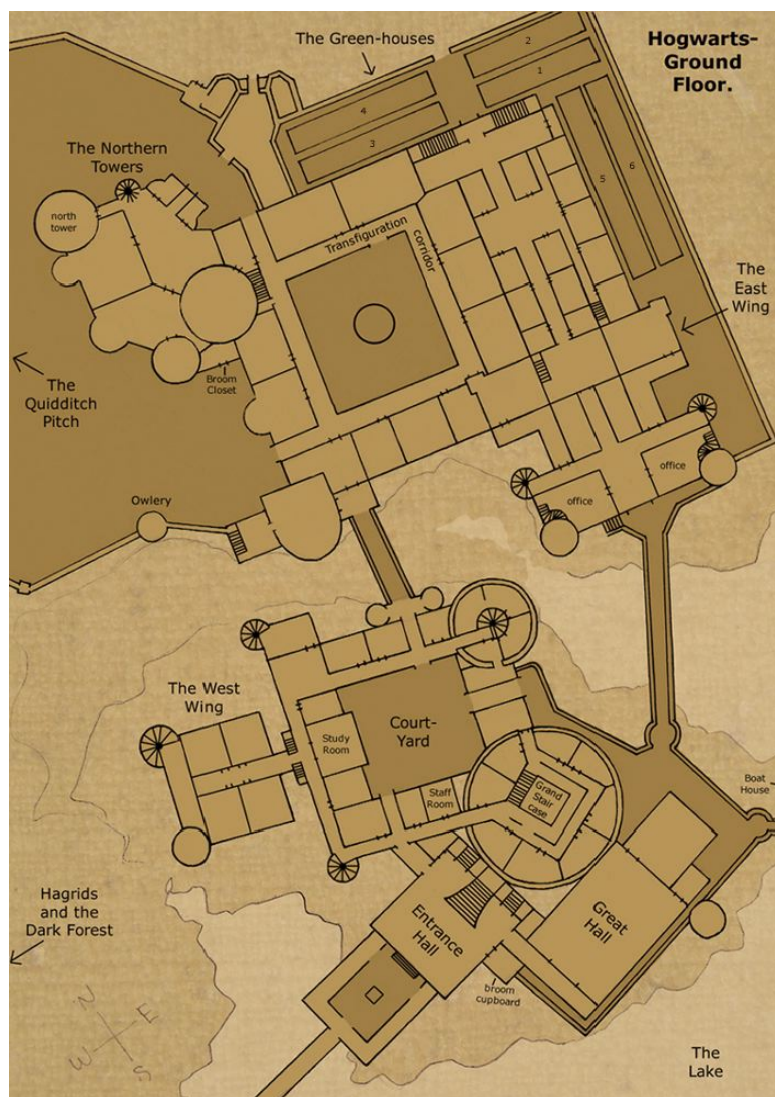


Figure 2: Floor plan of the ground floor of Hogwarts
(Source: <http://hogwarts-castle.deviantart.com/art/Hogwarts-Ground-Floor-47140781>)

Both qualitative and quantitative data was gathered from the eight instalments of the movie series (almost 20 hours of material)⁵ and structured observations of learning processes and their locations were made. Based on the Merriam Webster dictionary definition of learning the number of learning episodes was recorded for all important locations (classrooms, the Great Hall, corridors, special rooms⁶, common rooms, bathrooms, library, teachers' studies, courtyard, quidditch pitch, school grounds and the forest). A learning episode was defined as a scene in the movie, which could consist of more than one single piece of knowledge. Three different learning modes were distinguished: individual learning (i.e. pupils gaining knowledge or skill without further interactions); peer learning (i.e. gaining knowledge or skill through the interaction among peers) and taught learning (i.e. gaining knowledge or skill through the direct instruction of a teacher). To give an example, the welcome of all pupils and staff to the new school year by Headmaster Albus Dumbledore often included a series of announcements, consisting of several pieces of knowledge. This was counted as one single

⁵ It was deemed too time-consuming to systematically evaluate more than 3000 pages of text across the seven novels

⁶ Special rooms include for instance the trophy room (HP1), the shrieking shack in Hogsmead, which is connected to the school via an underground corridor (HP3), the potions storage room (HP4), or the Room of Requirements (HP5 & HP6).

learning episode and recorded as ‘taught learning’ in the Great Hall. Only scenes actually playing in the school⁷ or the extended school grounds were recorded.

In addition to the structured quantitative observations, qualitative data was extracted to inform the analysis of certain aspects of teaching and learning.

6. Teaching and learning at Hogwarts School of Witchcraft and Wizardry

Accommodating different teaching styles is rather rare, since the majority of teaching follows a traditional instructional model with the teacher at the centre of attention. However, certain elements of the curriculum are more practical, for instance in Flying and Charms classes, but also in Potions, where pupils practice new skills in a hands-on approach. One example of a varied teaching style can be found in a Charms class (HP1), where Prof Flitwick teaches the first year pupils to levitate a feather. He first introduces the spell (instructional), then the pupils team up to practice (peer learning) and when Hermione Granger manages the spell (individual learning), he praises the pupil in front of the class (instructional / peer). It also shows a shift in the alignment of teacher, taught and material in the space of a single lesson, since Prof Flitwick first chooses a gatekeeper approach to introduce the topic and then switches to a midwife role to facilitate the pupil’s practice.

The classroom layout varies with the classes, which all have their own dedicated rooms, for instance Charms is taught in a classroom with lecture theatre style seating, Transfiguration classes show desks used by two pupils and the Potions class in the dungeons has square work tables with four students working around it facing each other.

In summary, due to the nature of the curriculum at Hogwarts and the practical character of some of the skills to be acquired, teaching styles vary and the spatial design of the school supports this well with different classroom layouts, however, the traditional instructional model is still prevalent in the story.

Hogwarts *accommodates different processes of learning*; in fact, learning as presented in the movies appears to be widely distributed between different locations and shows a balance between individual, peer and taught processes. Of the 418 observed episodes of learning, 35% occurred through individual learning, 38% involved peer interaction and the remaining 27% was taught (see Figure 3).

Slight variations of this balance between individual, peer and taught learning can be observed across different locations. For instance, no single episode of taught learning was observed in the library, teachers’ studies show a disproportionate amount of taught learning, so do classrooms. By far the highest proportion of peer learning took place in the common rooms, dormitories and courtyards.

⁷ ‘Harry Potter and the Deathly Hallows I and II’ were excluded completely from the analysis, since most of the plot is staged outside of the school, or the school was merely the background for fighting in the final scenes.

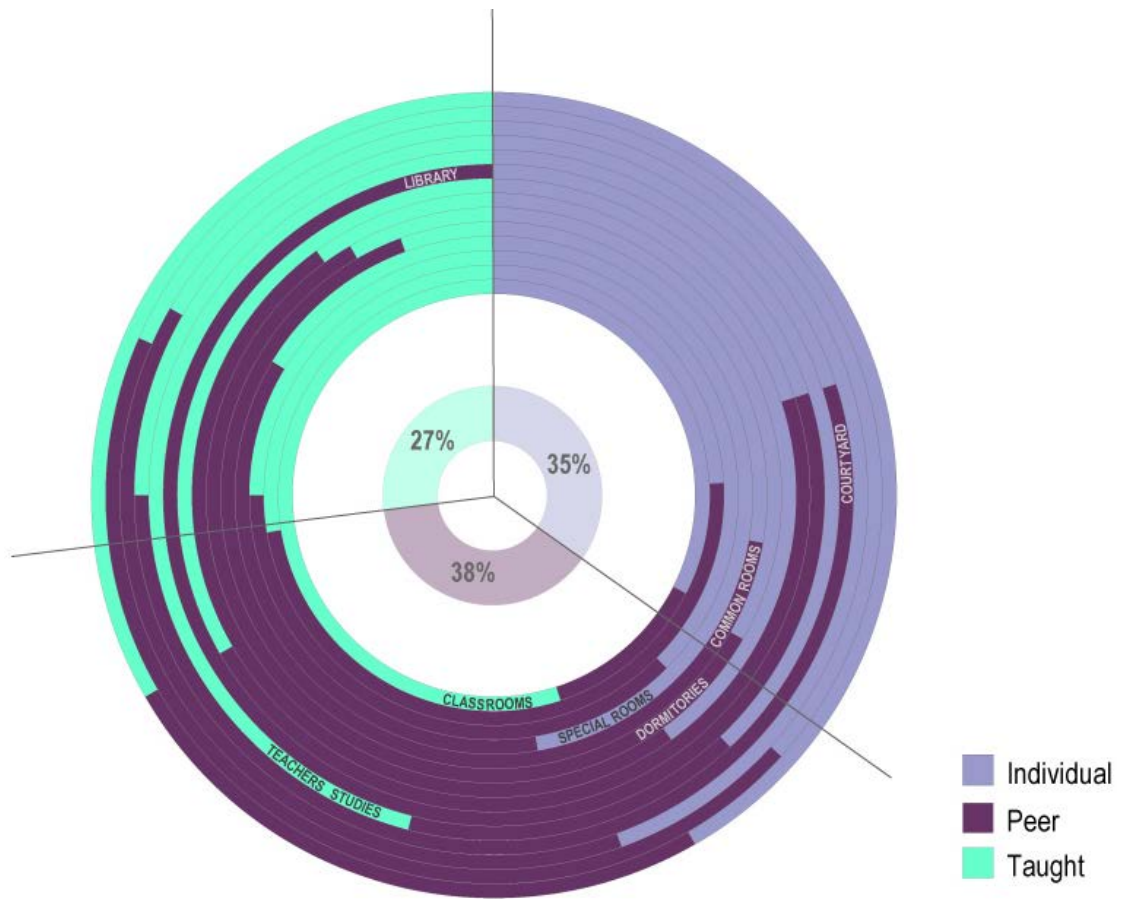


Figure 3: Overall split of learning processes by type (individual, peer, taught) as well as variation by location

The overall spatial and functional distribution of learning episodes is insightful, too. Figure 4 highlights where learning featured across the school premises.

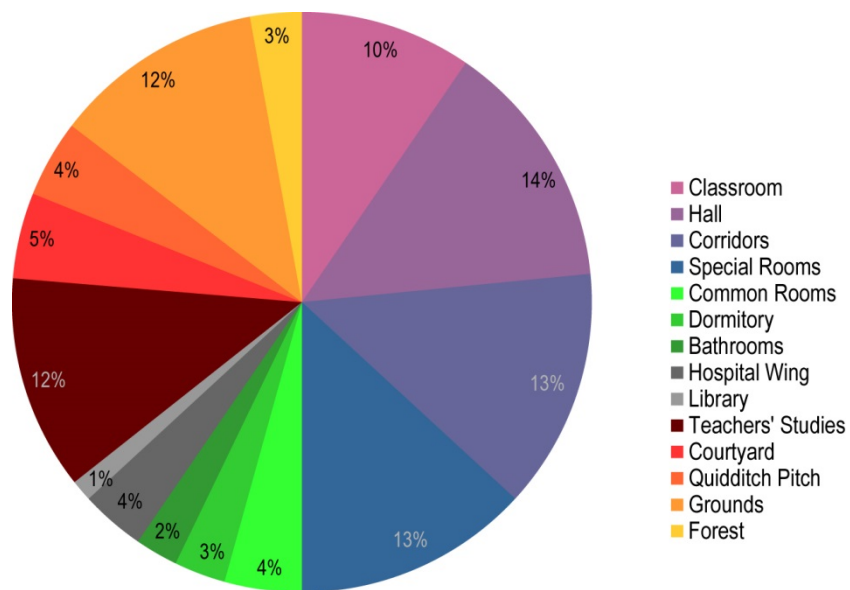
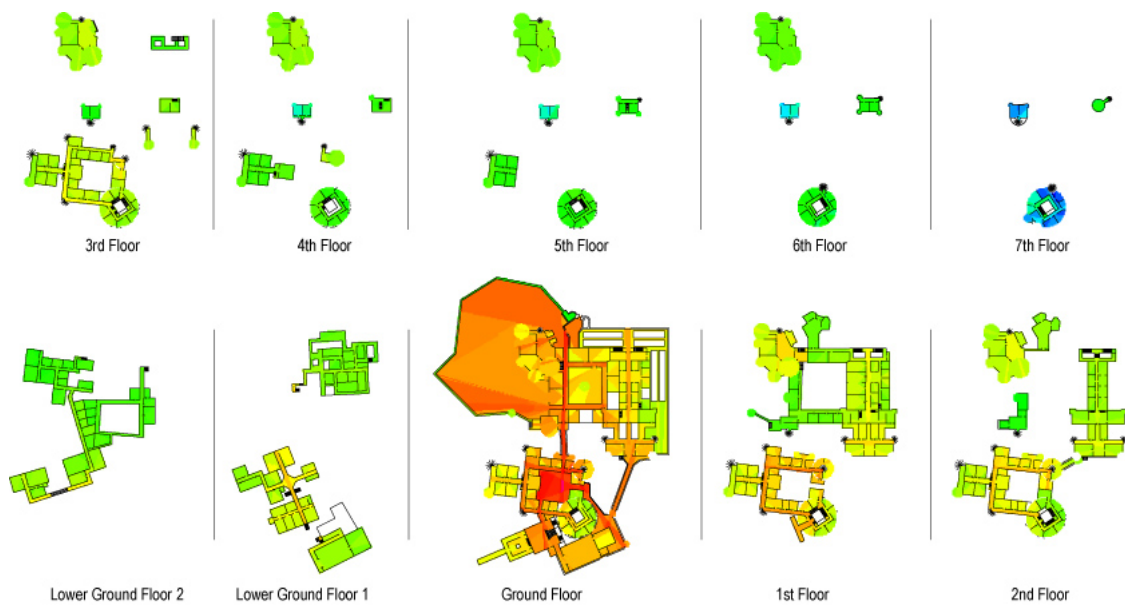


Figure 4: Overall split of learning processes by locations

Again, a very balanced picture presents itself with no single predominant location standing out. Classrooms account for only 10% of all learning shown in the movies. The most public spaces in the school i.e. corridors, the Great Hall, courtyards, quidditch pitch and grounds host 48% of all learning. Social spaces seem to be very important for learning and the way the plot is structured.

In order to understand further how learning processes are distributed across the school premises and to see which types of learning prefer integrated or segregated spaces, the floor plans of Hogwarts were analysed using visibility graphs (as shown in Figure 5a-b). The analysis highlights the main circulation system of corridors and outdoor spaces on the ground and first floor as the most integrated parts. The Great Hall is also rather integrated. Classrooms vary significantly in their integration depending on their location. The house common rooms and dormitories, but also the teachers' studies are rather segregated.



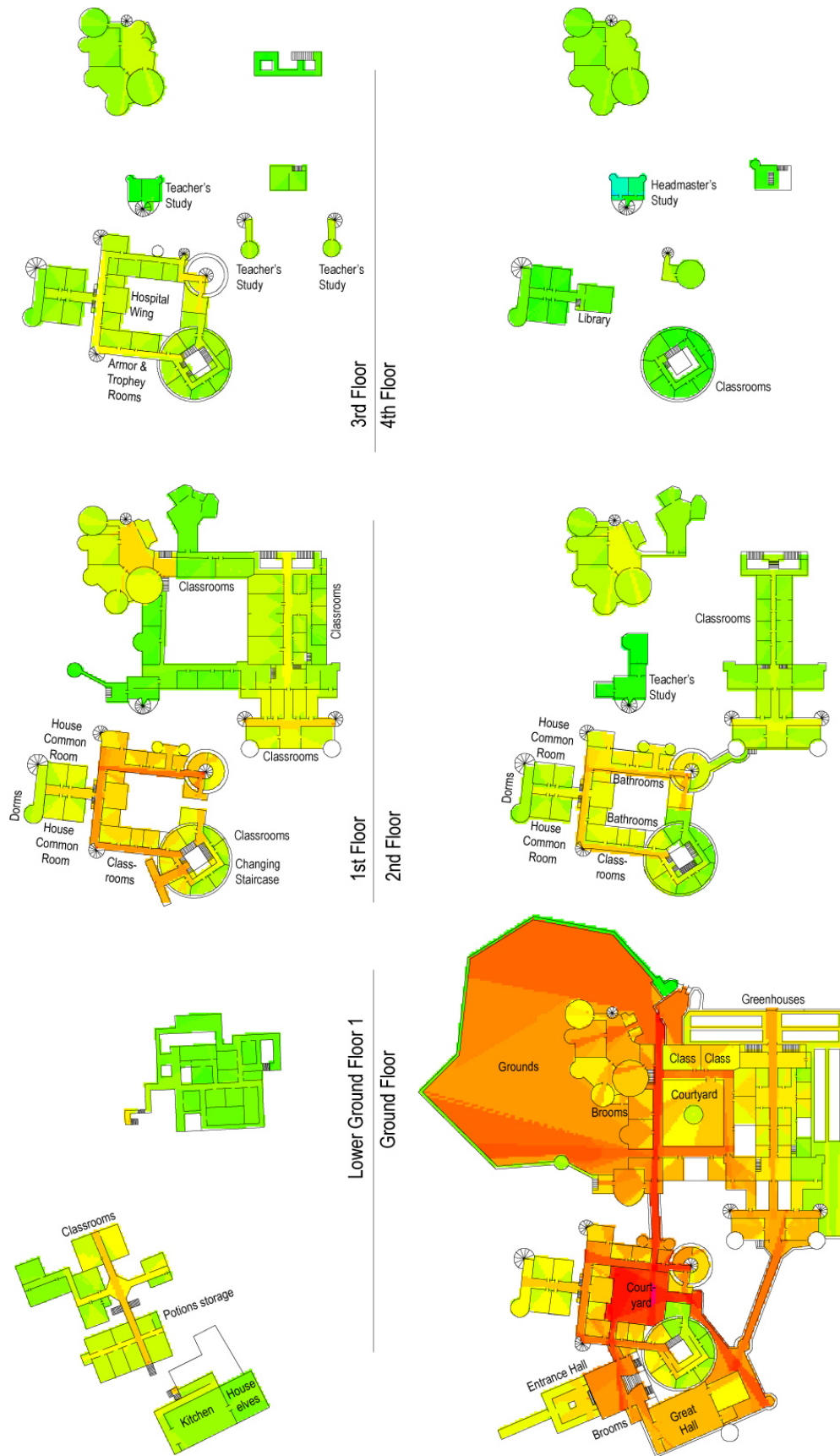


Figure 5a-b: Visibility Graph Analysis of the spatial configuration of Hogwarts (including outdoor spaces) for (a) all floors (top) and (b) for the most important floors including annotations

A full list of average mean depth values for the different functions can be found in table 1. Overall, the building presents itself as a very deep space. Mean depth values range from 6.8 (min.) to 25.2 (max.), which means that from the most segregated parts 25 'turns' (i.e. steps of visibility) are required on average to see all other areas. Average mean depth is 11.4, which is rather high even for a building with so many floors.⁸

LOCATIONS	AVERAGE MEAN DEPTH
Classroom	12.67
Hall	8.73
Corridors	10.17
Special Rooms	12.91
Common Rooms	10.69
Dormitory	11.41
Bathrooms	9.76
Hospital Wing	10.73
Library	14.42
Teachers' Studies	17.15
Courtyard	8.29
Quidditch Pitch	---
Grounds	8.38
Forest	---

Table 1: Average Mean Depth values of different functions and spaces at Hogwarts

Bringing together the syntactical analysis with the distribution of movie-staged learning episodes across different spaces, no relationship emerged for taught and individual learning, however, it was found that highly integrated functional areas tended to attract a higher percentage of peer learning. The relationship is only significant if the library is excluded from the analysis. Only 5 episodes of learning featured in this space and 4 of them were peer learning; therefore, due to small numbers the role of the library as an almost exclusive location of peer learning might be unrealistic. Unpacking the scattergram further (see Figure 6), it becomes apparent that the locations attracting a disproportionately higher rate of peer learning (i.e. those above the regression line) are mostly functions with a stronger programme (Hillier & Penn, 1991), where a deviation from configurational logic is to be expected. In contrast, the social and public spaces of the school are rather close to the regression line, indicating a weak programme and thus underlining the configurational logic. This means that the distribution of peer learning is jointly shaped by both the spatial configuration and attractors, which introduce strong programming.

⁸ To compare this to other buildings, two offices with seven floors each (as discussed in: Sailer, Pomeroy, Raheem, Budgen, & Lonsdale, 2012) showed average mean depth values of 4.6 and 7.4, which is considerably lower.

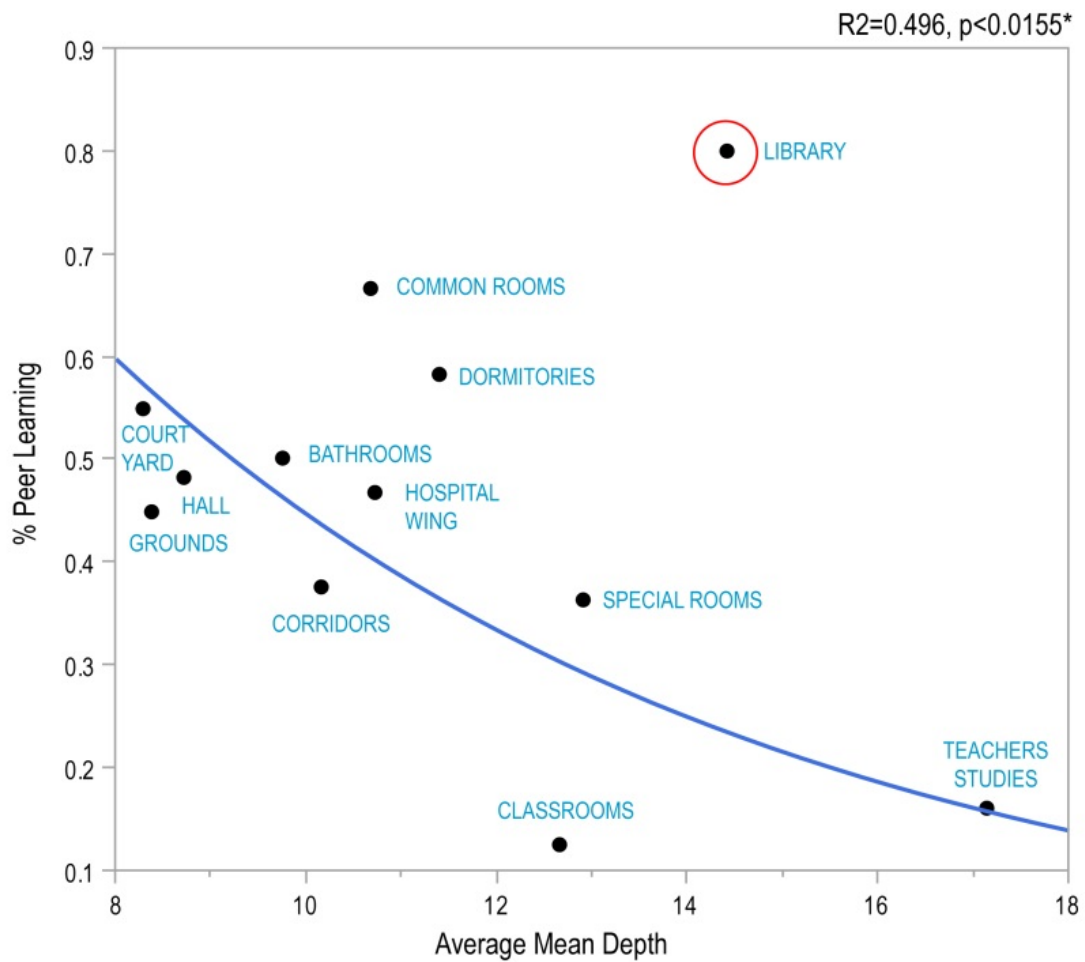


Figure 6: Correlation between average Mean Depth and percentage of peer learning across different functions and spaces at Hogwarts (Library excluded)

In summary, with a highly differentiated configuration, providing not only a wide range of integrated and segregated spaces, but also plenty of spaces for pupils to socialise and learn from their peers, it could be argued that different modes of learning as featured in the stories are supported well at Hogwarts.

The *relationship between teacher and taught at Hogwarts is generally shown as strong framing*, i.e. sharp boundaries between teacher and pupils, a high degree of discretion of the teacher and rather hierarchical relationships. Classrooms are strictly closed towards the corridor with no visibility relationships, thus assigning the teacher exclusive control over the class. In the movies, teachers always teach their classes alone and processes of coordination among teachers did not take place, which again underlines the powerful position of the teacher in the narrative. Two exceptions are noteworthy: firstly, Harry enjoys quite close and friendly relationships with some teachers, for instance with Prof Lupin (HP3) or Prof Dumbledore (especially in HP1 and HP6), which blurs the strict boundaries between teachers and pupils and indicates that framing is weakened under special circumstances. The second exceptional case is the interference of the Ministry of Magic in HP5 with the instatement of Prof Dolores Umbridge as High Inquisitor of Hogwarts, giving her the right to inspect and sack other teachers. Again, this temporarily introduced elements of weaker framing in an otherwise strictly strongly framed setting and plot. The spatial structure of Hogwarts supports the strong framing of relationships, not only through limited visibility into the classrooms, but also by the overall depth in the configuration, which corresponds to long models and mechanical solidarities.

The *movement economy* at Hogwarts is characterised by high levels of flow. Since each lesson takes place in its own dedicated space, all pupils move in between classes, generating a system of rich encounters and plenty of opportunities for pupils to interact. The complex layout of the school, specifically on the ground floor provides an element of choice in the system and means pupils can choose between different routes. As a whole, the building is not very intelligible with $R^2=0.27$ for the correlation between connectivity and integration (Hillier, 1996). However, the correlation is mostly driven by outliers introduced through outdoor spaces (grounds, courtyards). An alternative configurational model of Hogwarts excluding all exterior spaces results in an even lower intelligibility with $R^2=0.09$. This is mirrored in first year pupils often losing their way and coming late to classes, as it happened to Ron and Harry in HP1.

In contrast to movement flows, which introduce an element of generativity into the school, Hogwarts constructs rather controlled and limiting *interfaces among its user groups*. While a staff common room and a shared table for meals in the Great Hall enables solidarity among teachers, the seating arrangement is fixed, thus controlling the teacher-teacher interface. Teachers and pupils are mainly brought together in a structured way in classes, although informal and random encounters occur in corridors and public areas, too. The pupil-pupil interface is confined by the sorting of pupils into the four houses of Hogwarts, Gryffindor, Slytherin, Hufflepuff and Ravenclaw. 'Your house will be like your family' is what first year pupils hear in HP1 from Prof McGonagoll. The houses determine relationships at Hogwarts rather strongly: each has a dedicated table in the Great Hall and its own common room, where pupils spend their free time; most classes are taught by house with only some classes joined between the houses. This means the interface between pupils is controlled spatially (separate common rooms and communal tables in the Great Hall) as well as organisationally (class schedules) and not constructed as an all-play-all interface.

The structuring of interfaces relates very closely to the realisation of *spatial and transpatial solidarities*. For the teachers it is very difficult to build transpatial solidarities among themselves, since only one teacher of each subject speciality teaches at Hogwarts, which means there is no wider disciplinary community to consult with or exchange teaching practices and ideas. For the pupils, transpatial solidarities in contrast are rather strongly supported by the school organisation, since the sorting of pupils into houses follows their ideals, abilities, skills and character traits. The houses do not only form living and learning communities, but also drive competition and antagonism between them, since one house wins the annual House Cup and the houses compete for instance in the school sport Quidditch. Likewise, spatial solidarities through proximity and encounter arise partially from structured routines and rules (classroom schedules, house affiliation), but partially also from informal encounters in the corridors and halls, stemming from the generative movement economy at Hogwarts.

How and whether spatial and transpatial solidarities overlap and coincide determines *correspondence and non-correspondence models*. On the whole, Hogwarts can be considered a correspondence model, since transpatial identities (e.g. through house affiliation) are spatially enforced (e.g. common rooms, joint classes, seating arrangements in the Great Hall). Some elements of non-correspondence can be found in the narrative, for instance in the overall movement economy, but also to some degree through the initiative of pupils. In HP5, Hermione, Ron and Harry founded a student association to learn and practice skills in 'Defence against the Dark Arts', which involved students from different houses. Individual friendships also formed between the houses, for instance between Harry (Gryffindor) and Luna (Ravenclaw). While those relationships break up the correspondence between spatial and transpatial relationships somewhat, providing an exemplary case of the 'strength of weak ties' (Granovetter, 1973), the main focus of Hogwarts as a spatial and social system lies in strong solidarities at the group level and rather weak overall coherence.

7. Conclusions

Drawing on pedagogical and syntactical theories, this paper has developed a framework to describe and discuss the social and spatial organisation of schools in order to support the diversity of processes of teaching and learning that take place in today's school environments. The framework

provides a useful lens to unpack various phenomena inside school buildings, which was highlighted by applying the seven developed criteria to a single case study, Hogwarts School of Witchcraft and Wizardry.

The most obvious shortcoming of the paper (but also possibly its greatest strength) is the choice of a case study. Hogwarts is an imagined building; the movies do not depict ordinary school routines and everyday life, but follow a constructed plot and narrative; the floor plan is not verified and full of assumptions; observations could not be mapped exactly in space, but had to be associated with a general function or location, which makes the argument on the spatial distribution of activities potentially error prone. Still, this does not affect the contribution made by this paper, i.e. the methodological, conceptual and theoretical development of a way to analyse a school building in relation to pedagogical ideas and processes.

As part of this conceptual contribution, the paper also proposes a shift in the perception of teaching and learning. Traditionally, the focus of a school building lay in its classrooms; however, it is argued here that the importance of classrooms for learning may be overrated. Contemporary learning theories consider learning as a social process, where new insights are actively constructed in the mind of a learner through a mix of activities and processes. This is not tied to a classroom. In this spirit, it has been proposed that innovative learning environments are founded on the social nature of learning (OECD, 2013).

Hence, one could argue that innovative school buildings should enable social learning processes alongside instruction-based and individual modes of learning. This means a radical shift away from classrooms as the main concern of school buildings towards an appreciation of the important role of public spaces, corridors, atria, outdoor spaces and pupil-owned spaces. It also means a renewed understanding of the school building as a coherent whole, not necessarily in the sense of an entanglement of spatial, social, organisational, institutional, managerial and political influences, but more so as a spatial system, which depends on the functioning of both its parts and its connections. This underlines the importance of a syntactic approach in investigating the social and spatial organisation of schools.

Acknowledgements

The author would like to thank Lusine Tarkhanyan for sharing a geeky passion for Harry Potter and in providing invaluable help in obtaining floor plans, cleaning and preparing them for a syntactic analysis and interpreting some of the data. Thanks to the anonymous reviewer for very helpful comments.

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