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PhD Thesis

Assessing educational environments: A temporal socio-spatial approach to lower secondary school buildings in Cyprus

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Declaration of Doctoral Candidate

The present doctoral dissertation was submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy of the University of Cyprus. It is a product of original work of my own, unless otherwise mentioned through references, notes, or any other statements.

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Abstract

This research is concerned with the interplay between the school environment and school practices. At its core, it seeks to understand and analyse school environments and to identify the role of spatial layout and agency in socio-educational practices, with the main research questions being: How do the spatial layout and agency of lower secondary school buildings built in Cyprus after 2000 impact the socio-educational school life? And to what extent do lower secondary school buildings constructed in Cyprus after 2000 illustrate spatial, functional, and morphological consistencies?

The ten(10) most recent lower secondary schools in Cyprus are selected as case studies. The selection stems from the fact that open-air secondary schools are remarkably under-investigated in the existing scholarly work. At the same time, Cyprus is selected as the appropriate context of study since there is an overall lack of research exploring the relationship between school environment and school practices. The methodology of this study combines a cross-case comparative approach (top-down) that examines all ten (10) schools of the sample with an in-depth approach (bottom-up) that inspects two (2) schools of the sample so as to achieve a more holistic understanding of space usage patterns and social agency in schools.

Results show that genotypical patterns can be found among schools due to the design guidelines given by the authorities. In that sense, the role of agency in school buildings through the guidelines issued and social actions is revealed. In addition, the empirical validation of the framework proposed by Bernstein's and used by various scholars in architectural research suggests that this model can be used to map the relationship between school buildings, pedagogical practices, and school community. Lastly, this thesis presents various spatial factors influencing users' perceptions of their school and space usage patterns. Results point to the importance of the school's density on the ground, school's porosity, school's configuration, school's overall integration, school's fragmentation, classrooms' axial centrality, and classrooms' visual mean depth.

This research's innovative aspect lies in combining different theoretical and methodological approaches through a holistic framework by articulating a crosswalk between research depths and data types. At the same time, it contributes to the current lack of knowledge about open-air schools and through an evidence-based approach, it provides a critical evaluation of the existing design guidelines for the design of lower secondary school buildings in Cyprus.

Abstract

Η έρευνα αυτή ασχολείται με την διερεύνηση της σχέσης μεταξύ του σχολικού περιβάλλοντος και των σχολικών πρακτικών. Επιδιώκει να κατανοήσει και να αναλύσει το σχολικό περιβάλλον και να εντοπίσει το ρόλο της χωρικής διαμόρφωσης και των κοινωνικο-πολιτκών πρακτικών στην κοινωνικο-εκπαιδευτική ζωή του σχολείου. Πιο συγκεκριμένα επιδιώκει να απαντήσει: Σε ποιο βαθμό η χωρική διαμόρφωση και οι κοινωνικο-χωρικές πρακτικές σε σχολεία δευτεροβάθμιας εκπαίδευσης που χτίστηκαν στην Κύπρο μετά το 2000 επηρεάζουν την κοινωνικο-εκπαιδευτική ζωή. Καθώς επίσης σε ποιο βαθμό τα σχολεία αυτά παρουσιάζουν χωρικές, λειτουργικές και μορφολογικές ομοιότητες.

Τα δέκα (10) πιο σύγχρονα σχολεία δευτεροβάθμιας εκπαίδευσης που κτίστηκαν στην Κύπρο επιλέχθηκαν ως μελέτες περίπτωσης. Η επιλογή αυτή προέρχεται από το γεγονός ότι τα σχολεία ανοιχτής δομής, όπως αυτά στην Κύπρο, είναι εξαιρετικά υποερευνημένα στο υπάρχον επιστημονικό έργο. Ταυτόχρονα, η Κύπρος επιλέχθηκε ως το κατάλληλο κοινωνικό πλαίσιο καθώς υπάρχει σημαντική έλλειψη υφιστάμενης έρευνας που να διερευνά τη σχέση μεταξύ σχολικού περιβάλλοντος και σχολικών πρακτικών. Η μεθοδολογία της έρευνας συνδυάζει μια συγκριτική προσέγγιση που εξετάζει και τα δέκα σχολεία, μια μια πιο εις-βάθος δερεύνηση που εξετάζει δύο σχολεία έτσι ώστε να επιτευχθεί μια πιο ολιστική κατανόηση των προτύπων χρήσης του χώρου και των κοινωνικών πρακτικών.

Τα αποτελέσματα της έρευνας καταδεικνύουν ότι υπάρχουν κοινά μοτίβα μεταξύ σχολείων που προκύπτουν από τις κοινές κατευθύνσεις σχεδιασμού. Υπό αυτή την έννοια, αποκαλύπτεται η δύναμη των κοινωνικο-πολιτκών πρακτικών στη διαμόρφωση τον χώρο. Επιπρόσθετα, η εμπειρική επικύρωση του πλαισίου που προτάθηκε από τον Βερνστειν και αργότερα χρησιμοποιήθηκε από πολλούς ερευνητές στην αρχιτεκτονική κατέδειξε ότι το εν λόγω πλαίσιο μπορεί να χρησιμοποιηθεί για τη χαρτογράφηση των σχέσεων μεταξύ σχολικού κτιρίου, παιδαγωγικών πρακτικών και σχολική κοινότητας. Τέλος, με την παρουσίαση των αποτελεσμάτων η παρούσα έρευνα εισηγείται διάφορους χωρικούς παράγοντες που φαίνεται να επηρεάζουν τις αντιλήψεις των χρηστών αλλά και τον τρόπο συμπεριφοράς των χρηστών. Πιο συγκεκριμένα, τα αποτελέσματα αναδεικνύουν τη σημασία της πυκνότητας του σχολικού κτιρίου, της διεπαφής αυτού με τον δρόμο, της συνολικής διαμόρφωσης του, του κατακερματισμού ή όχι του εξωτερικού χώρου, της κεντρικότητα των τάξεων αλλά και του οπτικού βάθους των τάξεων.

Η καινοτόμος πτυχή της εν λόγω έρευνας έγκειται στο συνδυασμό διαφορετικών θεωρητικών και μεθοδολογικών προσεγγίσεων μέσω ενός ολιστικού πλαισίου που συνδυάζει διαφορετικά βάθη έρευνας και τύπους δεδομένων. Ταυτόχρονα, συμβάλλει στην τρέχουσα έλλειψη γνώσης σχετικά με τα ανοιχτού τύπου σχολεία όπως αυτά στην Κύπρο και προσφέρει μια κριτική αξιολόγηση των προτύπων σχεδιασμού σχολείων δευτεροβάθμιας εκπαίδευσης στην Κύπρο.

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List of Abbreviations

MOEC	**M**inistry **O**f **E**ducation and **C**ulture
TDMOEC	**T**echnical **D**epartment of **M**inistry **O**f **E**ducation and **C**ulture
NACH	**N**ormalised **A**angular **C**hoice
AMD	**A**xial **M**ean **D**epth
VMD	**V**isual **M**ean **D**epth

To Zenon, Niki, Michalis, Andreas . . .

Chapter 1

Introduction

Schools have always been "complex systems with an important function in society, namely, educating the future generations" (Williams et al., 2014, p.83), fostering cognitive development, conveying information and knowledge about subject matters of the curriculum as well as conveying the joy and excitement of learning (Rivlin and Weinstein, 1984). Namely, schools have an important role to support individual achievement and help young individuals develop themselves and their skills.

Historically, schools have also been the first building type which pupils experience outside of their homes (Sailer, 2015) and have always had significant responsibility for contributing to pupils socialisation (Rivlin and Weinstein, 1984). In that sense, the purpose of today's schools is no longer to simply provide knowledge and skills (Heitor, 2005) but also to convey the ideas and values of society, prepare pupils for their role in society, and help them form meaningful interpersonal relationships and interactions.

However, despite the fact that schooling occurs in buildings while people interact and live in spaces, the physical setting of schools has often been neglected in relevant studies and discussions. In particular, as early as a century ago, educational reformers such as Dewey (1902; 1916) and Perry (**Perry1908TheSchool**) have pointed out that distinctive school characteristics could affect the life and learning of students. As characteristically stated by Dewey, the school environment can "promote or hinder, stimulate, or inhabit the characteristic activities of a living being" (Dewey, 1916, p.16). Therefore, it is essential to consider how a given school space operates and how it relates to school practices.

Such an understanding is particularly important nowadays since we live in an era of rising standards and expectations for education. For this reason, the provision of quality schools has generally moved up in the political agendas. In the particular context of Cyprus, this has been a significant issue for discussion during the past few years, since the public expenditure of Cyprus on education is relatively high and at the same time, the average national scores in international studies are significantly below expectations (The world Bank, 2014) (i.e, in studies such as TIMSS and PISA).

Additionally, in the specific context of Cyprus, the science of evaluating school environments and school design guidelines is currently non-existent. Only recently, the ongoing issues on students' performance, school safety, and the current educational crisis due to the Covid-19 pandemic and subsequent measures have fostered the initiation of collaborative channels between academia and the authorities for the evaluation of educational buildings in Cyprus.

Lastly, schools in Cyprus have an open-air structure, a fact that it is interesting in itself. The designation of schools as open-air is based on the particular properties of schools in Cyprus and is to a certain extent inspired by the open-air movement of schools in the early 20th century in Europe and elsewhere (Kingsley and Dresslar, 1916; Winsted, 1912). Open-air schools in the early 20th century were inspired by the German model of forest schools and were originally designed to prevent the widespread rise of tuberculosis that occurred after the Second World War. Those schools, unlike compact schools, were built based on the concept that exposure to fresh air, good ventilation, and generally adequate connection to the outside environment were paramount. Therefore, based on the degree to which schools in Cyprus articulate a non-compact school structure and are composed of various enclosed functional units which are connected by means of covered, open-air circulation units and outdoor areas (i.e courtyards or general outdoors), this thesis designates them as open-air. In particular, school buildings in Cyprus are mainly composed of two parts, one particularly big and instantly perceived (sports area) and another particularly fragmented, which is composed by various building units, open-air circulation structures (main school unit) and various outdoor areas. Hence, this unique spatial structure poses significant challenges regarding how school buildings in Cyprus can be studied, analysed, and evaluated.

1.1 Approaching School Environments and School's Life

The study of school environments has traditionally focused on more technical terms. Thus, not enough available evidence can explain the relationship of the school building with the school's life (Fisher, 2005). In particular, despite the fact that existing research studies dealing with the effect of basic physical variables such as lighting, sound, air quality, temperature, noise on students' attainment have a relative consistency (Barrett and Zhang, 2012; Shield and Dockrell, 2008), the conclusions regarding the relationship of other physical characteristics such as spatial configuration with students' behaviour and perception are relatively sparse (Higgins et al., 2005; Sailer, 2015; Fouad and Sailer, 2019). Only a small number of studies have considered and evaluated the spatial layout of the school in relation to various school practices.

Firstly, there is a valid contribution in investigating the link between various aspects of the school environment and students' attainment. Existing studies by adopting a rather instrumental approach for the evaluation of a school's layout, various studies have established a link between various spatial parameters (i.e, daylight, movement and circulation structure, patterns of view, and functional allocation) on students' attainment (Tanner, 2008; Barrett, Zhang, and Barrett, 2011; Tanner, 2009). Yet, it should be stated that in such approaches there is a tendency to reduce the educational action to learning and thus to address school environments as confined to school classroom. However, fostering community is critical to learning (Oblinger, 2006) and therefore, the reduction of learning to attainment scores is can no longer be considered as the sole indicator for positive school environments.

Additionally, few studies in the existing body of literature examine the relationship of school building with school processes by emphasising the social context of learning. For instance, they investigate a school's spatial configuration along with patterns of social interaction (Pasalar, 2003) and children's distribution in schools (Taguchi and Kishimoto, 2012). There are also valid attempts to examine the impact of school layout on school's social climate and students' social well-being (Gislason, 2009) as well as on students' and teachers' psychological well-being (Cotterell, 1984).

The school building as a pedagogical device is approached by few studies so as to decode the relationship between school building and pedagogical practices. For instance, they study the effect of the school building on pedagogy as well as the impact of various spatial conditions (such as the size of the school, the syntactical centrality of functions) on the school's ability to provide flexible education (Kishimoto and Taguchi, 2014).

In other directions, studies primarily from the field of space syntax research have incorporated Bernstein's (1973) dimensions of classification and framing so as to decode the relationship between the school building and pedagogical practices (Sailer, 2015; Sailer, 2018; Peatross and Peponis, 1995; Mclane, 2015). Into more details, they have attempted to transcribe Bernstein's dimensions to space and argue that an educational building could be characterised as strongly or weakly classified and framed. Classification refers to the degree of boundary between contents, while framing refers to the degree of control in the transmission of educational knowledge. Thus, strong classification and framing produce a *collection educational code*, while weak classification and framing point towards an *integrated educational code* which blurs the boundaries between subjects and at the same time reduces the power of the teacher over what and how it is taught. In turn, a *collection code* points towards a school community which is characterised by cohesion and originates from the homogeneity of individuals (mechanical solidarity), while an *integration code* points towards a school community where individuals rely on each other despite being different (organic solidarity).

In that sense, existing studies have contributed in establishing the existence of a strong link between school space, school practices, users' perceptions, and attributes. Arguably, existing work has made a valid attempt in highlighting the role of design and school's layout in affecting learning performance, attainment, interaction between students, users' perceptions, and the opportunities to accommodate different teaching and learning styles. Lastly, the incorporation of Bernstein's dimensions of classification and framing in existing studies has offered a promising framework through which the relationship between school space and pedagogical practices can be decoded.

1.2 Knowledge gap

Despite the valid contribution of existing scholarly work, the collection of existing studies in this field is remarkably diverse, inconsistent, and fragmented (Sailer, 2015; Higgins et al., 2005). Specifically, it still remains unclear how school environments can be approached, analysed and thus how they relate with particular school practices. The existing body of literature is also characterised by an overall paucity of research studies that address the parameters that define a positive school environment (Higgins et al., 2005). At the same time, the science of designing school buildings based on evidence (or empirical data) is currently remarkably underdeveloped.

In addition, it seems that very few studies have attempted to address and understand the school environment as a complex and dynamic socio-spatial system which is constantly changing (i.e, by principal's decisions, by students and teachers behaviours in schools etc). However, this is particularly important, since in recent years relational theories such as Assemblage Theory (Deleuze and Guattari, 1987; DeLanda, 2006) underscore the necessity of approaching space in 'terms of process, identity formation, [and] becoming' (Dovey and Fisher, 2014, p.49). In other words, they highlight the importance of embracing *social agency* in order to fully grasp the complex nature of school spaces as well as the embeddedness of various actors and social agency in the school environment. In that respect, by considering only *spatial agency* (**Hillier2012b**) or the way the spatial configuration can have particular lawful effects on the space usage pattern is not enough in order to fully address the complex nature of school environments.

Methodologically, in the existing literature there is an overall lack of empirical evidence (Higgins et al., 2005; Woolner et al., 2007). In that sense, in the existing body of literature, either a big database of schools has been examined comparatively by considering various aspects of the school environment or a small sample of schools has been examined by collecting empirical data. Therefore, no crosswalks between types of data have been achieved in the existing body of literature.

In the particular context of space syntax research, despite the fact that existing studies have offered valuable methodological insights on the way school space can be understood, approached, and analysed, there is currently no contribution on open-air schools. In particular, no previous studies have been identified exploring open-air schools such as the ones in Cyprus. Yet, open-air schools pose particular challenges for space syntax analysis, since they are composed by two completely different parts with different spatial logic. Additionally, despite the valid contribution of studies which have tried to incorporate Bernstein's (1973) in the investigation of the relationship between school space and pedagogical practices, there is currently no empirical validation of the above framework.

Additionally, rarely the wider context of learning and the relationship of the school community with school building design has been addressed. More precisely, in the existing body of literature there is a tendency of bounding the educational process to formal learning, and, thus, to examine school environments as limited to the school classroom. Lastly, it appears that secondary schools, schools which cater students during the critical age of adolescence, are remarkably underinvestigated in the existing body of literature (Ucci et al., 2015).

The problems that are mentioned above can be traced back to the following distinctive issues:

- School environments are particularly complex;
- School environments are on the edge of two scientific fields: architecture and education. Thus, neither studies from the discourse of architecture have been able to grasp in detail various socio-educational aspects, nor studies from the educational field have managed to describe with an increased level of detail spatial aspects that can be beneficial for school practices;
- The link between school space, school practices and social agency is complex and happens at various scales (i.e scale of the school environment and headteachers decisions, and scale of Ministry decision about design);
- There are diverse ways in which space can be evaluated and examined;
- There are diverse ways in which school practices are defined, prioritised and analysed;
- It is difficult to address by which terms a school can be considered successful from the various user groups;

Therefore, a more integrated framework is required in order to be able to understand and study this complex and multidimensional character of the school environment. In other words, the framework should be able to:

- Highlight the temporal aspect of the school environment;
- Reveal the role of social agency in school buildings;
- Approach school environments at different scales;
- Address effectively the relationship between school building and pedagogical processes;
- Address the complexity of school environments.

1.3 Research Objectives and Research Questions

This thesis is concerned with the interplay between the school environment and school practices. At its core, it seeks to understand school environments and at the same time to identify which characteristics of the school environment can contribute to better school practices.

More particularly, it questions the simplistic consideration of space as a shell or container of action. In contrast, it seeks to understand the socio-spatial conditions that constitute school environments complex, multidimensional, and dynamic. It also aims at developing a theoretical and methodological framework able to address, understand, and decode the interplay between the school environment, school practices, and social agency. More specifically, this thesis:

- Is concerned with the interplay between the school environment and school practices;
- Seeks to understand and approach school environments and at the same time to identify the role of spatial layout and social agency in socio-educational practices taking place within the school environment;
- Aims to illustrate the diversity and complexity of school buildings;
- Aims to enrich our current understanding of the relationships between school buildings and pedagogical practices.

Thus, the aim of this thesis formulates the overarching research question/hypothesis which is to explore, reveal, and identify:

The intertwining relation between the spatial layout and social agency, pedagogy and social behaviours, in lower secondary school buildings built in Cyprus after 2000

This complex question is addressed through a series of investigations that are grouped in three broad categories:

Genotypical Patterns in Open-Air Schools and Building Potential

- To what extent do lower secondary school buildings built in Cyprus after 2000 illustrate morphological, spatial, and functional consistencies? (is investigated in chapter 5)

School as a temporal socio-spatial educational assemblage:

- To what extent the school environment can be approached as an assemblage of various socio-educational codes that are constantly formed and create particular forms of solidarity? (is investigated in chapter 6)
- To what extent can a school's educational code be shifted by means of social agency and rule application? (is examined in chapter 6)

School layout, Actual Use of Space and Users' perceptions:

- What are the implications of school's characteristics on teachers' perceptions about the actual use of space? (is investigated in chapter 7)

- How do socio-spatial conditions in school affect school life and school community? (is examined in chapter 8)
- To what extent spatial, social, and personal parameters can address students' positive attributes towards school? (is investigated in chapter 8)

1.4 Thesis structure

To address the overarching hypothesis and research questions, this thesis is developed through the following structure:

Chapter 2 reviews the relevant literature in the field of interest and lies the foundation for this thesis. More precisely, it firstly discusses the critical age of adolescence in an effort to define the particular needs for this transitional period. Secondly, it includes relevant research studies dealing with the interplay between the school building and school practices from a wide array of perspectives. An introduction to the theory and concepts of space syntax, social assemblage, and Bernstein's educational theory follows in order to establish the link between spatial configuration and socio-educational practices. The review concludes that very few studies have collected empirical data, have approached the school building as a whole, and have addressed the importance of the wider context of learning. Therefore, it identifies the need for further exploratory work in the area that tries to understand the interplay between spatial configuration, social agency, space usage, and users' perceptions.

Chapter 3 introduces both the context of the study and case studies. Firstly, it portrays the historico-educational changes that have occurred in Cyprus and discusses the design of secondary schools in Cyprus diachronically. It then summarises the design guidelines for the construction of lower secondary schools in Cyprus and presents this thesis case studies.

The next chapter 4 outlines the methodological approach adopted by this research and explains the reasoning behind the selection of the particular methodology. It also provides explanations for the choice and the combination of methods. It also elaborates in detail on both the qualitative and quantitative methods which have been used so as to understand the interplay between school building and school practices. More precisely, it firstly explains how space syntax methods are used to study the spatial configuration of school buildings along with other methods able to grasp the spatial, functional and morphological composition of schools. Additionally, it discusses how qualitative feedback has been collected by school users through standardised online questionnaires and empirical information by ethnographic observations, interviews, and informal talks.

The following four chapters present empirical evidence and comparative analysis at different depths and cases to discuss the interplay between school building, socio-educational practices, and school life.

Chapter 5 gives a detailed account of the morphological, spatial, and functional composition of all 10 case studies. This chapter follows a three-step approach: At first, it explores schools from a rather morphological perspective. It presents all 10 cases comparatively in respect to the school plot, urban density around the plot, school porosity in relation to the street, and built form. Secondly, the spatial composition is decoded to shed light on the configurational structure of each school and thus rendering space usage potential. In a third step, the functional composition is studied to develop an understanding on how different architects have distributed functions across school plots and whether there are consistencies which derive from the common programmatic needs. Lastly, a more synthetic reading brings together all insights and discusses similarities and differences between schools.

Based on the spatial, functional and morphological data that are discussed in chapter 5 and existing research, chapter 6 classifies the 10 schools based on their 'educational code'. In particular, it builds on existing studies that are presented in chapter 2, which highlight the potential of incorporating Bernstein's theory of pedagogic practice to investigate school buildings. Hence, it brings together all metrics derived by the previous chapter and then uses a set of hypotheses in order to identify the degrees of classification and framing and thus the school's educational code. Additionally, this chapter, by building on the existing concepts, proposes a temporal approach through which the concepts of Bernstein (1973) can be transcribed to space. Eventually, this temporal approach highlights the role of agency in school buildings and the extent to which the social agency can shift the educational code which is provided by the school building itself.

The following chapter 7 explores the commonalities and differences between open-air secondary schools built in Cyprus after 2000 in relation to teachers' perceptions about school control, school community, and the school's ability to cope with changes. The process of understanding the commonalities and differences between schools is threefold: Firstly, a hypothesis-derived process identifies groups of schools that have particular characteristics through a correlation matrix that explores purely the correlation of variables (such as schools with bigger segment length, tend to have lower visual mean depth). Secondly, a assumption-based clustering explores relationships between schools based on a set of hypotheses which stem from the review of existing literature. Both groups are then visualised through a two-mode network which presents the strength of the relationships between different schools. This nuanced understanding enables firstly to render more precisely the relationships between schools and secondly offers a thorough reflection on teachers' perceptions about school control, school community, and the school's ability to cope with changes.

Chapter 8 evaluates the relationships between the school building and school practices by looking at the actual use of space and students' perceptions. Firstly, the different types of movement in open-air schools as well as stationary activities are explored. The results are then discussed in the light of the conclusions from the previous chapters, providing an empirical validation of the framework proposed for the investigation of a school's educational code based on Bernstein's concepts (chapter 6). Lastly, it provides a spatialised understanding of students' positive attributes towards their school.

Chapter 9 discusses the results by referring to the review of existing literature and by exploring six distinctive topics. Firstly, it points out through various insights from this research the role of agency in school buildings at different scales and levels of intervention. Thus, it discusses how the school environment can be understood as a socio-spatial assemblage and stresses the relationship of the school building with decision making. Secondly, by reflecting on this thesis' findings, it stresses the importance of the wider context of learning in adolescence and the relationship of the school building with users' perceptions. Fourthly, by synthesising all insights from this thesis, it provides particular design guidelines for practising architects that might contribute to an overall better school climate. Lastly, it offers a critical evaluation of the design guidelines given by the authorities in Cyprus and discusses the space syntax methods that appear to be useful when examining open-air schools. The last chapter, chapter 10, provides a top level summary of findings, discusses limitations and contribution of this thesis and identifies further research in the field.

Chapter 2

Literature Review

This chapter discusses theoretical prepositions and research studies exploring the relationships between school spatial structure and school life. The purpose of this literature review is to bring together some of the more well-known work on school environments and to highlight opportunities and directions for future research in this field of study.

Due to the fact that this research explores secondary schools, the literature review begins by referring to the critical age of adolescence. It renders the complex nature of this transitional period, and thus, it highlights the parameters that are important for this particular stage in an individual's life. The chapter continues with a thematic investigation of existing scholarly work exploring the relationships between school buildings and school practices, and the gaps in the existing body of literature are then discussed. Lastly, by revealing the dynamic and complex nature of school environments discusses three main scientific perspectives that are used in order to address firstly the complexity of school environments and secondly to bridge the gaps that have been identified in the existing scholarly work. Specifically, to disentangle school environments' complexity, it provides a brief introduction to space syntax theory, assemblage theory, and Bernstein's pedagogic framework in order to render the theoretical and methodological grounds of this research.

2.1 Understanding school practices in the light of the critical age of adolescence

Since this study explores secondary schools for young adolescents, it is firstly necessary to render the unique characteristics of the critical age of adolescence in respect to learning and development. Such an understanding can offer important insights when examining and evaluating the school environment for this particular age group. Hence, this section constitutes an attempt to decode the nature of this transitional period in ones individual's life by reviewing several representative accounts from a wide range of perspectives.

2.1.1 Understanding students during a period of change

The term *adolescent* has appeared in the fifteenth century and has derived by the ancient word *adolescence* which means to grow into maturity. For this reason, the beginning of adolescence is usually defined by a biological event (Blakemore and Mills, 2014). In contrast, the end of adolescence is often defined socially. Due to this complexity, it is usually defined as the transitional period from childhood to adulthood where there are tremendous changes on adolescents' physical, cognitive, emotional, social and behavioural development (Curtis, 2015; World Health Organization, 2018; American Psychological Association, 2002). In essence, adolescence is the stage in which individuals have to reexamine essential experiences and beliefs in order to be prepared for their new role in society. In addition, adolescence embraces a wide range of behaviours, thoughts, feelings, and health-related issues (Bergevin, Bukowski, and Miners, 2003). In essence, in comparison with childhood, during adolescence pupils participate in much more numerous and complex social domains, where they act, feel, and interact with others.

The most commonly used chronological positioning of this period includes 10 to 18 years. Yet, in various studies it may expand from 9 to 26 years depending on the definition (Curtis, 2015). In fact, theorists have historically differed in the chronological description of adolescence and its subsequent stages. Early adolescence is usually defined from 10 to 13, middle adolescence from 14 to 16 (Neinstein et al., 2009) or from 14 to 18 (Steinberg, 2002) and late adolescence from 17 to 21 or from 19 to 22 years old. However, currently, there is no accepted chronological definition for the age or stages of adolescence.

G. Stanley Hall was the first who developed a theoretical perspective on adolescence in 1904 and saw this period as a 'new birth'. Hall characterises adolescence as a time of storm and stress, a second birth, and primarily a time of oppositions (Arnett and Hamilton, 2006). His preposition mentions that by starting from early adolescence, pupils experience physical, cognitive, emotional, social and behavioural changes, with the most recognisable hallmark being the **physical changes**. During this period, adolescents face a pubertal metamorphosis that transforms them from children to adults through physical growth and sexual maturation (Lerner and Steinberg, 2009). The physical changes usually begin at the age of 10 to 12 in girls and from 12 to 14 in boys (American Psychological Association, 2002).

Secondly, significant **changes happen in the way adolescents think, understand and reason (cognitive development)**. During this period, pupils transform from the concrete black-and-white thinkers into abstract thinkers with problem-solving abilities. Specifically, according to Piaget (1954), during the critical age of adolescence, pupils pass from the concrete operational stage of cognitive development (7-11 years old) to the formal operational stage (12-adulthood). Generally, as the development moves towards the last two stages of development the ability of pupils to solve problems through experimentation increases. Simultaneously, they gradually understand that the things that surround them have a trajectory independent of themselves which means that the 'egocentrisism' decreases. Arguably, during these stages, pupils are able to analyse situations, to reason effectively, to think abstractly and to accommodate existing knowledge into new information - situations (American Psychological Association, 2002). Especially during this final stage of development (formal operational), adolescents start thinking in terms of abstraction, relations, and causes that help them to make sense of their environment.

The above developmental condition is also apparent in the way young adolescents understand their immediate environment. Research results in the field of environmental psychology suggest that children at the age of 10 or 11 (during early adolescence) view their environment in accordance with their reference system, which becomes more abstract and allocentric as they get older. In other words, they no longer consider their point of view of the world as the only point from which one can see the world, but they start to acknowledge other persons' perspectives of the world (Hart and Moore, 1973). At the same time, pupils in early adolescence tend to prefer places because of their specific activity, while older pupils tend to prefer places due to their aesthetics and cognitive values (Malinowski and Thurber, 1996) .

As regards adolescents' cognitive development, the importance of the social interaction between oneself and others has been also stressed (Vygotsky, 1978). Specifically, it appears that "every function in the child's cultural development appears twice: first, on the social level, and later on the individual level. In essence, between people (interpsychological), and then inside the learner (intrapsychological)." (Vygotsky, 1978, p.57).

Thirdly, **changes can also be found in adolescents moral development**. Moral development refers to the changes occurring in the sense of values and ethical behaviour. Specifically, during the critical age of adolescence, pupils pass through the post-conventional level of morality (Kohlberg, 1981). Also, there is a clear effort by individuals to define moral values apart from the authority of their group or their family. In that sense, individuals internalise their own rules and values and start acknowledging that the social rules can be differentiated. Therefore, such an understanding depicts the role of the group in moral reasoning and emphasises the individuals' ability to define what is valuable for them regardless of the group that might belong.

Adolescents' social development is also rendered in the existing body of literature. Social development is best addressed as the context where adolescents relate to their peers, friends, family, school and community in general. Arguably, what is particularly important during adolescence is the shift from family to peers. During this age, friendship and peer relationships are becoming particularly important both for their cognitive development (Vygotsky, 1978) as well as for their psychological adjustment. However, the nature of individuals' involvement with their peers changes throughout adolescence. Younger adolescents tend to have at least one peer group whose members tend to be similar in many respects (i.e gender). In that respect, during early adolescence there is a strong need for friendship intimacy

(American Psychological Association, 2002; Sullivan, 1953). During middle adolescence, groups tend to be more mix-gendered and there is a growing need for romantic intimacy (Sullivan, 1953). Lastly, by late adolescence more intimate dyadic relationships are formed (American Psychological Association, 2002) since there is a growing need to integrate a love relationship (Sullivan, 1953).

The above social conditions are not only reflected on the racial composition of adolescents' groups but also on their particular place preference. More precisely, studies suggest that 6-11 years old children are extensively engaged in their local environment with their same-sex friends, while older children (12-17 years old) form new mixed-sex groups in more distant settings (Chawla, 1992). In that sense, the dimensions of freedom and control are considered crucial factors for sdolescents when evaluating their outdoor places (Owens, 1988).

The **emotional development during adolescence** involves the establishment of the sense of identity in regards to others (American Psychological Association, 2002) as well as for an individual's personality formation (Blos, 1979). In that sense, the balance between the growing need for independence and the maintenance of parental bond is considered a critical aspect in adolescence. In addition, it is also argued that an individuals' identity formation is not totally formed during childhood, but it continues to be formulated during an individual's entire life (Erikson, 1968). In particular, Erikson (1968) have suggested that adolescence consists of developmental stages that are characterised by different sets of goals and needs and several psycho-social conflicts that have to be resolved: trust/mistrust, autonomy/doubt, initiative/guilt, industry/inferiority, identity/role confusion, intimacy/isolation, generativity/stagnation, and ego integrity/despair. Thus, during adolescence (11-18 years old), pupils engage in constructing their self-identity and their social role. In essence, during this period, pupils struggle with the crisis of identity formation versus role confusion, while their role in the social groups they belong is essential.

Going one step further, existing scholarly work suggests that experiences and cognition of place can form place identities that have a significant role on an individual's emotions and self-regulation (Korpela, Kytta, and Harting, 2002). In that sense, place preference is closely related to the development of self-identify, the need for security and social attachment. Thus, place identity measured by preferred places, is considered a sub system of self-identity and thus may be differentiated with age (Korpela, Kytta, and Harting, 2002).

Therefore, in order to summarise it can be argued that all ways adolescents develop, prepare them to experience a wide array of new behaviours. Risk-taking, new decision making, and realistic assessment of themselves are some of the characteristics behaviours of this period. Additionally, behavioural patterns during this age can be considered according to Lewin's (1939) field theory as conflicts. In particular, they can be understood as competing forces that primarily arise due to the fact that individuals find themselves in a social position between that of a child and that of the adult. In turn, these conflicts give rise to emotional tension.

It is becoming, therefore, apparent that:

- Adolescence is a transitional period;
- It is composed of at least 3 stages (pre-, early- and late-);
- Adolescents face tremendous changes (physical, cognitive, emotional, social, moral, behavioural);
- Pupils move towards the last stage of their cognitive development during the period of adolescence;
- Peer relationships are essential in many respects (cognitive, moral, social and behavioural development);
- This period is characterised by conflicts and confusion as well as by identity and personality formation;
- Young adolescents find themselves in a social position which stands in-between peer relationships and their family;
- Place preference and relationship with their socio-spatial environment are particularly important during this transitional period.

2.1.2 Adolescence and Wider Contexts of Learning

Traditional epistemology considered "children as 'empty vessels to be filled" (Sailer, 2015, p.34:2) and teachers as the only source for knowledge transmission. This paradigm has been gradually challenged by recent approaches claiming that knowledge cannot be considered as attained but constructed (Kim, 2005; Von Glasersfeld, 1989). Specifically, as the pragmatist philosopher John Dewey (1916) have pointed out, education is an active and constructive process and not merely a process of 'telling' and 'being told'. Thus, it should be considered as a process of continuous growth.

One of the most fundamental influences towards this conception has been Immanuel Kant's account (2010, p.27) on how we gain knowledge of the world. Kant in his book *critique of pure reason* argues that "all [of] our knowledge begins with experience". This constructivist thinking reveals the **importance of experience** in education (Dewey, 1902; Kolb, 1984) for the active engagement [1] of students in learning processes. In essence, experiential learning "is a continuous process and implies that we all bring to learning situations our own knowledge, ideas, beliefs and practices at different levels of elaboration that should in turn be amended or shaped by the experience – if we learn from it" (Fry, Ketteridge, and Marshall, 2009, p.15). In other words, learners can be involved in new experiences and then be able to reflect on their own experience. Subsequently, they have to be able to form as well

[1] An active learning involves the use of body as well as the handling of materials for the acquisition of knowledge, since it is closely associated with the needs and aims of the learner (Dewey, 1916)

as to re-form their ideas and in turn to use these ideas to make decisions and develop their problem-solving abilities (Kolb, 1984).

Apart from the importance of experience in learning, the **social environment** is also rendered as an important factor for learning and for students' cognitive development (Vygotsky, 1978) . The work of Dewey (1916) for example suggests that every social arrangement can be educative through the association of an individual with older and younger members of society. In that sense, learning is also considered as constructed by means of social interaction with other individuals as well as by means of pupils' participation in the particular groups they belong.

Such an understanding coincides nicely with existing scholarly work that suggests that **students' emotional, behavioural and social well-being** are determinant factors for students' educational outcomes. Specifically, existing work have suggested that academic motivation is not merely an intrapsychic state (Gutman and Vorhaus, 2012; Goodenow and Grady, 1993). Instead, it is developed through a complex network of personal as well as social relationships. For instance, Gutman and Vorhaus (2012) have examined students' educational achievement through standardised national exam scores in reference to a wide spectrum of dimensions of a child's well-being and argue that children with better emotional, behavioural, social and school well-being are more likely to have higher level of academic achievement and be more engaged with their school environments. Additionally, positive friendship relationships, as well as better emotional and behavioural well-being are considered significantly supportive for adolescents' academic achievement.

For these reasons the **sense of community** is also considered a determinant factor for adolescents' achievement. Scholarly work by Goodenow and Grady (1993) indicates that to "create a sense of community where adolescents feel personally known, important, and encouraged to be active participants may have a more powerful impact [on their academic performance] than the influence of individual friends or cliques" (ibid. p. 69). In the same vein, Newmann et.al. (1992) agree that school membership is essential for student engagement and academic achievement. A strong sense of school community could also satisfy participants' need for connection and belonging, since each member knows each other, cares about, supports one another and fells personally committed (Solomon et al., 1996). In that sense, school community could be considered a feeling and a shared sense of connection and belongingness to school (Osterman, 2000).

Students' sense of belonging to school is a concept that is gradually taking attention from researchers and practitioners due to the fact that it appears that it can predict a wide array of educational and developmental outcomes (Allen et al., 2021; Allen and Kern, 2017; Allen and Kern, 2020; Osterman, 2000). Specifically, existing scholarly work has shown that adolescents' sense of belonging to school is positively related to school motivation, self-efficacy, self-esteem, classroom behaviour as well as academic achievement (Walker, 2012;

Dotterer and Wehrspann, 2016; Korpershoek et al., 2020). More explicitly, existing literature suggests that adolescents who feel personally accepted and supported by their school (Goodenow and Grady, 1993) are more likely to have higher academic achievement and higher behavioural and cognitive engagement.

At the same time, the feeling of being supported and encouraged by their peers or their teachers seems that stimulates adolescents' self-esteem and vice versa (Korpershoek et al., 2020). In that sense, meaningful **relationships between teachers and pupils** can potentially engage pupils into school life and lead to higher pupil's participation (Reynolds, 1982). In essence, scholarly work has suggested that students who perceive that their teachers are interested in their growth (Reynolds, 1982) or have a positive attribute towards school (Eschenmann, 1991), tend to have higher performance and motivation.

In an effort to reveal more details on students' feelings of belonging, Finn and Voelki (1993) have argued that **student's engagement consists of a behavioural component (i.e. participation) and an emotional component (i.e. identification)**. Participation occurs when adolescents participate in school activities, while identification is achieved when students feel that they 'belong' to the school and perceive their school environment as supportive and warm. Finn and Voelki claim that an internalised sense of students' identification with their school results in higher participation in classes and school activities. Therefore, in order to identify the aspects of the school environment that may enhance students' engagement, they have divided the environment into two sets: the structural and the regulatory. According to the authors, the structural environment refers to the school size as well as the racial composition of the school's population, while the regulatory environment addresses the degree of structure and discipline of a school. Pupils and teachers' questionnaires have been contacted to identify students' engagement, while school size and teacher-student ratio have been used as indicators for the structural environment. In general, research findings suggest that school size appears to be a crucial factor in students' engagement, while the enforcement of rules in a school is associated with lower students' attendance and poorer perceptions of the supportiveness of the environment.

In a similar line of thought, Voelkl highlights the importance of the **school's sense of 'warmth'** both for students' participation and academic achievement (Voelkl, 1995). School's warmth and students' participation have been evaluated through students' questionnaires that examined students' feelings (i.e. real school spirit e.t.c) as well as students' participation. Students' achievement has been considered by the US standardised test scores. Results have suggested that there is no straight forward relationship between a warm and supportive school atmosphere with higher students achievement. Instead, results point out that an environment perceived as warm and supportive might encourage greater level of students' participation, and thus greater students' participation might encourage higher level of academic achievement. Therefore, Voelkl argues that "the relationship between school warmth and achievement may be elucidated by the interceding effect of student participation" (Voelkl, 1995, p.131).

Lastly, school climate research reveals that positive students' perceptions about school climate have a positive impact on adolescents' mental and physical health, self-esteem (Hoge, Smit, and Hanson, 1990), psychological well-being (Ruus et al., 2007) as well as learning and academic achievement and contributed positively on overall youths' development (Thapa et al., 2013). In the existing body of literature *school climate* is usually associated with feelings and attributes that are elicited by the school environment (Kutsyuruba, Klinger, and Hussain, 2015) and its often used as interchangeably with *school culture*. However, *school culture* refers to the shared value, assumptions and beliefs across individuals in school as opposed to *school climate* which refers to individual experience and feelings about the school. In that sense, school climate is usually associated with the "attribute or mood" while school culture with "values and beliefs" (Gruenert, 2008). However, despite culture and climate being two different concepts, existing literature has highlighted that climate and culture depend on each other. Thus, it is suggested that is a headteacher wants to change the school culture should firstly asses the school's climate (Gruenert, 2008). Such an understanding therefore, reveals the interdependence of the school environment and agency in the school context.

In general, research on *school climate*(Thapa et al., 2013; Kohl, Recchia, and Steffgen, 2013; Tableman, 2004; Thapa, 2013) has highlighted the independence of four areas for achieving positive school climate: safety, relationships among school community users (i.e students-students, students-teachers), teaching and learning and school's institutional environment (physical surroundings, resources, organisational structure etc) (Cohen et al., 2009; Thapa et al., 2013). In that sense, school climate research suggests that various aspects of the school unit, interpersonal relationships, organisational structure but also teaching and learning methods should be considered (Kohl, Recchia, and Steffgen, 2013).

Therefore, such conceptions could challenge the idea of learning as bounded to the classroom (Sailer, 2018) and could offer a broader and more complex understanding of learning and teaching processes. Hence, they can reveal the importance of understanding the school environment as a whole since firstly every aspect of the school environment can be educative and secondly knowledge can be gained through socialisation, experience, and interaction. In that sense, it can be argued that the socio-spatial context of learning is particularly important, especially for this transitional and complex period. In essence, not only interpersonal contact between students and teachers but also between students should be considered as an important aspect for learning and developmental during this transitional period. Hence, it is crucial to render the properties of this particular socio-spatial context of learning and address wider issues of learning and development in order to be able to render what is important when designing school environments for this particular age group.

2.2 Research on School Environments and School Practices: A thematic Investigation

When looking at school environments in the existing body of literature, there are subsequently diverse definitions that embrace different aspects related to the respective disciplines. In the educational literature, for example, the school environment is mainly related to **pedagogical processes** and is primarily influenced by the philosophy of education focusing mostly on learning resources and various teaching means and modes of learning (Warger and Dobbin, 2009). Cognitive psychologists, discuss the school environment setting through the study of the **activity structures or patterns of interaction** between learners and teachers (Duke, 1998). Studies from the discourse of environmental psychology focus on understanding the school environment in relation to what **inhabitants perceive it to be** (Zube and Moore, 1989). Sociologists tend to focus more on the **social dimensions** of the environment, while anthropologist highlight the environment's **cultural dimension** (Duke, 1998). Lastly, studies in the built environment tend to approach the school environment as related to the spatial structures and mainly refers to the **physical space** where teaching and learning practices occur.

The existing body of literature, which departs mainly from the discourse of the built environment, is usually characterised as subsequently diverse and not very well established overall (Sailer, 2015; Higgins et al., 2005). However, existing scholarly works can be grouped in four(4) broad categories in accordance with the themes that are explored. Namely, in the existing body of literature, the school environment has been broadly investigated in relation to:

- Students' academic achievement
- Students' and teachers well-being
- Space usage behaviours and school community
- Educational practices, pedagogy, teaching and learning

This section, therefore, discusses research studies that investigate the relationship between school buildings and school practices through varying methodological perspectives that depart primarily from the field of the built environment. It aims to enrich the main discussion thematically and to shed light on aspects worth to be investigated when considering the interplay between school design and school practices. In essence, this section firstly aims to address the way school environment is approached (i.e, spatial configuration, parts of the environment) and secondly to identify the types of school practices that are explored (i.e academic performance etc.) and by which means.

2.2.1 Students' Academic Achievement

The investigation of a school building in relation to students' academic achievement has been among the most investigated themes in the existing body of literature. In the majority of cases, a wide array of school building characteristics have been examined in relation to students' results from various standardised tests (Tanner, 2000; Tanner, 2008; Tanner, 2009; Tanner, 2011; Barrett, Zhang, and Barrett, 2011; Barrett and Zhang, 2012; Barrett et al., 2013; Barrett et al., 2015; Barrett et al., 2019; Earthman, 2004; Moore and Lackney, 1993).

For instance, Tanner (2000) approaches school environments as composed by various physical aspects and defines various parameters for examination such as clearly defined pathways, positive outdoor spaces (Tanner, 2000), adequate movement and circulation areas, large group meeting areas, day lighting and views (Tanner, 2008) etc. The results have revealed that the above design parameters positively affect pupils achievement, and learning progression. Other design parameters have also been defined and examined by Barrett (2013). For instance, the parameters of 'choice', 'complexity', 'light', 'flexibility' of the school environment appear to have a positive effect on students' attainment. However, in both cases, the various spatial parameters have been defined qualitatively without particular reference to the actual quality of the spatial layout of the school. Even more importantly, the spatial parameters defined constitute singular elements with no reference to the school building as a whole. This, however, can easily be challenged since various school elements exist within a particular context (the whole school unit) and are articulated in relation to each other.

In some other cases, the school environment has been conceptualised by considering primarily environmental conditions. In particular, it has been judged by considering the extremes of environmental elements (such as poor ventilation or noise) in relation to students' academic performance (Schneider, 2002; Earthman, 2004). These studies show a relative consistent impact on students' attainment (Higgins et al., 2005), while other aspects such as colour and lighting appear inconclusive (Sailer, 2015).

In contrast to these insights, several research studies fail to prove that there has been any effect of this type of classroom (i.e, cellular classrooms and open-plan design) on pupils' achievement (Deed and Lesko, 2015; Stone, 2001). Therefore, the contradictory evidence could strengthen the argument that it is particularly challenging to systematically relate school design with attainment (Fouad and Sailer, 2017; Williams, Sailer, and Priest, 2015; Sailer, 2018).

2.2.2 Students' and Teachers' Well-Being

Students' and teachers' well-being has been approached from various perspectives and addresses social, psychological dimensions of well-being as well as issues related to thermal comfort and users' well-being. Cotterell (1984), for example, has examined four suburban high schools, two of which open-plan and the other two conventional layouts, in relation to the users' anxiety levels. The study, has examined the school's space through school's plans and by identifying the various design features. Additionally, it has utilised students' event diaries, observations of space usage, and a "what I did form". Results have suggested that the open-plan school layout appears to be associated with more student and teacher anxiety, since a vast amount of their school time is devoted to transition from one activity to another.

Gislason (2010) has studied the spatial layout of one open–plan senior public school in relation to students' and teachers' social well-being. Specifically, he approaches the school environment through a qualitative reading which derives from the researcher's sketches, notes, and photographs of the school space. Additionally, by collecting on-site observations of space usage and users' qualitative feedback, he has suggested that an open-plan school organisation contributes to the formation of a positive social climate in the school environment where students feel more receptive and socially accepted. At the same time, the school's design appears to facilitate collaborative and multidisciplinary teaching.

In the specific context of Cyprus, and from an environmental perspective, Michael (*Μιχαήλ*, 2011) has evaluated the effectiveness of school buildings by considering the overall comfort and energy efficiency of school premises. Michael has developed a multidimensional framework for studying school effectiveness by examining thermal, visual, acoustic, functional, and aesthetic comfort as well as air quality in the classroom environment with students' thermal comfort and well-being levels.

2.2.3 Space Usage Behaviours and School Community

Space usage patterns such as moving, interacting, and stationary activities in schools have been extensively studied in the existing body of literature. Current studies that primarily approach the school environment by studying the spatial configuration, suggest that the spatial layout of the school appears to be particularly important for students' interpersonal contacts. Specifically, it is rendered as essential both for students of the same or different grades as well as for students and teachers (Sailer, 2015; Moore, 1986; Pasalar, 2003). The size of the school appears to have a negative impact on students-teachers relationships as well as on interpersonal contacts between students (Kishimoto and Taguchi, 2014). In the existing literature it has also been argued that students are more likely to illustrate social interaction and cooperation in well-defined school settings than in poorly defined settings (Moore, 1986). However, the spatial characteristics of a well-defined area are not clearly identified.

Taking a step further, Vieira and Kruger (2015) have classified students' activities into programmed and unprogrammed and thus have studied formal and informal students' interactions in relation to the school's layout and the school's spatial configuration. Results suggest that higher students' occupancy and interaction, both formal and informal, are found in spatially integrated spaces.

Other research studies such as Pasalar (2003) and Taguchi and Kishimoto (2012) have also introduced the parameter of students' age in the investigation of the interplay between school's spatial configuration and space usage patterns. Specifically, it has been suggested that compact school buildings could simplify contact between students within a particular level of education by means of proximity and classrooms' clustering. At the same time, more hierarchical, finger layouts could encourage friendships between students from different grades (Pasalar, 2003). Intelligible layouts are also essential for promoting interactions between students from different grades (Kishimoto and Taguchi, 2014). It has also been highlighted that the classrooms' depth in the overall schools layout is related to students' territorial behaviours. Arguably, for younger students there has been a strong relationship between the depth of their classrooms and their location in the school during a break. As students' get older this relationship becomes weaker (Taguchi and Kishimoto, 2012).

Lastly, space usage patterns in schools have also been considered by existing scholarly work. Specifically, existing research studies have examined space usage patterns in relation to a school's spatial configuration in order to understand a school's community. Results suggest that in morphological divided and dispersed spaces there is a greater chance for the users to be divided into smaller groups and (Mclane, 2015) their transpatial identities (i.e affiliation, gender) to be spatially reinforced (Sailer, 2015) and thus a correspondence type of school community to be formulated.

2.2.4 Educational Practices, Pedagogy, Teaching and Learning

School buildings have also been examined in relation to teaching and learning practices in multiple ways. Empirical studies in this investigation by examining the school's spatial configuration and users' perceptions have suggested that highly integrated schools are less flexible in adapting different teaching styles (Kishimoto and Taguchi, 2014), while the classroom organisation is to a certain extent linked with the teaching style that is adopted (Martin, 2002). Additionally, few studies had suggested that by bringing Bernstein's (1973) sociology of education to bear, the relationship of the school building with educational practices can be decoded (Peatross and Peponis, 1995; Sailer, 2015; Vieira and Kruger, 2015; Sailer, 2018) . Specifically, they have suggested that by finding the spatial analogous of Bernstein's educational code, the strength of the pedagogical framework can be decoded and thus the form of school community that is promoted by the school's layout can be identified (this theme is further discussed in section 2.3.3.1).

By adopting a different direction, existing studies such as the one by Scott-Webber, Strickland, and Kapitula (2013) have concluded that students have rated non-traditional classrooms (i.e open-plan layouts) better in 12 factors such as better collaboration, active involvement etc. On the other hand, teachers in a study by Zhang and Barrett (2010) have argued that open spaces are not fulfilling the design scope of flexibility compared to traditional classrooms. Not only, it has been found that the open plan school space create unintended consequences such as the low level of stimulation and lack of the sense of space ownership (Barrett and Barrett, 2016).

Few studies have also explored informal learning (Fouad and Sailer, 2019), self-directed learning (Fouad and Sailer, 2019) and peer-learning (Sailer, 2015) with regards to the school's spatial configuration. Results suggest that the school' spatial configuration could cultivate spatial affordances and thus trigger students' constructivist learning (Fouad and Sailer, 2019). It has also been claimed that peer learning is jointly shaped by both school's spatial configuration (highly integrated areas, thus well-connected areas with the rest of the building) and by particular attractors (Sailer, 2015).

2.2.5 School Environments and School Practices: A complexly formed relationship

To summarise, based on the review of existing studies dealing with school environments and school practices, it can be argued that the above relationship appears to be particularly complex and embraces various factors and conditions. At the same time, the way the school environment is approached and analysed is particularly diverse in the existing body of literature. In other words, sometimes the school environment is addressed through the study of spatial configuration or through various evaluation criteria and evaluation forms. However, rarely the school environment is approached as a whole structure that is composed by both indoor and outdoor spaces.

In addition, a wide array of practices is addressed in relation to school building through users' qualitative feedback, on-site observations, or standardised questionnaires. Thematically, school practices are particularly diverse and usually refer to the social and educational context of learning.

2.3 Theoretical Framework: Addressing the Complex Nature of School Environments and School Practices

Unesco (2012) in an effort to capture the complex relationship of school environments and school practices, argues that the school environment is the complete physical/spatial, social and pedagogical context in which learning and teaching practices are intended to occur. Likewise, Mulcahy, Cleveland, and Aberton (2015) argues that school space is a product of three heterogeneous dynamics. In fact, it is argued that is composed by a discursive dynamic (pedagogical vision), a material dynamic (design) and a social dynamic (organisational structure). Similarly, Bojer (2019) conceptualises the school environment as composed by school organisation, pedagogical practices and learning space design. In Bojer (2019) terms school organisation refers to school management, pedagogical practices refer to individual planning and executing of teaching and learning practices, while learning space design is mainly associated with the physical environment.

The importance of cultural dimension in the consideration of school environments has also stressed by scholars (Duke, 1998; Gislason, 2018). For instance, the model that is proposed by Gislason (2018), which is based on Owens and Valesky (2007) environmental model of school climate and addresses school space by means of 4 interconnected dimensions: physical design, organisation (administration, daily schedule), culture (school community) and students' dynamics (space usage patterns, age dynamics etc). In that sense, school's cultural dimension is also rendered as an important factor that should be considered when approaching school environments.

The consideration of school spaces is based on Lefebvre's (1991) spatial trial (see also section 2.3.2) has been proposed by a number of scholars (Boys, 2010). Specifically, Boys (2010) argues that school spaces are composed of three main aspects. The first aspect refers to the *'everyday' educational, social and spatial school practices*. This aspect includes all types of experience and daily routines that take place in time and space. The second aspect is named *designing learning environments* and is defined as the conceptualised space of designers, planners and other experts. The third aspect is called *participants perceptions of, and engagement with, practices and environments*. This aspect refers to how school users individually engage with, adapt, and change social and spatial practices. The model that is developed by Boys explains how the three aspects run in parallel and therefore the intersection between them should be considered in order to fully understand the relationship of school space with school practices.

From a slightly different perspective, Sailer (2015) proposes a framework composed by 7 criteria: the degree to which the school layout accommodates different teaching styles, different processes of learning, the relationship between teachers and taught, movement potentials, interfaces between school users, types of solidarity and school community type. This framework in essence, is slightly more elaborative and highlights the opportunity of shifting the focus of school building research away from the classroom and studying to the whole school unit as a potential educational area.

Therefore, it can be argued that despite minor variations in all approaches, three elements are common between cases:

- **Spatial Structure** (school's physical environment) ;
- **Organisational Structure** (leadership, school management, daily schedule);
- **Educational Practice** (teaching and learning practices, assumptions and values regarding educational practice);

Additional parameters that have been pointed out from the framework proposed are:

- **School Culture and School Community** (Gislason, 2018);
- **Users' perceptions and behaviours** (Boys, 2010);

Therefore, it can be understood that a theoretical framework that embraces all aspects is needed in order to address more holistically school environments and address their complex nature. More specifically, it could be argued that the physical environment of a school should be considered with activity patterns, social agency, and pedagogical issues to be able to address its complex nature effectively and holistically.

Based on the above insights, this thesis proposes the usage of three main theoretical concepts to understand and approach school environments: **space syntax theory and method, assemblage theory and Bernstein's theory of pedagogic practice**. The combination of those three theoretical frameworks offers theoretical and methodological insights to deal with the limitations of existing studies in this field.

More specifically, this framework proposes firstly the usage of space syntax theory since it can provide theoretical and methodological insights to deal with the relationship of school building with school practices, space usage patterns, and school community socio-spatial characteristics. Unlike other theories of space, space syntax offers a set of tools linked to a set of theoretical accounts. In that sense, unlike more qualitative approaches to understanding space, space syntax theory offers a systematic account through which sociospatial phenomenal can be described and studied (Netto, 2015; Hillier and Vaughan, 2007). Hence, it offers a quantitative framework through which a school's spatial configuration can be decoded and then certain aspects of school life can be explained. Additionally, the consideration of school space as a spatial configuration is particularly useful since it helps to approach the school building as a whole and to avoid subjective judging by the researcher which is the case in many existing studies.

Secondly, it proposes the consideration of a theoretical framework that highlights the role of social agency and points towards a more relational approach to space (Müller, 2015). Assemblage thinking and actor-network theory (ANT) are among the most popular conceptual approaches that assign to space a relational ontology (Müller and Schurr, 2016; Müller, 2015). Although the two approaches are compatible, it is primarily assemblage theory by Deleuze and Guattari (1987) that draws attention to 'conceptualisations of flux, becoming and process' (Müller and Schurr, 2016, p.2) and thus approach space as constantly in the process of making.

Therefore, this study proposes the usage of assemblage theory since it can offer a solid starting point to consider the socio-spatial spectrum constantly in the process of making and thus could offer a reformed understanding of the school's built form not as a mere physical structure. In essence, this theoretical framework can render the school space as more relational and temporal which could help in acknowledging the role of social agency, leadership, and organisational structures in the materialisation of socio-spatial realities in schools.

Lastly, based on the apparent complexity of school environments, a theory of pedagogic practice should additionally be considered in order to effectively address the ways in which pedagogical practice is deployed in space. According to Peatross and Peponis, in such an investigation a 'theory of pedagogical transmission [like the one proposed by Basil Bernstein] which emphasises the pattern of transmission rather than the content, and which addresses pedagogy itself rather than its socio-political background' (Peatross and Peponis, 1995, p.376) could be particularly useful. Not only, Basil Bernstein's (1973) theory of pedagogic practice, it suggests that the organisation of space and time are central in the way in which pedagogical principles operate. Hence, it could offer a valid theoretical stance by which the relationships between educational processes and educational spaces can be decoded.

2.3.1 Introduction to Space Syntax

Space syntax is a theory and method dealing with the relationship of the built environment with human behaviour. It is based on the theoretical foundations that have been first established by Hillier and Hanson (1984) in their book *'the social logic of space'*. The theoretical stance of this work highlights that space cannot be seen as a background to social activity but as an intrinsic aspect of human behaviour (Hillier and Vaughan, 2007). Specifically, space syntax by "analysing space rigorously and observing human activity carefully" (Hillier and Vaughan, 2007, p.6) argues that "space both acquires social meaning and has social consequence" (Hillier and Vaughan, 2007, p.3). Therefore, it is argued that how spaces are arranged together in order to form a whole and how people move through them, mingle, encounter, interact with others is consequential for social behaviours.

Space syntax uses the concept of spatial configuration [2] to describe the relationships between spaces and how integrated (well connected) or segregated (isolated) are in a system of spaces. Specifically, the idea behind the concept of spatial configuration is that 'the shape, size and form of an individual space such as a classrooms does not give the full story of how it may be occupied and how it will work for the emergence of social life' (Sailer, 2018, p.6). Instead it is the relationships between individual spaces that matter.

A growing body of literature in space syntax has highlighted how the spatial design of buildings is related to a certain extent to the way they work socially (Sailer, 2015). For instance, existing scholarly work has highlighted that more integrated spaces tend to attract more people by being livelier and more frequently used by people. On the other hand, more segregated spaces are characterised by lesser frequentation. Additionally, research in the field has highlighted how stationary and moving activities follow to a great extent the spatial configuration logic. In essence, the results suggest that more people move in integrated spaces with shorter path lengths from one space to all other spaces.

[2]spatial configuration describes the relationships that take into account other relationships and highlights that what is important in space is the relationship between elements rather than the elements themselves (Space Syntax, 2021)

Depending on the relationship between spatial configuration and behaviour, Hillier and Hanson (1984) have developed an understanding of how spatial domains and social grouping might relate to one another. Specifically, they argue for different types of solidarity by first explaining that humans belong both to spatial and transpatial groups. In essence, "all human social formation appear to exhibit ... a spatial and transpatial [duality], of local group and category" (Hillier and Hanson, 1984, p.42). Namely, people belong to a local group through spatial proximity and their bodily presence as well as to various transpatial groups based on several socially defined categories.

Based on the distinction between spatial and transpatial groupings, Hillier and Hanson have argued that these types of groupings do not necessarily have to overlap. When there is an overlap between a transpatial category of people who come together by means of kinship, gender, class, ethnicity, and their distribution in space, a correspondence system is emerged. In other words, in a correspondence socio-spatial system, similar people tend to occupy adjacent spaces and this creates an elusive system that is characterised by strong boundaries, isolation and 'territorial principles'. The system emphasises the coherence of the local system and maintains its strength by restricting encounters, having strong boundaries, and a hierarchical organisation. On the other hand, socio-spatial systems with a high degree of non-correspondence emphasise the coherence of the global system at the expense of local coherence. In that sense, people are brought together by space regardless of their transpatial labels. Thus, a non-correspondence model thrives from openness, equality, inclusivity and brings people from different groups together across multiple scales.

Therefore, it may be understood that if a non-correspondence model indeed brings people together and forms strong ties between them, it is of particular interest in the case of school buildings. Specifically, it could give insights regarding the way different school user categories (i.e, students that belong to different classes, gender, ethnicity, students and teachers etc) can be brought together to form a distinctive school community. In essence, this context could give insight into how solidarity is fostered between teachers and students or between students (Sailer, 2015).

2.3.1.1 Space Syntax Research in School Buildings

School buildings constitute a building type that has not been studied in the same depth as other building types (such as offices, museums, or hospitals) (Sailer, 2015) in the field of space syntax. However, few studies have been able to systematically analyse school buildings and have provided sufficient insights on the way school buildings can be analysed in relation to various school practices. This section, therefore, goes one step further and elaborates on the methods and metrics that are used to understand the spatial configuration of school buildings.

Kishimoto and Tagushi (2014) have studied 76 primary schools in Japan about four different evaluations of students' activities and eight different evaluations of educational performance by conducting a teachers' survey. The authors have used space syntax methodological tools, and specifically convex map analysis [3] by including both exterior and interior spaces to evaluate the school space as a whole. The authors have used the space syntax metrics of integration, connectivity, and intelligibility in order to classify the schools into 5 different school types based on their distinctive syntactical properties. Furthermore, they have invented the all low type school (19 schools), the very intelligible school (5 schools), the loop type school (6 schools), as well as the integrated-type school (21 schools). Furthermore, the various parts of the schools under investigation have also been analysed based on their functional labelling. Lastly, the authors have developed a metric that calculates the centrality of the multiple functions of the school in the overall school layout. The relative centrality of functions is calculated by dividing the mean integration of a particular function with the mean integration of school spaces. Therefore, this exploration has allowed the authors to explore the school layout both as a spatial and functional assembly and then to reflect on teachers' perceptions. Results suggest that when intelligibility is high or the school is small, the interaction of students from different grades increases. Additionally, when the teachers' room is centrally located, it becomes easier for the school unit to collaborate with the local community. Lastly, when the school integration is low, more teachers perceive that it is easier to follow various educational styles. As well as isolated classrooms along with weak circulation systems tend to afford flexible education. Generally, the results suggest that the very intelligible type of school performs better in many respects since teachers can lead their students more easily, develop good relationships, and students learn in many ways. Therefore, this study methodologically can offer valuable insights so as to approach the school building as a whole as well as to analyse the various functions positioning in the school.

Sailer (2018) has tried to shed light on the importance of corridors and interspaces in school buildings as well as to understand the configurational properties of corridors and the relationship between classrooms and corridors. In order to study the choice of movement in 5 contemporary secondary schools, she has generated a segment analysis and by means of the NACH metric, she has compared and contrasted the movement potentials in schools. The choice potential has been captured by the segment map and then has been considered along with insights from various sources (i.e, doctoral thesis, website information etc). This work is one of the few in the tradition of space syntax that uses the NACH metric to capture the movement potentials in buildings. Not only, this study provides a nuanced image of different spatial qualities in a school building and challenges the clear-cut categorisation of a school into open or closed. In that sense, it can offer a valuable contribution to the analysis of open-air school layouts.

In another study of primary schools, Kishimoto and Taguchi (2012) have investigated the effect of spatial configuration on students' activities. Unlike previous studies, this study

[3] A convex map is defined as the least set of fattest spaces that covers the system (Hillier and Hanson, 1984)

combines spatial analysis with on-site observations of space usage during breaks. Convex maps have been used to understand the spatial layout of the three primary schools along with Justified Graphs capturing the relationship of all school spaces. The depth of students' locations from their classrooms and the integration measure have constituted the indicative markers to be correlated with space usage patterns. Results suggest that there is a correlation of children's territory and the depth of their classrooms. Equally important, it appears that children in higher grades are less affected by the depth of their classrooms, and the territory they occupy is more extensive than lower grades.

The spatial affordances of the school building for informal and self-directed learning have been explored by Fouad and Sailer (2019) by studying two secondary schools in the UK. By producing a joint visual mean depth that is derived by accessibility and visibility, results suggest that self-directed learning is expected to flourish in assembly areas, arcades, wide corridors or multi-use labs. In the same context and by studying 9 secondary schools in the UK Fouad and Sailer (2017) have argued about the importance of spatial configuration for students' socialisation patterns. Specifically, the joint measure of visual mean depth appears to be related to students' performance in school. Specifically, the results suggest that schools with less integrated spaces show better outcomes in terms of students' attainment. Extreme ends of the configurational spectrum (i.e, very segregated or integrated spaces) have been neither supportive nor inhibiting of the learning process.

In an empirical study, Pasalar (2003) has considered a school as a three-fold structure; as a spatial organisation, as a social organism and a set of interfaces for social and educative activities. Pasalar, by considering, comparing, and contrasting US secondary schools, has examined the extent to which spatial relationships can influence students' behaviour and interactions. Pasalar by using the idea of 'cross-case analysis' has reviewed 4 different case studies with similar populations but varying spatial configuration (i.e, two of them represented finger-plan type, while the other two academic house school model). The four case studies have been examined spatially through syntactic evaluation and empirically through user-based information. The methodology that has been implemented for the on-site observations combines students' questionnaires with students' 'activity log' in which students themselves provide information about the type as well as the location of their activities. Results suggest that the spatial organisation of school buildings can influence usage pattern, movement distribution as well as interaction among students. Specifically, schools with higher accessibility illustrate a higher percentage of incidental interaction among students. At the same time, space occupancy in highly accessible areas has been associated with higher students' movement and interaction. Furthermore, single-storey school buildings appear to facilitate more social interaction among students than two-storey buildings.

De Jong (1996) has studied two different primary school buildings in Sweden and has discussed preconditions and potentials for usage patterns. The two case studies have been selected based on their differentiated building type and educational ideas. Specifically, the two case studies have been analysed as spatial and social systems. The analysis combines a syntactical analysis based on space syntax methodological tools with on-site observations of space usage. The examination of the spatial structure in the light of space usage behaviour has allowed the author to make valuable conclusions about schools' life. In particular, it has been concluded that there is a tendency by schools to separate children of the three lower grades from those of the three higher grades. At the same time, the location of the head-teacher's office appears to be particularly important for school life and particularly school leadership. Lastly, the physical connection between different classrooms as well as proximity facilitates collaboration between teachers and the functional allocation is associated with the collection code of the curriculum. Overall, the resultss suggest that the school environment is highly complex and the changes in the educational model can be handled by different spatial means.

Therefore, it could be argued that studies in the field of space syntax show how a school's spatial configuration can be decoded and then certain aspects of school life can be explained. In particular, it could be argued that the consideration of school space as a spatial configuration is particularly useful since it could help to:

- examine the school building as a whole;
- avoid subjective judging by the researcher;
- decode the ways the different closed units of the school can be considered together with completely open or covered areas of the school;

2.3.2 Introduction to Relational Ontology of Space: Assemblage theory

As discussed in the previous section, the space syntax approach gives valuable insights regarding the relationships of spatial structure and social structure. However, regarding space as constantly in the process of becoming, its theoretical and methodological base is limited and offers little insight on the way social agency interacts with socio-spatial structure of schools. This discussion about the relational view of space goes back to Lefebvre's (1991) conception about the spatial triad. Lefebvre understands space through a three-fold division: the perceived, conceived, and lived space. For Lefebvre, perceived space has socio-spatial significance and refers to the spatial practice which is a social product. Conceived space is a representation of space and it is bounded by papers, elevations, and perspectives. Finally, the lived space is the representational space that is experienced through its association with images and symbols. In a similar line of thought, Harvey's (1973) has classified the space into absolute, relevant, and relational. The absolute space refers to a stable and unchangeable space, the relevant space is related to Einstein's work and non-Euclidean geometries, while relational space is the space that does not exist outside of the process of its making and considers the simultaneous existence of the various actors that are involved. Thus, in this context, this thesis can use the theory of social assemblage since it can offer 'a useful way of rethinking theories of place in terms of process, identity formation and becoming' (Dovey and Fisher, 2014, p.48).

Assemblage thinking is a concept that goes back to the philosophers Deleuze and Guattari (1987). The term assemblage is the translation of the French word *'agencement'*, which refers to an arrangement or alignment. Assemblage is a mode of ordering relational and heterogeneous entities in a way to work together for a certain time to form a new whole. In that sense, assemblages are productive, since they constitute aggregations of different elements linked together to form a new whole. Assemblages are relational and heterogeneous where there are no pre-determined hierarchies, and thus, they constantly produce new behaviours, new territorial organisational, actors and realities (Müller, 2015). However, the properties of an assemblage are irreducible to the properties of its parts. In that sense, a part can be detached from an assemblage and be attached to another. Thus, assemblages are defined both by the variable role of their components and by the synthesising process in which the various components are involved. Specifically, the varying role of the components is addressed by means of their material or expressive nature, while their synthesising process is addressed through the processes of territorialisation and deterritorialisation. Territorialisation is the process that stabilises the identity of an assemblage, while deterritorialisation destabilises its identity. In that sense, the territory is a stabilised assemblage.

By adopting an assemblage thinking, Delanda (2006) has developed a theory of social assemblage. DeLanda argues that social entities are social assemblages and emerge through the interaction between heterogeneous elements. DeLanda also argues that social assemblages can be used so as to understand and analyse complex entities such as cities. Specifically, he has claimed that cities can be approached as assemblages of both social and physical elements (i.e., people, networks, buildings, streets), the emergence of which involves various scales (not just the micro and macro scale).

2.3.2.1 Assemblage thinking in School Buildings

Few studies in the field of the built environment (Charalambous and Geddes, 2015) have highlighted the potential of incorporating assemblage theory in the examination of spatial structures. The contribution of assemblage thinking in such investigations lays exactly on the attention paid to multiple materialities of the sociospatial relationship (Brenner, Madden, and Wachsmuth, 2011). However, very few studies have tried so far to incorporate assemblage thinking in the investigation of school buildings. More importantly, very few have suggested methodological ways to approach this concept in this investigation.

In the particular context of school building, Dovey and Fisher (2014) have studied various primary schools in the UK in an effort to investigate the relationship of school's plans to pedagogical theories. Specifically, by using the theoretical framework that is suggested by assemblage theory, they have firstly identified various clusters of learning spaces in a series of school plans. Then, they have analysed them in terms of their capacity for socio-spatial interconnection and adaptation. Specifically, five plan types have been identified, ranging from the traditional classroom through various degrees of convertibility to permanently open plan schools. The authors have argued that open plan schools, even though they have been designed so as to maximise flexibility, they appear to be not as agile and fluid as expected. However, despite the valid theoretical contribution of this study, methodologically it has not been clear how the concept of assemblage has influenced the way the authors have analysed and examined school buildings.

Based on this particular theoretical basis, other studies by jointly examining spatial configuration and space usage patterns have suggested that socially inscribed rules have the power to differentiate the configurational structure and thus behavioural patterns in a school environment (Psathiti, 2018; Psathiti, 2019). In fact, existing research results suggest that socially inscribed rules can differentiate the relationship between indoor and outdoor space and the mutual visual areas of the layout as well as users' potential zones of operation.

Therefore, it seems that such an approach can offer a solid starting point to consider the socio-spatial spectrum constantly in the process of making. At the same time, its major contribution lies exactly on the attention paid to the multiple materialities of the socio-spatial relationships (Brenner, Madden, and Wachsmuth, 2011). Therefore, such a framework can offer an alternative perspective in the understanding of school space, since it reveals the importance of acknowledging the complexity and rationality of the built form. This relational view of space can also offer the possibility to understand the built form not as a mere physical system but in an interaction with the otherness, as multiple, incomplete, different and always in the process of making (Tornaghi and Knierbein, 2015). Specifically, relational theory can suggest that:

- School space should be considered as a relational socio-material system that is composed by heterogeneous pieces that create a whole. However, the characteristics of the whole are not defined by the characteristics of the parts, and therefore the built form should be analysed both as a system with different parts as well as a single entity in a constant process of making;
- School space should ideally be examined at different socio-material scales (not only on the micro and macro scale) and across time. In other words, relationality across scales and time in a nonhierarchical manner should be adopted to capture the complexity, emergence, and temporality of socio-material constructs;
- Relational, socio-material interactions have to be taken into account for the analysis and investigation of a complex system such as schools (ie, how the school layout is related to particular decisions or actions of the headteachers);

2.3.3 Introduction to Basil Bernstein's Pedagogic Framework

A wide array of existing scholarly work in the discourse of architecture (Sailer, 2015; Sailer, 2018; Peatross and Peponis, 1995; Tzortzi, 2011; Vieira and Kruger, 2015; Capille, 2016; Pradinuk, 1986; Zamani and Peponis, 2010; Tzortzi, 2007) has stressed the potential of incorporating Bernstein's framework in the examination of buildings that organise knowledge (i.e, schools. museums, libraries). These investigations stem from the fact that Bernstein's work suggests that the organisation of space and time are central in the way in which pedagogical principles operate.

Basil Bernstein is a sociologist known for his contributions to the sociology of education. His ideas about the classification and framing of educational knowledge and his development of the educational code that could result in two ideal types of social structures, are of particular interest here.

More specifically, Basil Bernstein, by elaborating on formally constructed knowledge, has examined "how a society selects, classifies, distributes, transmits and evaluates ... educational knowledge" (Bernstein, 1973, p.227). Bernstein argues that formally constructed educational knowledge is realised through three different systems – curriculum, pedagogy, and evaluation. Bernstein considers that the curriculum defines valid knowledge to be transmitted, while pedagogy defines the valid way of transition of knowledge. Lastly, the evaluation describes what is considered as a valid realisation of the acquired knowledge. In that sense, he has argued that the underlying principles that shape the relationship of those three aforementioned message systems (curriculum, pedagogy, and evaluation) define certain 'educational knowledge codes'.

Therefore, Bernstein has proposed two different dimensions, *classification and framing*. Classification refers to the degree of boundary between contents, while framing refers to the degree of control in the transmission of educational knowledge. If the classification is strong, then the boundary between different contents of knowledge is also relatively strong. Weak classification, in contrast, depicts a more integrated curriculum, where different contents are allowed to have an influence on each other. Simultaneously, if the framing is strong, there are reduced options, while a weak framing provides a range of options in control of what is transmitted and received.

Strong classification and framing produce a *collection educational code*, while weak classification and framing point towards an *integrated educational code* which blurs the boundaries between subjects and at the same time reduces the power of the teacher over what and how it is taught.

In turn, strong classification and framing construct social relationships by means of 'obedience' to an explicit social order. Thus, collection codes create a mechanical solidarity (Durkheim, 1893) since they require a unified acceptance and results in a rather hierarchical structure, highlighting differences and maintaining boundaries. On the other hand, integrated codes depict a Durkheimian organic solidarity (Durkheim, 1893) and thrive of openness, blurred boundaries, and weaker differences. The table below summarises the characteristics of a collection and integration educational code table 2.1.

BASIL BERNSTEIN – EDUCATIONAL CODES	
COLLECTION CODE	**INTEGRATION CODE**
Strong classification, strong frames	Weak classification, weak frames
The contents are well insulated	Reduced insulation between contents
Reduced options, sharp boundaries, reduced power of pupil over what, when and how a pupil receives knowledge (Strong rules govern where & what can be taught & learned)	Blurred boundaries, range of options over what, when and how a pupil receives knowledge (Weak rules govern where & what can be taught & learned)
Explicit & strong boundaries maintaining features	Implicit and weak boundaries maintaining features
Rest upon a tacit ideological basis	Rest upon an explicit & closed ideological basis
↓ **Mechanical solidarity**	↓ **Organic solidarity**

TABLE 2.1: Characteristics of Bernstein's Educational Code

2.3.3.1 Bernstein's Educational Code for the Examination of Educational Spaces

By transcribing Bernstein's dimensions to space, Sailer (2018) has argued that an educational building could be characterised as strongly classified when there are clearly demarcated sections promoting disciplinary differences in pedagogy (i.e different locations for STEM and Arts and Humanities). Peatross and Peponis (1995) has also addressed the dimension of classification by means of spatial dispersion, which has the power of ensuring the boundaries in space, while Pradinuk (1986), as well as Zamani and Peponis (2010) have introduced the visual dimension in the investigation and have claimed that limited visual contact between the contents of knowledge and thus classrooms for different subject matters could identify a strong classification.

Similarly, in an effort to translate the framing dimension in space, Sailer (2015; 2018) has argued that when the spatial structure is in that way that gives control totally to the headteachers over the individual teachers, this could point towards a strong framing. Strong framing can also be found when classrooms are characterised by limited visibility towards the corridors and thus maximising teachers' control. Lastly, the limited intervisibility among pupils could reduce pupils' control and thus could enhance the framing (Sailer, 2015). In the investigation of framing, Peatros and Peponis (1995) have mapped the educational programme and have noted how the organisation works in order to address the degree of framing in the institution. Lastly, Zamani and Peponis (2010) have argued that movement potential can allow users to construct their own narrative - reading of spaces and thus point towards a weaker framing.

The above along with other studies have suggested multiple ways in which Bernstein's dimensions can be transcribed to space. In an effort to systematically address all dimensions that have been mentioned in the existing literature, table 2.2, table 2.3 and table 2.4 give an overview on how the concepts of classification and framing have been transcribed by various scholars in space and by which methods and metrics. This comparative investigation has shown that a common approach can be found between existing studies. Specifically, what is shared among the cases is the attempt to translate the concepts that are proposed by Bernstein in the school's environment. In fact, they all use spatial, functional, and organisational mapping in order to address the different dimensions, while they point out the importance of visibility and permeability when trying to conceptualise Bernstein's dimensions in space.

Therefore, it becomes clear that the different studies might be based on the same theoretical background, but they also differ in various respects such as:

- The hypotheses generated for both dimensions (classification and framing) are pretty diverse but can be considered particularly valid and well justified;
- the methods used to address the 2 dimensions are particularly diverse (visibility, accessibility graphs, functional mapping, isovist analysis, segment analysis, A-B-C-D spaces);
- the level of the educational building under investigation differ between cases (primary, secondary, school, university, museum);

Therefore, it could be argued that despite the valid contribution of existing scholarly work, various gaps can be identified:

- There is no framework at the moment to understand the various dimensions of classification and framing at once and all together contributing to the formation of an educational code derived from the school layout;
- there is currently sparse empirical validation of the concepts that are proposed (i.e whether the educational code that is generated could eventually result in the correspondent type of community as suggested by Bernstein). The research study that has been executed by Peatross and Peponis (1995) has made a valid contribution towards this side;
- the educational code that is proposed by all studies is rather stable in time and there has been no reference to the power of the agency in changing or even shifting the educational code;

		(+Cl) Strong Classif.	**(-Cl)** Weak Classif.	**(+Fr)** Strong Fram.	**(-Fr)** Weak Fram.
Peatros & Peponis (1995)	Concept	• Clearly demarcated sections – Disciplinary differences in pedagogy	• Blurred Sections – No disciplinary differences in pedagogy	• Distinct teaching for different levels of study (there are no mixed ups between students) • Teachers are working separately to produce educational material	• Mixed years of study (there are mixed ups between students) • Teachers are working together to produce educational material
	Method	• Functional Analysis • Correspondence Mapping between spatial and departmental boundaries • Axial Analysis – Integration Core		• Mapping of the educational Programme • Notes on the way the organization works	
Sailer (2015)	Concept	• Disciplinary differences in pedagogy	• No disciplinary differences in pedagogy	• Fixed teaching styles • The authority over what is taught remains with an individual teacher who determines what is right or wrong • Teachers prepare educational materials individually	• Teaching flexibility • Switch between different teaching styles to guide pupils to learn by themselves • Shared authority between teacher and pupil • Teachers prepare educational materials together
	Method	• Functional distribution • Split of learning processes by location • Joint functional & spatial analysis (VGA analysis - Integration_HH_) • Average Mean Depth per Function		• Spatial Analysis (Integration Value). Very integrated layouts less favourable for teaching flexibility (point made based on Kishimoto & Taguchi(2014)) • Visibility and openness towards the corridor enable or hinder control of a teacher • Intervisibility or not among pupils (to give or prohibit control to pupils)	

TABLE 2.2: Comparison of concepts and methods for all studies that tried to spatialise the concepts of classification and framing proposed by Bernstein

Sailer (2018)	Concept	• Disciplinary differences in pedagogy (i.e between STEM subjects and Arts & Humanities) • Differences by role, for instance between teachers and pupils , or between junior and senior teachers • Differences in spatial layout (i.e a segregated school building with different wings for different age groups) • Limited movement options • Solid partitions and walls correspond to a stronger classification, since the spheres of movement and occupation are strictly	• No disciplinary differences in pedagogy (i.e between STEM subjects and Arts & Humanities) • No differences by role, for instance there are no differences between teachers and pupils , or between junior and senior teachers • No differences in spatial layout (i.e an integrated school building with mixed wings for the different age groups) • Movement options • Open spatial layout allowing for visibility means weak classification since both spheres are connected	• Control of what is taught (selection) and how it is taught (organisation, pacing) is over individual teacher • All control would lie with the head teacher	• Control over what is taught (selection) and how it is taught (organisation, pacing) is shared between students and teachers • Teachers working together in a collective way with emerging coordination activities
	Method	• Segment Map Analysis (NACH value) • A,B,C,D space types analysis based on segment map analysis • Degree of overlap between movement and occupation		• School with or without glass partitions between classrooms and corridors (reduced or enhanced control over teaching practices)	

TABLE 2.3: Comparison of concepts and methods for all studies that tried to spatialise the concepts of classification and framing proposed by Bernstein

2.4 A dynamic, socio-spatial approach to the study of lower secondary schools

The chapter explores research that is relevant to this thesis, focusing primarily on the interplay between the school environment and school practice. It has been shown in section 2.3

Pradinuk (1986)	**Concept**	• Visual insulation of the contents (for museum buildings)	• Open visual relationships and cross-comparisons between contents (for museum buildings)	• The layout is sequenced to generate a rigid circulation and govern the degree of differentiation in visitors' itineraries.	• The layout allows to each visitor to create his or her personal itinerary by mean of multiple options.
	Method	• Convaxial integration that is the degree to which spaces, non-adjacent as well as adjacent, are linked by lines of sight.		• Mean convex integration of space. This measures how far it is necessary to move through sequences of intervening spaces to arrive at every other space in the layout.	
Zamani & Peponis(2010)	**Concept**	• Clearly demarcated themes (individual displays into thematic groupings)	• Recurring comparisons across boundaries are engaged	• Movement sequence and control of visual horizon of visitors and thus of the way they organize their conceptual understanding of exhibits.	• Alternative paths through the exhibition. Visitors much make independent efforts so as to organise their conceptual understanding of exhibits
	Method	• Degree of visibility between spaces and thus different contents of knowledge • Isovits analysis capturing the visible areas from a given vantage point		• J graphs analysis that highlights the movement paths within the layout	

TABLE 2.4: Comparison of concepts and methods for all studies that tried to spatialise the concepts of classification and framing proposed by Bernstein

that the school environments are particularly complex environments and embrace a wide array of aspects. Thus, cannot be merely considered as physical constructs. Instead, it should be considered in reference to space usage patterns, agency, and pedagogical issues to be able to address its complex nature effectively and holistically.

The three main scientific domains used by this thesis to tackle this complex nature have been presented in section 2.3.1, section 2.3.2, section 2.3.3. Specifically, space syntax theory, assemblage theory, and Bernstein's pedagogical theory are jointly considered to provide a rich theoretical and methodological framework to address the complex nature of school environments in relation to school practices.

Going one step further, to decode further methods that could be used for the investigation of school space and school practices, additional research studies have been considered. Of particular interest, it is how existing scholarly work approaches methodologically school building and by which means the school practices are decoded.

In section 2.1 a subset of studies dealing with the critical age of adolescence have been presented to identify the various needs of this particular age group. The consideration of the critical age of adolescence has highlighted that it is particularly important to acknowledge the changing needs of this particular age group in order to be able to understand better the relationship of school building and school practices in secondary education. Moreover, it is shown that the critical age of adolescence is a transitional period where the students are neither children nor adults. In this particular age, interpersonal relationships, friendship, and interaction appear to be particularly important. In that sense, the importance of the school community and school climate for this particular age is highlighted, suggesting that the school's scope for this particular age group should be much broader than merely addressing high attainment scores.

Therefore, through the review of the existing literature, it is highlighted that the school environment for adolescents is primarily addressed by:

- adopting a subjective evaluation by the researcher;
- considering environmental markers (i.e, thermal comfort etc);
- studying the spatial configuration;
- considering Bernstein's dimensions of classification and framing

As regards school practices, existing scholarly work explores a school's spatial structure with various socio-educational aspects of schooling (attainment, teaching and learning , space usage behaviours, interaction, attributes about schooling etc). However, despite the wide array of statements in favour of the importance of the social environment in learning, there is very little attention on the socio-emotional needs of students, either individual or collective (Osterman, 2000). Instead, especially in secondary education, the emphasise is on standardised achievement tests and academic accomplishment. However, current directions in learning and teaching have revealed that not only formally constructed knowledge is rendered as important, but also the knowledge which is gained through socialisation, experience, and interaction. In that sense,the consideration of school building in terms of attainment can be particularly problematic, since it reduces learning to standardise scores and a mere individualistic process. Therefore, a more holistic consideration of aspects influencing pedagogical practices should be considered. Lastly, studies that consider school design and school control or student disciplinary incidents are rather secluded in the existing literature and mainly concentrated on issues around health and safety.

Methodologically, school practices have been addressed through:

- students' standardised score tests;

- space usage patterns;
- users' qualitative feedback;

The review of the existing literature therefore has suggested the following gaps in the exiting body of literature:

- Despite the fact that more holistic approaches have been stated theoretically, very few studies (Kishimoto and Taguchi, 2014) have tried to approach school building as a whole and reflect on school life and users perceptions holistically;
- the role of agency has been very rarely considered in the existing body of literature;
- users' qualitative feedback is sometimes missing from the investigations;
- standardised score test might limit school practices in exam test;
- the wider context of learning is particularly important for adolescence and thus it should be considered when designing school buildings for this particular age group;

Thus, by using the concepts and methods that have been discussed in this chapter, the motivation behind this dissertation is to bridge this gap and provide more insights on the relationship between school building, school practices, and the role of agency.

Chapter 3

Introduction to the Context of Study and Case Studies

This chapter portrays the context and case studies of this research. Firstly, Cyprus is briefly introduced as the context of the study, and the historical evolution of secondary school buildings is presented. Additionally, the educational system and the current design guidelines for lower secondary school buildings are summarised. Lastly, all 10 selected case studies are briefly introduced.

3.1 Cyprus as the context of Study

Cyprus offers a suitable context of study, since there is currently an overall paucity of research exploring the relationship between the school environment and school practices. Additionally, despite the fact that there is an extensive body of research dealing with the pedagogical principles and pedagogical effects in Cyprus, there is no acknowledgement of the potential role of the school's spatial structure. Lastly, schools in Cyprus are mainly open-air schools due to the weather condition, a condition which is interesting in itself.

Education in Cyprus is primarily dominated by state-funded schools and receives funding and general guidance from the Ministry of Education and Culture. There are 1338 full-time educational institutions, 15428 teachers, 197309 students at all levels of education, and the student-teacher ratio is around 12.5 (Statistical Service, 2021). The public expenditure on all levels of education accounts for 13.6% of the government's budget. Lastly, the total current public cost per student in secondary education accounts for €10.900.

In Cyprus, there are both public and private schools that are financed by governmental funds and tuition fees, respectively (Pashiardis and Ribbins, 2003). The construction, maintenance, and equipment of all public school buildings are the responsibility of school committees but under the supervision and general guidance of the technical services of MOEC.

3.2 Historical Evolution of Secondary School Buildings and Schooling in Cyprus

"Pedagogical ideas or educational goals are usually determined ... [by] the socio-political and cultural period"(Pashiardis, 2004, p. 565) in which they are developed. Cyprus is a particularly interesting example since the educational aims and curriculum have been shaped to a great extent by the county's socio-political circumstances, and thus different emphasis has been assigned to the analytical programs depending on the varying socio-political conditions of the country (i.e British rule, Independence e.t.c)(Kambouri, 2012).

In the last five centuries, Cyprus was first conquered by the Ottomans (1571-1870) and then passed to the British Empire which ruled until 1960. In 1960, Cyprus became an independent republic with 2 different communal chambers (Greek-Cypriots and Turkish-Cypriots). The conditions of independence, however, failed to satisfy both Greek-Cypriots and Turkish-Cypriots. Thus, in 1974, Turkey invaded the island and occupied approximately 40% of the total territory of the Republic. The consequences of the Turkish invasion were significant and influenced every part of life in Cyprus but more importantly, society, economy, and education. In the 1990s, Cyprus applied for membership in the European Union and had started declaring a European orientation in all aspects (Zembylas, 2002).

Thus, the following subchapters are tentatively organised into five periods: the period of **British rule (1870-1960)**, the independence period until the **Turkish Invasion (1960-1974)**, the **'I do not forget' era (1974-1990)**, the **moving towards European Union era (1990-2000)** and **the Euro-Cyprus state in the 21st century (2000-today)** and aims at explaining the socio-educational conditions of each period. Those periods are some of the most essential socio-political periods for Cypriot Education and are presented to set the socio-political dependency of educational ideas and goals. The Ottoman period is not discussed, since the major changes in education have only started during the British Rule (Tsiakkiros and Pashiardis, 2002). Hence, the following subchapters refer to the general conditions in education, the national curriculum's emphasis, and the most representative building types of each period. Lastly, since the emphasis of this research is secondary schools, only secondary school buildings of the Greek-Cypriot chamber are considered.

3.2.1 British Rule(1878-1960)

Cyprus came to British in 1878 when the British rented it from the Ottomans. The British rule lasted almost a century, and at the beginning the population was around 186 000 of which 137 000 Greek-Cypriots and 45 000 Turkish-Cypriots. During this period, the educational system went through various phases of centralisation and decentralisation. Initially, the educational system was very decentralised and local communities were responsible for employing teachers, allocating their salaries, and raising their taxes for funding education (Solsten, 1993). The two different communities had separate schools, teachers and curricula that were primarily determined by Greece and Turkey, respectively. Additionally, during this period, a significant increase in the number of primary schools was recorded, and the first secondary school on the island was founded in 1893.

As regards the Colonial Curriculum, at the beginning, the Greek-Cypriot schools adopted thoroughly Greek educational policy and implemented every educational reform occurring in Greece (Christodoulou, 2014). However, in 1933 with a new educational rule, the British Governor took complete control of the island's educational system(Pashiardis, 2004). During this period, there was an emphasised on agricultural education since it was perceived that the island's socioeconomic condition demanded an emphasis on rural training. As a result, the uniform curriculum of that period included natural history, rural science and gardening(Kambouri, 2012).

As happened with the educational curricula, the construction of Greek-Cypriot schools during this period adopted ultimately Greek guidelines for schools' design. One of the most representative examples of secondary school buildings in the early British rule was the Pancyprian Gymnasium. Although the Pancyprian Gymnasium was founded in 1893 was accommodated in the existing buildings of the Hellenic School of Nicosia. A new school building was built in 1922 to host the Pancyprian Gymnasium and constituted the first secondary school building built in Cyprus. The building was designed by Theodoros Fotiades, an important architect that determined the school architecture of this period.

School buildings of the early British Rule such as the Pancyprian Gymnasium in Nicosia (1922), the Hellenic Gymnasium in Ammochostos (1935) (*Τεχνικές Υπηρεσίες Υπουργείου Παιδείας και Πολιτισμού*, 2021) and the Hellenic Gymnasium in Lapithos (1943) were mainly neoclassical and operated as ideological symbols against the British empire(*Χρυσάνθου*, 2017). Their neoclassical and hierarchical exterior was also supported by the spatial layout of the school. For example, the spatial layout of the Pancyprian Gymnasium was characterised by a more or less symmetrical layout organisation, dramatic and central entrance, compactness and symbolic axiality (fig. 3.1).

Towards the end of the British Rule, some visual qualities of early modern aesthetics were revealed in school architecture. Examples such as the Hellenic Gymnasium of Limassol - Laniteio (1945), the Athenium Girls Gymnasium in Limassol (1950), as well as the Pancyprian Girls Gymnasium in Nicosia (1957-62) were some of the most representative school buildings of this period. All schools were characterised by pure white finishes, simple architectural exteriors with concrete planes in some cases, and enhanced transparency. Regarding their spatial layout, it was the first time that the open-air school building typology was introduced in Cyprus. More specifically, the Hellenic Gymnasium of Limassol, as well as the Pancyprian Girls Gymnasium fig. 3.2 in Nicosia were highly dispersed within the school plot and incorporated the idea of open-air courtyards around open-air circulation routes and building units.

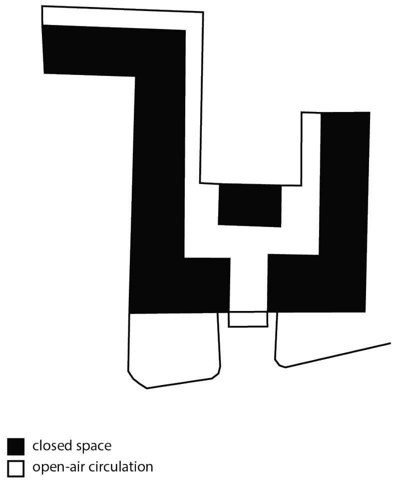


FIGURE 3.1: Pancyprian Gymnasium in Nicosia, 1922

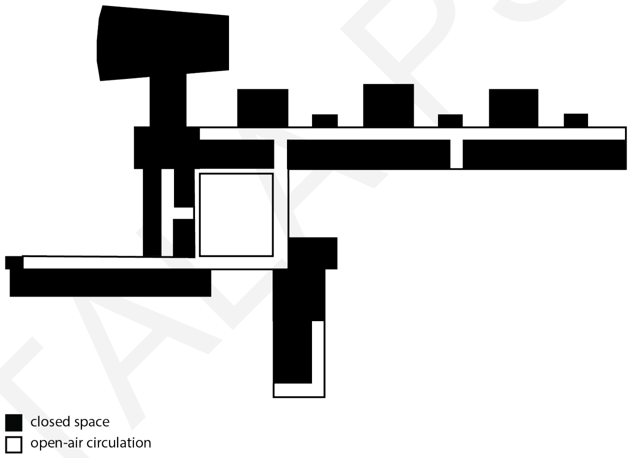


FIGURE 3.2: Pancyprian Girls Gymnasium, 1957

3.2.2 Independence

In **1960, Cyprus became an independent state** with two parallel communal chambers for education - the Greek Orthodox and the Turkish Ottoman chamber. In 1965, the Turkish Ottoman Community withdrew, and thus all administrative functions for education were transferred to the Ministry of Education and Culture. During this period, the educational system in Cyprus was developed with its own particularities and centralisation of powers (Pashiardis, 2004). Specifically, MOEC was responsible (and still is) for all Greek schools, general administration of education, establishment and enforcement of educational laws, preparation of educational syllabi etc. (Pashiardis, 2004). Under MOEC and throughout the years, the educational system of Cyprus has been evolved into its present structure.

Given this period's varying and challenging conditions, there was a general emphasis on education, since a well-educated population was seen "as the best way of guaranteeing a thriving economy" (Solsten, 1993, p. 73). Simultaneously, given the prior orientation of Cyprus education towards Greece, the national curriculum of that period was totally adapted to the Greek educational principles, and all academic materials and textbooks were sent from Greece. The only differentiation from the educational system in Greece was the emphasis assigned to the technical-vocational education in an attempt to provide the expanding economy of the island with skilled workers. (*Επιτροπή Εκπαιδευτικής Μεταρρύθμισης*, 2003).

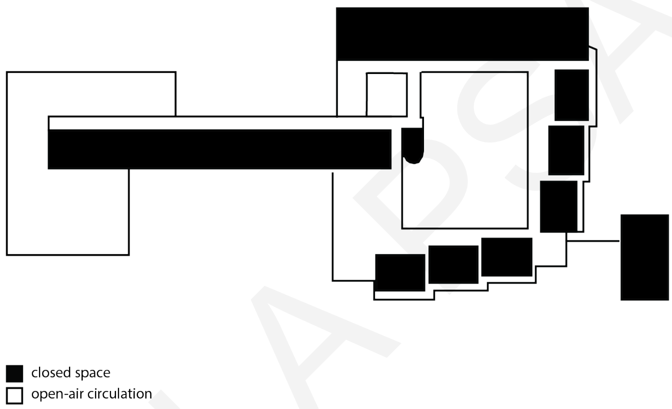


FIGURE 3.3: Kykkos Gymnasium in Nicosia, 1961

Regarding the late British Empire, the secondary school buildings of this period were highly influenced by the modern movement in architecture due to a wide array of young architects returning from their studies abroad and practising architecture on the island. Generally, in secondary schools of this period, there were no tentative symmetrical plans, and there were primarily modern aesthetics and materials. The school layout was highly dispersed (i.e, Kykkos Gymnasium, 1961; Gymnasium Egkomis, 1960), had an open-air structure and three (3) floors in some cases fig. 3.4. Lastly, there was an experimentation with the way buildable and unbuildable areas were arranged in the plot. More specifically, in the case of Gymnasium Egkomis, which at the beginning of its operation was a private school, was composed of two linear structures parallel to the street (*Μιχαήλ*, 2011). A zigzagged corridor followed the general layout and provided access to all different functions of the building.

3.2.3 Turkish Invasion

After **1974 and the Turkish Invasion in Cyprus**, the primary purpose of education was to ensure freedom. Therefore, during this period, the Greek-centred perspective in education was enhanced both by curriculum and educational policies. At the same time, this period was characterised by a valuable attempt to achieve a total reform in education and

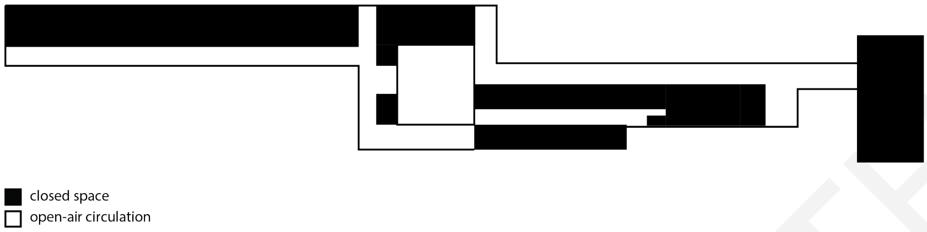


FIGURE 3.4: Gymnasium Egkomis, 1960

upgrading of the educational curriculum, its philosophy and structure, as well as its organisation(Zembylas, 2002). A significant change that occurred during this period (1981) was the division of secondary education into upper and lower cycle (*Υπουργείο Παιδείας και Πολιτισμού*, 2015).

In respect to the educational curriculum of this period was mainly adopted on Greek guidelines and the educational materials were provided by the Greek government. Simultaneously, between 1976 and 1980, a degree of freedom was assigned to the educational curriculum of upper secondary education. Specifically, the Lyceum of Choice was introduced and students were allowed to select modules of their own particular interest.

Due to the socio-political conditions of this period, there was a growing demand for new school buildings. In particular, almost half of the existing school building stock was occupied by the Turkish along with 38% of the island's territory (18 out of total 45 secondary schools) (*Υπουργείο Παιδείας και Πολιτισμού*, 2015). As a result, after the Turkish invasion, many new schools were constructed in areas where Cypriots refugees were displaced. Precisely, based on the data retrieved by the TDMOEC, it was estimated that more or less 40% of the existing secondary school building stock in the Greek-Cypriot part was built during this period.

The school buildings of this period were mainly designed and constructed by in-house architects of the TDMOEC and they shared similar characteristics (*Τεχνικές Υπηρεσίες Υπουργείου Παιδείας και Πολιτισμού*, 2021). Characteristic examples of this period were the Gymnasium Akakiou (1987), Gymnasium Linopetras(1980), Gymnasium Agiou Stylianou (1985), Gymnasium Neapolis (1987) and many others fig. 3.5. Specifically, due to the urgency and limited resource, the school buildings constructed during this period were characterised by standardised geometrical exteriors, an open-air structure with functional stripes along open-air corridors and courtyards(*Μιχαήλ*, 2011).

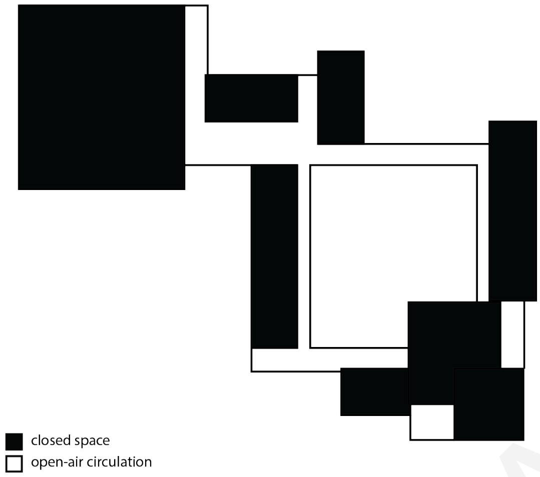


FIGURE 3.5: Gymnasium Akakiou, 1987

Lastly, there were also cases that schools were either gradually completed throughout the years (i.e Agiou Theodorou Gymnasium in Paphos), or were accommodated in different building types (i.e, the English Orphanage that accommodated the Gymnasium Akropoleos for a certain period of time).

3.2.4 1990s

Further on, the 1990s was also marked as a critical period in education in Cyprus. Notably, in **1990, Cyprus with its application for the European Union membership,** declared the European orientation for its formal education. More specifically, the European orientation of Cyprus as well as the globalisation of Cyprus in both economic and cultural terms, demanded the modernisation of education (Kambouri, 2012). Thus, in 1991 an American curriculum expert was invited to evaluate the national curricula and suggested ways for improvement. As a result of this evaluation, in the mid-1990s, the Government of Cyprus requested UNESCO and the International Institute for Educational Planning to undertake an appraisal of the system. In 1997, Unesco published the first attempt to introduce to the educational system of Cyprus "international ideas, ideologies, policies and practices and an emphasis on outcomes, benchmarks, efficiency, accountability, and performance measures" (The world Bank, 2014, p.10).

However, the design of secondary schools during this period was not that revolutionary. Specifically, it was only by the end of this decade that architects and organised bodies required the undertaking of architectural studies by independent architects to provide better schools. Until then, schools continued to be designed by the in-house architecture of the Technical Department and by adopting the same principles as the previous years (i.e, Gymnasium Verginas 1995, Gymnasium Ipsona 1997, Gymnasium Agiou Athanasiou 1999). Therefore, this action created significant dynamics for the upcoming decades. It underlined the possibility of abandoning the standardised school buildings applicable to every part of the island, with unique solutions that were based on each architects' approach and aesthetics under the general guidance of MOEC.

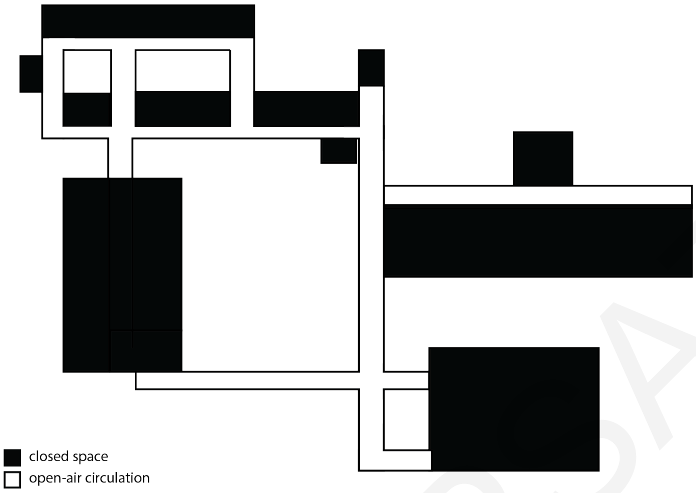


FIGURE 3.6: Gymnasium Ypsona, 1997

3.2.5 21st Century

In the **21st century**, Cyprus joined the European Union (in 2004) and had embraced a vision for education in the Euro-Cyprus state. During the last 20 years, several evaluations had been executed and thus major changes occurred in the education in Cyprus. One of the most critical evaluations was implemented in 2003 by a committee of seven academics and a comprehensive educational reform was proposed titled a 'Democratic and Human Education in a Euro-Cyprus State: Prospects for Reconstruction and Modernisation' (The world Bank, 2014). This report initiated a new manifesto for education which formulated a vision of a free, democratic and anthropocentric school where all students could come together discarding inequalities. It also underpinned a student-centred school which acknowledged the characteristics of childhood and youth (*Υπουργείο Παιδείας και Πολιτισμού*, 2010).

Such an understanding revealed an emphasis on experiential learning and the usage of students' senses, which were the central principles of the new analytical programs developed both in 2010-2011 and in 2014-2015. In fact, the latest reform differentiated the focus and pointed towards a new model of classroom - the model of classrooms as a life laboratory. In such terms, learning could be achieved by incorporating students' mind, body, and senses. Lastly, another important aspect of the current national curriculum (2015) was the introduction of a new direction for upper secondary education that diminished the concept of 'Eniaio Lykeio'. 'Eniaio Lykeio' was implemented from 2000 to 2015 and was structured to provide students of upper secondary education with more flexibility since it combined compulsory modules with optional subjects (Ministry of Education and Culture, 2001). However, continuous evaluation and critical reflections on this concept highlighted its problematic aspects and thus, a critical reform was necessary.

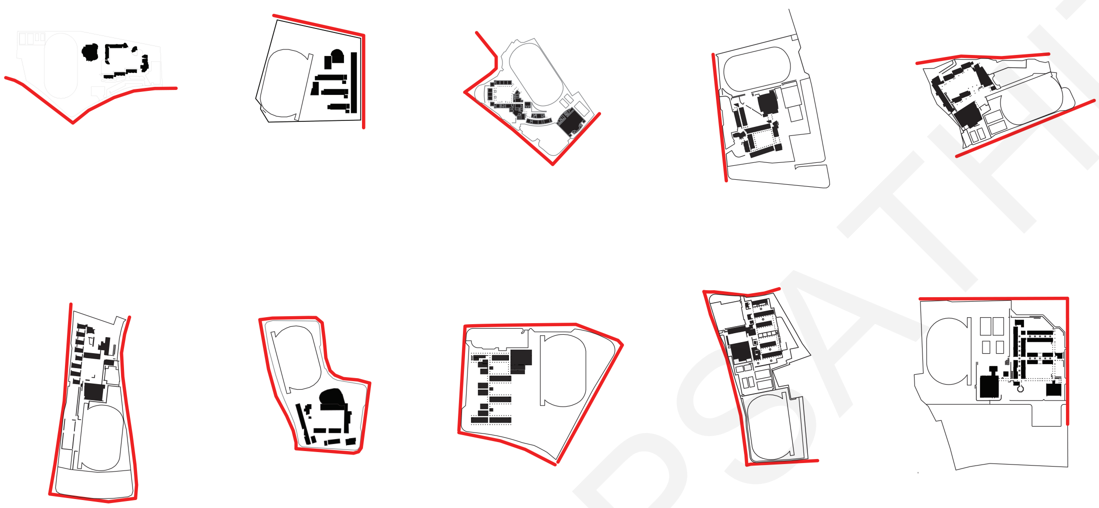


FIGURE 3.7: Built form and school plot. Black: Built space, White: Open Space, Red Line: Adjacent Street Network

The secondary school buildings of this period were designed by independent architects under the general guidance and observation of the TDMOEC fig. 5.1. Apparently, all schools of this period shared some common characteristics such as the open-air structure, courtyard-based compositions, and the enhanced functional dispersion along the school plot.

3.2.6 Critical Reflection

In the particular context of Cyprus on-going struggles and negotiations between local ideals, socio-political conditions, and global influences have played an important role in determining valid knowledge and primary educational goals (Persianis, 1996; Zembylas, 2002).

The responsiveness of the educational system to social conditions has apparently been very strong. However, the schools' spatial and architectural synthesis has not been as responsive as expected. The responsiveness of school buildings to socio-educational conditions has been most apparent during the periods of British Rule and Early Independence. During these two periods, architects have used architecture as a political manifesto either by using Neo-classical architecture and symbolism for the promotion of greek-oriented architecture and philosophy in education during British Rule or by using modernistic architecture as a mean for symbolising governmental rebirth and independence.

It may also be argued that the decade 1960-1970 could be considered another critical period for the design of secondary schools in Cyprus. In particular, the minimalist aesthetics, open-air structure, and functional dispersal along open-air corridors and courtyards were first introduced during this period. During the decades that followed the Turkish invasion, the responsiveness of educational buildings to socio-economic conditions had also been apparent. In fact, the increased demand for new school buildings and the economy of resources was evident in this period's general organisation, aesthetics, and design of school buildings. The decade of 1990-2000 constituted a transitional period in socio-educational conditions and school buildings' construction. Precisely, this period signified the minimisation of the Technical Department's authority in defining the school buildings of the island. Before that, the TDMOEC had defined the school architecture in Cyprus for over three (3) decades. However, since 2000 the TDMOEC has had only a consultancy role.

To summarise, it may be argued that the schools' physical structure was adopted to the socio-educational changes rather slowly as opposed to the educational reforms that responded to the social conditions very quickly.

3.3 Educational System in Cyprus: Current Structure and Composition

The educational system in Cyprus is characterised by a centralisation of power. MOEC is responsible for all educational institutions via the inspectorate committee and school headteachers. MOEC is also accountable for evaluating, preparing, and enforcing the legislation, syllabi, national curriculum, and national textbooks.

The educational system in Cyprus is consisted by pre-primary, primary, secondary, general (lower and upper) and secondary technical/vocational schools, special schools (i.e, for blind, deaf students etc), tertiary universities and non-university institutions (Kambouri, 2012; Statistical Service, 2021).

Pre-Primary Education is for pupils below five(5) years old and has been compulsory and free since the educational year 2004-2005. Pre-primary education is offered in three different types of schools: public kindergartens which are fully funded by the state, community kindergartens which are supported by communities as well as private kindergartens that are financed by tuition fees.

Free **Primary Education** has been compulsory since 1962 and caters pupils from six(6) to twelve (12) years-old. Primary education is mainly pursued in public schools (95% of pupils) but also in private schools (5% of pupils) (Statistical Service, 2021). This cycle of education offers general education, which aims at familiarising the pupils with fundamental education. Primary schools operate in every community, and children must attend the schools around their residential area.

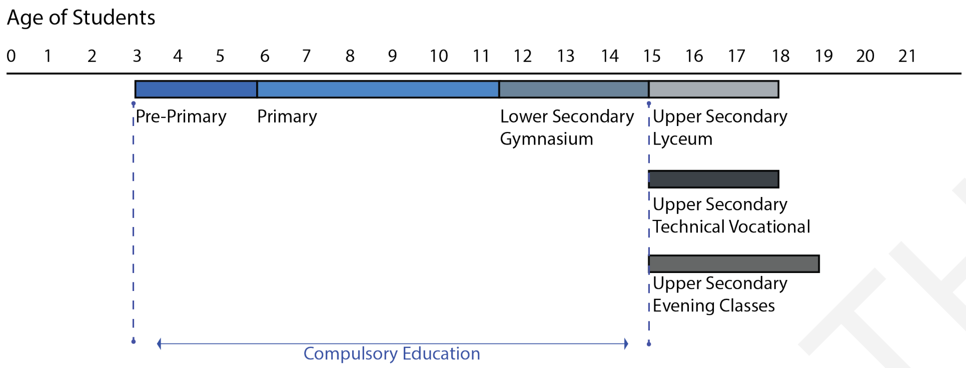


FIGURE 3.8: Educational System in Cyprus

Secondary Education in Cyprus is mainly pursued in public schools (with few private schools) and is composed of two cycles: lower and upper secondary education. The upper cycle of secondary education is classified into two types: upper secondary general and secondary technical/vocational.

A) Secondary General Education: Lower and Upper

A.1)Public:

Schools in this category are Gymnasiums and Lyceums. The lower cycle of secondary general education (Gymnasium) is for children from 12-15 years old and is comprised by three grades where all students learn a broad spectrum of general subjects and the humanities. Since 1985, students in Cyprus have to attend at least the lower cycle of secondary education and almost 100% of students reach this level of education(Kambouri, 2012). Secondary upper cycle (Lyceum) is composed by the last three grades of secondary education and provides several specialisation areas depending on the skills and bent of the students.

The latest curriculum has been introduced in the school year 2015-2016 and has created several changes, mainly in the upper cycle of secondary education. Specifically, from 2015/2016, the concept of 'Subject Orientation Groups' has been introduced in grade 10 (1st year of Lyceum), leading to six directions of study in the remaining two grades (grades 11 and 12). The six directions are the following: Classical and Humanities, Foreign Languages and European Studies, Science and Technology, Economics, Fine Arts, Commercial and Services (Statistical Service, 2021).

A.2)Private:

Private secondary education consists also of two cycles: Lower and Upper and extends over either six or seven years.

B) Secondary Technical and Vocational Education

Secondary technical-vocational education is offered only in the second cycle of secondary education (upper secondary). Specifically, technical-vocational education is offered as an alternative to the upper secondary general education and aims at "providing the local industry with technicians and craftsmen" (Statistical Service, 2013; Statistical Service, 2021).

To conclude, it could be argued that the Cypriot educational system is particularly fragmented. At the same time, as it is argued by Tsiakkiros and Pashiardis (2002) the Cyprus educational system is composed by four (4) fundamental components: the historical past, the social and political present as well as the vision for the future.

3.4 Design Guidelines for Lower Secondary Schools in Cyprus

The responsible body for the provision of general guidelines and principles for the design of school buildings in Cyprus is the Technical Department of the Ministry of Education and Culture (TDMOEC). The design of the school is assigned to various independent architects and should be based on the guidelines that are provided. According to TDMOEC, the aim of the detailed design guidelines for lower secondary schools is to give a systematic overview for the design of schools. More precisely, the design guides aim to explain the various functions, the relationships between functions, their sizes, and generally to provide a common base for the design that ensures quality. The detailed guidelines provided by the authorities include:

- General information about the design (i.e, aims, legislation, processes, and the selection of the school plot)
- Design guidelines and the analytical building programme
- Basic morphological characteristics
- Other construction requirements

According to MOEC, the design of lower secondary should primarily be developed in such a way to ensure that the school design is aligned with the current educational needs and at the same time to be easily adapted to future educational changes (*Τεχνικές Υπηρεσίες Υπουργείου Παιδείας και Πολιτισμού*, 2011).

The selection of the school plot is based on various parameters. Firstly, it is based on the *local plan* that is provided by the Planning Permit Department, which specifies the zones of development. Secondly, it is based on the geographical distribution of students' population and the demands in the various administrative areas. The whole school unit should also have sufficient road access and articulate pedestrian and vehicular movements in a safely manner. As regards the general topographical requirement, the plots should be more or less smooth with small inclinations. However, what small means in metric terms is not defined.

One of the most critical parameters for the design of lower secondary schools in Cyprus is the horizontal development of the school unit. According to the TDMOEC, the school unit has to be deployed in maximum 2 floors (ground and first floor) and 50% of school's functions should be accommodated on the ground floor. Thus, an essential requirement is the existence of covered circulation areas that connect the various parts of the building together. Additionally, the guidelines underline the importance of creating functional and pleasant places that support the educational process, while integrating natural elements within the school layout. Into more details, according to TDMOEC, the school unit of lower secondary education has to accommodate the following functions:

- **Entrance areas** should facilitate easy access to the school unit. A separate access is necessary for the sports indoor areas to facilitate its usage by the wider community after school hours;
- **Administration:** includes all administrative functions (i.e teachers' and headteacher's offices, supportive uses for those areas such as storage etc). The area should be easily accessible from the entrance and parking, and for this reason, it is preferred to be adjacent to the main access road;
- **Canteen:** refers to the area from where students and teachers can have their food and drink supplies. It is proposed to be placed close to the sports indoor area and in relation to the main outdoor areas. Additionally, its location should not disturb the classroom's normal operation;
- **Circulation:** refers to the covered circulation structure, which is usually paved and is designed so as to provide covered access to the various uses of the building. According to the guidelines, a well-developed and covered circulation area that unifies the school unit as a whole constitutes an essential functional requirement that should be taken into account by the architects. As regards the vertical connections, at least one staircase should be placed for every 4 classrooms or 100 students;
- **Courtyard [4] or Open-air Gathering areas:** should accommodate the school's usual gatherings as well as various programmed school events (i.e, school meetings). This area is described in the guidelines as a sort of public square which can also be amphitheatrically developed;
- **General & Special Classrooms:** general classrooms are areas that are dedicated for general education, while special classrooms are for specific modules such as music, technology etc. Both types of classrooms are perceived by the TDMOEC as the core elements of the school. Adjacent to those core elements, supportive functions (i.e, toilets, stores) have to be incorporated. The guidelines specifically mention that covered

[4] A courtyard area as defined by (Dictionary, 2021) is an area on the ground floor that is partly or completely surrounded by a building. This dissertation define a school courtyard an outdoor, partially enclosed space that is defined by 4 sides (at least 3 sides by a building and other 1 by height difference or material difference)

circulation areas should connect general and special classrooms together and facilitate students' movement. Equally important, this functional unit has to be easily accessible from all areas of the school and at the same time to be functionally linked to the main gathering areas of the school. Special classrooms, in particular, have to be incorporated within the school unit and at the same time do not disrupt the regular operation of the school (i.e, music, etc.).

- **Secondary Areas:** refer to areas that accommodate supportive and secondary uses such as toilets and storage areas that are proposed to be organised along with other primary functions (i.e, classrooms);
- **Sports areas (Indoor & Outdoor):** refer to sports facilities that should be incorporated into the school design. For this purpose, these areas should be easily accessible from the adjacent street network and parking area;
- **Stairs or Levels Connectors:** refer to all staircases or ramps that provide vertical connections between levels;
- **Study Area:** refer to a dedicated area of the library that should be easily accessible by students and teachers.
- **Outdoor Areas:** refer to general outdoor areas that are either leftover areas around the building or intentionally designed covered by greenery and flowers. All outdoor spaces should be designed so as to provide recreational areas for students. It is also suggested that the school should have peripheral green spaces around the building every 4 meters.
- **Parking Places:** refer to the parking areas for staff and visitors;

Therefore, based on the above guidelines, fig. 3.9 visualises the relationships between the above functions. In particular, with thicker dotted lines stronger and more direct relationships are visualised, while with thinner dotted lines less direct relationships are depicted.

These general school's organisational guidelines are combined with more specific functional needs and demands for every single area of the school. For example, in the case of general classrooms the guidelines mention that they should be 55 m^2 to be able to accommodate 26 students. They should also be used with multiple educational methods, and thus, the design should allow users to move the furniture based on their specific requirements. Similar and other requirements such as the particular equipment, desirable square meters, lighting and others are reported for all the different functions of the building and summarised in the analytical building programme that is provided by TDMOEC (*Τεχνικές Υπηρεσίες Υπουργείου Παιδείας και Πολιτισμού*, 2011, p.71-98).

In respect to the morphological characteristics, even though there is a specific section for this aspect, no specific guidelines have been given. Instead, it is only mentioned that the

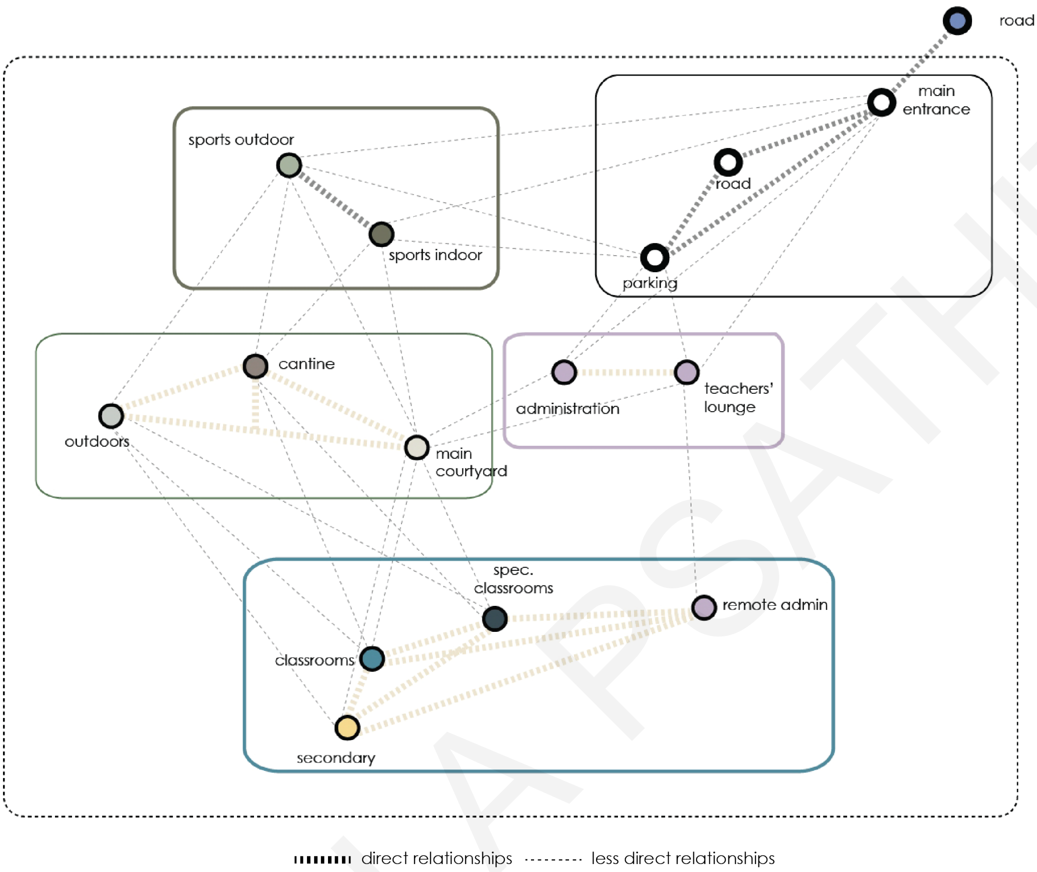


FIGURE 3.9: Visualisation of the relationships between functions proposed by the design guidelines

architectural solution for the school building should be aligned with the fact that it is a public building, it should operate as a reference point for the community and as a pedagogical institution with a particular pedagogical mission as well as a cultural environment.

Lastly, other specific requirements are also mentioned by the TDMOEC, such as the height of the peripheral fencing. School fencing should be at least 1.80 m high, and around the sports area should be 4.00 m high to ensure students' safety and prevent people from outside of the school to enter the building during school hours.

3.5 Lower Secondary School Community: Composition and Operation

The school community in lower secondary schools is composed of one headteacher per school, around more or less 50 teachers per school depending on the number of students, students across three grades (approximately 250-450 students), administrative staff (i.e secretariats etc), and operational staff (i.e school cleaners, cantine staff etc). All users of each school unit are assigned centrally by MOEC. More specifically, both the headteacher and teachers are centrally assigned by MOEC and work at each school for only a few years. Students entitled to attend a particular school are the ones whose permanent residence falls into the administrative area that corresponds to this school.

Lower secondary schools in Cyprus operate from September to May. The school year is composed of thirty weeks and is divided into two semesters (September-January and January-May). A typical school week extends from Monday to Friday from 7.30 until 13.35. However, not all days have the exact timetable. Two days of the school week have seven (7) educational periods and three (3) breaks, while three days of the school week have eight (8) educational periods and three (3) breaks (table 3.1). Lastly, beyond the regular school hours, extra curriculum activities happen in schools from 14.45 - 17.45, while the sports areas (indoor and outdoor) can also be used by the wider community outside of school hours.

	TIMETABLE 1 Wednesday, Friday	TIMETABLE 2 Monday, Tuesday, Thursday
	ENTRANCE	ENTRANCE
1	7.30 - 8.15	7.30 - 8.10
	TRANFER	TRANFER
2	8.15 - 9.00	8.10 - 8.50
BREAK	9.00 - 9.20	8.50 - 9.05
3	9.20 - 10.05	9.05 - 9.45
	TRANFER	TRANFER
4	10.05 - 10.50	9.45 - 10.25
BREAK	10.50 - 11.10	10.25 - 10.45
5	11.10 - 11.55	10.45 - 11.25
	TRANFER	TRANFER
6	11.55 -12.40	11.25 - 12.05
BREAK	12.40 - 12.50	12.05 - 12.15
7	12.50 - 13.35	12.15 - 12.55
		TRANFER
8	....	12.55 - 13.35
	EXIT	EXIT

TABLE 3.1: Lower Secondary School's Timetable

Consequently, it is becoming apparent that a typical school day is composed of different hours with different characteristics table 3.1. The first period could be considered the entrance hour, where students gradually start arriving at the school from 7 o'clock. Secondly, there are educational periods which are very tranquil periods and are characterised by the extensive usage of classrooms. Thirdly, there are transitional periods, where students and staff transfer from one classroom to another or from one module to another. Those periods are significantly quick and noisy. Fourthly, during break hours, students move from their classrooms to outdoor areas and cantine where they eat, hand out with their friends, play, and socialise. Usually, some rules can be applied by the headteacher that regard the areas students are allowed to use during breaks. The exit hour is an expeditious period five (5) minutes long (until the whole school is empty). At last, three (3) times per month, the entire school community could be gathered in the central open-air courtyard of the school. Thus, it is becoming apparent that the majority of school time is dedicated to attending school modules. Furthermore, a vast amount of time is devoted to breaks and transfers between school areas.

3.6 Overview of Case Studies

Lower secondary schools in Cyprus serve as a case study of this research. The selection stems from the fact that open-air secondary schools are remarkably underinvestigated in the existing scholarly work.

Only lower secondary schools from the Greek-Cypriot part of the island are considered since data from Northern Cyprus cannot be obtained. Cyprus has been selected as the appropriate context of the study since there is an overall lack of research exploring the relationship between school environment and school practices.

All ten(10) [5] lower secondary schools that built in Cyprus in the 21st century have been selected as case studies. The cases have been chosen according to the following criteria:

- **Level of Education:** Lower Secondary Education. All schools that are analysed by this research are lower secondary schools that cater pupils from 12-15 years old (Kambouri, 2012). The selection stems from the fact that young adolescents, students attending lower secondary education, start developing the ability to think in concrete ways (Piaget, 1954) and thus are considered more appropriate to provide qualitative feedback than primary school students. Additionally, all lower secondary school students attend the same courses as opposed to students from the upper circle of secondary education.
- **Type of Building:** Public school buildings. All the selected cases are public schools since the interest of this study is for school environments. Only public schools have been considered since they have been designed by various independent architecture with the same guidelines from TDMOEC.
- **Location:** Cyprus. Schools from all cities of Cyprus(Greek-Cypriot part).
- **Date:** Built after 2000. The selection of that specific period ishas been based on a variety of reasons. Firstly, the end of the 20th century and the beginning of the 21st century has marked one of the most pivotal periods for education in Cyprus. During this period, the orientation of Cyprus towards the European Union along with a series of official reports that have been executed by UNESCO and local authorities, have

[5]For the purposes of this dissertation schools are coded as S1,S2,S3,S4,S5,S6,S7,S8,S9,S10.

originated tremendous changes in education(Kambouri, 2012; The world Bank, 2014). Secondly, since this period, individual architects have been responsible for the design of lower secondary schools under the general supervision of TDMOEC.

- **Spatial embedding in the context:** Diverse. City and peripheral city locations.
- **Architects:** Diverse. All schools were designed by different architects and followed the guidelines given by the TDMOEC.

Half of the schools in the sample were built in 2002 (S3, S5,S9) and 2003(S1,S10). S2, S4, and S6 were constructed in 2005, 2006, and 2009, respectively. The two most recent lower secondary schools built in Cyprus were constructed in 2011 (S7 and S8 both in the same city).

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Date	2003	2005	2002	2006	2002	2009	2011	2011	2002	2003
No. Students	347	265	292	286	368	210	430	498	386	414
No. Teachers	57	47	48	48	51	32	55	68	60	63
Student/Teacher Ratio	6.09	5.64	6.08	5.96	7.22	6.56	7.82	7.32	6.43	6.57

TABLE 3.2: Schools' General Characteristics

FIGURE 3.10: Schools in their immediate surroundings

As far as the school population is concerned, the total **number of students and thus teachers** in the schools vary and ranges from 210 (S6) to 498 students (S8). More specifically, as it is shown in the table 3.2, 40% of the schools have under 300 students, 30% of the schools have up to 380 students and 30% more than 400 students [6]. As regards the student-teacher ratio ranges from 7.82 to 5.64. Schools 5, 7, and 8 (7.22, 7.82, and 7.32) have the highest ratio, which indicates that the number of students is significantly high, while the number of teachers is relatively small. Schools 2,3, and 4 have the lowest ratio (5.64, 6.08, and 5.96), thus assuming that those schools have a bigger potential to effectively address students' individual needs.

[6]The school population refers to the school year 2020-2021. However, significant changes in the school population might be recorded from times to times

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Location	suburban	urban	urban	urban	urban	suburban	urban	urban	urban	urban
City	C1	C1	C2	C2	C2	C3	C3	C3	C4	C5
Density	med	low	high	high	high	low	high	med	med	low

TABLE 3.3: Schools' Location Characteristics

The schools are spread all over Cyprus and are located in all 5 cities of the island. **All schools apart from S1 and S6 are located in urban areas** with varying degrees of building density [7] around them. More specifically, significantly low density is recorded around schools 2,6, and 10. Medium-density is illustrated around S1, S8, and S9, while the high density is around S3, S5, and S7. The differences between schools in this respect could suggest a completely different character between schools that are surrounded by greenery and open spaces in comparison to schools that are surrounded by high density areas and most possibly a street network. A detailed fact sheet for every school can be found it appendix I.

[7]The density is judge qualitatively based on the google earth images presented in fig. 3.10

Chapter 4

Methodology

Based on the review of the literature, an exploratory, multilayered, across scales, methodological approach has been chosen. More specifically, it has been concluded that both **a cross-case comparative study** and an **in-depth study** are required to be able to fully understand the complex relationship between school spatial layout and school practises.

This chapter first introduces the research design and details on the case-study research implemented. The challenges that are faced during the pilot study are then elaborated and lastly, both qualitative and quantitative methods are discussed and explained.

4.1 Research Design

The review of the existing literature and empirical case studies in Chapter 2 have shown that the existing body of literature is characterised by incompleteness and fragmentation and revealed several methodological gaps. Firstly, it has been concluded that the school space is usually approached as abstract and unstructured, and thus, a more systematic and in-depth understanding of the spatial structure is required. Moreover, in most cases only parts of the school environment have been considered (i.e, classroom design etc). Hence, it can be suggested that a study that could approach the school building as a whole is required since it can give insights regarding the general design and composition of school buildings. Secondly, it has been also highlighted that even though a wide array of studies have been conducted so far exploring school environments and school practices, there is an overall paucity of empirical evidence. Thus, a more empirical reading of the school building is also necessary to render the complex school reality. Additionally, little attention has been paid to the role of agency and the transpatial forces that govern the school's socio-spatial reality, and thus this leaves room open for further investigation and consideration. Lastly, either a comparative examination of various school units has been proposed or an in-depth study between fewer schools has been adopted with no crosswalks between them. Thus, a methodological approach that can provide both an in-depth understanding of school life and at the same time could offer a comparative understanding of various cases can be very promising and powerful. Such a methodological perspective could also ensure the crosswalk between levels and depths of study.

Thus, based on the insights, limitations, and analytical requirements that have been retrieved by the review of the existing literature, an exploratory across scales and depths methodological approach is adopted. Specifically, it combines a top-down approach that examines all 10 schools of the sample with a bottom-up approach that inspects 2 of the schools to achieve a more holistic understanding, and a more in-depth reading of space usage patterns. This combination provides both generalised knowledge about school design, school composition, and teachers' perceptions as well as contextual, real-world, in-depth knowledge about school behaviour and socio-educational dynamics. Nevertheless, a central aspect of the methodological framework of this research is the pilot study. The pilot study firstly aims at testing and evaluating the methodological approach in a real context and secondly at refining the methodological framework for the final study.

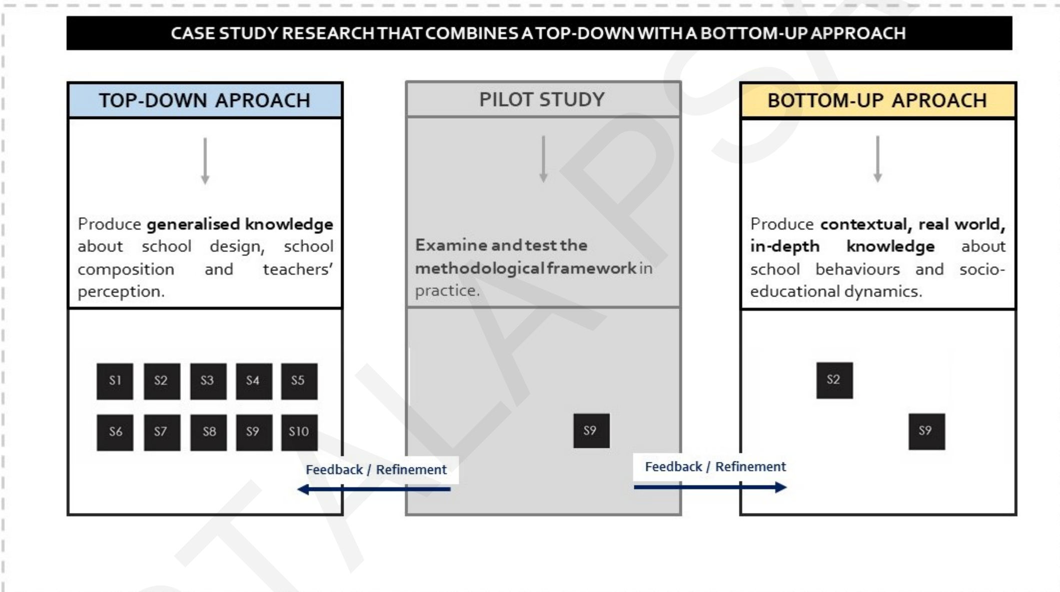


FIGURE 4.1: Methodological Framework

The cross-case comparative study (top-down) offers a comparative understanding of the whole sample and reveals differences and similarities between schools. The entire sample of case studies of this dissertation is used for the cross-case comparative study. Both qualitative and quantitative methods are used to compare the different schools and are summarised in fig. 4.2 and fig. 4.3.

The first level of analysis firstly aims to provide a comparative understanding between different school layouts and at the same time to offer insights for the selection of the in-depth study's case studies. More specifically, this process reveals similarities and differences between schools and thus highlights the two representative schools that can be used for the in-depth study.

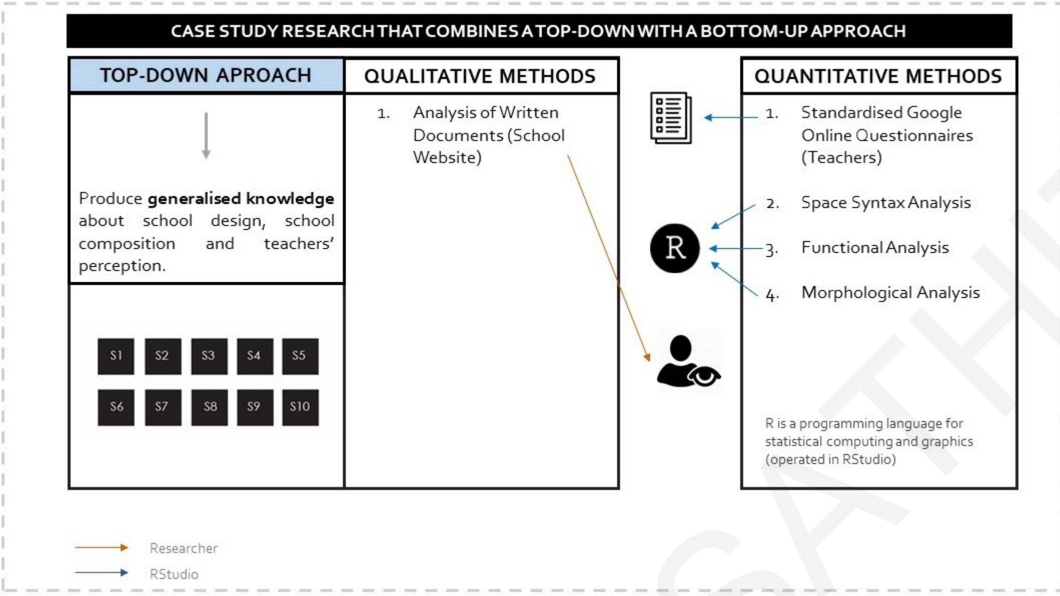


FIGURE 4.2: Methodological Framework, Methods for top-down approach

Secondly, the in-depth study aims to shed additional light on the complex relationship between school spatial layout and school practises. Furthermore, to provide sufficient empirical evidence and reflect on users' perceptions and actual use of space [8]. The methods used for the in-depth study are summarised in fig. 4.3.

Lastly, one of the two most representative schools has been selected as the case study for the pilot study to test and refine the methodological framework proposed [9]. The pilot study was implemented during the spring semester 2017-2018.

The collection of empirical evidence during the final study was executed in October 2020. Since April 2000, schools have been operated by embracing extra measures and regulations due to Covid-19 pandemic. The most important rules that have been applied to the schools due to Covid-19 are the following:

- More than one entrance to school (if possible);
- sanitation stations in the classroom;
- masks are mandatory in the classroom;
- students have their own desk;
- outdoor teaching and learning is encouraged (if possible);
- visits by parents are reduced and alternative ways of contacting parents are proposed (such as through virtual groups);

[8] A detailed explanation of the sampling design process is given in section 4.1.1
[9] See section 4.1.2 for the analysis and discussion of pilot study

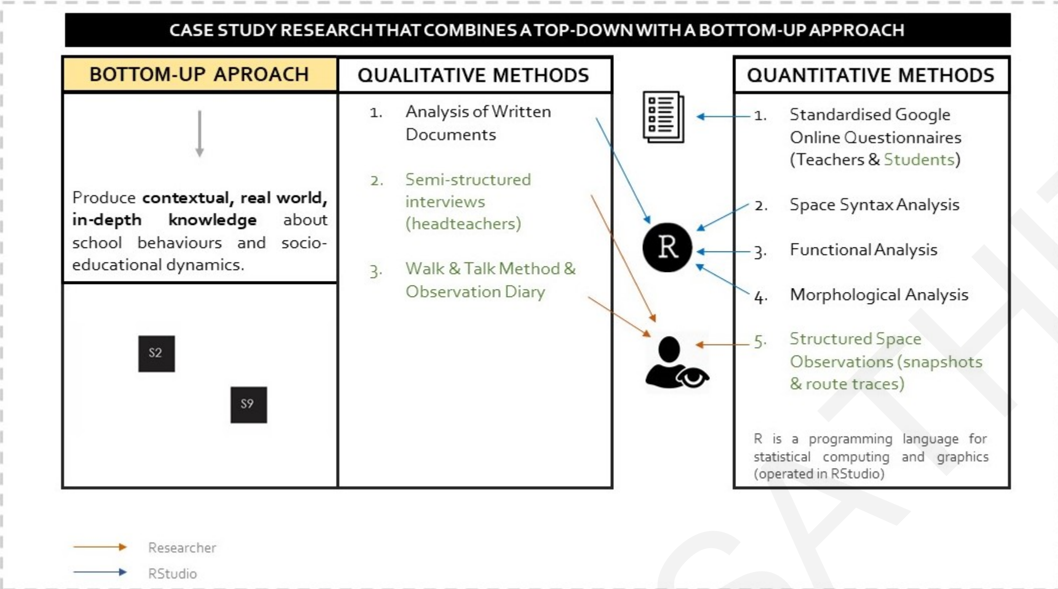


FIGURE 4.3: Methodological Framework, Methods for bottom-up approach

- during breaks, each level of education (i.e 1st, 2nd, and 3rd year) has dedicated areas for breaks. However, observations of space usage have shown that students do not stick to the rule (see also chapter 6);

This dissertation aims at embracing Covid-19 situation based on the following criteria:

- Firstly, based on the central hypothesis of this dissertation that schools can be approached as assemblages of various socio-spatial elements materialised by means of various heterogeneous parts (spatial aspects, social conditions, regulations, student and teacher behaviours e.t.c) which are constantly in the process of making, it could be hypothesised that there are no normal conditions suitable for observations in school buildings;
- Covid-19 regulations can be considered as additional rules and transpatial conditions imposed to the school;
- Covid-19 regulations have been centrally provided by MOEC and thus can offer a common base to compare schools with the same transpatial dynamics but different spatial settings;
- The framework that this thesis aims to develop should be applicable in different transpatial rules and conditions. Thus, such an extreme situation can provide sufficient evidence not only to test the framework but also to illustrate the importance of agency in school buildings, and how it is related to the spatial structure of the school;
- Covid-19 regulations might reveal some interesting facts about schools' operation and design that worth to be considered;

Thus, it can be argued that despite the fact that this new situation has produced various changes in the school life, it could suggest that there is no normal condition or normal period where everything is the same in school. Instead, schools are constantly in change by means of transpatial ordering and socio-spatial dynamics.

4.1.1 Selection of Case Studies for In-depth and Pilot Study

The selection of the most representative schools that could work as case studies for the in-depth investigation has been implemented by examining the commonalities and differences between all ten (10) schools. Firstly, the initial correlation matrix has enabled to understand the relationships between schools as well as to reveal which variables might be related to which variables. Secondly, a assumption-based clustering has been implemented by considering insights from the existing body of literature (it is explained in detail in chapter 7).

AP clustering, which stands for affinity propagation clustering, is used to identify relationships between schools. Affinity propagation is an algorithm that identifies exemplars among data points and forms clusters of data points around these exemplars. It operates by simultaneously considering all data points as potential exemplars and by exchanging messages between data points until a good set of exemplars and clusters emerges (Frey and Dueck, 2007). Lastly, affinity propagation identifies clusters with much lower error than other methods [10].

An R package for affinity propagation clustering proposed by Bodenhofer et al. (2019) has been used in order to construct a series of clusters exploring commonalities and differences between the case studies of this dissertation. Specifically, based on conclusions and hypothesis that are derived by the most important existing literature review, a series of assumption-based clusterings has been achieved. Hypotheses are for example: relatively high school porosity and high movement potential can contribute to a rule-driven school operation, higher school accessibility can contribute to higher incidental interaction among students (Pasalar, 2003) etc. Only 2 variables per hypothesis are considered in order to be able to control the clustering and achieve a better sense-making of the groups that are formed. The complete list with the hypothesis and variables that are used can be found in the table 4.1.

This process has resulted in a series of connections between schools and thus has allowed a nuanced understanding of the commonalities and differences between schools. Precisely, eighty-four (84) different groups of schools have been identified. The groups have emerged by considering both the initial correlation matrix and the assumption-based clustering. In

[10] AP clustering is a relatively new clustering technique that has significant advantages against most commonly used clustering techniques such as k-centers clustering technique. "The popular k-centers clustering technique begins with an initial set of randomly selected exemplars and iterative refines this set so as to decrease the sum of squared errors. k-centers clustering is quite sensitive to the initial selection of exemplars, so it is usually rerun many times with different initialisation in an attempt to find a good solution. However, this works well only when the number of clusters is small and chances are good that at least one random initialisation is close to a good solution"(Frey and Dueck, 2007, p.972)

A/A	Hypothesis	Variable 1	Variable 2
1	Relatively High school porosity and high movement potentiality can contribute to a rule-driven school operation	School Porosity	Mean Segm. Length
		School Porosity	Mean NACH
2	Relative high school porosity and relatively segregated sports area can contribute to a rule-driven school operation	School Porosity	Rel. Central. Sports
		School Porosity	Step Depth Sports
3	Relatively high school porosity and relatively deep school layout can contribute to a rule-driven school operation	School Porosity	Axial Intelligibility
		School Porosity	Axial Mean Depth
		School Porosity	Visual Mean Depth
4	Relative segregated administration area and relatively high school porosity can contribute to a rule-driven school operation	School Porosity	Step Depth Entrance
5	Relatively deep school structure can contribute to a correspondence model, while a relatively shallow school building can contribute to a non-correspondence model	Axial Integration	Step Depth Entrance
		Axial Mean Depth	Step Depth Entrance
6	An integrated school where the administration area is centrally located can offer higher potentials for accidentally meeting and thus contribute to a positive school climate	Axial Integration	Rel. Central. Admin.
7	Relatively centrally located classrooms and high movement options in school reduce the framing since they reduce the power of the teacher	NACH	Rel. Central. Gen. Classrooms
		NACH	Rel. Central. Spe. Classrooms
8	Smaller schools & less segregated can enhance social interaction and cooperation between school users (Moore 1986)	School Size	Axial Integration
9	Smaller schools & less integrated can be assumed to be more flexible in adapting different educational styles (Tagushi & Kishimoto, 2014)	School Size	Axial Integration
10	Smaller schools & highly intelligible schools perform better in many aspects (teachers can more carefully lead their students and students can easily develop good relationships (Tagushi & Kishimoto, 2014)	School Size	Axial Inteligibility
11	Higher school accessibility can contribute to higher incidental interaction among students (Pasalar, 2003)	NACH	Axial Integration
12	The higher the difference between the relative centrality of special classrooms and general classroom, the stronger the classification in school and differentiation between subjects	Rel. Central. Gen. Classrooms	Rel. Central. Spe. Classrooms
13	The most segregated the sports area in relation to the administration area, the stronger the need for rules in the school	Rel. Central. Admin.	Rel. Central. Sports
14	Isolated and Independent Classrooms and weak circulation system tend to afford flexible education (Tagushi & Kishimoto 2014)	Axial Integration	Rel. Central. Classrooms
		Rel. Central. Circul.	School size

TABLE 4.1: Table for assumption-Based Clustering

essence, by counting the times each school appears in the same group with any another school, a 10x10 matrix table is developed and then visualised as a two-mode network (fig. 4.4). [11]. The strength of the relationship between schools is represented with the weight of the ties (the number of times a school has belonged in the same group with another school). Only relationships above fifteen (15) connections are illustrated on the diagram in order to make the diagram more readable and the relationships between school more obvious.

Based on the above process, two schools (S2 and S9) have been selected as the most representative schools for the in-depth study based on the following criteria:

- Both are relatively central to the network;

[11]"In social network analysis, 2-mode data refers to data recording ties between two sets of entities. In this context, the term "mode" refers to a class of entities – typically called actors, nodes or vertices – whose members have social ties with other members (in the 1- mode case) or with members of another class (in the 2-mode case). Most social network analysis is concerned with the 1-mode case, as in the analysis of friendship ties among a set of school children or advice-giving relations within an organisation. The 2-mode case arises when researchers collect relations between classes of actors, such as persons and organisations, or persons and events. For example, a researcher might collect data on which students in a university belong to which campus organisations, or which employees in an organisation participate in which electronic discussion forums. These kinds of data are often referred to as affiliations."(Borgatti, 2009, p.1)

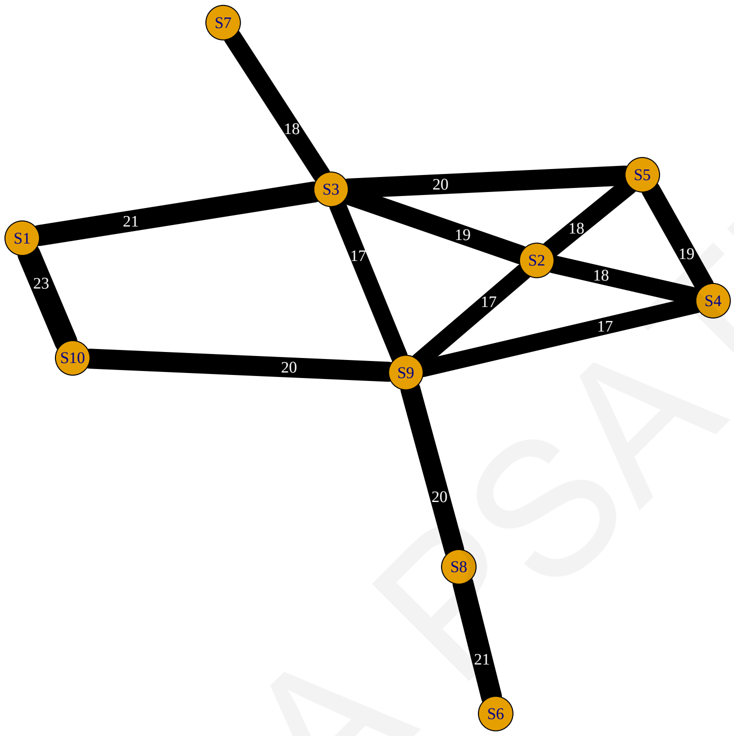


FIGURE 4.4: Network of the Relationships Between Schools, Selecting Schools Process

- Have more than 4 connections with other schools;
- Have 17 connections between them;
- Share similar spatial and morphological characteristics

One of those two schools (S9) has been selected as the case study for the pilot study to implement, test, and refine the methodological framework for the final phase of data collection.

4.1.2 Pilot Study: Methodological Insights and Successive Refinement

The pilot study was implemented in School 9 during the spring semester 2017-2018. The pilot study was implemented to examine in a real context the methodological framework proposed and aimed at:

- analysing the feasibility of the methodological framework prior to the final study;
- inspecting and testing the methodological framework;

- checking the reliability and validity of the research methods proposed for the on-site observations;
- Highlighting issues that are worth to be examined further;

The school examined by the pilot study, S9, was built in 2002, has a medium size, approximately 448 students, and 8.77 student-teacher ratio. The school is located close to the city centre and is organised around structured open-air circulation units, smaller courtyards, and function stripes. The majority of the school plot is open (88%), since only 12% of the school unit has closed areas. In fact, only the right part of the school accommodates various functional units that are organised around structured open-air circulation units & smaller courtyards. Lastly, the vast majority of the built structure of the school is attached to the adjacent street segment (58% of the school perimeter is covered by the street network).

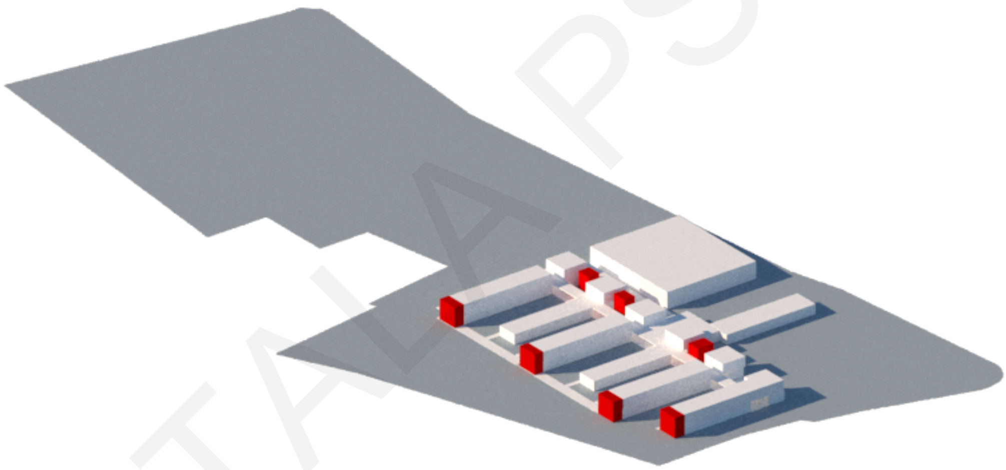


FIGURE 4.5: Volumetric 3d of the pilot study school

The methodology proposed for the pilot study combines spatial, functional and morphological analysis of the spatial layout with on-site observations of human spatial behaviour and combined:

- Semi-structured interviews with headteacher (appendix D);
- Teachers' and students' online questionnaires (appendix B);
- 'Walk and Talk' activity which has been used to get a sense of the school space usage patterns, school environment and users' perceptions through small discussions with students and teachers;

- Structured space observations (snapshots which capture stationary and moving activities, formal and informal learning activities as well as interactions in space and route traces which capture users' daily movement routines);

The main challenges faced during the pilot study and needed reconsideration for the final study were the following:

- Students sometimes needed assistance to answer some of the questions of the questionnaire. This suggested phrasing some questions differently;
- The speciality section in the teachers' questionnaire was suggested to be eliminated since it revealed the identity of the responder;
- The analysis of qualitative feedback highlighted that more Likert questions were needed in both questionnaires to allow various types of analysis to be executed afterwards;
- There was a significant difficulty in collecting approvals from parents so as students to answer the questionnaires. Thus, this highlighted that in order for this study to be feasible, the schools from which students' questionnaires could be collected should be limited;
- Particular questions from both types of questionnaires were eliminated since they showed to be less useful and repetitive [12].
- From the semistructured interview with the headmaster appeared that the issue of safety and rules is particularly important. Thus, a set of questions regarding this issue has been added to the final study.

4.2 Qualitative Methods

Three main qualitative methods have been used in this dissertation: Semi-structured interviews with the school's headteacher (covering different topics), ethnographic space observations by means of the 'walk and talk' method, and the observation diary and analysis of written documents.

4.2.1 Semi-Structured Interviews

Semi-structured interviews have been led with 2 headteachers from S9 (studied for pilot and final study) and 1 headmaster from S2, covering the relationship of school building design and everyday school practices, space usage, effective leadership, options and perspectives.

The interview guides have been prepared prior the interviews and have operated as a base for the main questions to be asked. However, the intention has been to keep the interview

[12] The complete pilot questionnaire can be found in the appendix B

discussion as open and unstructured as possible to motivate the participants to talk about any topic they would consider important. Overall, the interview guides are used in this thesis to offer a more detailed image of the socio-spatial dynamics that are generated in the school. Not only, they are used so as to understand how social agency might influence,to a certain extent, human spatial behaviour and school practices.

The interview guides firstly include questions regarding the profile of the headteacher, their education, years in school, etc. The second set of questions aims to address their major concerns about the school and includes questions such as:

- 'what is your primary concern about this school?'
- 'Did you face any difficulty in executing effective leadership because of the school design?'
- 'What spatial features do you like or dislike the most?'
- 'Do you consider the location of the administration area as an advantage or disadvantage in this school?'
- 'Which challenges have you faced due to the covid-19 pandemic in the school's operation?'

The content of the interviews is used as a set of qualitative information which can provide a more prosperous and denser image of each school. In addition, the points mentioned by the headteacher are used to illustrate and enrich the understanding and reading of each school regarding the specific layout and potential issues they face, space usage, effective educational practices, rules etc. Lastly, the interviews have helped to sketch important qualitative information that could be matched with other findings of this research and in some cases could initiate further points of interest.

4.2.2 Ethnographic Space Observations - Walk and talk and Observation Diary

Being inspired by existing empirical research in this field (Pasalar, 2003; Sailer, 2015; Sailer, 2018), space syntax observation manual (Vaughan, 2001) and general consideration on qualitative research studies (Flick, 2009) the schools have been openly observed qualitatively by adopting a 'walk and talk method' and keeping an observation diary. Field notes have been kept on every sort of behaviour, informal talk, space usage, users' feedback, and organisational culture. This includes looking at how school space is used, how groups of students are formed during the break, which aspects are revealed as important by the users, whether students sit alone during breaks or not, how often teachers tend to speak with students informally, what kind of discussion students have with their teachers (informal, personal or rule driven) etc. This qualitative reading of schools gives an additional set of information that enriches the analytical description of schools.

4.2.3 Analysis of Written Documents

Thirdly, the open-ended answers from students' questionnaires have looked at to enrich the understanding of students' opinions, feelings, attitudes, and experiences through systematic text mining [13] and text analysis in RStudio. Text mining is typically defined as the process of discovering useful information from written documents through automated identification of interesting patterns and relationships (Fieldman and Sanger, 2007). Text mining techniques have been adopted by this thesis to avoid bias in categorisation of the answers by the researcher. This, however, does not diminish the qualitative nature of the method. Instead, text mining techniques, despite the fact that they perform computer-generated analysis, do not diminish the qualitative nature of texts and words that are the primary data source for the analysis (Krippendorff, 2004). Thus, can provide valuable qualitative insights. The specific types of analysis that are executed by this thesis are: text categorisation, word count, and sentimental analysis (*tm, wordcount* and *syuzhet* packages). [14]

4.3 Quantitative Methods

Five main quantitative methods have been used in this dissertation: standardised students' and teachers' questionnaires, spatial analysis, functional analysis, morphological analysis, and structured space observations.

4.3.1 Space Syntax Analysis

The school's spatial layout analysis has been achieved by using Space Syntax methods (Hillier, 1996). The data required for this method is the 2D school floor plans situated within the wider school plot for all schools, which is obtained by the TDMOEC.

Due to the fact that there is no previous research in the field of space syntax analysing open-air schools, both line maps (axial lines and segments) and visibility graphs have been used to identify the best methods able to describe open-air schools.

An axial line map represents the potential lines of movement through space (Bafna, 2003) and constitutes the least set of straight lines that passes through each convex space (Hillier and Hanson, 1984). In that sense, in the case of school buildings a line could run through the whole length of a corridor and connect with other lines when there is for example a door that leads to a classroom. However, as stated by Sailer (2010), this definition seems to be problematic in building scale analysis. Thus, a slightly adapted version of axial analysis

[13] Text mining is the process that extracts valuable information from unstructured texts. Since unstructured texts cannot be progressed as such, specific algorithms and techniques are applied in order to extract valuable information and then use textual data in other types of analysis.

[14] "Sentiment Analysis is the process of determining whether a piece of writing is positive, negative or neutral. It's also known as opinion mining, deriving the opinion or attitude of a speaker. With ever increasing data size, it is no longer feasible to read text manually and understand the emotion. Instead, an algorithm is used that extracts emotions from thousands of text documents in seconds"

able to represent in a better way the real-life relationship between people in buildings is required.

This dissertation, based on the insights above, has adopted a slightly revised version of an axial map. The method is firstly based on the proposed model by Sailer (2010), but further refinement is achieved based on the insights retrieved by the pilot study of this dissertation. More specifically, the convex spaces of the school are defined based on both the geometrical and functional character of each space[15]. For example, in the classroom, the area that is reserved for the entrance and is in front of the whiteboard is conceptualised as one convex space, while the rest of the classroom as a different one. To draw the axial line map, AutoCAD software has been used. Lastly, axial and segment analysis have been derived by using the *RDepthmap* [16] package in RStudio fig. 4.6 .

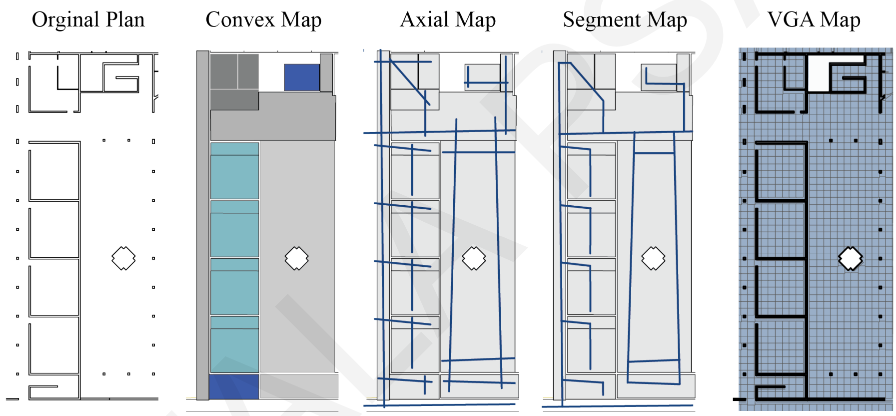


FIGURE 4.6: Space Syntax methods used in this PhD

Regarding the open spaces, the axial map (fig. 4.6) has been based both on real-life scenarios and the automated fewest line map of each school. Both conventional measures derived by axial analysis but also joint measures that combine spatial analysis with other types of analysis are used.

Secondly, based on Sailer (2018) that has highlighted the potentiality of segment analysis in school research, this dissertation also uses segment analysis to capture best the movement structures within the schools. Segment analysis is a refinement of the axial map as introduced by Hillier and Iida (2005), where each axial line is broken down into single segments at each intersection.

[15]section 4.3.2 elaborates further on the definition and design of functional polygons by this dissertation
[16]RDepthmap is an R package for Space Syntax analysis through depthmapX

Of particular interest of this dissertation is the measures of integration and choice. Integration identifies the centrality of the system, while choice identifies those segments in a spatial system that show the highest opportunities for being chosen as a movement paths due to their strategic location. Based on the human propensity to favour straight lines in navigation and perception, the measure of Normalised Angular Choice (NACH) models routes with less angle change as less costly, and thus, more likely to be followed by users Hillier, Yang, and Turner (2012). [17] This analysis views the choice as a global property of space and considers the location of a space in the wider system. This dissertation uses an angular segment analysis with metric radius which is the most promising for capturing both to and through movement (Al Sayed et al., 2014).

Thirdly, a visibility graph analysis (VGA) has been generated for all schools. A visibility graph overlays a human-scale grid spacing such as 0.50 x 0.50 m on top of the architectural plan and constructs an isovist from the centre of each pixel of the grid. Hence, it connects every pixel to all other pixels that are covered by the generated isovist. The metrics used in this type of analysis are summarised in the table 4.2. The VGA analysis has been implemented for accessibility [18]. Visibility at the eye level is not considered in this case since each classroom has curtains or blinds able to block the visibility levels. The VGA analysis captures how integrated or segregated a space is within the school by using a red to blue colour scheme where cool colours indicate segregated areas and highly integrated areas are shown with warm colours. Thus, the visibility graphs could be analysed both graphically and statistically.

VGA Metrics	Axial Metrics	Segment Metrics
VGA Connectivity	Axial Connectivity	Angular Connectivity
VGA Integration	Axial Integration	T1024 Integration
Visual Mean Depth	Axial Choice	T1024 Choice
Step Depth Administration	Axial Choice R3	T1024 Choice R3
Step Depth Sports	Axial Control	NACH Mean
Step Depth Entrance	Axial Mean Depth	NACH Max
VGA Connectivity Without Sports (WS)	Axial Length	Segment Length
VGA Integration WS	Axial Intelligibility	
Step Depth Administration WS		
Step Depth Sports WS		
Step Depth Entrance WS		

TABLE 4.2: Space Syntax Metrics used by this Dissertation

Based on axial, segment, and VGA spatial representations, a wide array of measures have

[17] Based on the existing body of literature, NACH values have been calculated in this thesis based on the following expression: NACH = log(Segment$T1024Choice) + 1)/log(Segment$T1024TotalDepth)+3

[18] Accessibility refers to the VGA analysis that takes into account all possible accessibility boundaries (i.e walls, glasses etc)

been calculated and summarised in table 4.2. Due to the fact that only a small handful of studies have been analysed schools in the field of space syntax research (Sailer, 2015) and there are no examples of research studies exploring open-air schools, an explanatory usage of methods has been adopted in this dissertation.

4.3.2 Functional Analysis

A set of three quantitative methods has been used for the investigation of schools' functional composition. Firstly, the functional composition per school and per floor is considered by looking the percentage of coverage for each function regarding the total school area and floor area, respectively. Therteen (13) different categories of functions are identified based on the review of the existing design guidelines provided by TDMOEC that have been already discussed in chapter 3.

Functional polygons have been drawn based on the convex map proposed by space syntax theory and method and presented in fig. 4.6. Specifically, each functional polygon is conceptualised as a fat convex space in which all pairs of points are intervisible. However, the idea of convex map has been enriched by programmatic needs as already explained.

Secondly, the complex spatial relations between functions have been visualised through justified graphs. [19] In a justified graph spaces that are immediately adjacent have one step of depth between them. Spaces that have a minimum of one space separating them have two steps of depth in between and so on. In that sense, the depth of a Justified Graph describes the number of topological steps (the shortest topological distance) needed to move from a route to all other spaces of the system (Al Sayed et al., 2014). The justified graphs have been both visually examined and analysed via graph network analysis through the igraph package for R. Three types of centrality have considered: degree, betweeness, and closeness. The *degree* centrality illustrates a node's centrality and describes the number of edges a node has. This means that the higher the degree, the more central the node is and the more immediate neighbours it has. This is very useful to understand in school buildings to see how central are the courtyards or the classrooms e.t.c. *Betweenness* centrality measures how important a node is on the shortest path through the network. This means that the higher betweenness centrality is a way of measuring the node control. Betweenness is calculated for each node by looking at the number of shortest paths between every pair of nodes in the network and counting how many paths go through the subject node. Lastly, *closeness centrality* calculates the distance of a node to all other nodes. Thus, nodes with higher closeness centrality have the shortest distances to all other nodes. Hence, a graph with lower mean closeness is characterised by more spaces that have lower closeness centrality, and thus, it is a system where all functions are closer to another.

[19] A justified graph constitutes a graph that is deployed based on a base note - a starting point. All points of depth 1 from the point of origin are aligned horizontally immediately above it. All points at depth 2 are placed horizontally above those at depth 1 and so on until all levels of depth from the starting point are accounted for (Space Syntax, 2021).

Thirdly, this thesis has examined the relative centrality of functions by slightly adapting the FIR metric proposed by Kishimoto and Taguchi (2014). The FIR in the study of Kishimoto and Taguchi (2014) has been generated by means of convex map analysis and is defined by the following expression:

$$FIR = \frac{Mean\, Integration\, of\, Specific\, Function}{Mean\, Integration\, of\, all\, School\, Spaces}$$

If the FIR value is greater than one, it points to a relatively centrally located function in the school. If the FIR value is less than one, it means that the function is located at a relatively segregated position in the school. This metric has been calculated for every functional polygon within the school and has been aggregated per unique function (i.e, classrooms, administration, etc.). Nevertheless, this dissertation calculates the FIR metric through axial map analysis, since the convex map has a static approach to space that seems to neglect the movement and paths within it (Behbahani, Gu, and Ostwald, 2014).

4.3.3 Morphological Analysis

Morphological analysis refers to all the methods that are used in this dissertation to grasp some insights regarding the morphological compositions of schools. In particular, this dissertation, so as to capture the building density of the school scheme, uses the spacemate framework proposed by Berghauser Pont and Haupt (2004) investigating the relationship between density and built mass. The framework relates geometrical properties of a building such as the floor space index (FSI), ground coverage index (GSI), the relative number of floors (L) and open space ratio (OSR). In essence, GSI is a metric that captures the density of the scheme on the ground floor. In order words, this metric can identify the compactness of the scheme and whether there are more functions on the ground in respect to the school plot. Thus, the higher the number, the denser the functions and the potential mix between functions on the ground floor. FSI describes the built intensity of the plan area, and thus, the higher the number, the denser the functions in the whole buildings (Berghauser Pont and Haupt, 2007).

The metrics are calculated as follows:

1. Floor Space Index (FSI) is calculated as follows:

$$\mathbf{FSI} = \frac{F}{A}$$

Where F is the gross floor area in m^2 and A is the area of the plot in m^2

2. Ground Space Index (GSI) is calculated as follows:

$$\mathbf{GSI} = \frac{B}{A}$$

Where B is the building footprint in m^2 and A is the area of the plot in m^2

3. The average number of floors (L) is calculated as follows:

$$\mathbf{L} = \frac{FSI}{GSI}$$

This dissertation uses only the morphological variables suggested by the spacemate framework and not the framework itself, since morphological variables are considered among other variables comparatively in a unified framework. Moreover, OSR metric is not considered since it is perceived by scholars as another way of expressing the same data (Steadman, 2013).

Along with the metrics above, other metrics, the importance of which have been derived from informal discussions with school users, have also been used. The metrics used are: *Plot Perimeter*, *Plot Size*, *Adjacent street Length*, *School Porosity* which stands for the percentage of school perimeter attached to street network and *height difference of sports area* with the rest of the school. Lastly, *floor separation index* which is calculated by dividing the relative number of floors and the relative centrality of staircases. The lower the floor separation index, the lower the separation between floors.

4.3.4 Standardised Online Questionnaires

Two different types of standardised online questionnaires have been conducted. Firstly, a questionnaire for the teachers of all ten(10) schools under investigation (S1-S10) on the relationship between school building and school practices and secondly, a questionnaire for the students of the two(2) selected schools selected for the in-depth study.

The teachers' questionnaires are proposed in the context of the top-down methodological approach so as to capture teachers' conceptions, perceptions, experiences, and concerns about their school. The questionnaires have been distributed to all staff members of all 10 institutions (approximately 500 individual people) and 103 fully completed questionnaires have been obtained (20.6% response rate). The response rate for each particular school is also summarised in table 4.3.

Four different sets of questions have been asked. The first section contains general information about the participants (i.e, their gender, school role). The second and third sections explore the school building's relationship with school life and school safety, respectively. This last section is concerned with the new socio-educational dynamics that are generated due to Covid-19 regulations in schools. In this context, this section approaches Covid-19 regulations as additional rules and transpatial conditions imposed in the school unit. A sample of both questionnaires' types can be found in the appendix C of this dissertation.

Students' questionnaires have been conducted in the context of the bottom-up approach so as to capture students' conceptions, perceptions, experiences, and concerns about their schools. The questionnaires have been distributed to all students of the two selected schools under in-depth study (approximately 650 individual students) and 207 fully completed

SchoolID	Teachers (No.)	Students (No.)	Teachers Responses (No.)	Teachers ResposeRate (%)	Student Responses (No.)	Students ResposeRate (%)
S1	57	347	13	23%	NA	NA
S2	47	265	20	43%	121	46%
S3	48	292	4	8%	NA	NA
S4	48	286	5	10%	NA	NA
S5	51	368	4	8%	NA	NA
S6	32	210	5	15%	NA	NA
S7	55	430	10	18%	NA	NA
S8	68	498	10	15%	NA	NA
S9	60	386	16	27%	83	22%
S10	63	414	11	17%	NA	NA

TABLE 4.3: Questionnaires Response Rate

questionnaires have been obtained (31% response rates). Five different sets of questions have been asked. As it is happened to the teachers' questionnaire, the first section contains general information about the participants (i.e, gender, level of education, specific classrooms, perception of school performance etc). The second section explores the frequency of particular activities in the school and the third section is concerned with the school community, students sense of belonging, and connection with the school. The fifth section is concerned with the new socio-educational dynamics that are generated due to Covid-19 regulations in schools. Lastly, a more explanatory section, which contains open-ended questions, aims at grasping students' opinions on their favourite places at school, the worst part of the school, and the best things about their school.

Statistical models have been used to assess the extent to which school layouts play a role in school practices and school reality. To proceed with the statistical analysis, explanatory factor analysis has been implemented with varimax rotation to achieve multivariate data reduction. Factor analysis is a variable reduction procedure in which a series of variables are replaced by a few factors that summarise the relationships between the variables. This has been considered necessary since the relationship of school building to school practices is a relatively complex phenomenon and thus cannot be measured via single questions.

Factor analysis has suggested the grouping of all statements from teachers' questionnaires into 3 factors: **Issues with school control, strong school community, easy adaptation to changes**. Additionally, regarding students' questionnaires, factor analysis has suggested the grouping of all students' statements into 4 factors: **Positive Attribute Towards school, Pressure because of Covid-19 measures, Meet friends despite covid-19 measure, Influence on Learning by Sitting Alone due to Covid-19 measures**.

Variables derived from the questionnaires have been analysed using inferential statistical methods like analysis of variance, ANOVA, Pearson correlation, linear regression analysis, and multiple linear regression through RStudio.

4.3.5 Structured Space Observations

Finally, varying patterns of space usage have been observed through a systematic and structured way by following the Space Syntax Observation Manual (Vaughan, 2001). In particular, both moving and stationary activities like sitting, interacting, and standing, as well as the way groups are formed are studied by this method.

As regards the specific methods that have been employed for observations, snapshots capturing stationary activities and movement traces have been used to investigate space usage in the two selected schools (S2 and S9). In total, 90 hours of observations with 33 rounds of observations for stationary activities and 50 rounds of observations for route traces at different points in time were executed.

Snapshots have been recorded of all school outdoor spaces. Snapshots capture where people sit, stand, move, interact, read, or play during breaks. In order to be able to observe the whole school unit during the limited time of a school break, the floor plans have been divided into areas that could be easily observed from a single point. During this method, the observer is placed in all different areas at repeated times throughout the regular school days. The information from all the individual territories is overlaid on all distinct rounds of observations to give an overall image of the behaviours, interactions, density, and dynamic behaviours happening within the school.

Movement traces have been conducted at three different points in time (entrance hour, transition in between courses, and exit hour) and capture the movement path of students, where students come from and move to. Only students' movement traces have been recorded since teachers' movement is primarily programmed and originates or leads to the administration area. At the same time, during the minimal time of transfer between modules, there is no adequate time to trace more than one individual at a time. Thus, to be able to have a sufficient number of traces, only students' trails have been recorded.

Various measurements and aggregated metrics have been produced based on the observational data. The measures include:

- **Co-presence in Space (CIS):** Number of people per functional polygon co-present (i.e, number of people in a single courtyard)
- **Normalised Co-presence in Space (nCIS):** Normalised number of people per functional polygon with school population
- **Student Interactivity Ratio (SIR):** Number of students interacting per functional polygon

$$\textbf{SIR} = \frac{Number\ of\ Students\ Interacting\ in\ Functional\ Polygon}{Number\ of\ People\ in\ Functional\ Polygon}$$

- **Student-Teacher Interactivity Ratio (STIR):** Number of students interacting with teachers per functional polygon

$$\textbf{STIR} = \frac{Number\,of\,Students - Teachers\,Interactions\,in\,Functional\,Polygon}{Number\,of\,People\,in\,Functional\,Polygon}$$

- **Group Formation (GFR):** Mean and max size of the groups that are formed by students in school as well as the frequency of those instances.

The insights that are collected by the structured observations have been used both qualitatively and quantitatively. Firstly, they have offered a qualitative understanding of the complexity of human behaviour in schools and secondly they have informed qualitatively the study in various stages.

Chapter 5

Cross-Case Analysis: Understanding the schools' morphological, spatial and functional composition

The aim of this chapter is to classify the schools based on their spatial, functional, and morphological structure. Specifically, it aims at answering the following questions: To what extent do lower secondary school buildings built in Cyprus after 2000 illustrate spatial, functional, and morphological consistencies? and how do those consistencies can be traced and mapped?

Precisely, the argument moves from morphological to spatial and then from functional composition to emerging interpretations. At first, the morphological composition is decoded. In a second step, the spatial and functional composition is looked at so as to develop an understanding on how different architects assemble the different parts of the school and distribute functions across the school plots. At last, it aims at answering whether there are any consistencies derived from the common programmatic needs and guidelines given by the authorities.

Thus, in the following subchapters, all cases are comparatively introduced and discussed concerning the school's morphological, spatial, and functional configuration and building potential. The building potential is defined by this dissertation as all opportunities offered by means of the spatial configuration to its users. Lastly, similarities and differences between schools are discussed. However, an important distinction should be made here. The potential that is offered by the school layout might be shifted, changed, or adapted by means of agency and social control (i.e, headteachers' decisions etc) and thus, the building potential might not be fully utilised and realised and thus might differ from the actual use of space. For instance, while school space could offer a more open and uncontrolled area, social agency and power decisions could potentially restrict the potential zones of operation and thus alter the actual use of space. Therefore, the building potential should be distinguished from the actual realisation since school users appropriate space and perform power authority in many ways.

Finally, conclusions are drawn on the potentials the different buildings offer by means of their spatial, morphological, and functional composition.

5.1 Morphological Composition

5.1.1 School Plot

The cases under investigation differ in their plot shape and size. The shape of the school plots is significantly different, since only a few similarities can be observed in some cases. For instance, S6 and S9 both have a long and narrow plot. S3, S5, and S7 have the most irregular plots, while S2, S4, S8, and S10 are accommodated in more or less rectangular plots.

The plots' size ranges from approximately 28 000 m^2 to 58 000 m^2. Specifically, S1 has the biggest plot, while S5 the smallest. Almost half of the sample has plots up to 35 000 m^2 (S2, S3, S5, S7) and between 35 000 m^2 and 45 000 m^2 (S4, S6, S9, S8). Only S10 and S1 have plot sizes above 45 000 m^2, 49 516 m^2 and 58 624 m^2 respectively. The difference of almost 30 000 m^2 in the extreme cases can suggest that the school life in those extreme cases might be completely different. In particular, as concluded from the literature review, school size plays a significant role in the formation of a positive school climate and interpersonal relationships between users.

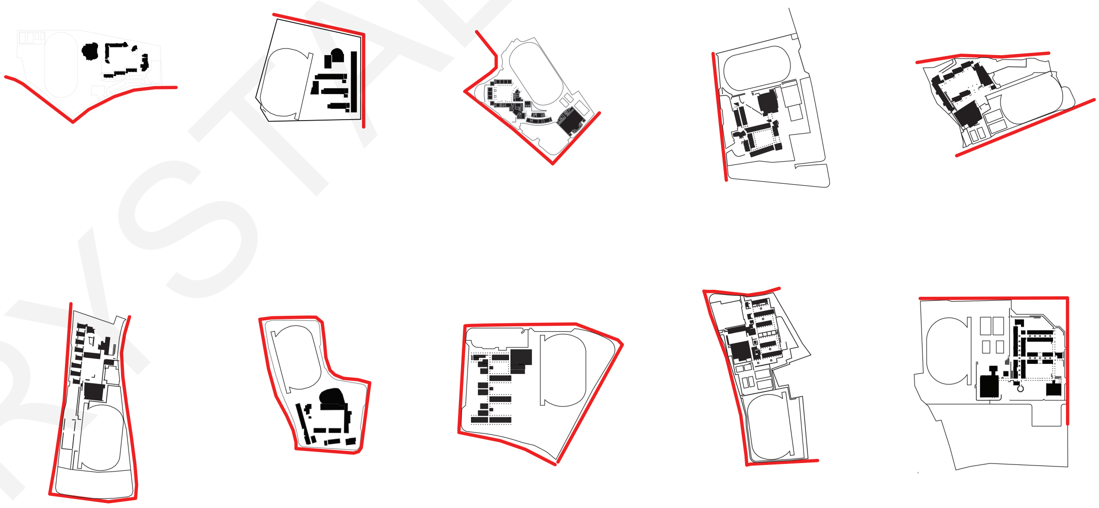


FIGURE 5.1: Built form and school plot. Black: Built Space, White: Open Space, Red: Street Network

Thus, as expected, apparent differences can also be found in the length of the schools' perimeter. As a matter of fact, all schools, due to their size, have a relatively long perimeter. Specifically, in the majority of cases, the school's perimeter ranges from 700 to 950 meters. The school with the smallest perimeter is S2 (677.75 m), while the two schools with the longest perimeter are S10 (1068.57 m) and S1 (1020.94 m). Schools 3,4,5, and 7 have more or less the same perimeter length despite their apparent differences on the overall school plot shape. Schools 6 and 9 have more or less the same plot perimeter and particular similarities in their school plot shape and layout organisation (fig. 5.1). What is also interesting is that in all cases, the sports area, which is used only at particular times of the school day, is responsible for more than half of the school perimeters' length. This, however, also raises questions regarding the exposure of the school to its immediate surroundings and how this perimeter can be controlled or supervised.

School Porosity

Comparative Undestanding

Variables	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Plot Perimeter (m)	1020.94	677.75	736.35	785.99	736.14	935.95	792.41	824.29	996.83	1068.57
Adj. Street Length (m)	409.12	308.59	430.31	221.59	298.27	823.40	792.35	824.27	556.12	489.64
School Porosity (%)	40.07	45.53	58.44	28.19	40.52	87.98	99.99	100.00	55.79	45.82
Plot Size (m2)	58624.94	29911.38	30483.04	36314.39	28849.03	37967.54	31023.86	41418.76	37446.84	49516.77

Red colour highlights the highest value among schools. Blue colour highlights the lowest value among schools

TABLE 5.1: School Plot and School Porosity

The cases also illustrate significant differences regarding the percentage of the school perimeter covered by the adjacent street network (school porosity). Interestingly, the percentage of school perimeter which is covered by the street network ranges from 28% to 100%. The schools with the highest porosity are S7 and S8, both located in the same city. On the other hand, the school with the lowest porosity is school 4 (28.19%) that has only one side of the plot covered by the street network. Schools 1,2,3,5,8, and 10 have more or less medium porosity, namely, interface with the street, since only half of the plot is covered by road.

However, from the informal discussion with schools' teachers and headteachers, it appears that the above condition is particularly challenging during a school's operation. More precisely, users' qualitative feedback highlights that in most of the cases they are facing issues with uncontrolled areas on the boundaries of the schools. Not only, usually several informal exists and entrances are created by students in various parts the schools' perimeter and thus headteachers have an increased concern with students' safety in relation to the immediate school context.

5.1.2 Building Density

Regarding the building density, compactness, and the relative number of floors, case studies illustrate both similarities and differences. As far as the **floor space index (FSI)** [20] is concerned, the intensity of the school schemes varies and is located in the range of FSI=0.08 - 0.21. This highlights that the relation of gross floor area to the plot area, for all schools, is significantly low compared to other building types (Nes, Pont, and Mashhoodi, 2012). As regards **the ground space index (GSI)**, all schools are located in the GSI range 0.06 - 0.12. This highlights the fact that the density or compactness of the scheme on the ground floor is significantly low. Such an understanding shows that the school plots that are provided by the TDMOEC are intensively big and the building structure intensively small.

Morphological Variables

Comparative Undestanding

Variables	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
FSI	0.08	0.17	0.19	0.13	0.17	0.08	0.21	0.11	0.13	0.10
GSI	0.06	0.12	0.15	0.09	0.11	0.07	0.11	0.08	0.09	0.10
L_Number of Floors	1.35	1.49	1.25	1.39	1.54	1.26	1.80	1.43	1.38	1.00
Ground Floor Size (m2)	3320.55	3508.29	4549.40	3293.01	3119.12	2503.58	3561.72	3243.76	3468.83	4910.24
Plot Size (m2)	58624.94	29911.38	30483.04	36314.39	28849.03	37967.54	31023.86	41418.76	37446.84	49516.77

Red colour highlights the highest value among schools. Blue colour highlights the lowest value among schools

TABLE 5.2: Built Form and School Plot

However, regardless of the aforementioned, common base, differences can also be found between schools. For instance, S1 and S6 have the lowest FSI (0.08) and GSI values (0.06 and 0.07). This means that the overall built intensity is at its minimum in those two schools. Interestingly, those two schools are the only ones that are located in suburban areas, as it has been discussed in chapter 3.

On the other hand, S3 and S7 have recorded the highest FSI values, 0.19 and 0.21, respectively. This highlights the fact that those two schools have the highest building intensity across floors. Additionally, school 3 has the highest ground floor density (GSI), something that is also visible on the figure-ground mapping (fig. 5.1) that shows the relative compactness of the school to the one side of the plot.

As regards the **relative number of floors**, the highest value is captured in school 7. School 7 is the only school that is closer to the maximum number of floors set by the guidelines provided by the TDMOEC (section 3.4). In the majority of cases the relative number of floors range from 1.25-1.54 floors, which means that the ground floor accommodates more

[20] FSI refers to the floor space index and the intensity of the scheme across floors (Berghauser Pont and Haupt, 2004)

functions than the 1st floor. Lastly, only one school is deployed on just one floor (S10) and maximises the idea of the horizontal development of schools. This architectural decision can also be seen in the light of the overall area of the plot, which is the among the highest (49 516.77 m^2)of the sample.

5.1.3 Composite assemblies of built forms

The way in which the schools' built form is articulated in relation to the schools' plots is visually examined through the figure-ground maps [21] that have been presented earlier (fig. 5.1) and volumetric 3D visualisations that are illustrated in fig. 5.2. Firstly, a common characteristic among cases is that most of the plot is empty. In essence, a wide open area (sports outdoor area [22]) is articulated parallel or next to the primary school unit. At the same time, it seems that the primary school unit (black volumes) covers only a part of the school plot regardless its plot size or shape. The above spatial strategy is common among all schools, and thus, it can be assumed that it might derive from the standardised size of the sports areas (section 3.4).This becomes particularly important if we consider that, in all cases, half of the school plot perimeter is dedicated to the sports area, an area that is used only at particular times of the school day.

As far as the relationship between those two parts of the school is concerned, in the majority of cases the two parts seem relatively separated. Specifically, in cases such as S1, S3, S5, S6, S7, S10, the main school unit's composition is to a certain extent enclosed and thus does not allow any direct relationship with the wide-open sports area. In cases such as S2, S4, S8, S9, despite the fact that there is an attempt to create, to a certain extent, a dialog with the sports area, the two parts seem rather separated. Thus, based on the above design conditions, it can be assumed that there is a common intention in the designs to keep those two parts of the schools as separate as possible. This design decision might derive from the fact that the sports area should be separately accessible to the wider community in the afternoon as it has been mentioned in section 3.4.

Secondly, common among all cases is that the built space is constantly developed in association with various courtyard spaces. In some cases, **the design is defined by a single courtyard**, while in others is **determined by various smaller courtyards.** More specifically, in schools 1, 3, 4 , 5, and 7, the design seems that is governed by a central courtyard. In these cases, the courtyard acts as the focal point of the design and gives emphasis to the area that the whole school community could be gathered. However, in some cases this design strategy is either extended (S3, S4, S7) with one or two functional stripes that lead to a few functions or it is dismantled to enhance the interaction that this central element has with the rest of the open area of the school (S1). Lastly, school 7 seems that is governed by a unique

[21] A figure-ground diagram is a mapping technique used to illustrate the relationship between built and unbuilt space

[22] see also is section 5.3

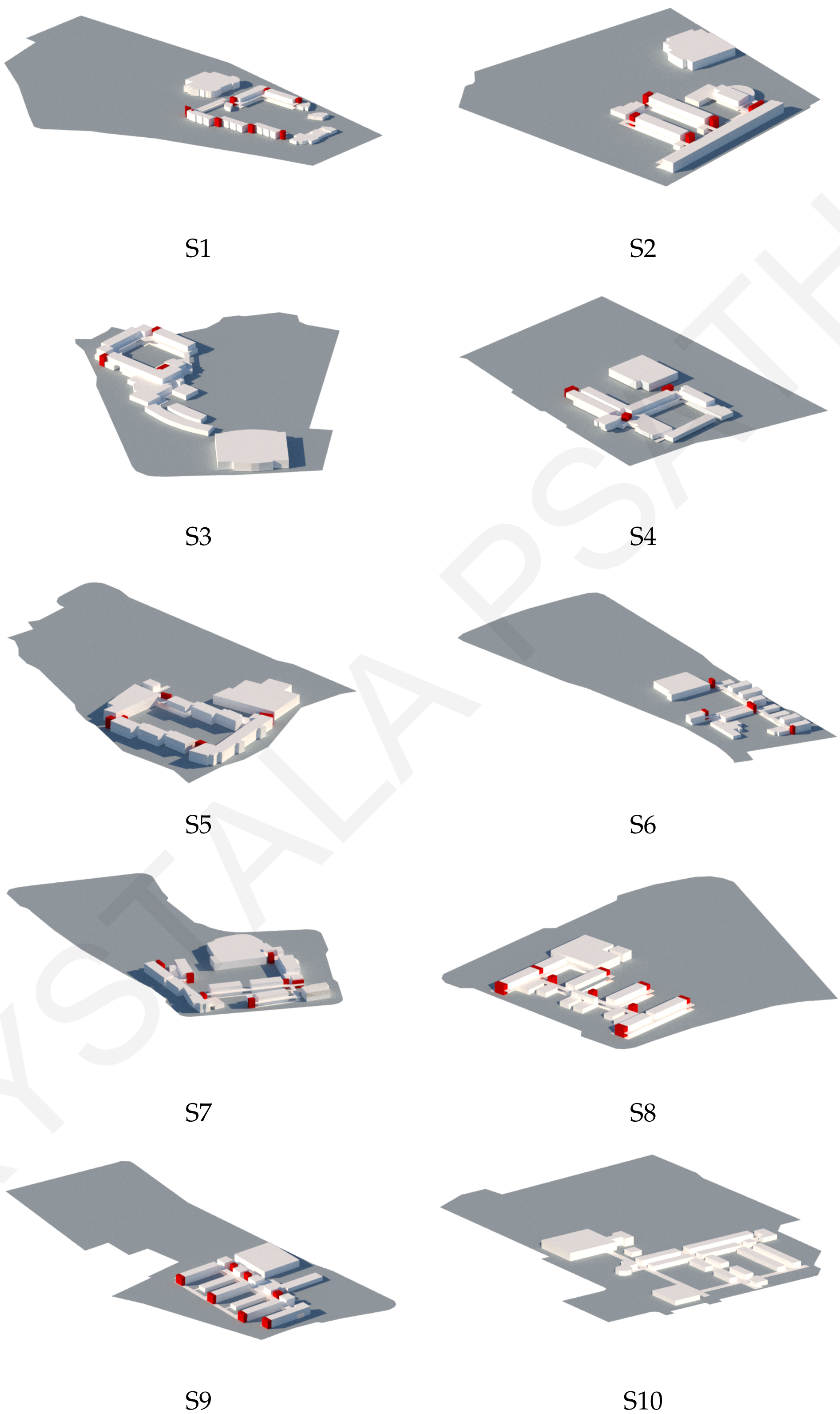


FIGURE 5.2: Volumetric 3D visualisations, White Volumes: Building Mass, Red Volumes: Vertical Connections

condition since it is the only school that has one of its courtyards exposed to the immediate street network.

In other cases, such as in schools 2, 6,8,9, and 10, the school building breaks into smaller parts with various courtyards and is linked by a linear circulation system. In that sense, the school building is composed of a series of 'street-like' strings and parallel functional stripes. Two subtypes of the above strategy can be found. The more street-like schools (i.e, S2, S6, S9) and more grid-like schools (i.e, S8, S10). For instance, in the case of S6 and S9, the building is dismantled into smaller parts that are connected by means of a street-like circulation system. In between the functional stripes, more individualised courtyards are formed. A similar structuring principle is also visible in the case of school 2. However, school 2 applies this synthetic strategy in a much simpler manner by creating bigger and less functional stripes. Schools 8 and 10 are developed based on a more grid-like system. This system offers a peripheral movement, as in the case of courtyard-based organisations, but at the same time is based on a more linear street-like organisation.

Thus, by visually inspecting the schools' formal composition in relation to school plots, two distinct building types are intuitively delineated: courtyard-based (T1) and hierarchical-based schools (T2). Courtyard-based schools can be considered schools that their design is defined by one central courtyard. On the contrary, hierarchical-based schools are defined by smaller courtyards and linear, more grid-like circulation systems.

5.2 Spatial Configuration

This type of analysis focuses on how parts of space are put together to form a whole school unit and thus offer particular behavioural potentials. Specifically, based on space syntax theory which has been explained firstly as theory (section 2.3.1) and secondly as method (section 4.3.1), the spatial configurations of the ten (10) case studies are compared and contrasted.

Case by case, axial and segment maps but also visibility graphs are presented. It firstly discusses where the integration core of each school is located by using axial and segment maps. In particular, the size and shape of the schools' 10% most integrated spaces are examined. Secondly, the depth or shallowness of the schools under investigation is examined by using depth-related measurements. Moreover, it investigates which areas of the schools tend to be relatively segregated or integrated and thus attracts or not more users. Thirdly, the schools' circulation system is approached. Schools' circulation structure is evaluated to see whether it offers a diffused or centralised movement potential. This section also discusses which areas can be considered as easily accessible and which areas appear to be relatively difficult to reach. It also discusses which spaces operate as through movement paths and which spaces operate as attractors of movement. Lastly, visual cohesion and visual dispersion are comparatively discussed to understand whether schools offer high potentiality of copresence between different types of users (i.e, from different gender, classrooms etc). Hence, it shows how each type of analysis highlights different possibilities for the building potential. The final section discusses genotypical patterns between schools and the invisible asset that is given to its users by means of the schools' spatial, morphological, and functional composition.

5.2.1 Integration Core of an Open-Air School

The integration core [23] of all 10 schools is captured by axial and segment analysis. Schools of different sizes and different school plots can be found in the sample. Thus, the integration metric has been used by this investigation since it is already a normalised metric and thus, can provide a comparable image between cases with different sizes (Teklenburg, Timmermans, and Van Wagenberg, 1993).

Both axial and segment analysis (fig. 5.3 and fig. 5.4) have clearly identified that in the majority of cases the most integrated spaces are mainly movement corridors, primarily on the ground floor and on the one side of the plot. Such an understanding shows that in most of cases the shallowest spaces of the system and thus the spaces with the highest potential of usage are the movement corridors. It could also suggest that schools' circulation system has not only a functional-practical role but instead could potentially encourage both stationary and moving activities (Sailer, 2018; Pasalar, 2003; Sailer, 2015). At the same time, this is interesting from an architectural point of view, which is that it reveals the corridors' synthetical role in the school's design.

Secondly, by considering the dispersion of the integration core, it can be seen that in only a few cases it reaches the outdoor sports area. This highlights that school buildings in Cyprus are primarily composed of two parts. It can also be assumed that in the cases where the integration core reaches the sports area, the two parts of the building could be better connected by means of the design and thus can offer higher accessibility potential than in the case where the integration core is bounded to the primary school unit.

By going one step further, a detailed comparison between axial and segment integration cores for each school is achieved. **The integration core of S1**, in both types of analysis, it is concentrated mainly at the centre of the school but is also extended towards the left side of the plot (sports area). This suggests that occupation is mainly generated within the centre of the building. In addition, the fact that the integration core is stretched towards the sports area suggests that the main school is connected with the sports area to a certain degree. What is also particularly interesting in this case is that most of the integration core is concentrated in the central courtyard, and very few spikes of the integration core are attached to the circulation system. This suggests that the different parts of this school are put together via the central courtyard rather than by the circulation system.

[23] Integration core refers to the 10% most integrating spaces, of a given number of spaces (Hillier and Hanson, 1984)

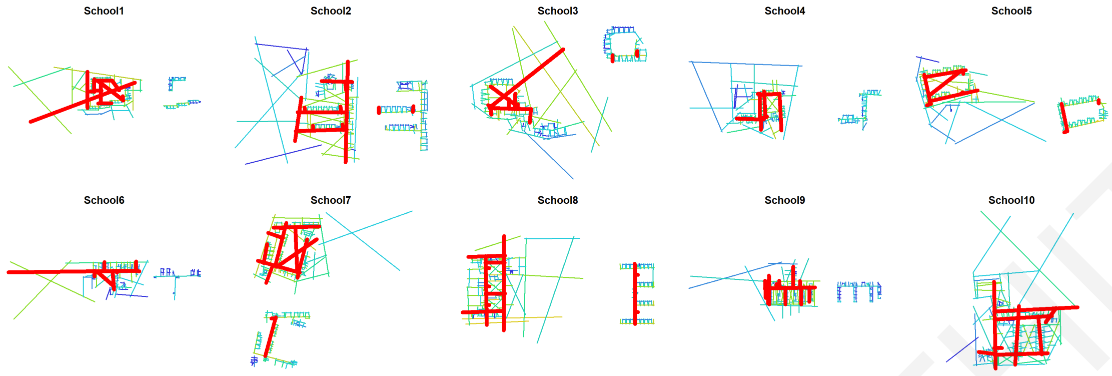


FIGURE 5.3: Axial Integration Core

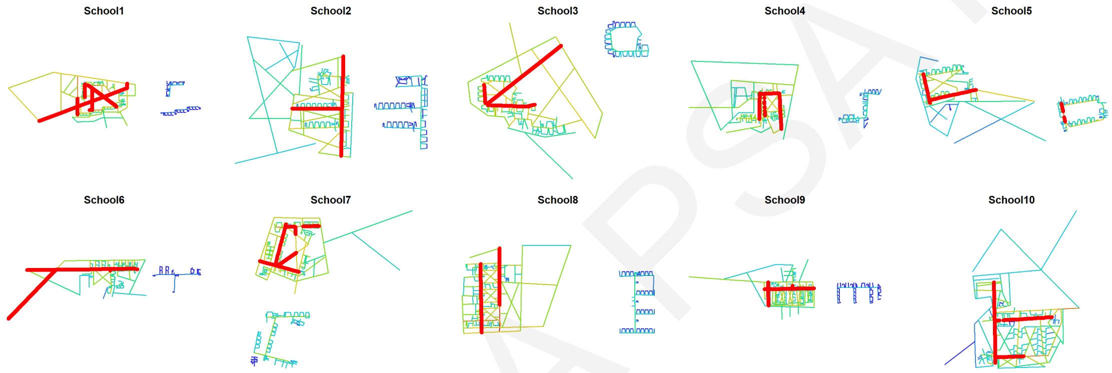


FIGURE 5.4: Segment Integration Core

As opposed to S1, **the integration core of S2** is much more hierarchical and follows purely the structure of the school's circulation system. In both types of analysis, the central corridor that connects the whole school together and the 1st perpendicular corridor fall into the 10% of most integrated spaces. As regards the relationship with the sports area, the integration core reaches the area through which access to the sports area is provided, but it is not extended until the sports area.

The **integration core of S3** shares some characteristics with S1, such as the connection with the sports area and the integration core which penetrates the central courtyard. In both models, the integration core is organised around the main courtyard. At the same time, only in the case of the segment model the integration core is also extended more and forms an L shape on the lower left corner of the courtyard. Thus, it may be argued that the classrooms on the lower right part of the school are more segregated compared to the classrooms that are developed around the central courtyard.

The **integration core of S4** is almost identical in both models (axial and segment). The only difference between the integration cores that are suggested by both models is the deployment of the integration core towards the left part of the building that hosts additional classrooms. Regarding the relationship of the integration core with the sports area, the connection is rather limited, since the overall configuration seems to be deployed in two different directions. The 1st direction embraces the main courtyard and faces towards the entrance, while the other dimension is arranged towards the left side of the school but without forming a particular relationship with the sports area.

The integration core of S5, in both models, it is concentrated around the central courtyard formed in the middle of the building. The axial integration core suggests that the circulation that surrounds the main courtyard belongs to the most integrated space of the system. Instead, the segment integration core depicts the lower left corner of the school as the most integrated area. The sports area is particularly segregated from the rest of the school, since the integration core is inward looking towards the main unit and there is no attempt by design to connect the main school unit with the wider school plot.

The **integration core of S6** can be considered the longest and most linearly stretched core among the sample. The fact that the main circulation structure is extended linearly to the sports area stretches the integration core on both sides of the plot. Apparently, the upper part of the school appears to be particularly well connected by means of the integration core. However, the lower side is rendered as less well connected with the rest of the building.

The **integration core of S7** is somewhat complicated in both models. In both models, the lower corridor that connects the lower part of the school along with its perpendicular corridor extending to the upper part of the building falls into the 10% most integrated spaces. In both models, the sports area and all spaces located between the main courtyard and the sport area are rather segregated. Lastly, despite the fact that it has a central courtyard in the middle of the building, the segment integration core does not highlight much of it in the school's 10% most integrated spaces. Instead, the integration core is rendered as rather outward looking towards the street.

The structure of the **integration core of S8** is highly hierarchical in both models. Both axial and segment analysis depicts two central vertical corridors connecting the school vertically in the school's 10% as most integrated spaces. Additionally, in both models, the sports area is very distant from the integration core. More importantly, the integration core seems that connects the building vertically rather than horizontally where the sports area is located.

Similarly with S8, **the integration core of S9** is hierarchically structured and follows completely the circulation system. In both models, the central corridor in the middle of the building and the perpendicular axis at the end of the building fall into the 10% most integrated spaces. Unlike S6, in this case the main movement corridor does not continue to the sports area due to an additional separating wall, and thus, the sports area is rather segregated from the rest of the building. Furthermore, unlike S8, the direction of the integration core in S9 is facing towards the sports area despite the apparent separation.

Lastly, as regards **the integration core of S10** is also hierarchically formed. Specifically, in both models, the vertical and horizontal circulation lines are depicted as the most integrated spaces of the system. Unlike the axial integration core which points out an integration core that connects the whole building together, the integration core that is suggested by the segment analysis is mainly concentrated on one side of the school. It connects only parts of the school, while it seems that excludes completely the sports area.

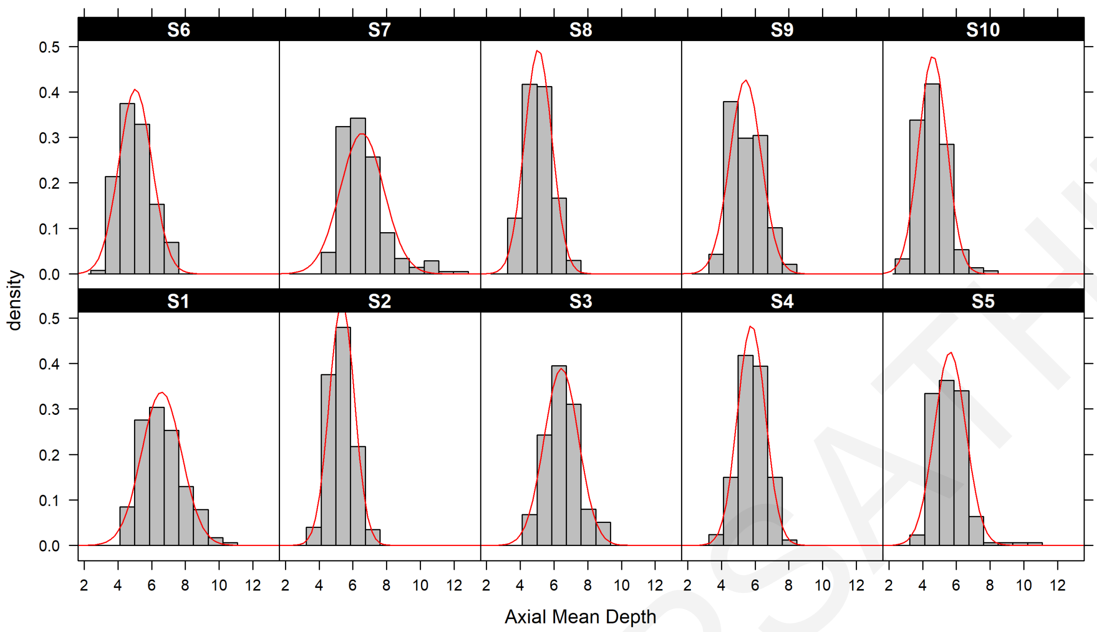
Therefore, bearing in mind the similarities and differences between cases, it can be firstly concluded that in only three cases, the integration core extends towards the sports area (S1, S3, and S6). Secondly, the integration core of S2, S6, S8, S9, and S10 is much more hierarchical and follows mainly the structure of the main movement corridors. Lastly, the integration core of S4 and S5 seems rather inward-looking, and there is no attempt to connect the main school unit with the wider school plot. Lastly, the integration core of S7 could be argued that it is, to a certain extent, outwards looking since it tends towards the exterior of the school rather than the interior.

5.2.2 Deep or Shallow Open-Air School

Axial mean depth, being a global measure, identifies the topological steps required from any space to reach all other spaces of the system. The *axial mean depth* is used here to depict the extent to which schools can be classified as deep, thus requiring more steps to reach the whole system or fewer steps and therefore be shallow. By considering comparatively the distribution of axial mean depth (fig. 5.5), it can be seen that more or less all distributions are symmetrical. This highlights the fact that there are very few spaces in the schools that have significantly low mean depth and very few with extremely high mean depth. Schools 2, 6, 8 and 9 illustrate some consistencies, since their mean depth is approximately 5 and max mean depth 7 topological steps. On the other hand, the highest mean and max depth has been recorded in S7 and S1. More precisely, S7 has the highest topological depth among the sample (12), a fact that reveals the school's design complexity. It is thus the most deep school of the sample and it can be assumed that particular spaces would be very difficult to be reached from any given location in this school.

Since all schools of the sample do differ as regards the size of the plot as well as the number of floors, a normalised depth has been generated by dividing the mean depth of each school with a standard mean deapth value [24] which is generated by considering the mean depth of all schools of the sample. From the normalised mean depth it can be seen that among the shallowest schools are S2, S6, S8, S9 and S10 (all school belong to the hierarchical type). Among the highest normalised mean values have been recorded in schools 1,3, 4 and 7 which belong to the courtyard based schools (Type1 from chapter 4). Seemingly, hierarchical-based schools tend to be shallower and courtyard-based deeper since the depth is more centralised. On the other hand, in the case of hierarchical schools, the depth is more equally distributed by means of the circulation system.

[24] MDstandard = Mean Values of All schools / 10



Axial Mean Depth (Mean & Max)

Comparative Undestanding

Metrics	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Mean_MD	6.58	5.35	6.43	5.78	5.63	5.03	6.54	5.06	5.42	4.60
Norm_Mean_MD	1.14	0.93	1.12	1.00	0.98	0.87	1.14	0.88	0.94	0.80
Max_MD	10.22	7.12	9.10	8.21	10.38	7.21	12.45	7.37	7.68	8.22
Norm_Max_MD	1.16	0.81	1.03	0.93	1.18	0.82	1.41	0.84	0.87	0.93

FIGURE 5.5: Distribution of Axial Mean Depth

From the normalised max mean depth, it can be seen that S7 has the highest value with significant difference with the other schools. This suggests that S7 is the deepest school of the sample and thus the most maze-like school. S1, S3, and S5 have among the highest values but significantly lower than S7. S2 has the lowest max values, which reveals that S2 is the shallowest school of the sample S4, S6, S8, S9, and S10 also recorded among the lowest values.

In an attempt to investigate the effect of the depth on the 'readability' of schools and ease of navigation, the intelligibility metric is considered in this context. Even though both the school size and the number of floors might affect the intelligibility metric, it is considered

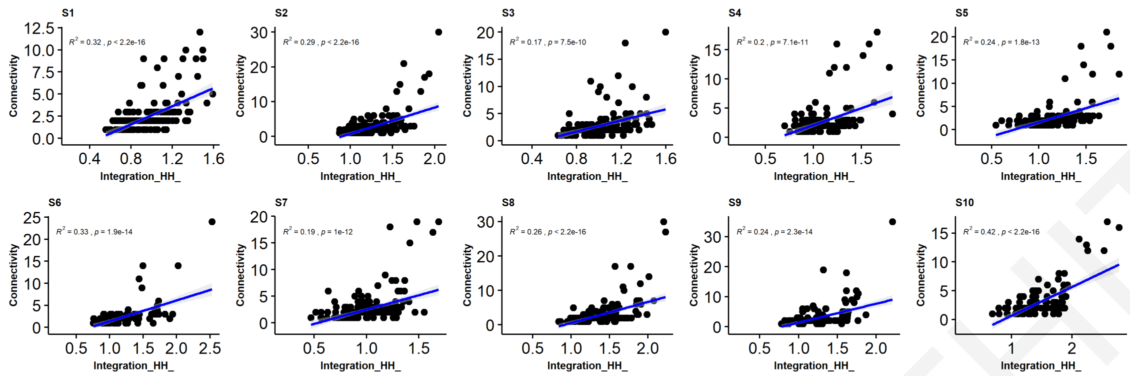


FIGURE 5.6: Axial Intelligibility

so as to explore whether some of the conclusions that are derived by the previous analysis might be also reflected on the intelligibility metric.

As expected, S10, due to the fact that it is deployed on only one floor, has relatively moderate intelligibility ($R^2 = 0.42$). However, apart from S10, it can be argued that the size of the school plot is not determinant for the intelligibility metric. In particular, S1, which has the biggest school plot, recorded one of the highest intelligibility value. It might be the case that the school buildings in Cyprus are mainly deployed on one side of the plot and thus have more or less similar size across the sample as regards their main school unit. This, therefore, suggests that intelligibility can also be considered in this context to compare schools with the same number of floors. Hence, all schools apart from S10.

The least intelligible schools are S3 and S7 ($R^2 = 0.17, R^2 = 0.19$). This reveals that both schools are characterised by an increased complexity that might create difficulties in users' understanding of the whole structure from its parts. This is also reflected in the analysis of normalised depth (fig. 5.5) since both schools (S3,S7) have recorded among the highest, mean, and max normalised depths. On the other hand, S1, S2, and S6 have among the highest intelligibility values ($R^2 = 0.32, R^2 = 0.29, R^2 = 0.33$). Thus, a better understanding of the whole structure of the school is expected in these schools. Another particularly interesting point is that S1 has recorded among the highest mean and max normalised depths despite being intelligible. However, by considering these results in the light of the analysis of the integration core in section 5.2.1 it may be argued that S1 is a relatively deep school, but due to the fact that its integration core seems that connects all parts of the school together, it is easily understandable at once from its parts.

5.2.3 Diffused or Centralised Circulation System in an Open-Air School

What is the degree of movement in open-air schools? Are there any commonalities and differences in the way schools articulate movement? Is there any predominant corridor that attracts more movement or the movement is more equally distributed?

With the purpose to address the above questions, the choice metric has been considered. The measure of choice identifies the parts of the school that illustrate the highest potential for being chosen as movement paths due to their strategic positioning in the system. In particular, it highlights the routes with less change as less costly and thus more likely to be followed by users. Thus, it is used in this context to reveal the schools' movement structure based on the school's configurational properties. This analysis views choice as a global property of space and considers the location and connectedness of a space in the wider system by considering both axial and segment choice.

In the case of axial choice, the shortest path refers to the shortest topological path (turning) between any pair of axial lines, while in the case of segment analysis, the 'shortest path' refers to the path of least angular deviation in the system (Space Syntax, 2021).

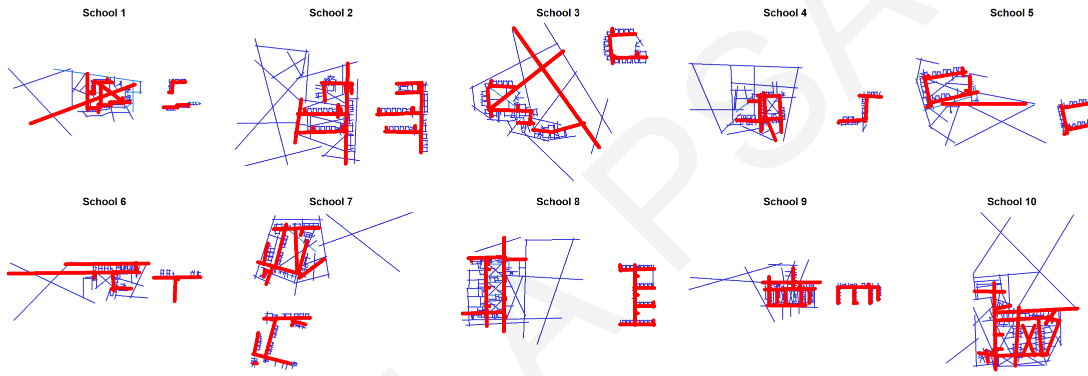


FIGURE 5.7: Axial Choice Core

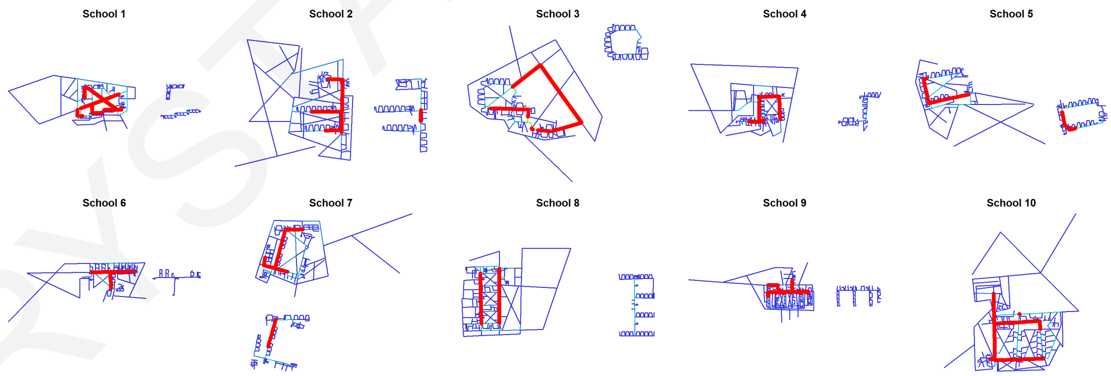


FIGURE 5.8: Segment Choice Core

By considering comparatively the choice core that is highlighted from a topological (axial analysis) and angular (segment analysis) point of view, diverse patterns can be observed. In some cases, the 10% of the lines with the highest choice value are the same between the different types of analysis, while in others differ significantly.

Specifically, the **choice core in S1**, both from a topological and angular depth, is concentrated in the school's central courtyard and thus highlights that the central courtyard of the school offers the highest through movement potential and thus it connects the different parts of the building together by means of movement.

The **highest movement potential in S2** almost coincides with the integration core of the school, as it is illustrated in section 5.2.1. This suggests that to a certain extent in this school, it is expected the occupation to coincide with movement. In addition, in both models (axial and segment), a part of the 1st floor is also depicted with an increased movement potential and thus, it reveals that this specific junction could be of higher use.

The **choice core of S3** differs significantly in the two models. By considering the topological depth, almost all the circulation system is depicted, forming a complete circular movement that passes through the sports area. From an angular point of view, the highest movement potential is concentrated only in some parts of the circulation and the sports area, suggesting a much more fragmented movement structure in the school than the axial analysis.

In school 4, the circulation system falls into the 10% of spaces with the highest choice both as regards topological and angular depth. Thus, this suggests that the highest movement potential is concentrated in the circulation system of the school that surrounds the main courtyard and is also extended to the left side of the school unit.

A similar but more concentrated image is illustrated **in S5**. In both models, the highest choice value on both floors is depicted on the lower left corner of the courtyard. This illustrates that the highest choice values are concentrated on one side of the periphery of the main courtyard. Thus, it is expected this specific junction to have the highest through movement potential and more users to use the staircases that are close to this junction for their everyday movements between floors.

The choice core in S6 is characterised by a hierarchical distribution of choice with a clear T-shape structure. The horizontal corridor that connects most of the school functions and leads to the sports area is the circulation chunk with the highest movement potential. By considering the 1st floor, it can be seen that the junction formed by the horizontal and perpendicular circulation system attracts the highest choice values. Thus, it is expected the vertical connection which is adjacent to this junction to attract the majority of movement that happens between floors. Such an understanding is particularly important especially in the schools' rush hour (i.e, during transfers).

As regards the**school7** it can be seen that the cores that are proposed by axial analysis and segment analysis are significantly different. Unlike axial choice core, segment choice is deployed outside of the school's main courtyard towards the second smaller courtyard and facing the street. Interestingly the corridor with the highest segment angular choice is directly connected to the adjacent street network and is far away from the rest of the school and especially the sports area. This conclusion supports more the argument of an outward-looking school unit which has been argued in section 5.2.1.

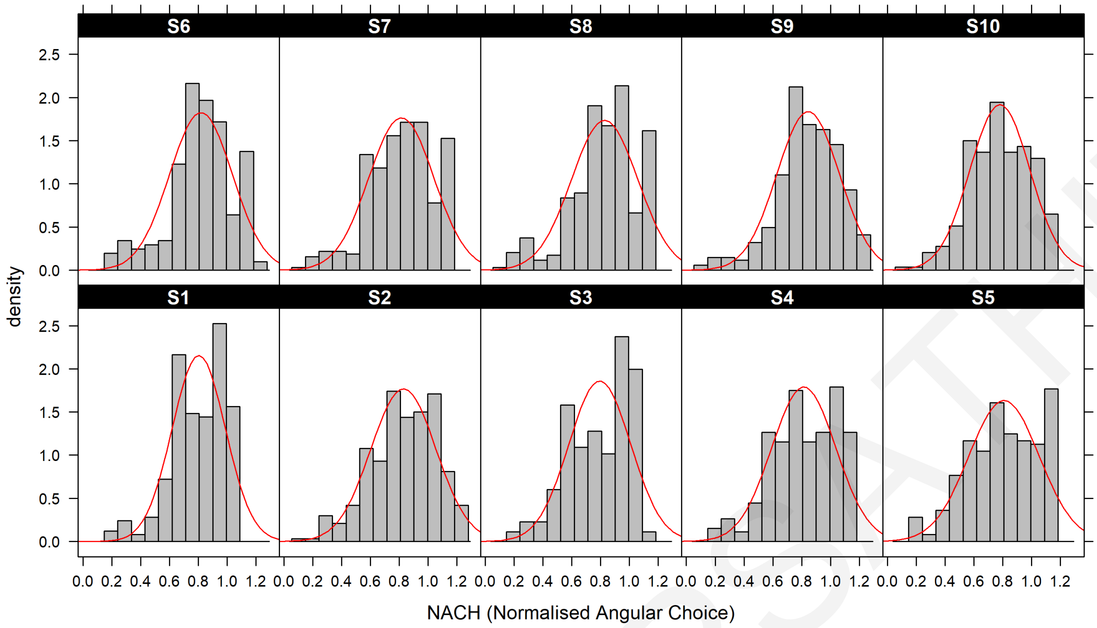
The **choice core of S8** appears to be quite similar to its integration core (section 5.2.1). The two parallel circulation corridors that connect the building vertically are highlighted in both types of analysis. In essence, the analysis highlights the existence of a double circulation system that attracts the highest choice and thus an overall hierarchical distribution of movements that is initiated from the centre of the building and goes towards the edges of the main school building. Lastly, there is also limited connection by means of through movement to the sports outdoor area.

Similarly with S8, S9 illustrate a more concentrated choice in the middle of the building. This suggests that the movement flows are concentrated at the centre of the building. This centralised corridor then distributes the movement hierarchically to the rest of the building. It thus may be assumed that this particular area is characterised by significant congestion and significant density of movement during the whole school day.

The choice core of S10 from an angular point of view creates a reversed F-shape. This shape of choice core suggests that there is sufficient movement flow both vertically and horizontally. Specifically, the shape and location of the choice core suggests that there is a hierarchical distribution of choice from the left side of the school to the right and from the lower part to the upper part. However, and in this case, the sports area is rather segregated from the main movement structure.

In order to shed additional light on the differences and similarities between schools as well as to reveal the extent to which each school offers more or less movement potential compared to the other schools of the sample the metric of normalised angular choice is considered. Normalised Angular Choice (NACH) highlights the routes with less angle change as less costly and thus as more likely to be followed by users. Since this metric is a normalised metric could allow comparison between cases, and thus, it could reveal the schools with the highest movement potential among the sample.

Mean and max NACH values for all schools are presented comparative in fig. 5.9. The mean normalised angular choice in all schools ranges from 0.78 to 0.84. Thus, it could be argued that there are no particular differences between most of the schools. However, between the two extremes significant differences can be found. Among the highest max values have been recorded in S2 and S6, all of them hierarchical-based schools (T2). The lowest mean NACH values have been recorded in schools 1, 3, and 10 while the highest in S9. Results also suggest that schools' designs that offer more informal crossings (i.e, what happens in the main courtyard of S1) record a lower NACH value compared to schools in which the design concentrates most of the movement in one or two main circulation 'streets' (i.e in S9). Therefore, such an understanding suggests that school 9 is the school with the most concentrated movement potential of the sample.



Normalised Angular Choice (Mean & Max)

Comparative Undestanding

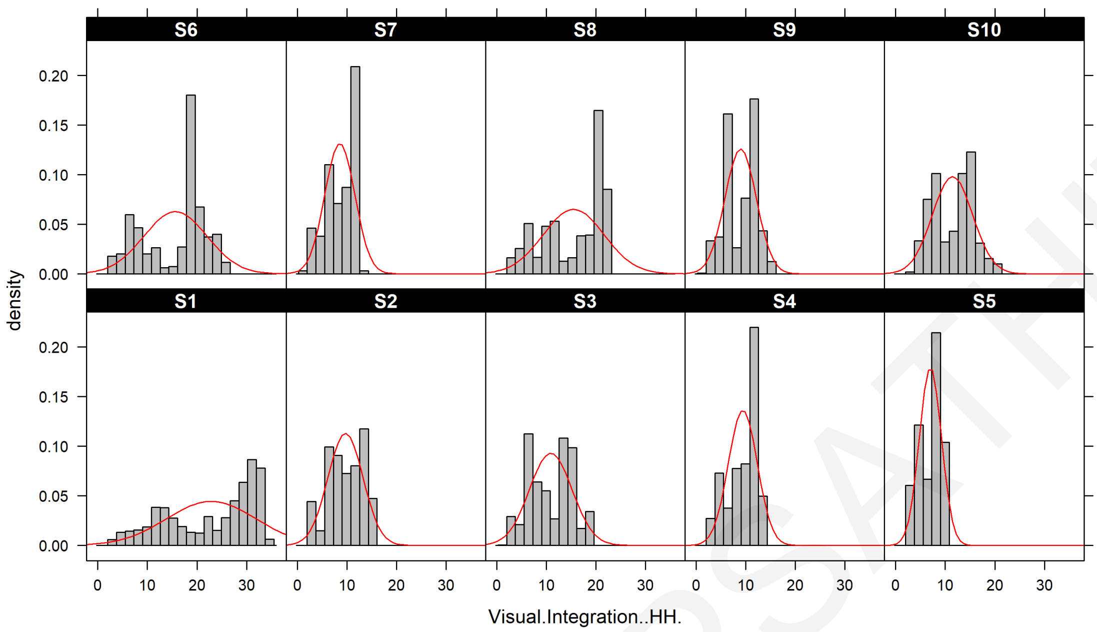
Metrics	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Mean_NACH	0.80	0.83	0.80	0.81	0.81	0.82	0.81	0.83	0.84	0.78
Max_NACH	1.07	1.21	1.10	1.13	1.16	1.19	1.17	1.17	1.23	1.16

FIGURE 5.9: Distribution of Normalised Angular Choice

5.2.4 Visual Cohesion or Visual Dispersion in an Open-Air School

This section discusses visibility relationships in open-air schools. The integration measure is used here only comparatively, to understand the distribution, mean, and max value of visual integration in all schools. Integration is a normalised measure and thus can be considered here to examine the schools' visibility properties.

The highest mean visual integration value has been recorded in S1 (22.87). The mean visual integration of S1 is significantly different from all other mean values of the sample. It might be the case that S1 has one of the biggest school plots (section 5.1.1) and thus, a vast amount of its school plot is devoted to open spaces and it has one of the biggest central courtyards.



Visual Integration(Mean & Max)

Comparative Undestanding

Metrics	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Mean_VGAIntegration	22.87	9.72	10.89	9.40	7.00	15.66	8.58	15.51	8.95	11.46
Max_VGAIntegration	34.19	15.90	19.02	14.97	10.82	25.72	13.78	22.99	15.53	21.08

FIGURE 5.10: Distribution of Visual Integration

This suggests that the visually integrated areas are instantly perceived (i.e quasi-synchronic) and do not predefine specific routes within the school. S6 and S8 have recorded the following highest values among the sample, 15.66 and 15.51, respectively. The lowest mean integration value is recorded in S5 and S7, 7.00 and 8.58, respectively, that reveals the schools' visual dispersion and fragmentation.

As regards the max values, the highest visual integration is recorded in S1 (34.19). The second highest max values have been recorded in S6 and S8 and the lowest in S5 (10.82). Thus, it could be argued that S5 is the least visually integrated school of the sample and it is followed by S7. Schools 2, 3, 4, 9, and 10 have recorded rather moderate visual integration in comparison with the whole sample. These conclusions suggest a visual fragmentation in S5 and S7 and a more equal distribution of visual depth in schools 2,3,4,9, and 10.

5.3 Functional Configuration

Having understood the spatial and morphological composition of schools, the investigation of the school programme and functional composition follows. The first type of analysis focuses on understanding how each school's functional programme is distributed in the school plots. The functional composition is analysed through a functional mapping which considers the percentage of each function in relation to the total school and it is presented both as a table as well as through a Treemap visualisation [25]. Secondly, the topological distribution of the programme is explored through coulour-coded justified graphs [26]. The different colours correspond to different functions, while the connections between them reveal their topological relationships. Lastly, a joint analysis that explores the centrality of the various functions is presented. Specifically, the question to be investigated is whether commonalities and differences can be identified by the distribution of functions.

5.3.1 Functional Distribution

By looking into the functional mapping of all 10 schools (fig. 5.11), it can be seen that there are diverse ways in which the various functions are distributed within the plots. At a glance, it can be seen that **all schools apart from S10, distribute the functional programme in two floors.** In all cases, the second floor accommodates classrooms and supportive uses(i.e, toilets, storages) as well as some remote administrative functions or library functions (if there is a library in the school). The case studies, however, can be distinguished based on the way they articulate functions as well as the percentage that each function covers in relation to the entire building.

In all cases, the **administration area** acquire more or less 1 to 2% of the total school programme. S2 has recorded the highest percentage within the sample due to the fact that the administrative areas accommodate the offices of the school board committee (this is not mandatory in the design guidelines provided by TDMOEC). Suburban schools (S1 and S6) have the lowest percentage of administrative function among the sample.

Cantine area is one of the smallest areas in the school programme (0.10% - 0.36%). The differences between the size of this area among schools are due to the fact that sometimes it is associated with a closed entertainment area. Regardless of its size, in all cases it is located in the junction between sports area and the main school unit (fig. 5.11). However, although the cantine is one of the smallest areas of the school is also one of the most important ones. As a matter fact, the cantine area operates as a significant attractor in the school where all

[25] Theemaps constitute a space-filling visualisation method which is able to represent large and hierarchical collections of data. The way a treemap works is by dividing the display area into various nested rectangles whose area corresponds to the data set (Johnson and Shneidernman, 1993)

[26] A justified graph constitutes a graph that is deployed based on a base note - a starting point. All points of depth 1 from the point of origin are aligned horizontally immediately above it. All points at depth 2 are placed horizontally above those at depth 1 and so on until all levels of depth from the starting point are accounted for. (Space Syntax, 2021)

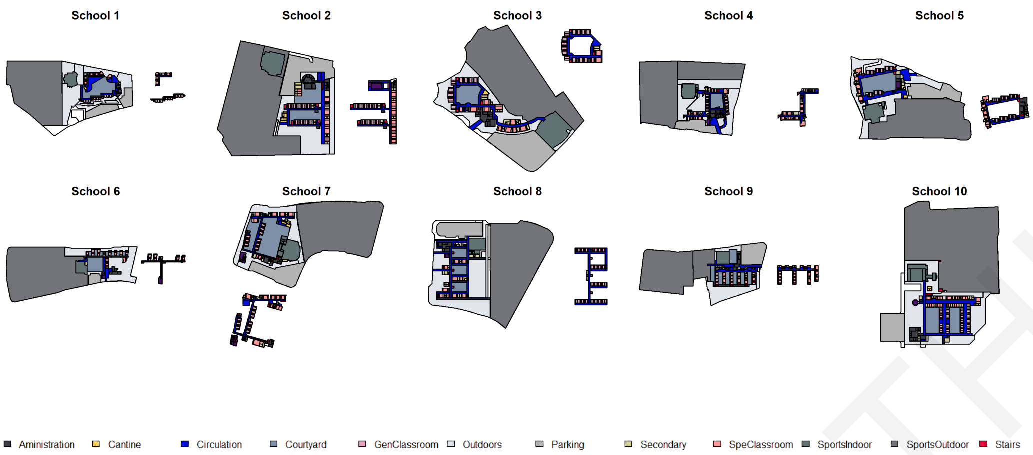


FIGURE 5.11: Functional composition of schools

categories of users (i.e, teachers, students, cleaning staff, and special staff) have food and drink supplies during a minimal period (break). Thus, it may be understood that its impact on the school's life is inversely proportional to its size.

Functional Composition(%)

Comparative Undestanding

Ftype	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Aministration	0.84	2.12	1.98	1.78	1.58	0.94	1.43	1.10	1.38	1.28
Cantine	0.10	0.34	0.16	0.09	0.16	0.13	0.36	0.14	0.14	0.14
Circulation	5.74	5.89	6.40	6.45	7.59	3.93	5.14	9.84	7.97	5.40
Courtyard	6.39	6.02	3.54	5.74	7.42	6.02	11.89	4.28	8.02	5.24
GenClassroom	1.72	3.35	4.56	2.36	3.81	1.31	3.00	2.87	2.35	2.09
Outdoors	24.70	15.11	12.72	18.59	18.07	17.48	12.80	22.36	14.43	18.76
Parking	7.41	9.10	13.42	5.46	8.53	2.18	8.40	6.68	9.16	5.43
Secondary	0.74	1.87	1.35	1.52	2.54	0.82	1.69	1.67	1.46	1.20
SpeClassroom	1.58	3.53	3.00	2.98	2.64	1.76	3.80	1.95	2.95	1.72
SportsIndoor	2.52	3.78	6.47	3.12	4.21	2.29	4.45	2.53	2.99	3.01
SportsOutdoor	47.76	47.53	46.04	51.21	42.38	62.23	45.43	45.81	48.25	55.36
Stairs	0.51	0.70	0.38	0.47	0.74	0.30	0.62	0.58	0.90	0.20
StudyArea	0.00	0.64	0.00	0.24	0.32	0.62	1.00	0.21	0.00	0.17

Red colour highlights the highest value among schools. Blue colour highlights the lowest value among schools

TABLE 5.3: Percentages of Functional composition in Schools

FIGURE 5.12: Treemaps of the functional composition of schools

Circulation areas refer to the covered open-air corridors that provide access to the different parts of the building. Concerning the percentage of circulation areas, S8 is the school with the most square meters that are dedicated to corridors (9.84%). What is particularly interesting is that S8 can be characterised as a hierarchical school with grid-like organisation, grid-like circulation system, parallel courtyards, and functional stripes around them. Similar organisation is also apparent in the case of S9, which has also recorded the second highest percentage of circulation system (7.97%) among the sample. On the other hand, the school with the lowest value is S6. S6 might be the smallest school of the sample regarding the number of students attending it, but it may be assumed that this is not the only reason it has such a small percentage of the overall area that is devoted to circulation. In fact, the circulation structure in S6 has a 'T' organisation by means of which it provides access to all distinct functions. Subsequently, it could be argued that it is characterised by an 'economy' in the way circulation areas are utilised by the design. In particular, the synthetic approach minimises the circulation areas needed as opposed to other schools such as S8. This synthetic organisation is also supported by the strategic placement of vertical connections. Lastly, what is also particularly interesting is that completely different spatial organisations (i.e, S5 compared to S9) have approximately the same amount of space dedicated to circulation. Thus, it could be assumed that regardless of the type of the school, the strategic design of the circulation system in relation to the overall compositional strategy can reduce significantly the amount of space dedicated to circulation.

As regards **courtyard areas**, there are significant differences between schools. Schools that have recorded the largest courtyard areas in total are S7 (11.89%) and S9 (8.02%) , while the lowest area is recorded in S3(3.54%). In school 7, despite the small size of the plot, seems that the design maximises the idea of courtyards within the plot, since the design has created two parallel courtyards, one particularly big and one small. However, the courtyards seem rather forced by the site limitations instead by a particular design intention. S9, on the other hand, articulates multiple smaller courtyards throughout the school plot. It seems that the conceptual approach for S9 has been aimed to create separate courtyards for the different types of classrooms or smaller niches for the different levels of education that are somehow separated from the main movement structure. S3 has recorded the lowest percentage of courtyard areas in the school. This is also apparent when looking at the functional mapping of the school (fig. 5.11). The proportions of the central courtyard are notably smaller than other schools in the sample, while the overall design concept seems forced by the sports area and parking area.

As regards the **distribution of special and general classrooms** within the schools' premises, there are different strategies both as regards the placement of different types of classrooms along the floors as well as along functional stripes. More specifically, in all cases, apart from S8, both types of classrooms are accommodated on both floors. S8 is the only school with different floors for general classrooms (1st floor) and for special classrooms(2nd floor), suggesting that special education should be separated from general education. All other schools propose a certain degree of blending between types of classrooms across floors. In most of the cases, a building stripe accommodates a certain type of classroom (i.e, S1, S2, S5, S6, S7, S9,S10) that is then articulated in the whole school structure. In that sense, there are entirely mono-functional stripes, as regards the type of classrooms, that either are separated visually and topologically (S2, S6,S7,S9,S10) or they may allow a type of interrelation by means of common circulation stripes and/or common courtyards (S1, S3, S4, S5). S1 and S5 more clearly assign different types of classrooms to different building stripes, while S3 and S4 have a more random way of articulating the different types of classroom that might be related to space availability rather than to any particular synthetic or educational intention.

Concerning the area that is devoted to **general classrooms**, 4 groups of schools can be identified. S1 and S6, the two suburban schools, have recorded a percentage lower than 2% of the general classrooms in reference to the overall building programme. Four schools (S4, S8, S9 and S10) devote from 2 to 2.80% of the building composition to general classrooms, while 3 school has recorded values between 3 and 4 (S2, S5 and S7). The highest percentage is recorded in S3 (4.56%), a school which has been characterised in section 5.1.2 as one of the denser schools of the sample. As regards **special classrooms**, a similar pattern can be identified. S1, S6, and S10 have the lowest percentage as regards special classrooms, 1.58%, 1.76%, 1.72%, while S2, S3, and S6 the highest percentage (3.53%, 3.00%, 3.80% respectively).

By looking at the **sports outdoor area** it can be seen that acquires for more or less half of the school composition (45% - 62% of the programme), while the actual buildable areas acquire for the 1/3 of it (fig. 5.12). This common characteristic among all schools could suggest that it derives by the overall square meters required for the sports outdoor area in relation to the school plot as well as by the demand that is stated by TDMOEC (chapter 3) for the necessity of an adjacent access road.

Lastly, as regards the **outdoor areas**, S1 and S8 have recorded among the highest percentage of space dedicated to general outdoors or leftover areas (areas that surround the building and are loosely defined by greenery or ground) around the school. The lowest percentage of outdoor area is recorded in S3 and S7. Apart from the percentage the way spaces are articulated in relation to the main school unit is of interest here (fig. 5.1). For example, in the case of S2, the outdoor areas seem very well structured and are articulated in accordance with the main school unit. On the other hand, in schools such as S1, S3, S5, and S7, general outdoor areas seem leftovers rather than purposely designed areas.

Apart from that, by looking the functional adjacency in (fig. 5.11) it could be seen that in all cases **the parking area is associated with the entrance, administration, sports indoor, sports outdoor and an access road** (external in the majority of cases or internal in the case of S10).The above functional condition has also been underlined by the TDMOEC so as to facilitate the school's operation during afternoon hours for the local community.

Lastly, if the percentage of **sports outdoor area** is considered additionally to the leftover **outdoor areas** and courtyards it would appear that a vast amount of school plots (ranging from 63% to 86%) remains open. Hence, bearing in mind that this programmatic requirement refers to more or less 60% of the overall programme, thus it can be assumed that it can drive the whole school design.

5.3.2 Topological Relationships

All things considered, the relationships between the various functions can be further understood by looking at the connections between functions. To be specific, a more in-depth reading of the relationships between functions is achieved by examining the topological relationships between functional polygons through a justified graph [27]. Specifically, the justified graphs that have been produced consider both the relationships between elements as well as their programmatic labelling. The justified graphs have been firstly considered visually, and the topological relationships between functions are explained. On top of this, the properties of the graph have been considered by looking at the network characteristics such as *network density* along with network analytics such as *centralisation*.

5.3.2.1 Graph Shape, Clustering and Depth of Functions

Firstly, the graph's shape, clustering, and depth are considered here to understand the structuring relationships between functions within the schools. The discussion explains important structuring principles in each school and refers to the courtyards, articulation, circulation structure, location of the administration in the system, classroom's clustering, and sports location in the system. Thus, the structural relationships between the various nodes of the whole school unit are revealed by having as a starting node the administration area. The selection of this particular origin point has been made based on the following criteria:

- It can provide insights regarding the depth of the whole school unit from the location where the teachers are located and thus can offer insights that might be useful when considering issues with school control (chapter 7);
- The administration area is always associated with the entrance area thus can offer a more holistic understanding of the way a school is deployed from the entrance as well as from the particular location where the headteacher and teachers are located;

[27]'A justified graph is one in which a node is drawn at the base, and the all points of depth 1 from that point are aligned horizontally immediately above it, all points at depth 2 from that point above those at depth 1, and so on until all levels of depth from that point are accounted for' (Space Syntax, 2021)

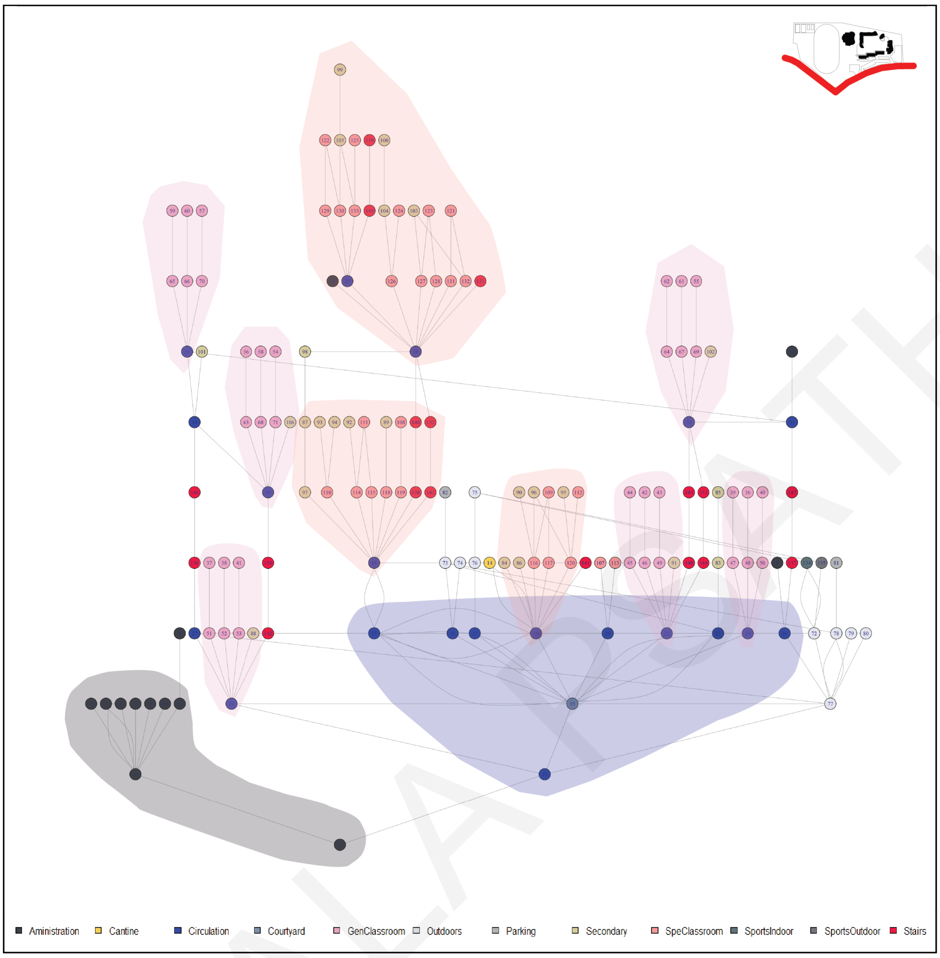


FIGURE 5.13: Topological Relationships Between Functions in School1

S1 graph is deployed in 11 steps and thus can be considered as topologically deep school. It has an irregular shape that is composed of a triangle at its base, a rectangular, and a polygonal with two peaks on the top. The form of the graph is skewed towards the left side and is irregularly developed across depths. In respect to the topological relationships of administration, it seems that the central courtyard operates as a hub space that provides access to all other functions. Five distinctive mono-functional classroom units can be identified on the ground floor and five on the first floor. In essence, the topological break-ups follow the morphological break-ups, while the central courtyard provides access to all the individual spaces. The sports outdoor area is located 4 steps away from the administration and thus almost halfway the total depth.

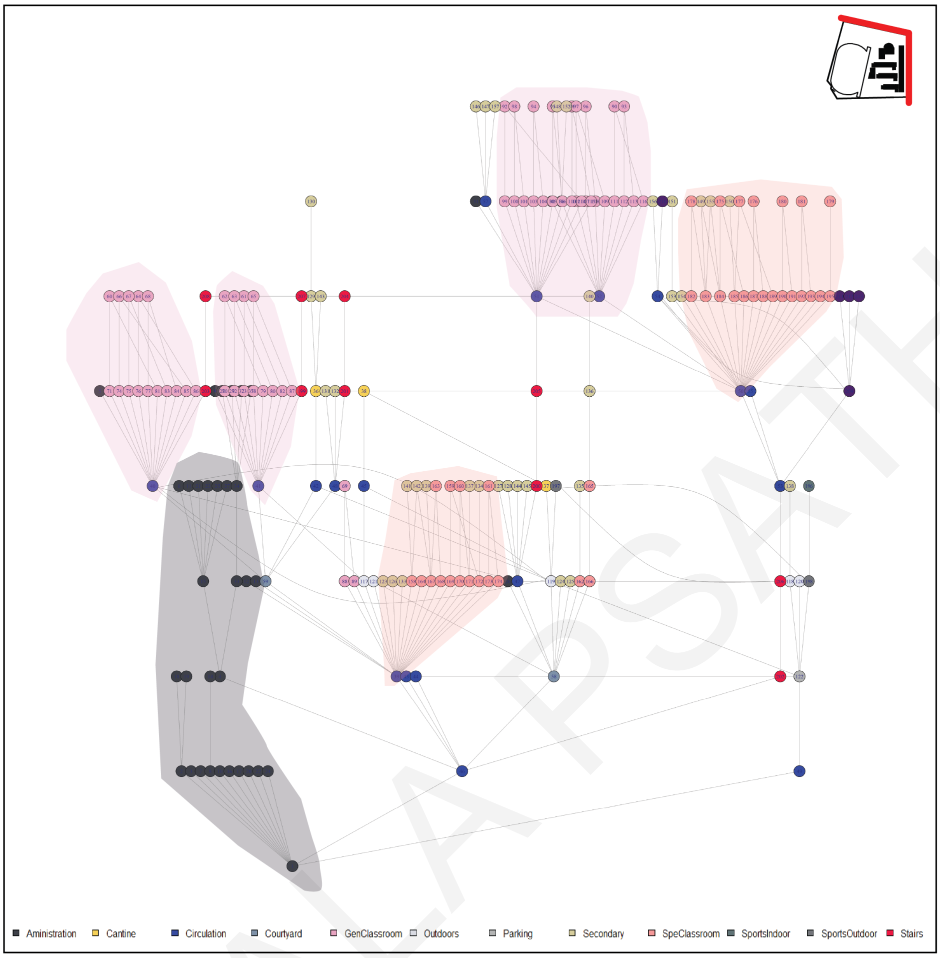


FIGURE 5.14: Topological Relationships Between Functions in School2

S2 network is deployed in 8 steps from the administration area and is considered among the shallowest schools of the sample. It has a more or less square-shape graph, and the topological relationships are more or less equally developed across the depths of the graph. Regarding the functional clustering, three distinctive mono-functional units can be identified on the ground floor and 3 on the first floor. In this case, the distinctive classroom clusters are connected by means of a structured corridor system. On both floors, the central corridor provides the connections hierarchically to the other two chunks. As regards the administration area, it is relatively deep, since it is deployed in 5 steps. It might be the case that S2 also accommodates additional administrative functions (section 5.3.1). Lastly, the sports area is 5 steps away from the administration area and thus relatively deep in the system compared to the overall depth of the school.

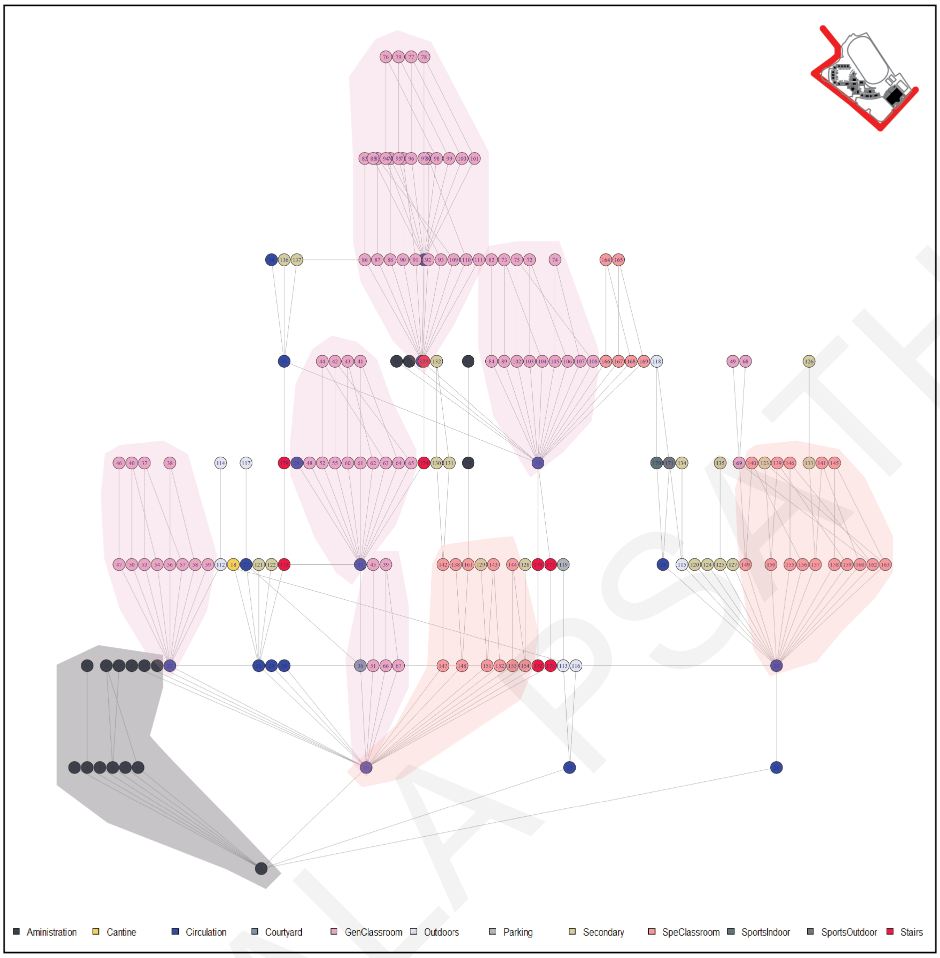


FIGURE 5.15: Topological Relationships Between Functions in School3

S3 is deployed in 10 steps and has an almost triangular-shaped graph which leads hierarchically to the functions that are located on the 1st floor of the school. From the administration 5 classrooms clusters can be identified on the ground floor. On the 1st floor, there is only one unit that accommodates both special and general classrooms. However, no relationships are formed apart from the common access corridor. Additionally, despite the fact that this school is formed based on a courtyard, the role of the courtyard from a topological point of view is not that central as in S1. Instead, the different clusters are connected via a shared circulation loop on both floors. The sports outdoor area is 4 steps away from the administration and thus relatively few steps away compared to other schools.

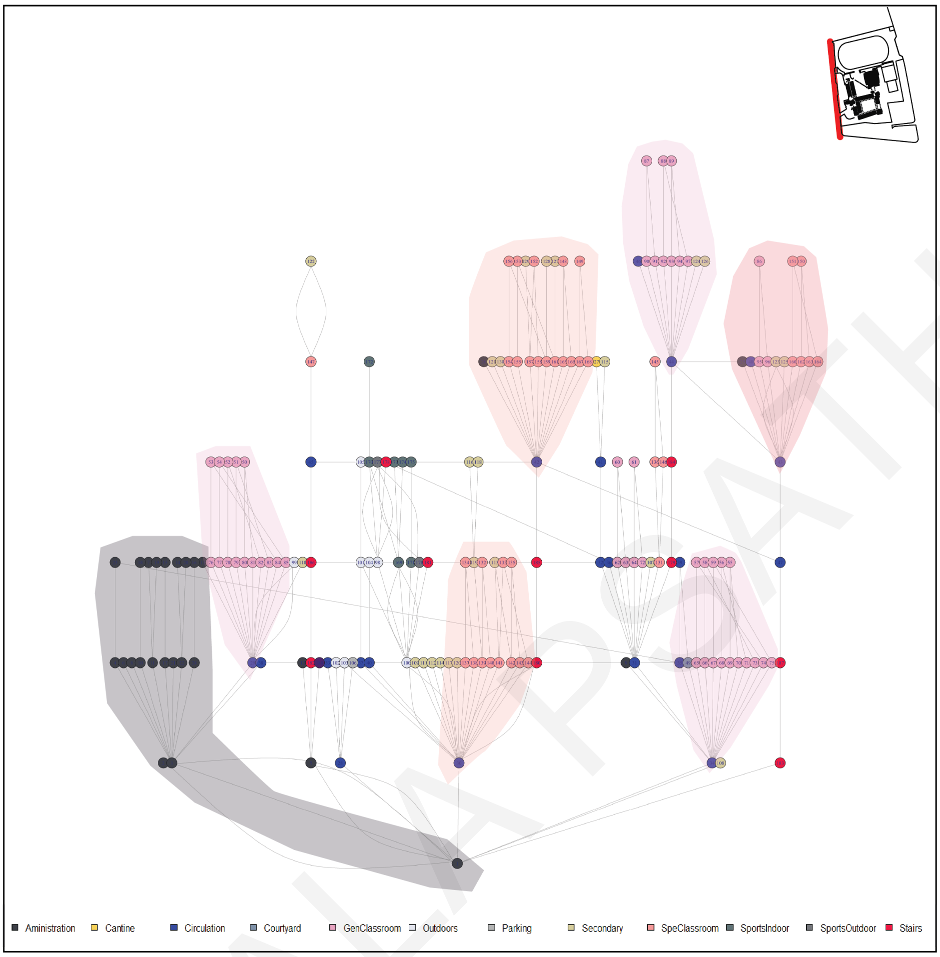


FIGURE 5.16: Topological Relationships Between Functions in School4

S4 is deployed in 7 steps from the administration and is among the shallowest schools of the sample. It has an irregular shape graph that is developed towards the right side. Four distinctive classrooms' clusters can be identified on the ground floor and 3 on the 1st floor. S4 is also one of the few schools which has 2 classroom clusters, one on the ground and one on the 1st floor that accommodate both types of classrooms. The sports area is 4 steps away from the administration, which in relation to the overall depth of the network is relatively high.

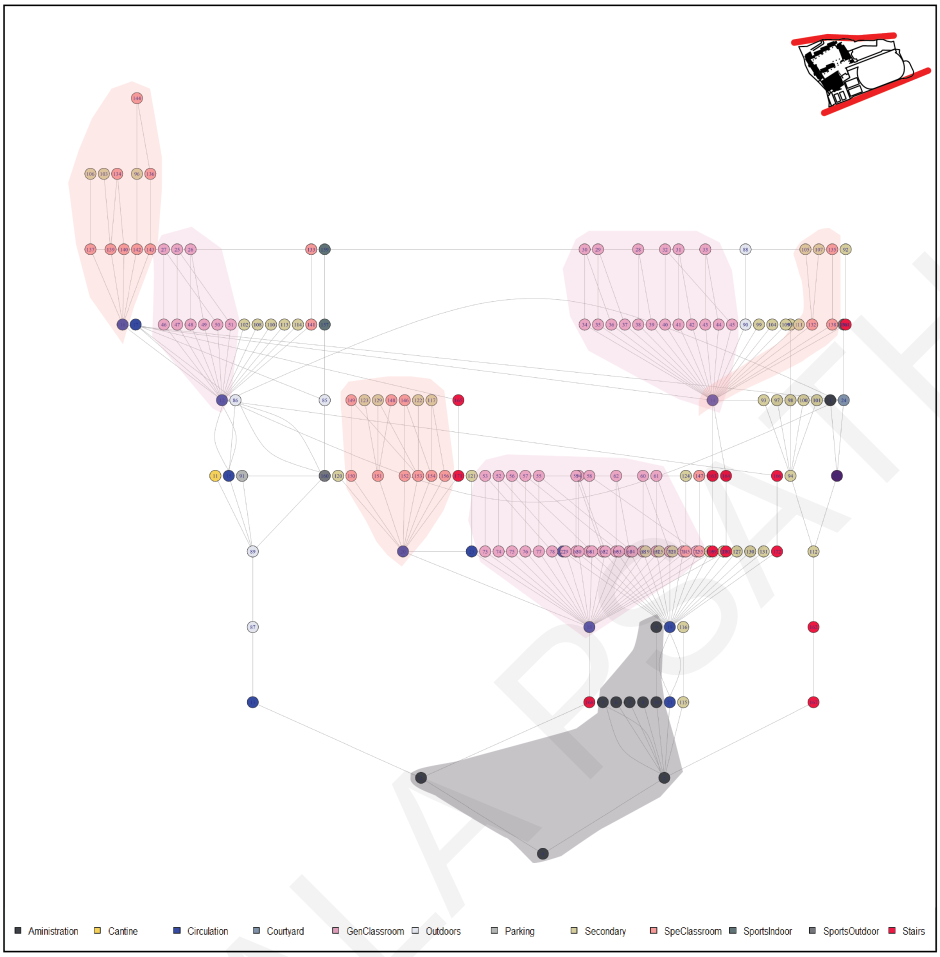


FIGURE 5.17: Topological Relationships Between Functions in School5

S5 is deployed in 8 steps from the administration and has a reversed triangular shape graph that starts from a small base and opens up throughout the depth of the graph. It has 6 distinctive mono-functional classrooms' clusters on both floors. In essence, the distribution of classroom types follows exactly the morphological logic and the various clusters are linked through the circulation system. The administration area is deployed in 5 steps, while the sports outdoor is 5 steps away from the administration. Thus, it may be assumed that the sports area is relatively segregated from the administration area.

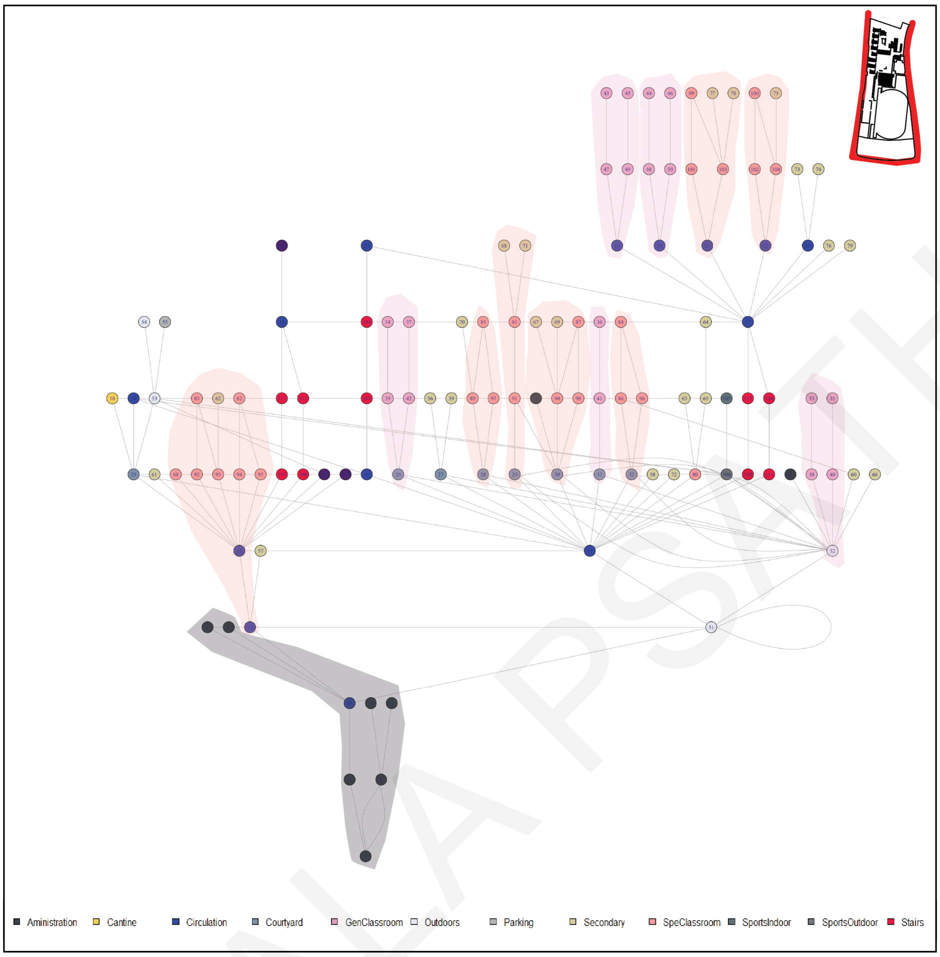


FIGURE 5.18: Topological Relationships Between Functions in School6

The justified graph of S6 is deployed in 10 steps from the administration and has a complicated graph's shape that combines a triangle at the base, a rectangular in the middle, and a triangle on the top. Compared to all other schools, it is characterised by small mono-functional classroom units. Those small mono-functional units are associated with immediate courtyard areas, and thus the access provided to the classrooms is through the courtyards and not through the circulation system as happens to all schools of the sample. Lastly, the sports outdoor is located 5 steps away from the administration, thus almost halfway the depth of the overall system.

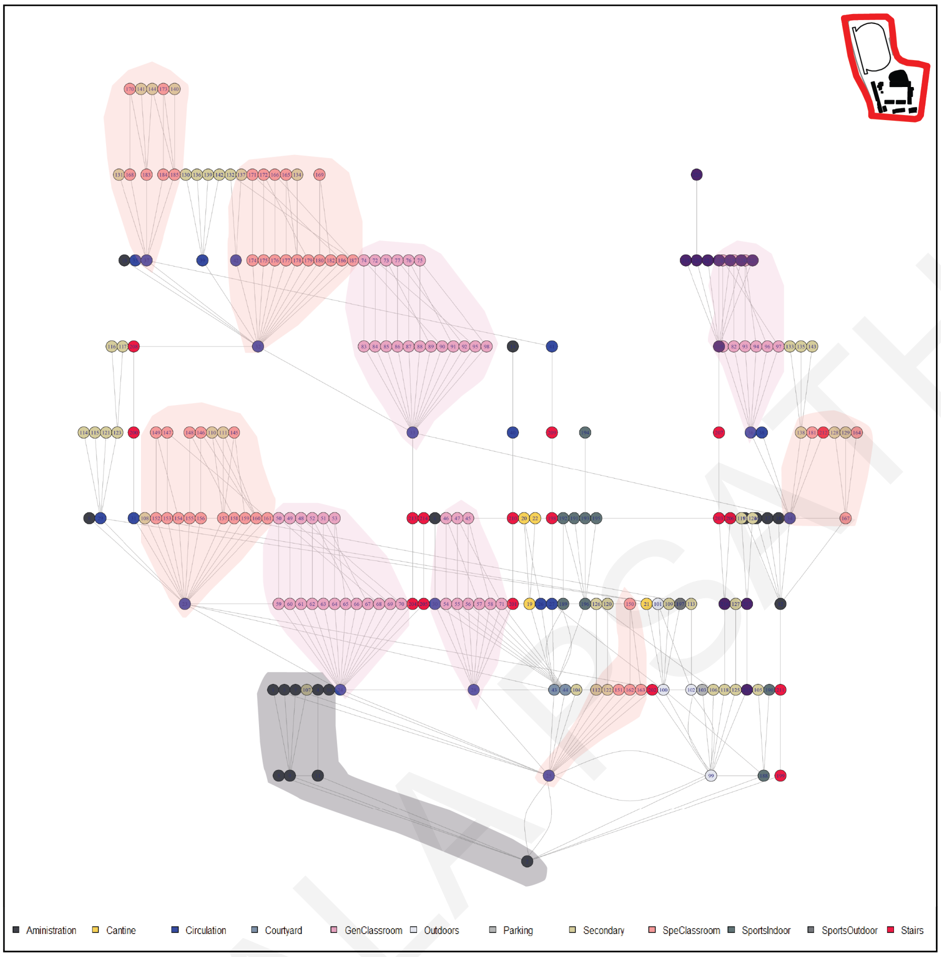


FIGURE 5.19: Topological Relationships Between Functions in School7

S7 is deployed in 9 steps from the administration.The form of the graph is more or less rectangular on the basis and has two peaks on further steps. The school is also characterised by 8 mono-functional classroom clusters. The sports area is 3 steps away from the administration and it suggests that it might be relatively well connected to the administration area compared to other schools of the sample.

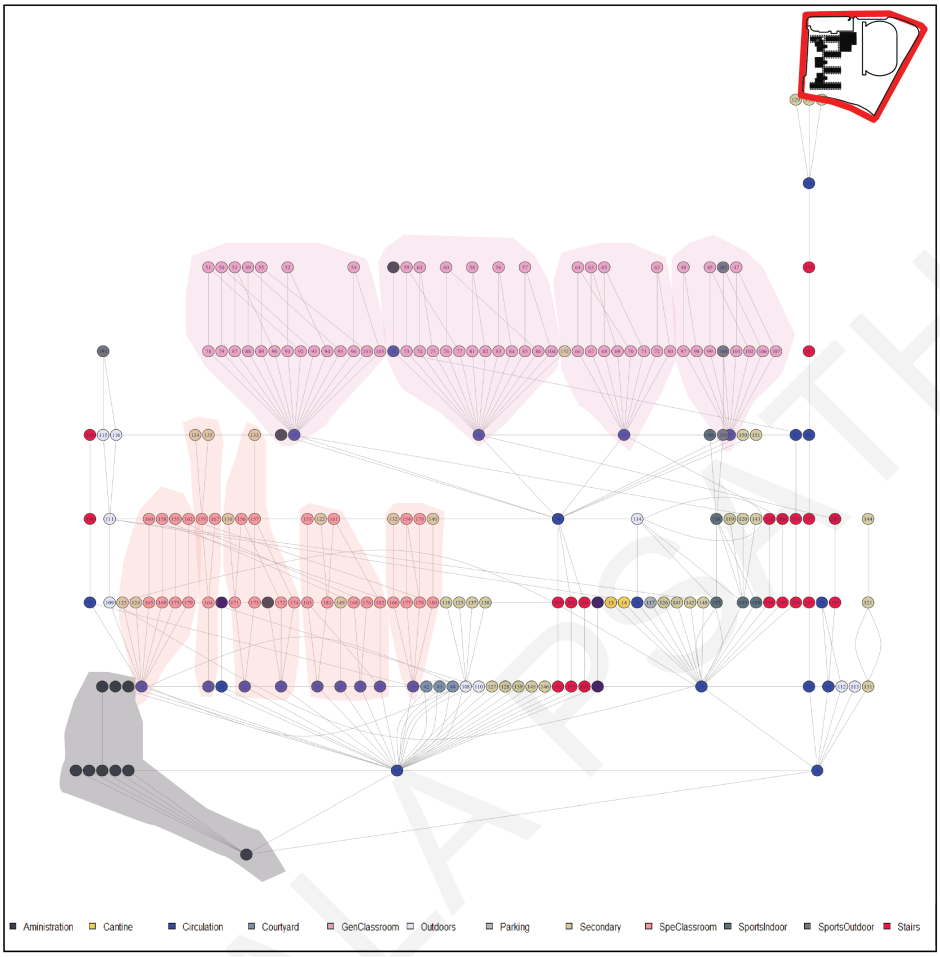


FIGURE 5.20: Topological Relationships Between Functions in School8

S8 graph is deployed in 9 steps from the administration area and has a more or less rectangular shape and thus it distributes the functions equally across depths. As concluded from section 5.3.1, S8 is the only school that arranges mono-functional classroom's clusters and completely mono-functional floors as regarding the type of classroom. The sports outdoor area is located 6 steps from the administration area and thus relatively segregated from this area.

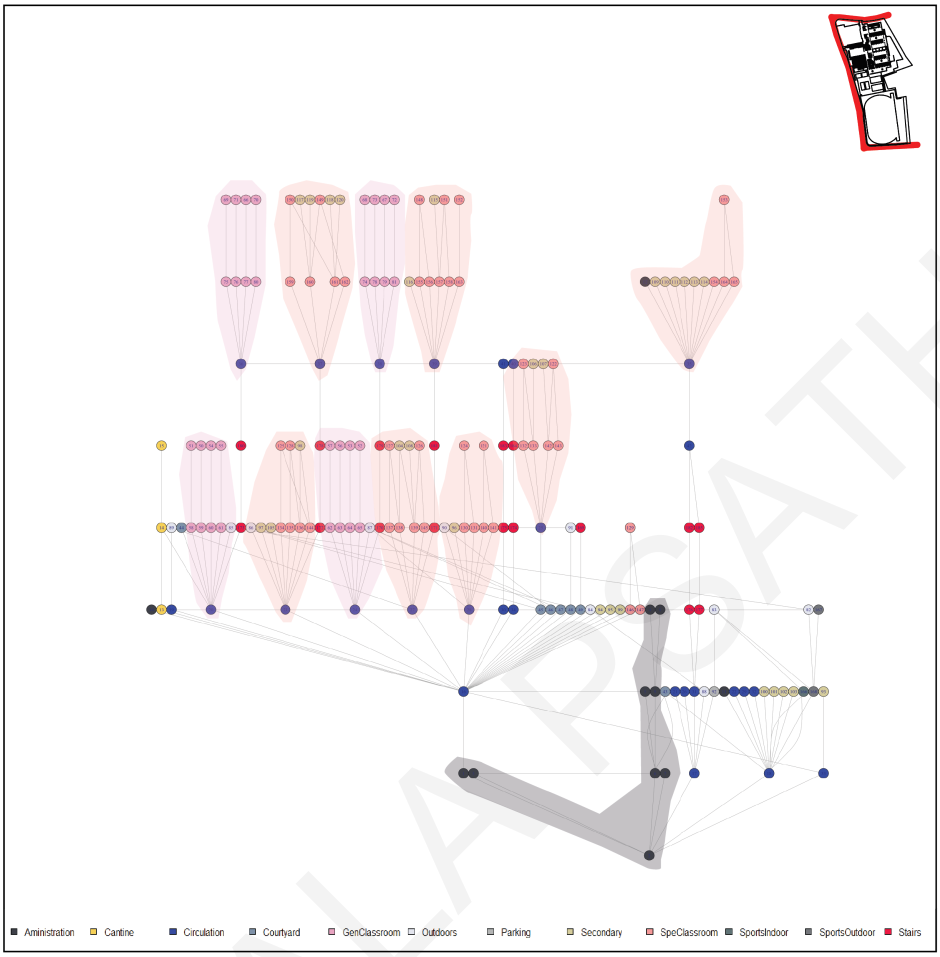


FIGURE 5.21: Topological Relationships Between Functions in School9

S9 is deployed in 8 steps and is considered among the shallowest schools of the sample. The graph's shape is formed by a triangle on the base, a rectangular in the middle, and two different geometrical peaks at the end of the graph (a more rectangular and a more triangular). It has 11 mono-functional classroom's clusters across the school. Thus, it could be argued that it has a similar graph structure as S6. The sports outdoor appears to be 2 steps away from the administration area.

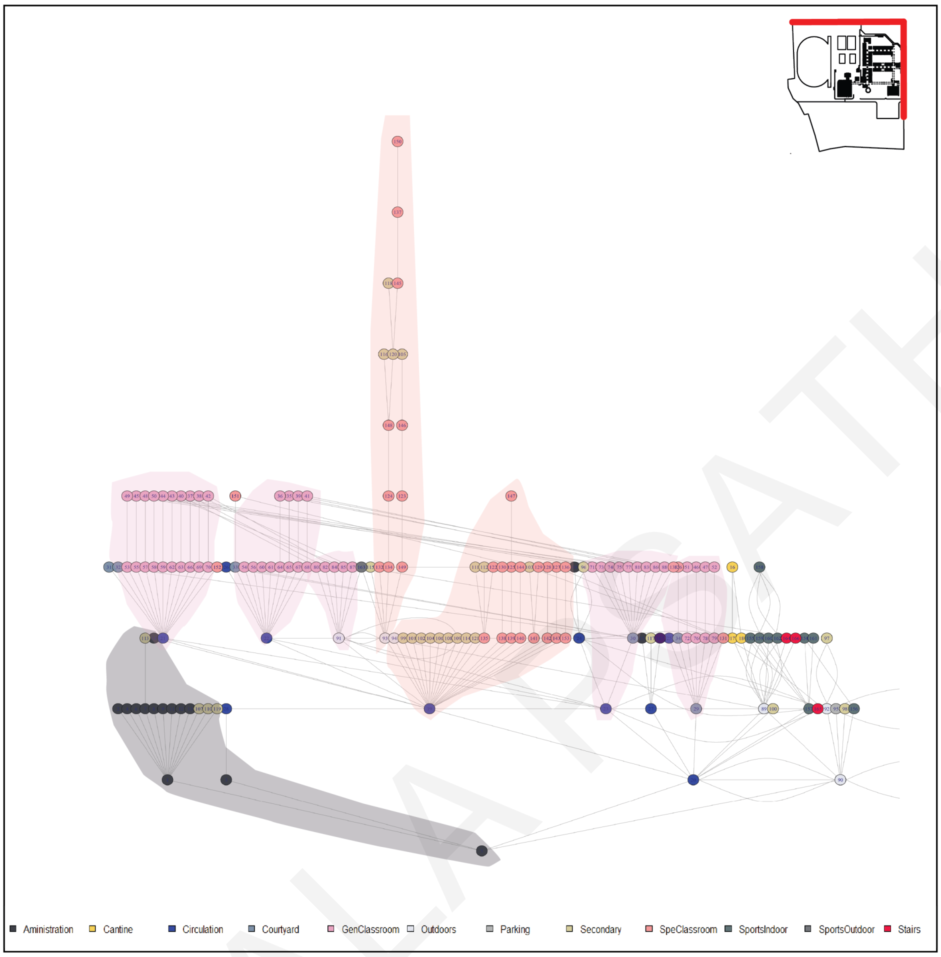


FIGURE 5.22: Topological Relationships Between Functions in School10

S10 is the only school deployed in one floor. The school's depth from the administration is deployed in 10 steps. The shape of the graph is composed of an almost rectangular base which on further steps becomes a slim and very narrow triangle, highlighting that a particular functional chunk (special classrooms) goes really deep compared to all other functions. It has 5 mono-functional clusters and two joint clusters. Sports outdoor is arranged 4 steps away from administration.

Overall, by looking at the topological relationships between functions and visually evaluating the graphs, valuable conclusions can be drawn. Firstly, as far as the **distribution of functions in reference to the circulation system** is concerned 3 different types of schools can be identified. **Type A** refers to schools that created almost separated functional 'islands' on both floors and provide movement through distinct circulation stripes or courtyards. S1 for instance, falls into this category, since there are 2 distinctive functional wings with distinctive circulation systems on both floors. Those distinctive units come together only by means of a central courtyard. **Type B** refers to schools that on both floors articulate at least one complete loop of movement that combines the different functions together through a circular circulation system (S3, S5, S10). **Type C** refers to schools that connect functions sequentially via movement stripes and thus a more linear experience (S2, S4, S6, S7, S8, S9).

5.3.2.2 Characteristics of the School Graph

With regards to the overall network structure, all justified graphs are considered as a whole network with particular network characteristics (i.e., *network density* and network *centralisation*, number of edges and number of ties). Table 5.4 summarises the various network characteristics per school.

Network density[28] captures the number of edges in a network divided by the total number of possible edges. Thus, the bigger the number the higher the density of the graph and thus the more potential links exist between nodes in the graph. As far as the **network density** is being concerned, all schools have recorded significantly low density. The highest density value is recorded in schools 1, 2, and 10, while the lowest in all remaining schools. This highlights the fact that very few connections exist in comparison with all possible links of the network. However, it should be considered that these networks are spatial. In a spatial network, typically each element has two to four links, since it is physically impossible to achieve more in terms of arranging doorways in space. Therefore, it could be argued that the theoretical centralisation of a star-like network where all nodes are linked to one central node that underpins a high network density is practically impossible.

Justified Graph Network Analsysis

Comparative Undestanding

Variables	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Network_Density	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02
Centralization_Degree	0.07	0.09	0.10	0.10	0.12	0.12	0.07	0.14	0.14	0.13
Centralization_Betweeness	0.53	0.36	0.58	0.36	0.40	0.58	0.42	0.34	0.59	0.44
Centralization_Closeness	0.19	0.13	0.20	0.19	0.13	0.26	0.19	0.18	0.23	0.29
Edges_No	196.00	276.00	232.00	257.00	220.00	155.00	306.00	307.00	244.00	245.00
Ties_No	153.00	213.00	179.00	188.00	173.00	119.00	226.00	214.00	185.00	167.00

Red colour highlights the highest value among schools. Blue colour highlights the lowest value among schools

TABLE 5.4: J-graph Network Analysis

As regards network analytics, **centralisation** is a global analytical measure and refers to the overall cohesion or integration of the graph as a whole. Three different measures have been

[28] **Network Density** captures the number of edges in a network divided by the total number of possible edges. The bigger the number the higher the density of the graph and thus the more potential links that exists in the graph.

used in order to identify centralisation of the graphs, **centralisation degree**, **centralisation betweenness** and **closeness centralisation**. [29] (table 5.4).

As regards the **degree centrality** of the graphs' network, S8 and S9 have recorded the highest value. This means that both schools have various nodes in the system that have a lot of connections, and thus, their network is closer to a star-like network than other schools. In fact, in both cases there is a central circulation system that provides access to all other functions. This central circulation system seems to operate as the spine of the whole system. Among the highest values are also recorded in S10. On the other hand, S1, S7, and S2 have recorded the lowest degree centrality. This insinuates that in these cases, the connections between edges are more equally distributed across various spaces, and there are multiple circulation chunks and outdoor areas that equally provide access to the different parts of the school. Relatively moderate values are recorded in S3, S4, S5, and S6.

With respect to the **betweeness centrality**, S9, S6, S3 and S1 have the highest values. This highlights that both schools have central spaces with many connections that operate as the shortest paths of the system. Among the highest values have been recorded in S3 (0.58), S4 (0.58) and S1 (0.53). On the other hand, S8 has recorded the lowest betweenness centrality. Among the lowest values have also been recorded in S2 (0.36), S4 (0.36). Relatively moderate values have been recorded in S5, S7 and S10. Lastly, as regards **closeness centrality** [30], S10 has the highest value and it is followed by S6 (0.29 and 0.26, respectively). The lowest centrality is recorded in schools 2 and 5 (0.13).

Lastly, as regards the **number of edges and ties** that the networks have, the highest number of edges is recorded in S7 and S8. Both schools have more or less 307 edges. On the other hand, the lowest number of edges is recorded in S6 (155) which has also the lowest number of ties between edges (119). As regards, the highest number of ties is also recorded in S7 (226). Therefore, by considering all network analytics together, it could be argued that S7 is the school with the highest number of edges, the highest number of ties, and has among the lowest centralization degree. This therefore, highlights that the network not only has a lot of connections and space but also the access to various spaces happens from everywhere in the school. On the other hand, S6, which has among the highest network densities, it has the lowest number of edges and ties.In essence, this school has very few spaces overall, since population-wise it is the smallest school of the sample but at the same time it offers a more centralised system that provides access to various spaces.

[29] **Degree Centralisation** indicates the number of links upon a node (i.e., the number of ties that a node has). In the case of a whole graph, the degree is maximised when the graph contains a central hub to which all the nodes are connected. **Betweeness Centralisation** looks at the number of shortest paths between every pair of nodes in the network and counts how many of those paths go through the subject node.Is thus a measure of control that represents how frequently a node appears to be on shortest paths. Thus, the bigger the number the bigger the sum of the shortest paths in the graph. Thus, the bigger the number the most determinant the role of the spaces with high betweeness is in the system. **Closeness centrality** is based on the length of the average shortest path between a vertex and all vertices in the graph.

[30] Nodes with a high closeness score have the shortest distances to all other nodes. Thus, higher closeness centrality of a graph suggests that more nodes of the system have the shortest distances to all other nodes.

5.3.2.3 Depth of graph from mono-functional labelling

The depth of the graph from certain functions-nodes that are located in one singular position in the school (i.e, cantine, administration area, sports area, entrance) is considered comparatively in order to examine the topological location of those functions in the whole schools' graph. In essence, this analysis aims at providing insights regarding the positioning of those essential functions in the overall school's composition.

As regards the **depth from the entrance**, it can be seen that a user needs on average 8 steps from the entrance to reach the most distant space of the schools. The schools with the highest depth from the entrance are S8 and S10. S8 and S10 share a similar spatial structure, parallel functional stripes articulated around parallel movement corridors and courtyards. What is also particularly interesting is that S10, although it is deployed on only one floor, is the school with the highest number of steps (11), which means that it is the deepest school of the sample from a topological point of view. Arguably, it could be claimed that the schools' topological depth depends primarily on their design and not on the number of floors. Secondly, it can also be assumed that spatial organisations with parallel corridors that assemble a more street-like organisation tend to be deeper from the entrance.

Justified Graph Analysis, Step Depths from single location functions

Comparative Undestanding

Depths	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Entrance	9	8	9	8	9	8	9	10	8	11
Admin	11	8	8	7	10	10	9	9	8	10
Sports	10	8	9	9	8	7	9	13	10	8
Cantine	10	9	8	11	9	8	10	10	8	10

Red colour highlights the highest value among schools. Blue colour highlights the lowest value among schools

TABLE 5.5: Topological Depths from single location functions

What is more, regarding the **graphs' depth from the administration area**, it is evident that in some cases (S1, S5, S6) the depth has become higher compared to the depth from the entrance. In other cases it has been lower or even stable (S2,S3,S4,S7,S8,S9,S10). The interesting aspect of the schools' graph that became deeper is that their design is characterised by a system of leftover areas that are directly connected to the entrance and surround the building. This therefore might be the reason that creates a shallower graph from the entrance compared to the graph generated from the administration area. In all other cases, the user originating from the administration area is closer to the main school unit, and thus, it is expected the number of steps required to be the same or even less in comparison with the graph generated from the entrance. Another important aspect is that S4 has recorded the shallowest graph compared to all others from the administration area. This indicates that S4 has a more centrally located administration area than all other schools and especially S1 which has the highest depth (11) from administration.

The **depth of the network from the sports area** is also considered. S6 has the lowest depth among schools. This might suggest that the sports area of S6 is more centrally located in comparison to all the other schools of the sample. S8 has the highest depth among schools from the sports area. This is because there is a highly complex system on the one side of the plot (main unit) that is significantly distant from the sports area. In most of cases, the depth of the graph from the sports area ranges from 8 to 10 steps.

Lastly, in respect to the **depth of the systems from cantine**, the highest depth is recorded in S4. This is because the cantine area is topologically segregated and not centrally located in reference to the overall system of the school. S3 and S10 are the only schools that have a lower depth from the cantine than from the school's entrance (8 and 10, respectively). Both examples have the cantine area in conjunction between the sports area and the main school unit. At the same time, in the case of S3, it seems that the cantine area is more organically connected with the main functional unit, since it is located in the middle of the main unit.

5.4 Conclusion: Genotypical Patterns

The previous sections have discussed three aspects: spatial, functional, and morphological configuration of the schools under investigation. At first, an intuitive classification of schools into two distinctive types in section 5.1.3 has been achieved (courtyard-based and hierarchical-based schools) by considering primarily morphological characteristics and the composite assemblies of the built forms. Then, the analysis has investigated spatial and functional consistencies.

Hence, the following sections provide a comparative overview of the 10 schools under investigation to identify whether particular genotypical patterns (Hillier and Hanson, 1984) can be found. They firstly compare the schools using the already discussed building types and then compare and contrast spatial and functional layout properties.

5.4.1 Building Types and Built Forms

Regarding the relationship of **the school type and school plot** variables such as urban density, school perimeter, plot size and porosity have been considered. Figure 5.23 and fig. 5.24 visualise values from the previous types of analysis per school building type. Due to the subsequently diverse scales of values, all values have been classified into small, medium, and large by considering the lowest and highest values per variable of investigation.

By concerning the plot size in both types of schools, it can be seen that the schools that belong to both types are significantly different. The differences are found both as regards their shape as well as their size (within the type and across types). Consequently, this can suggest that there is no particular strategy regarding the desirable plot shape and size. Instead, due to the extreme differences between schools, it can be assumed that the selection of the school plot is a matter of availability in the area of interest rather than a strategic decision based on certain criteria.

However, despite the above common base, the two types illustrate significant differences as regards the urban density around the schools. In fact, it appears that hierarchical-based schools (T2) are characterised by medium to low urban density around, while the courtyard-based schools (T1) by medium to high urban density. Such an understanding might suggest that when the urban density is moderate to high, the school design tends to be inward-looking and centralised. On the other hand, when the urban density is medium to low, it is easier to propose a hierarchical-based organisation that is comprised of various smaller parts to form the whole school's structure.

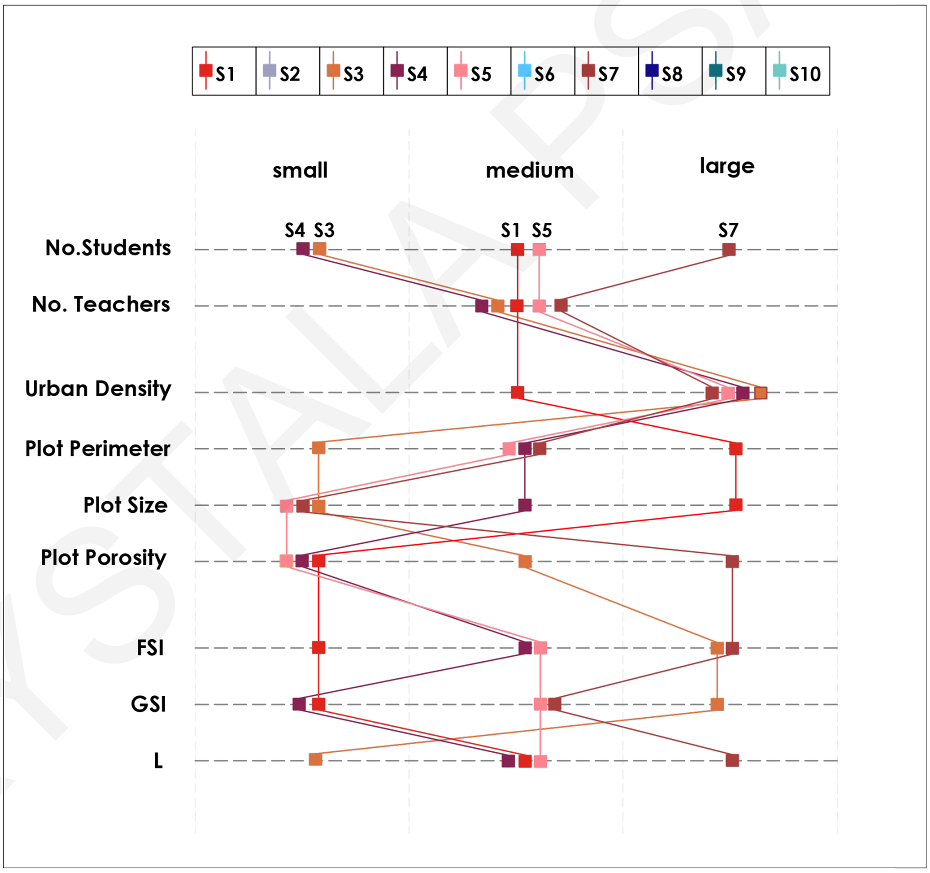


FIGURE 5.23: Comparative Examination Type 1

The cases also illustrate significant differences as regards school porosity relative to their immediate surroundings. The school porosity in the hierarchical-based schools ranges from

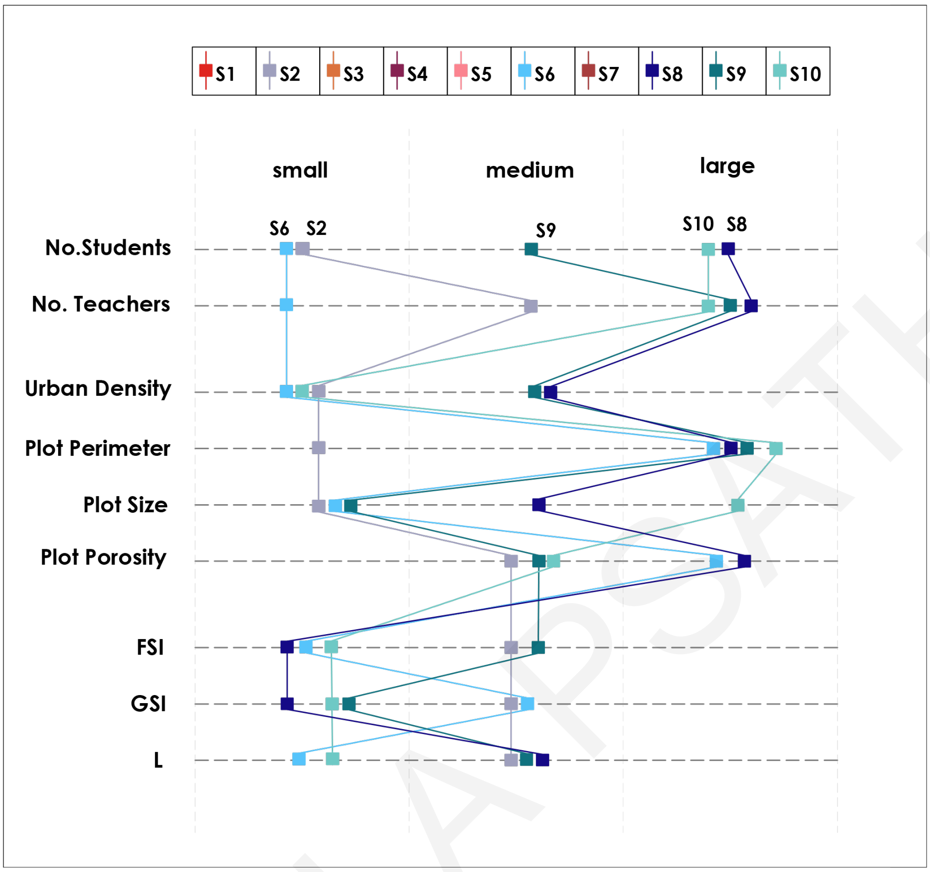


FIGURE 5.24: Comparative Examination Type 2

moderate to high, while in courtyard-based schools from low to high. This suggests a diverse school character regardless of the school type. In fact, it may be assumed that the operation and character of a school surrounded by a street network (S7, S6, S8) is completely different from the reality of a school with just a string of road attached to it (S4). In particular, this increased exposure of the school towards the wider community might raise issues of building safety, control and supervision. Arguably, the spatial conditions above can be particularly critical, since the importance of the school's safety has been stressed both by the existing literature on effective leadership (Brauckmann and Pashiardis, 2011) but also by all headteachers interviewed by this thesis. Specifically, they all reported serious concerns regarding schools' uncontrolled areas, informal exits and entrances at various parts of the schools' perimeter and generally the exposure of their schools to the wider context.

At last, regardless of the relationship of **school type with building densities**, hierarchical-based schools, illustrate medium to small FSI, GSI, and number of floors. This demonstrates that the hierarchical based schools of the sample are characterised by relatively moderate to low density both on the ground and across floors and relatively moderate to low number of floors. On the other hand, courtyard-based schools illustrate a much more diverse image that extents from small to high values for FSI, GSI, and L.

5.4.2 Layout Consistencies

As regards the layout consistencies, the comparative classification of schools based on the space syntax metrics is achieved in fig. 5.25 and fig. 5.26. Due to the subsequently diverse scales of values, all values have been classified into small, medium, and large by considering the lowest and highest values per variable of investigation. This analysis highlights that courtyard-based schools have medium to small axial and segment integration, while hierarchical-type schools have medium to large. Thus, as expected, the axial mean depth in courtyard-based schools is medium to large, while the opposite condition is found in hierarchical-type schools. This suggests that courtyard-based schools tend to be deeper than hierarchical schools.

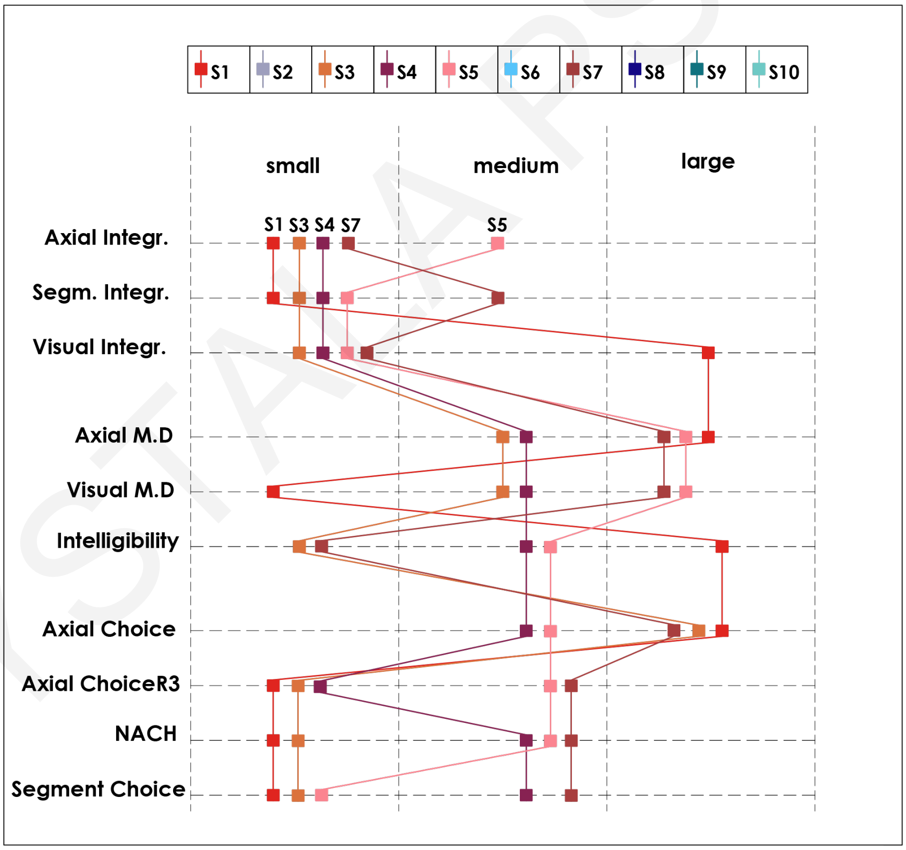


FIGURE 5.25: Comparative Understanding Between Type 1: Courtyard-based schools

However, when the visual properties of the layouts are considered, it is revealed that most of the schools have medium to small visual integration. Seven out of ten schools that belong to both types of schools are characterised by relatively small visual integration. S1 is the

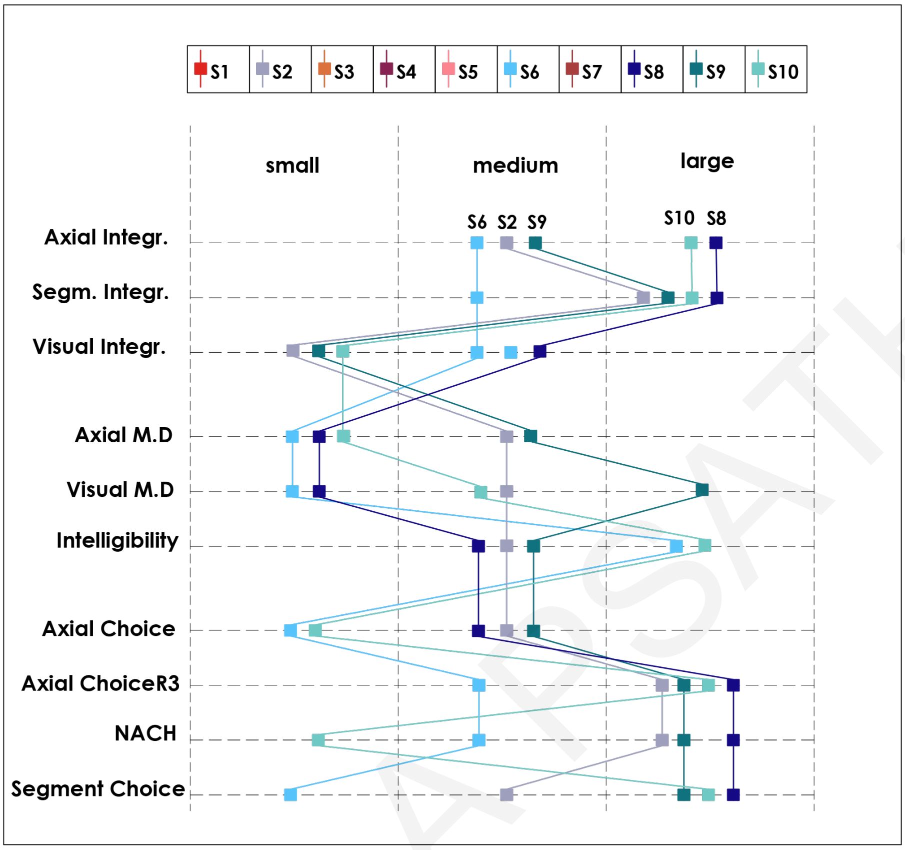


FIGURE 5.26: Comparative Understanding Between Type 2: Hierarchical-Based schools

only extreme case that is classified as having large visual integration. It might be the case that the design of this particular school is characterised by an unproportionally big outdoor area in respect to the buildable area as it is shown in section 5.1.3.

By considering comparatively axial intelligibility, it can be seen that most of the schools have medium intelligibility. S10, S6, and S1 are characterised by high intelligibility, while S2, S4, S5, S8, S9 by medium. Interestingly, only two courtyard-based schools are characterised by low intelligibility (S3, S7). This can be further understood by looking at the figure grounds of the schools (fig. 5.1). It seems that both schools have particularly irregular open spaces that surround the school buildings. In that sense, the outdoor area seems to be a leftover area rather than an important area of the school which is articulated in relation to the main school unit as happens in schools 2 or 4. Thus, it could be argued that this condition creates maze-like organisations that are characterised by low axial, segment and visual integration.

Generally, S1 and S3 are primarily on the small section of the diagram, suggesting that they illustrate rather small values compared to the rest of the sample. Schools 2, 4, 6 have remained predominantly in the medium section of the diagram (6 out of 10 types of analysis). S5 also is characterised primarily by medium values (5 out of 10), while S7 seems that has a

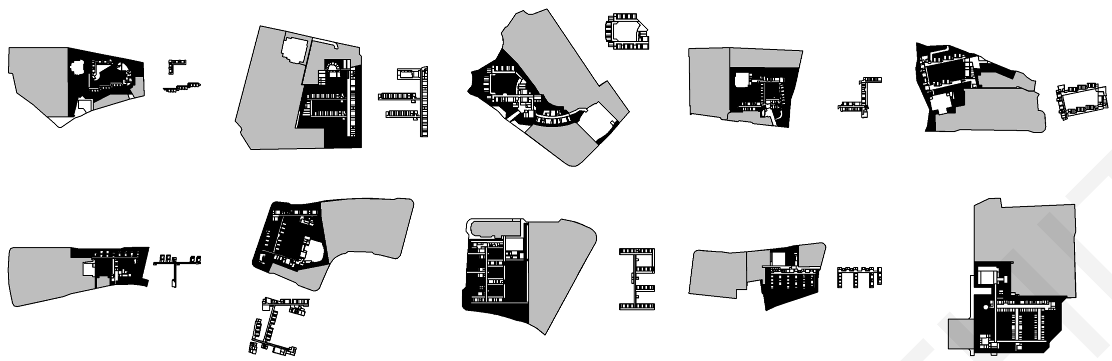


FIGURE 5.27: Invert Figure Ground highlighting the organisation of open to closed spaces in the school, black: open space, white: closed space, grey: parking and sports areas

more equal distribution across sections of the diagram. S7 is the only school that illustrates this pattern among the sample. Lastly, S8,S9, and S10 are predominantly located on the large chunk of the diagram, suggesting that they are characterised primarily by the largest values among the sample. Interestingly, the design of all 3 schools is defined by a hierarchical structure.

5.4.3 Functional Consistencies

In regards to the **functional consistencies** between schools, the relative centrality of functions is considered in order to identify whether the different designs place similarly or differently the various functions in the schools' spatial configuration. This analysis is based on the concept of functional integration ratio (FIR)[31] that is proposed by Kishimoto and Taguchi (2014) and considers the mean integration of a specific function divided by the mean integration of the entire school as explained in section 5.2.1.

The fig. 5.28 shows comparatively the relative centrality of the different functions in the schools. As far as the **administration area** is concerned, only two schools have placed the administration relatively central (S4(T1) and S8(T2)). In all the other cases the the administration area is placed relatively segregated regardless of the school type. S1 has recorded the most segregated administration area of the sample. **The cantine area** illustrates a diverse positioning in the overall system. S1, S2, S4, and S9 have a relatively centrally located cantine area. In all other cases, the cantine area is more segregated, with the lowest centrality to be recorded in S10.

In respect to the **circulation structure**, the relative centrality ranges from 1.04 (S3) to 1.24 (S10), highlighting the circulation system is placed centrally in the design of schools. As expected since S10 is deployed on only one floor, circulation is depicted with the highest value

[31]If its value is less than one, the function is located at a segregated position. If the value is greater than one then the function is located in relatively central location in the school

Relative Centrality of Functions

Comparative Undestanding

Relative_Centrality	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
FIR_Admin	0.879	0.980	0.977	1.011	0.965	0.933	0.984	1.000	0.947	0.956
FIR_Cantine	1.024	1.027	0.990	1.005	0.889	0.857	0.927	0.992	1.074	0.745
FIR_Circulation	1.068	1.111	1.046	1.131	1.144	1.175	1.165	1.076	1.088	1.240
FIR_Courtyard	1.260	1.100	1.281	1.186	1.223	1.194	1.135	1.072	1.152	1.011
FIR_GeneralClassroom	0.857	0.925	0.850	0.978	0.971	0.838	1.063	0.829	0.794	0.918
FIR_Outdoors	1.056	1.139	1.013	1.024	0.832	1.153	1.152	1.047	1.155	1.075
FIR_Secondary	0.814	0.900	0.830	0.970	0.959	0.913	0.956	0.868	0.869	0.974
FIR_SpecialClassroom	0.820	0.932	0.896	0.905	0.974	0.910	0.977	0.862	0.844	0.964
FIR_SportsIndoor	1.077	0.810	1.117	0.792	0.769	0.860	0.961	0.871	0.984	1.253
FIR_SportsOutdoor	1.199	1.009	1.125	0.999	0.910	1.431	0.926	1.060	0.888	1.162
FIR_Stairs	0.913	1.053	1.032	1.104	1.082	1.034	0.986	1.039	1.014	0.856

Darkest colours represent the higher centrality, while brightest the lower centrality

FIGURE 5.28: Relative Centrality of Functions

among the sample. Apart from S10, S6 and S7 have also recorded among the highest centrality of the circulation system. In addition to the circulation system is interesting to examine the positioning of **staircases** or vertical connections in the schools. Apart from S10 which is the only ground floor school and has only a few ramps that connect the levels on the ground floor all the other schools have two floors that are connected via staircases. All schools apart from S1 and S7 have centrally located staircases. S4 has the most centrally located vertical connections. As regards **the courtyard areas**, all schools have centrally located courtyards in the overall school layout. Likewise, all school of the sample apart from S5 have centrally located **outdoor** spaces. S6, S7, and S9 have the highest centrality of outdoor spaces, while S5 and S3 the lowest.

By considering the relative centrality of the **general classrooms**, it can be seen that S7 is the only school of the sample that has very centrally located classrooms. Such an understanding could suggest that S7 design might not give to classrooms the privacy that is required and is underlined by the guidelines provided by TDMOEC. As regards the special classrooms, none of the schools have placed them centrally. However, S7 has also recorded the highest value, highlighting that neither general classrooms nor special classrooms have the adequate privacy and segregation that is needed and stated explicitly in the design guidelines.

As expected, **secondary services** are less centrally located in all schools. Lastly, as regards the sports indoor and outdoor areas, a diverse image is illustrated. S10 has the most centrally located sports indoor along with S1 and S3. S5 has the most segregated sports indoor area along with S4,S6, and S2. However, S1, S2, S3, S6, and S8 have recorded among the highest FIR values for sports outdoor, highlighting that their design places the sports outdoor area in a relatively central location. The lowest centrality is recorded in S5, S7, and S9, thus assuming that the sports area in those three schools can be very segregated from the rest of the school.

5.4.4 Are there any real 'genotypical' patterns between schools?

The comparative investigation above highlights that common patterns can be found among schools. Common patterns can either be traced back to genotypical (Hillier and Hanson, 1984) patterns that arise primarily by means of architectural choices or by pure input-output issues that derive by the common design briefs. Into more details, input-output issues have been coined by Hillier and Hanson (Hillier and Hanson, 1984) as long models or g-models. In this case, global rules are predetermined and do not arise from morphogenesis, architectural choices or decision-making but rather by global design requirements provided by the authorities (section 3.4).

Hence, in order to identify whether there are any real 'genotypical' patterns between schools, this thesis only considers the commonalities that appear to be related to particular architectural choices or decision-making. Thus, it can be claimed that 'genotypical' patterns between lower secondary school buildings that are built in Cyprus after 2000 can be traced as follows:

- All schools are particularly sparse buildings;
- All schools are composed of two parts, the main school unit and the sports area. One of the parts is instantly perceived and open, while the other is composed by various building units, circulation structures, and open-air courtyards;
- 60% of the overall school is open, while there is a particularly high percentage of outdoor or left-over areas that surround the schools. However, the way in which each design treats those left-over areas differs significantly;
- Movement areas that are the shallowest spaces of the system and have the highest movement and occupation potential. Additionally, this suggests that corridors do not only have a practical-functional role but could potential encourage both stationary and moving activities. This also reveals the synthetical role of corridors since they are the means by which the various 'dots' of the system can be linked together;
- Integration cores are primarily inward-looking and mainly located at the centre of the main school units. The only school that has an outward-looking integration core is S7;

- Only a few integration cores have reached the sports area (S1, S4, S6). This reveals that the sports areas in open-air schools are rather segregated. This indicates that the two parts of the school may operate differently in the school's actual use, and at the same time, it may raise issues with school control since such a big open area is so distant from the main integration core of the school;
- In the majority of cases (all apart from S4 and S8) the the administration area is placed relatively segregated regardless of the school type;

In that sense, 'the laws of the field of architecture do not tell designers what to do. [Instead] by restricting and structuring the field of combinatorial possibility, they prescribe the limits within which [the] architecture is possible.' (Hillier and Iida, 2005, p.8).

Chapter 6

School as a Socio-Spatial Assemblage: Space, Pedagogy and Social Agency

Having understood the spatial, functional, and morphological aspects of all 10 schools under investigation, this chapter aims to elaborate on how the spatial layout and agency in lower secondary school buildings in Cyprus impact the socio-educational school life and how do the schools can be classified based on their socio-educational potentials.

Specifically, this chapter aims at first answering how the 10 schools under investigation can be grouped based on the educational code suggested by their layout and how the spatial layout and agency in lower secondary school buildings in Cyprus impact the socio-educational school life. Lastly, it sheds light on the extent to which a school's educational code can be shifted through social agency and rules application as well as the extent to which the strength of the rule is determinant in order the educational code to be shifted.

In this context, a set of spatial conceptualisations of Bernstein's concepts have been generated to discuss the relationship between space and pedagogy as well as the relationship of the educational code with the school's community and agency. Thus, this chapter is structured as follows. It firstly develops a method able to grasp the educational code of a school based on a list of spatial conceptualisations that is derived from the literature review chapter 2. Secondly, based on the educational code of each school as well as the similarities and differences between the schools, it discusses the type and strength of the school community. Lastly, it discusses the role of agency in shifting the educational code.

6.1 Educational Code and School Building

A wide array of scholars from the discourse of architecture have discussed the potential of incorporating Bernstein's theory (1973) for the investigation of the interplay between school building and pedagogical practices. Specifically, existing research (that is presented in chapter 2) has suggested various ways through which a spatilalised understanding of the concepts that are proposed by Bernstein can be achieved. Hence, by building on existing knowledge and in an effort to provide a unified framework through which the educational code of an educational building can be decoded, a series of spatial conceptualisations has been developed. In particular, the list of spatial conceptualisations works as a thinking device so as to render the degree of classification and framing and thus the educational code and the school community proposed by the spatial layout of an educational building. The list of spatial conceptualisations (SC) is based both on the review of the literature and additional assumptions by this thesis and is summarised below:

Classification

- **SC1:** The denser the functions on the school's ground floor, the greater the potential mix of the various contents of knowledge and thus the lower the classification. In this respect the GSI value which is examined in chapter 5 could be particularly useful. Specifically, GSI is a variable that captures the density of the scheme on the ground floor. Thus, it is assumed that the higher the GSI value, the denser the functions and thus the weaker the classification;

- **SC2:** The higher the separation between school floors, the stronger the separation between types of classrooms and thus the stronger the classification. The floor separation index is a joint measure that describes the separation between floors. Floor separation index is defined as the relative number of floors divided by the relative centrality of staircases;

- **SC3:** The more movement potentials exist in a school, the more a school building stitches its different parts together by means of movement and thus the lower the differentiation between types of contents (weaker classfication). In space syntax terms, choice metrics capture the potentiality of a space to be selected as a route when people are moving from one space to another. Thus, the higher the values (axial choice, axial choice r3, t1024 choice, NACH), the more the movement potentials offered within the school and the weaker the classification and the boundary between types of contents (i.e, classrooms, sparts, special classrooms);

- **SC4** The more segregated the sports area is in relation to the rest of the building, the stronger the classification, since it is differentiated from the spaces that accommodate other contents of knowledge. Thus, the higher the relative centrality of the sports area, the lower the differentiation with other functions and hence the weaker the classification (FIR Sports).

Framing

- **SC1:** The more integrated the school building is, the less control exists on the events and encounters. In essence, the shallower the building, the easiest is to reach all other spaces. Thus, the less hierarchical is the pedagogical process, since it is more easily exposed to adjacent activities and thus the lower the framing (Axial Integration, T1024 Integration, Visual Integration, Axial Mean Depth, Visual Mean Depth);

- **SC2:** The lower the depth from administration, the lower the framing, since there is less separation between teachers and headteachers location from students in the school (Step Depth from Admin, FIR Administration);
- **SC3:** The higher the centrality of the cantine, the easier is to reach it from all the other parts of the school. Cantine constitutes a destination for all school users, and thus, it centrality could satisfy accidental encounters between school users such as teachers, students, headteacher, etc. (FIR Cantine);
- **SC4:** The higher the centrality of general and special classrooms, the lower the framing, since the more centrally the classrooms are located, the less control is given to the teachers, since the pedagogical process is more exposed to the movement and encounters happening around(FIR General Classroom, FIR Special Classroom);
- **SC5:** The more visually synchronous the space is, the more the teachers 'lose their inhabitant status and become visible, synchronised and controlled' (Sailer, 2018, p.3) since different user groups are connected by means of co-presence. Thus, the higher the mean isovist perimeter in a school, the lower the framing.

6.1.1 General Description of Data

Based on the above list of spatial conceptualisations, a model that could acknowledge all factors simultaneously has been developed. This has been considered necessary to examine all conceptualisations at once and thus to extract conclusions on the potential educational code proposed by the spatial layout of schools.

Spatial data have been retrieved by the spatial, functional, and morphological analysis of all schools. The metrics that are used for this comparable investigation are GSI, floor separation index, axial choice, local axial choice (R3), axial mean depth and visual mean depth, segment choice, mean NACH, max NACH, relative centrality of sports (FIR sports), axial mean depth, axial integration, segment angular integration, step depth from administration, relative centrality of administration, relative centrality of classrooms, relative centrality of the cantine and isovist perimeter table 6.1.

To achieve a comparable understanding between cases, the metrics that are used in the model are rescaled from -1 to 1. Values towards -1 capture the lowest values among schools, while values towards +1 the highest values among schools. Then the distribution of classification and framing variables is represented through box plots (fig. 6.1, fig. 6.2) with a dominant median value. Hence, this helps in visualising the two dimensions schematically. By looking at the distribution of values in relation to the concpetualisations mentioned above, values above 0 denote weak classification and weak framing, while values below 0 denote strong classification and framing. Lastly, the metrics that have been considered for classification dimension are GSI, floor separation index, axial choice, segment choice, NACH, FIR

Variables addressing Classification & Framing

Educational Code Variables

Variables	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
GSI	-1.000	0.333	1.000	-0.333	0.111	-0.78	0.111	-0.56	-0.33	-0.111
Floor_Separation	0.058	0.249	0.786	0.726	0.223	0.85	-1.000	0.37	0.41	1.000
Axial_Choice	0.461	0.107	0.364	-0.144	-0.133	-1.00	1.000	-0.05	-0.05	-0.947
Axial_Choice_R3	-1.000	0.792	-0.675	-0.452	-0.088	-0.16	-0.251	0.96	1.00	0.525
T1024_Choice	-1.000	0.263	-0.563	-0.064	-0.493	-0.64	0.143	0.75	1.00	0.414
NACH_Mean	-0.254	0.491	-0.536	0.069	-0.128	0.21	0.052	0.50	1.00	-1.000
NACH_Max	-1.000	0.647	-0.529	-0.176	0.059	0.41	-0.059	0.18	1.00	0.176
FIR_Sports	0.254	-0.360	-1.000	-0.392	-0.678	1.00	-0.628	-0.19	-0.75	0.132
Axial_Mean_Depth	-1.000	0.249	-0.852	-0.188	-0.036	0.57	-0.958	0.53	0.17	1.000
Axial_Integration	-1.000	0.271	-0.931	-0.454	-0.228	0.18	-0.773	0.71	0.14	1.000
T1024_Integration	-1.000	0.464	-0.525	-0.463	-0.642	-0.36	-0.301	0.59	1.00	0.782
Step_Depth_Admin	-1.000	-0.553	0.259	-0.322	-0.982	0.11	-0.063	0.21	1.00	0.478
FIR_Admin	-1.000	0.538	0.538	1.000	0.310	-0.18	0.594	0.83	0.04	0.178
Isovist.Perimeter	1.000	-0.798	-0.506	-0.731	-0.917	-0.64	-0.971	0.71	-1.00	-0.474
FIR_Spe_Classrooms	-1.000	0.438	0.023	0.085	0.964	0.15	1.000	-0.47	-0.70	0.836
FIR_Gen_Classrooms	-0.528	-0.024	-0.024	0.367	0.319	-0.67	1.000	-0.74	-1.00	-0.082
FIR_Cantine	0.697	0.714	0.714	0.579	-0.123	-0.32	0.108	0.50	1.00	-1.000
Visual_Mean_Depth	1.000	-0.221	0.022	-0.224	-1.000	0.51	-0.569	0.50	-0.42	0.138

TABLE 6.1: Variables used to address the dimensions of classification and framing

sports. On the other hand, the metrics considered for framing dimensions are axial, segment and visual integration, axial and visual mean depth, FIR administration, step depth from administration, FIR general and special classrooms, and isovist perimeter.

6.1.2 Educational Code

Considering the above spatial conceptualisations, the schools can now be placed in a 2x2 matrix (fig. 6.3) with the degree of classification on x-axis and the degree of framing in the y-axis. The strength of those two dimensions is found by calculating the average value of all conceptualisations per dimension (i.e classification or framing). Hence, by plotting the average values on the diagram, the educational code suggested by the layout of each school can be revealed. From the figure below (fig. 6.3), three distinctive patterns can be identified. Firstly, S2, S8 and S10 are placed on the bottom left quadrant. S4, S5 and S1 are located

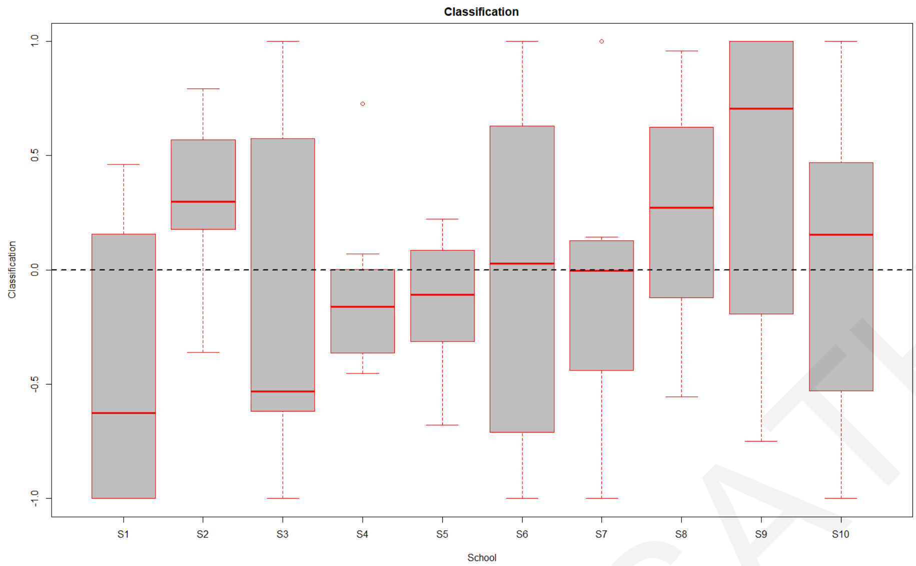


FIGURE 6.1: Classification Dimension

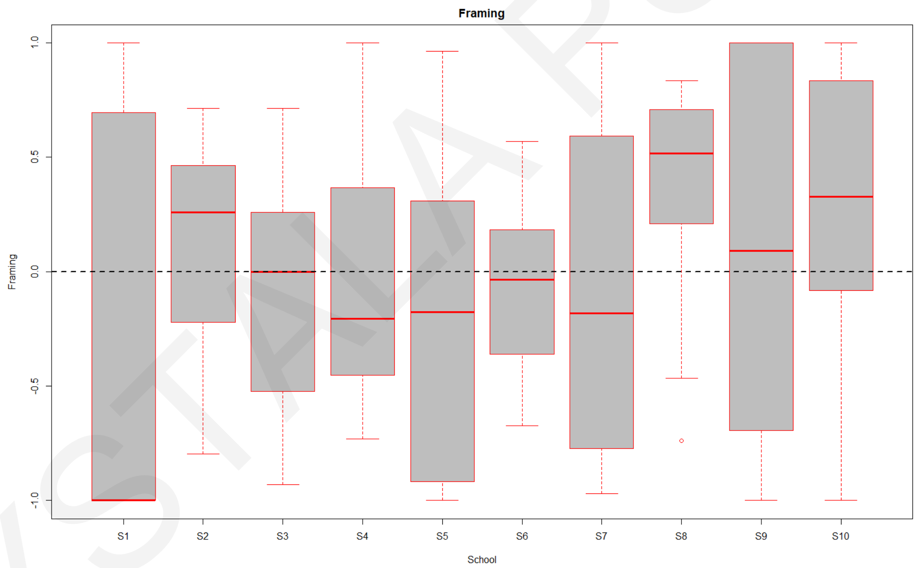


FIGURE 6.2: Framing Dimension

on the upper right quadrant, while S9, S6, S3 and S7, are attached either on x-axis or y-axis. Schools placed on the bottom left quadrant are characterised by weak classification and weak framing and thus an overall integration code (S2, S8, S10), while schools placed on the upper right quadrant are characterised by strong classification and strong framing and hence a collection code (S1, S4, S5).

Schools that occupy the x-axis or y-axis axis have an exceptionally high one of the two dimensions, while the other is primarily neutral. This, therefore, suggests that S9 is primarily weakly classified but neutrally framed. S6 is placed almost in the middle of the matrix since both dimensions are almost neutral. S3 is strongly classified but neutrally framed, while S7 is strongly framed and neutrally classified. Hence, this might suggest that those schools do not construct a robust educational code.

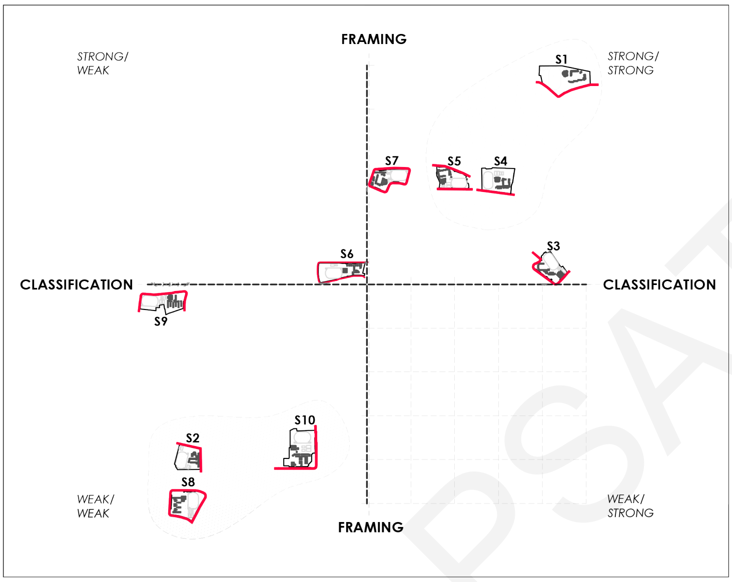


FIGURE 6.3: Characterisation of the 10 schools as weakly or strongly classified and frames according tot the criteria and spatial conceptualisations set above

Thus, the profile of each school based on the educational code is the following:

- **S1** has strong framing and strong classification and thus a **strong collection code**;
- **S2** has weak classification and framing and thus a **strong integration code**;
- **S3** has relatively strong classification and almost neutral framing and thus a relatively **weak collection code**;
- **S4** has moderate to strong classification and moderate to strong framing and thus a **moderate to strong collection code**;
- **S5** has moderate to strong classification and moderate to strong framing and thus a **moderate to strong collection code**;
- **S6** has slightly weak classification and neutral framing and thus a **very weak integration code**;
- **S7** has almost moderately neutral classification but strong framing and thus a **weak collection code**;
- **S8** has weak classification and framing and thus a **strong integration code**;

- **S9** has weak classification and almost neutral framing and thus a **weak integration code**;
- **S10** has weak classification and framing and thus a **strong integration code**;

Considering this type of analysis with the formal types that are derived by section 5.4.1 it can be seen that all schools that fall into the bottom left side, and thus form an integration code, belong to the hierarchical-type of school (as classified in chapter 5). In contrast, schools that belong to the upper right quadrant are courtyard-based and primarily collection code. In those clear examples, therefore, the type of school community may be assumed. Thus, the following section will elaborate further on the type of school community proposed by the educational and the community's strength.

6.1.3 Educational Code and School Community Type

Based on the educational code that is identified above, the type of community that is generated in the different schools as well as the strength of the community is examined here. Specifically, according to Bernstein (1973), different educational codes may create opposing types of solidarity in schools.In other words, if the framing is strong, the authority over what and how it is taught is mainly up to the teacher who determines the way and pace of teaching. At the same time, the different teachers have low interdependency between them. Therefore, this structure results in a hierarchical organisational structure by highlighting the differences between user categories. On the other hand, in an integration code school, individual users rely on each other. In fact, a weak framing 'decreases the discretion of the individual teacher and requires coordination and homogeneity in pedagogy and evaluation, thus giving authority to an institution' (Sailer, 2015, p.34:3).

The above forms of solidarity can also be seen in the light of Hillier and Hanson's correspondence and non-correspondence models. In particular, Hillier and Hanson (1984) have argued that the mechanisms of solidarity might be spatial or transpatial. Spatial solidarity can arouse via proximity and co-precence, while transpatial solidarity via kindship, affiliation or profession (Sailer and Penn, 2009). Hence, based on this distinction between spatial and transpatial relationships they have distinguished correspondence from non-correspondence models. Correspondence models are those that spatial encounters are, in fact, reinforced by transpatial solidarity. On the other hand, non-correspondence models allow transaptial solidarity to overcome spatial proximity. Thus, as argued by Sailer (2015) a correspondence model, is primarily characterised by exclusivity, local strength, and boundaries maintenance. On the other hand, a non-correpondence model thrives on openness, equality, global strength, and inclusivity. Hence, a school can be assessed whether it instigates an overlap of spatial and transpatial solidarities, thus bringing everyone in contact (non-correspondence) or is organised by separate groups maintaining their own string identities(correspondence).

Such an understanding therefore suggests that the spatial layouts of S2, S8, and S10, which are primarily integration code could offer a base for a non-correspondence school community, where spatial location and social labelling do not overlap. On the other hand, schools such as S1, S4 and S5 that offer a more collection code it could be argued that point towards a correspondence model where spatial location and labelling overlap. As regards the remaining schools, the profile of the school community that is suggested by the educational codes is not clear, since the educational code is not robust and clearly identifiable.

Such an understanding is particularly controversial at first sight, since S2, S8, and S10 are all spatially hierarchical and strongly ordered layouts, while S1, S4, and S5 are all courtyard-based schools and thus offer a less strongly ordered school layout. However, if all the spatial conceptualisations are considered, additional light could be shed on this controversy. In particular, the list of spatial conceptualisations that is taken into account for identifying the educational code does not only consider the spatial layout per se but also other dimensions. Specifically, it considers the density of the scheme, the centrality of particular functions in the school, the movement potentials as well as the visual prospects that are offered. Therefore, the spatial order of the school unit is just one of the dimensions that are considered among others.

6.2 Social Agency and the Temporal-Dynamic Educational Code

However, one may argue that 'different approaches to educational practices and school leadership [can] give rise to distinctive school cultures which in turn make differences in the use and adaption of a school building' (Daniels et al., 2019, p.44). In essence, 'humans [could] shape their buildings through design practice (social agency affecting spatial structure), humans[could] shape their organisations through management practice (social agency affecting social structure), then buildings [could] shape organisations (spatial agency affecting social structure), and then both organisations as well as buildings [could] constrain agents in their behaviours (social structures and spatial structure-agency affecting social agency); in turn, humans [could] change the way they shape buildings and organisations, starting the cycle of influences again' (Sailer and Penn, 2010, p.12).

Correspondingly, this study hypothesises that the school environment is a complex socio-spatial whole where different degrees of classification and framing might be identified during different school time periods and thus, it could shift the educational code that is provided by the layout by means of various social decisions (i.e. headteachers' regulations, covid regulations by MOEC etc). Into more details, it is assumed that ongoing socio-spatial dynamics and actors' actions within a school unit are in constant relationship with the school spatial structure and thus might shift the educational code by creating different degrees of classification and framing and thus different solidarities in the school. Therefore, this section aims at investigating:

How does the spatial layout of lower secondary schools and social agency are related? and to what extent the strength of particular social ordering could potentially shift the educational code?

Thus, this subchapter aims at highlighting the interplay between the physical structure, social agency, and decision making. More specifically, the aim of this sub-chapter is to address this relationship between school design and social agency. In order to achieve that, it compares two schools (S2-S9) to highlight that social agency in schools has the ability to shift the educational code that is suggested by the school layout. Additionally, by comparing the S9 during two different periods with different social rules it highlights that in order for a social rule to be able to shift a school's educational code should be strong enough in order to achieve this alteration.

6.2.1 Temporal and dynamic Educational Code

This section compares and contrasts S2 and S9 (in 2020) fig. 6.4. In particular, this section aims at identifying the degree to which a social action that has been applied by the two schools' headteachers can shift a school's educational code.

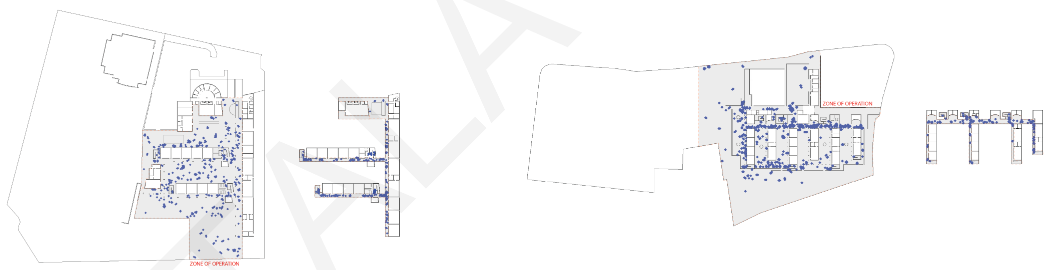


FIGURE 6.4: Zone of Operation with rules Application in S2 (left) and S9 (right)

In particular, the strategy that is implemented by the two headteachers to eliminate completely the sports area is considered. In essence, both headteachers by means of their power authority have restricted students and teachers' zones of operation and thus have prohibited the usage of the open sports area during the school breaks by adding particular fences and by excluding the sports area from the rest of the school. This social action has significantly changed the school's spatial structure, since the school's principal decisions have differentiated the socio-spatial dynamics within the school. Specifically, this action has:

- defined smaller areas for students during breaks;
- influenced users' distribution in the school as well as the spatial potentiality of the school;

- differentiated the relationship between built and unbuilt space, since it excluded the whole open area from the entire school unit;
- influenced students' and teachers' zones of operation;

Variables Addressing Classification & Framing

Educational Code Variables, After Rule Application

Variables	S2	S9
GSI	1.000	-0.100
Floor_Separation	0.111	0.417
Axial_Choice	-0.019	-0.064
Axial_Choice_R3	0.989	0.981
T1024_Choice	0.308	1.000
NACH_Mean	1.000	0.998
NACH_Max	0.529	1.000
FIR_Sports	-0.070	-0.775
Axial_Mean_Depth	0.338	0.182
Axial_Integration	0.341	0.067
T1024_Integration	0.681	1.000
Step_Depth_Admin	-0.489	1.000
FIR_Admin	0.077	0.050
Isovist.Perimeter	0.069	-0.688
FIR_Spe_Classrooms	-0.240	-1.000
FIR_Gen_Classrooms	0.517	1.000
FIR_Cantine	-1.000	-0.506
Visual_Mean_Depth	-0.960	-1.000

TABLE 6.2: Re-calculated and re-scaled variables which take into account the additional rule and excludes the sports area from the analysis

On this account, all metrics mentioned in section 6.1.2 have been re-calculated by excluding the sports area. The complete list of the re-calculated and re-scaled variables is presented in table 6.2. The educational code is then re-examined, compared, and contrasted with the original code that has been suggested by considering the given spatial layout of the school. Lastly, it is schematically placed in the 2x2 matrix fig. 6.5 where a shift from the previous code can be identified.

Specifically, from fig. 6.5 it can be seen that both schools, by excluding the sports area, have enhanced their framing by controlling the interface between users, users' distribution and by

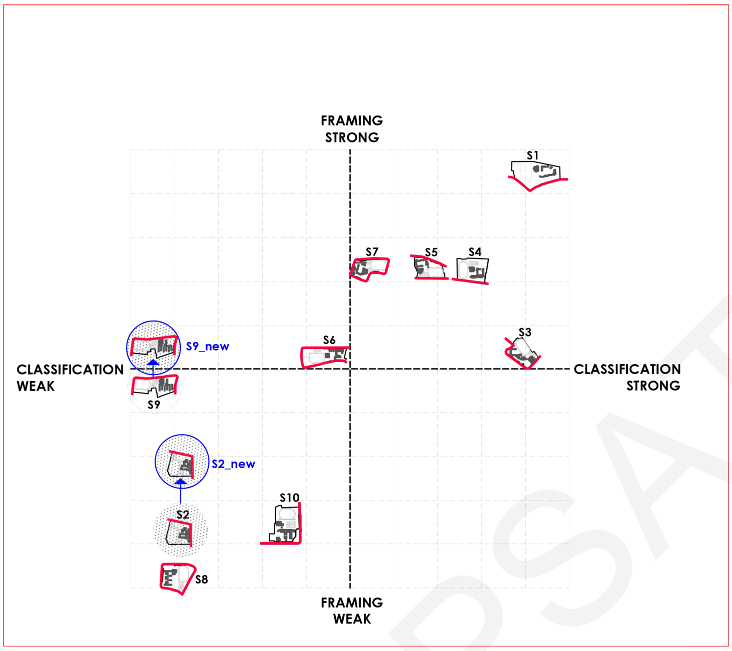


FIGURE 6.5: Shifted educational Code by means of social agency

restricting the space. Subsequently, this shifted image suggests that school 9 moves towards a correspondence school community, but again this is not predominant and that while S2 still complements a non-correspondence school community but not as robust as earlier.

6.2.2 Power Authorities and Socio-Spatial Implications: Covid-19 Measures

Going one step further, a temporal understanding of the educational code and it's relationship with rule application is achieved by studying S9 at two different time periods, before and during covid-19. In particular, covid-19 measures are treated by this dissertation as additional rules and transpatial conditions imposed on the school. Thus, the degree to which those measures have a socio-spatial implication is considered here through a temporal investigation that has derived from two days of observation before covid-19 and two days of observation during Covid-19. Since this section's interest is to investigate the rules' implications on 'un-programmed' activities and the distribution of students within the school, only snapshots of 'un-programmed' activities during breaks have been considered (see chapter 4 for the detailed methodology).

Un-programmed activities are shown in fig. 6.6 and fig. 6.7, and capture school activities before and during Covid-19 measures. From the visual inspection of both figures, it can be seen that the main movement corridor attracts the majority of un-programmed activities within the school. Additionally, both before and during Covid-19 measures, students'

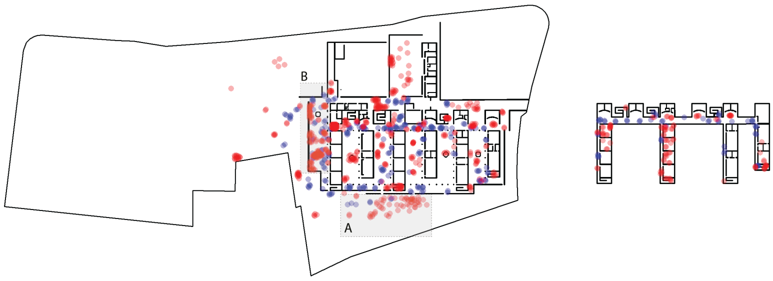


FIGURE 6.6: Location and density of un-programmed activities in School 9 before covid-19 measures during break, Red: Stationary Activities, Blue: Moving Activities

FIGURE 6.7: Location and density of un-programmed activities in School 9 during covid-19 measures during break, Red: Stationary Activities, Blue: Moving Activities

distribution has been limited to one side of the plot. That being the case, both headteachers (in 2018 and 2020) decided to limit students' zone of operation and exclude completely the sports area. In 2018, the restriction of this zone has been achieved by placing teachers on that particular area to operate as a virtual gate that supervises students and prevents them from using the sports area. During Covid-19 (in 2020) this rule has been materialised through a semitransparent fencing that separated the sports area completely from the rest of the school.

The density of space usage in the general outdoor areas surrounding the building seems to be rather sparse both before and during Covid-19 measures. However, the area (A) illustrates a particularly different density of people before and during covid-19. In 2018, this particular area accommodated outdoor gym equipment like an adult playground, and it was particularly famous among male students. However, a few weeks after the observations in 2018, the headteacher by means of his power authority and by claiming issues of health and safety, he removed all the equipment.

Another interesting difference in space usage patterns is observed in the courtyard that is adjacent to the cantine area (B). It seems that before covid-19 measures, this area has attracted more stationary activities than during covid-19. Based on informal discussions with school users, it appears that students tend to use the courtyard adjacent to the cantine area during the winter semester but not so much during the spring semester due to the weather conditions and its exposure to physical lighting and sun radiation. It might be also the case that this area, among others, has not been assigned to a particular level of education for breaks during the covid-19 measures.

Intending to understand more precisely the differences in space usage before and during Covid-19 measures, a normalised density [32] measure has been calculated for all spaces during breaks. The normalisation has been achieved by considering the overall school population. From the normalised density examination, it can be seen that students have been more densely populated in circulation areas and courtyards during the covid-19 measures than before. In addition, both before and during the measures, students have not been allowed to use their classrooms during breaks. However, especially before Covid-19, they tend to use their classrooms much more during breaks than during Covid-19. It might be the case that due to covid-19 ,teachers and the headteacher have been more strict about this rule application than before. Lastly, the density of activities in outdoor areas, sports outdoor, and stairs remained more or less the same.

S9 Behaviours (Before Covid-19)

Comparative Undestanding

Ftype	Students_Number	Norm_Students_Number
Circulation	406.00	1.05
Courtyard	291.00	0.75
Outdoors	122.00	0.32
SportsOutdoor	41.00	0.11
Stairs	54.00	0.14

FIGURE 6.8: Normalised Density of Space Usage in School 9 before covid-19 measures

Thus, it may be argued that despite the new regulations that have been applied to the schools during covid-19, the density and distribution of space usage behaviours have been more or less the same. Thus, this suggests that the power of spatial configuration, in this case, has been predominant, while the rules that have been applied have not been that strong so as to shift the educational code. Instead, the rule that has been applied and has created a tremendous impact on the spatial layout, both before and during covid-19, has been the elimination of the sports area from the rest of the school. This sole social action has restricted the potential zones of operation for students during breaks and shifted the educational code

[32] the density of students is normalised with the total number of students in the correspondence year

S9 Behaviours (During Covid-19)
Comparative Undestanding

Ftype	Students_Number	Norm_Students_Number
Circulation	607.00	1.57
Courtyard	328.00	0.85
Outdoors	129.00	0.33
SportsOutdoor	51.00	0.13
Stairs	55.00	0.14

FIGURE 6.9: Normalised Density of Space Usage in School 9 during covid-19 measures

as illustrated in section 6.2.1. Hence, it could be argued that the morphological, spatial, and functional structure of the school offers an intangible asset that interacts with social agency in many ways and thus produces different outcomes and might shift or not the educational code.

6.3 Conclusion

Specifically, two Bernsteinian concepts have been used to address each school's educational code and decode the relationship between school design and pedagogical practices. This comparative investigation has allowed both the visualisation and quantification of the aforementioned dimensions, but it has also illustrated a methodological way in which the educational codes are comparable between cases.

Besides the classification of schools based on their educational code, this chapter also highlights that socially inscribed rules could influence the configurational structure of the school. In fact, the analysis reveals that socially inscribed rules could differentiate users' potential zones of operation, the schools' operation area during breaks, and the relationship between indoor and outdoor spaces as well as the mutual visual areas of the layout. However, by comparing and contrasting S9 before and during covid-19 measures, it has been revealed that the degree to which a social rule might have a spatial implication seems that depends primarily on its strength and secondly on the spatial configuration where it stands and refers to.

At the same time, this discussion goes beyond the archetypical structure of school buildings and describes the space as dynamically made and unmade. Specifically, instead of focusing only on the physical form per se, it highlights that the school's spatial structure is not stable in time despite the apparent stability of the physical form. In that sense, this relational conception of space offers an alternative understanding of material and immaterial aspects in the study of built form and highlights the importance of empirical data.

All points considered,this analysis has suggested that “space [has to be considered] as constantly changing, as an outcome of the specific mutual relations between people and places and their contexts” (Tornaghi and Knierbein, 2015, p.244). Specifically, it has revealed that even though the school’s built form has appeared to be stable morphologically, there is a certain fluidity in the way socio-spatial dynamics are evolved in space and differentiate the configurational structure of the layout. Thereby, it is becoming apparent that despite the fact that the physical form of the school building itself and the location of the school building in the wider urban context might not change, different socio-spatial dynamics could challenge the ‘flat’ ontology of space.

Chapter 7

Schools' Layout Consistencies, Building Potential and Teachers' Perceptions:Issues on school control, strong school community and school's adaptation to changes

The aim of this chapter is to investigate the implications of schools' characteristics on teachers' perceptions about the actual use of space. In particular, it is assumed that common actions during design might contribute to common school spatial characteristics that could render similar socio-educational potential and thus users' perceptions. Hence, it jointly explores schools' layouts with teachers' perceptions and under three broad themes: issues with school control, the strength of the school community, and the school's adaptation to change. Hence, in order to investigate this hypothesis a four step approach is deployed.

In particular, **at first** a correlation matrix enables to understand whether particular decisions made by the architects have any influence on schools' overall design. **Secondly**, an assumption-based clustering process is used in order to group schools based on their socio-educational potential and explores the three themes mentioned above. **Thirdly**, the above two-fold process provides a series of connections between schools and therefore allows a nuanced understanding of the commonalities and differences between schools both as regards their design as well as their socio-educational potential. In particular, a relationship network is developed and visually reveals the centrality or uniqueness of some schools in the sample. This provides a nuanced understanding that allows to see which schools might have inter-type relationships and whether or not this might be related to a certain extent to teachers' answers. **Lastly,** this chapter deepens the understanding of the way school's spatial characteristics might be related to school's building potential and teachers' perception through various multiple regression models that consider simultaneously various non-colinear variables at a time.

7.1 Correlation Matrix: Investigating the implications of design decisions

Firstly, a comparative correlation matrix investigates the implications of design decisions on schools' layout. The correlation matrix (fig. 7.1) shows significant correlations that are produced through a pearson correlation between all variables (mentioned in previous two chapters) for all schools and identifies pairs of variables that have a positive or negative significant association. Based on the particular association each time, the most representative schools that satisfy the association are classified as one group.

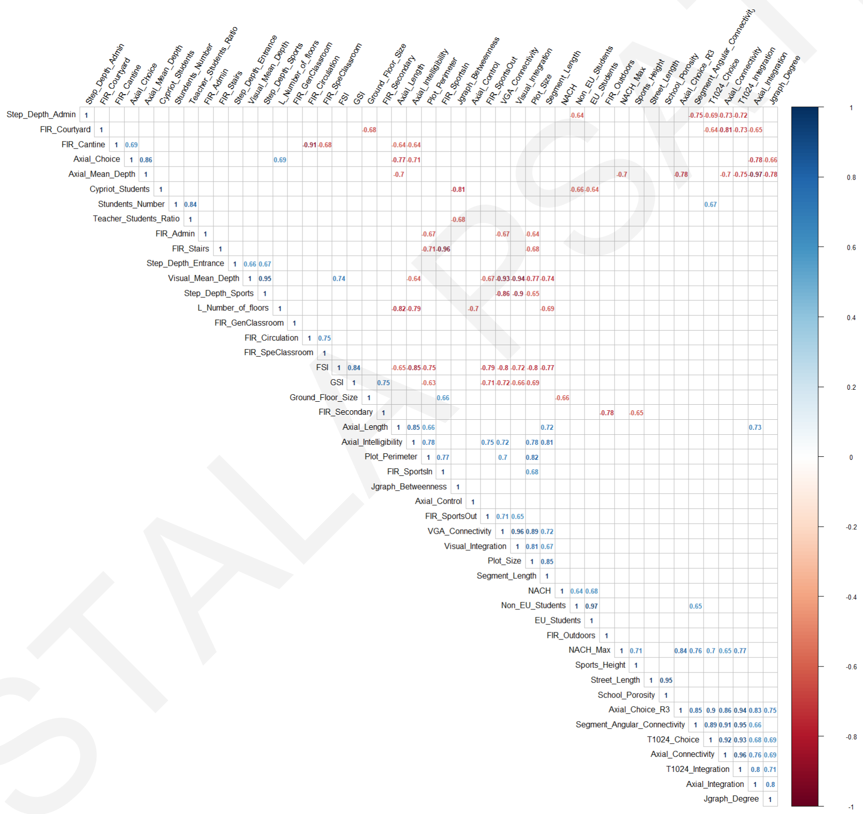


FIGURE 7.1: Correlation Matrix, Pearson Correlations between variables (only significant correlations are depicted)

Overall, the correlation matrix has suggested particular patterns as regards the overall school design, the depth of administration, cantine, classrooms, courtyards as well as sports outdoor. As regards the overall school design (fig. 7.2), it appears that S3,S5 and S7 are featuring very predominantly in many of the associations, since all of them satisfy most of the correlations that have been found (i.e there are schools with high FSI and low segment length). This suggest that those three school share similar characteristics which might be associated with particular design decisions such as the degree to which the school is densified across floors.

As regards the placement of the administration in the schools, it appears that S9 and S10 are featuring together in many associations as well as S1 and S10 (fig. 7.3). Apparently, S9 and S10 have relatively high segment angular connectivity, segment angular choice, and segment angular integration, which assist in the placement of the administration in a relatively low step depth. Interestingly, both schools have a very hierarchical school structure and place the administration at the beginning of this linear system and at the intersection of the school and the road. Additionally, the correlation matrix highlights that schools with bigger school perimeter and plot size, such as S1 and S10, tend to have the administration area less centrally located.

SCHOOL DESIGN							
A/A	VAR.1		VAR.2		HYPOTHESIS	R^2	SCHOOLS
1	Segment Length	↑	Visual Mean Deth	↓	Schools with higher segment length tend to have lower visual mean depth	-0.7	S10,S1,S4
2	Ground Floor Builtable Area	↑	NACH	↓	Schools with more functions on the ground tend to have lower NACH value	-0.66	S1,S10,S3
3	FSI	↑	Segment Length	↓	Schools with higher FSI (denser scheme across floors) tend to have smaller segment length	-0.77	S7,S3,S5
4	GSI	↑	Axial Intelligibility	↓	Schools with higher GSI (denser scheme on the ground) tend to be less intelligible	-0.85	S7,S3
5	GSI	↑	VGA Connectivity	↓	Schools with higher GSI (denser scheme on the ground) tend to less visual connectivity	-0.72	S7,S3,S5, S4
6	GSI	↑	VGA Integration	↓	Schools with higher GSI (denser scheme on the ground) tend to less visual integration	-0.66	S7,S3,S5

FIGURE 7.2: Correlation Matrix, Hypotheses Table 1

As regards the **location of the cantine area** in the school design S6 and S10 are featuring in two of the three associations since both schools are the most representative of the sample have relatively central circulation system and special classrooms, and relatively segregated cantine (fig. 7.4). This association therefore suggests that the centrality that a design proposal assigns to particular functions could potentially influence the centrality of other functions in the school. In both representative schools (S6 and S10) the cantine area is placed right next to the sports indoor, which is at the end of the main school unit. The centrality of cantine appears also to be influence by the axial length that is provided by the design. In this investigation, S8, S9, and S10 appear to be the most representative schools of this relationship since all of the have a relatively high axial length and lower centrality of cantine.

As regards the **special classrooms**, it appears that the overall centrality of the circulation system could influence the centrality of special classrooms. This condition is particularly apparent in S6,S10,S5,S7 where all schools have particularly centrally located circulation areas and centrally located special classrooms (fig. 7.4).

DEPTH OF ADMINISTRATION							
A/A	VAR.1		VAR.2		HYPOTHESIS	r	SCHOOLS
1	Segment Angular Connectivity	↑	Step Depth from Aministration	↓	Schools with higher segment angular connectivity tend to have lower step depth from admin.	-0.75	S9, S10
2	Segment Angular Choice	↑	Step Depth from Aministration	↓	Schools with higher Angular Choice tend to have lower step depth from admin.	-0.69	S8,S9,S10
3	Segment Angular Integration	↑	Step Depth from Aministration	↓	Schools with higher Angular Integration tend to have lower step depth from admin.	-0.72	S8,S9,S10
4	VGA Connectivity	↑	FIR Administation (Axial Centrality)	↓	Schools with higher VGA Connectivity have less centrally located administration	-0.67	S1, S6, S8
5	Plot Perimeter	↑	FIR Administation (Axial Centrality)	↓	Schools with bigger school perimeter tend to have administration less centrally located	-0.67	S1, S10
6	Plot Size	↑	FIR Administation (Axial Centrality)	↓	Schools with bigger school plot tend to have administration less centrally located	-0.64	S1, S10

FIGURE 7.3: Correlation Matrix, Hypotheses Table 2

DEPTH OF CANTINE							
A/A	VAR.1		VAR.2		HYPOTHESIS	R^2	SCHOOLS
1	Axial Length	↑	FIR Cantine (Axial Centrality)	↓	Schools with bigger axial length appear to have cantine areas less centrally located	-0.64	S8,S9,S10
2	FIR Circulation (Axial Centrality)	↑	FIR Cantine (Axial Centrality)	↓	Schools more centraly located circulation tend to have less centrally located cantine	-0.91	S6,S10
2	FIR Special Classrooms (Axial Centrality)	↑	FIR Cantine (Axial Centrality)	↓	Schools more centraly located special classrooms tend to have less centrally located cantine	-0.68	S6,S10

DEPTH OF COURTYARDS							
A/A	VAR.1		VAR.2		HYPOTHESIS	R^2	SCHOOLS
1	FIR Circulation (Axial Centrality)	↑	FIR Special Classrooms (Axial Centrality)	↑	Schools with centrally located circulation tend to have centrally located specila classrooms	0.75	S6,S10,S5,S7

FIGURE 7.4: Correlation Matrix, Hypotheses Table 3

In respect to the **depth of courtyards** it appears that it is influenced by the school's overall segment integration. In particular, schools with higher segment integration such as S8, S9 and S10 have less centrally located courtyards. All three schools are designed based on the logic of a street-like structure with various smaller courtyards and functions on the sides of those streets. Thus, it may be argued that such a design concept creates deeper and more segregated courtyards (fig. 7.5).

As regards **the sports outdoor**, S7 and S3 feature very predominantly in the association made by the correlation matrix. In particular, by the correlation matrix it is suggested that the school layouts that are particularly dense both on the ground floor and across floors such as S3 and S7, tend also to have less centrally located sport outdoor area. On the other hand, schools that tend to have centrally located sports areas tend to have also lower visual mean depth (S1,S10 and S6). Interestingly, the mots representative schools of this relationship (S1,S10 and S6) have among the lowest FSI values of the sample (chapter 5). Thus, it may be argued that the school's overall density (FSI) is a driving force determining the centrality of the sports outdoor area in the school (fig. 7.5).

DEPTH OF SPECIAL CLASSROOMS							
A/A	VAR.1		VAR.2		HYPOTHESIS	R²	SCHOOLS
1	Segment Integration	↑	FIR Courtyard (Axial Centrality)	↓	Schools with higher segment integration tend to have less centrally located courtyards	-0.73	S8,S9,S10

DEPTH OF SPORTS OUTDOOR							
A/A	VAR.1		VAR.2		HYPOTHESIS	R²	SCHOOLS
1	FSI	↑	FIR Sports Outdoor (Axial Centrality)	↓	Schools with higher FSI (denser scheme across floors) tend to have less centrally located sports outdoor	-0.79	S7,S3
2	GSI	↑	FIR Sports Outdoor (Axial Centrality)	↓	Schools with higher GSI (denser scheme on the ground) tend to have less centrally located sports outdoor	-0.79	S7,S3
3	FIR Sports Outdoor (Axial Centrality)	↑	Visual Mean Depth	↓	Schools lower visual mean depth tend to have sports outdoor centrally located	-0.37	S1,S10,S6

FIGURE 7.5: Correlation Matrix, Hypotheses Table 4

As regards the placement of **staircases** in the schools it appears that the plot perimeter is significantly associated with the centrality of staircases in the school (fig. 7.6). In particular, school layouts that have high plot perimeter and plot size, such as S1 and S10, tend also to have less centrally located vertical connections. It should also be noted that S10 being a single floor school has only a few vertical connections connecting the various levels of the ground floor.

DEPTH OF SPORTS INDOOR							
A/A	VAR.1		VAR.2		HYPOTHESIS	R²	SCHOOLS
1	Plot perimeter	↑	FIR Sports Outdoor (Axial Centrality)	↑	Schools with bigger plot perimeter tend to have centrally located sports indoor	0.77	S1,S10

DEPTH OF STAIRS							
A/A	VAR.1		VAR.2		HYPOTHESIS	R²	SCHOOLS
1	Plot perimeter	↑	FIR Staricases (Axial Centrality)	↓	Schools with bigger plot perimeter tend to have less centrally located stairs	-0.71	S1,S10
2	Plot size	↑	FIR Staricases (Axial Centrality)	↓	Schools with bigger plot size tend to have less centrally located stairs	-0.68	S1,S10

DEPTH OF SECONDARY SPACES							
A/A	VAR.1		VAR.2		HYPOTHESIS	R²	SCHOOLS
1	GSI	↑	FIR Secondary (Axial Centrality)	↑	Schools with higher GSI (denser scheme on the ground) tend to have centrally located secondary areas	0.75	S3,S5,S7, S2
1	FIR Outdoor Areas (Axial Centrality)	↑	FIR Secondary (Axial Centrality)	↓	Schools centrally located outdoor areas tend to have less centrally located secondary areas	-0.78	S6,S9,S2

FIGURE 7.6: Correlation Matrix, Hypotheses Table 5

Lastly, **as regards the secondary spaces**, the correlation matrix suggests that the denser the school on the ground (GSI), the more centrally located are the secondary spaces (S3,S5,S7 and S7). Hence, the density that the architect assigns to the ground floor seems is associated with other aspects of the design. Apart from that, the centrality of secondary spaces is also related with the centrality of the outdoor areas of the school. In particular, schools with centrally located outdoor areas such as S6, S9 and S2 tend also to have centrally located secondary areas (fig. 7.6).

Hence, to summarise the above discussion, it is becoming therefore apparent that particular design decisions have contributed to the common spatial conditions between schools. This investigation has highlighted that S1 and S10 are very often associated with each other, which denotes particular similarities in their spatial structure. S3, S5 and S7 appear to share particular spatial characteristics that primarily derive by the density they assign to the school scheme. Based on the above commonalities, it may be expected that those two groups of schools share similar building potential, which could be reflected in users' perceptions.

7.2 Assumption-based Clustering: Investigating the implications of design decisions on building potential

In addition to the above discussion, this section explores how particular consistencies between schools depict particular socio-educational potentials. The consistencies are rendered through an assumptions-based clustering or a logical inference clustering that depicts certain groups of schools as regards three socio-educational themes: issues with school control, the strength of the school community, and the school's adaptation to change. The complete set of assumptions and variables that are used for each type of assumption are summarised in table 7.1, table 7.2, and table 7.3. This process does not aim to falsify or prove the assumptions but rather to identify groups of schools that share similar socio-educational potentials that could potentially be reflected on teachers' perceptions. Hence, only 2 variables per assumption are considered in order to be able to control the clustering better and achieve a better sense-making of the groups formed. During the assumptions-based clustering, the schools have been clustered by using *the affinity propagation clustering technique* (Frey and Dueck, 2007) as implemented in the R package apcluster (Bodenhofer et al., 2019) and is further explained in chapter 4.

The first set of assumption-driven clusterings investigates groups of schools based on their potentiality of being **rule-driven and having issues with the school control**. This list of assumptions derive primarily from the degree of school's exposure to the street network, the 'readability' of the layout, the movement potentials that are offered as well as the location of administration in the system. All assumptions are presented in table 7.1 along with all the variables used for the clustering. The first seven (7) assumptions-based clustering models depict two main groups of schools. The **first group** is composed by **S1,S2,S3,S4,S5,S9** and the **second group is composed by S6,S7 and S8**. The two groups are formed primarily by the degree of schools' porosity towards the exterior environment. Specifically, the first group is defined by small to moderate porosity and has S2 as the most representative school. The second group is defined by relatively high porosity and has as an exemplar S8.

HYPOTHESES: School Design & Potentiality of Use			
A.Issues with School Control			
A/A	**VAR.1**	**VAR.2**	**HYPOTHESIS**
H1a	School Porosity	Segment Length	Relatively high school porosity and high movement potential can contribute to schools that have issues with school control and with students who disobey the rules
H1b	School Porosity	NACH	
H2a	School Porosity	FIR sports outdoor (axial centrality)	Relatively high school porosity and relatively segregated sports area can contribute to schools that have issues with school control and with students who disobey the rules
H2b	School Porosity	Step Depth from Sports	
H3a	Axial Intelligibility	School Porosity	Relatively high school porosity and relatively deep school layout can contribute to schools that have issues with school control and with students who disobey the rules
H3b	Visual Mean Depth	School Porosity	
H3c	Axial Mean Depth	School Porosity	
H4	FIR sports outdoor (axial centrality)	FIR Administration (axial centrality)	The more segregated the sports area is in relation to the administration the less control teachers feel that they have of the school

TABLE 7.1: Table for Assumptions-Based Clustering: Issues with School Control

The last assumption-based clustering model (H4) groups schools slightly differently. The model depicts 4 groups and highlights the diverse conditions between schools as regards the centrality of the sports outdoor area and the administration. In particular, group 1 is composed of S7,S5, S9, and S3, group 2 of S2, S8, and S4, group 3 of S1 and S10, and lastly, S6 forms a single group. S6 forms a single group since the centrality of the sports outdoor area and the administration in this school is particularly different compared to the rest of the schools.

HYPOTHESES: School Design & Potentiality of Use			
B. Strong School Community			
A/A	**VAR.1**	**VAR.2**	**HYPOTHESIS**
H1a	Axial Integration	Step Depth Entrance	Relatively deep school structure can contribute to a correspondance model, while a relatively shallow school to a non-correspondance model of school community
H1b	Axial Mean Depth	Step Depth Entrance	
H2	Axial Integration	FIR Administration (axial centrality)	An integrated school where the administration area is centrally located can offer higher potentials for accidentally meetings and thus stronger school community
H3	School Size	Axial Integration	Smaller schools and less segregated can enhance social interaction and cooperation between school users (Moore, 1986)
H4	Axial Integration	NACH	Higher school accessibility can contribute to denser incidental interactions among students (Pasalar, 2003)

TABLE 7.2: Table for Assumption-Based Clustering: School Community

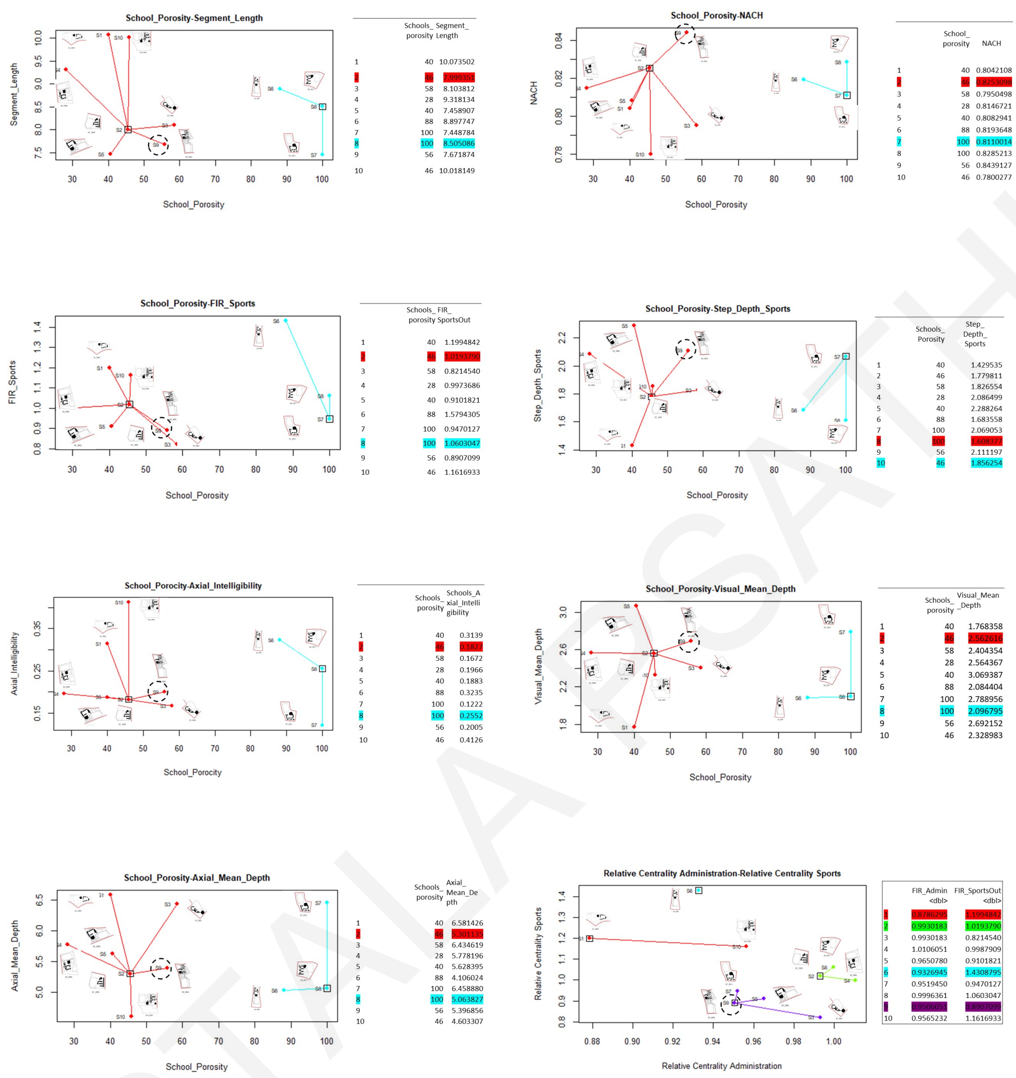


FIGURE 7.7: Affinity Propagation Clustering: Issues with School Control

The second set of assumption-based clustering groups schools based on their potentiality to have strong school community (fig. 7.8). The list that is developed forms assumptions that are related with the overall integration of the school, its depth from the entrance and its size in relation to their potentiality of creating a stronger school community. In particular, table 7.2 summarises the list of assumptions along with the variables that are used for the schools' clustering. At a first glance, it can be seen that S3 and S7 have belonged to the same group in all types of analysis and thus, a similar building potential as regards the school community may be assumed. Additionally, S8 and S10 have belonged to the same group in 4 of the 5 clusterings, suggesting a strong relationship between the schools. Notably, S2 is often depicted as an exemplar of one of the groups (3 out of 5 assumption-based clustering models), highlighting that it shares a lot of similar characteristics with other schools.

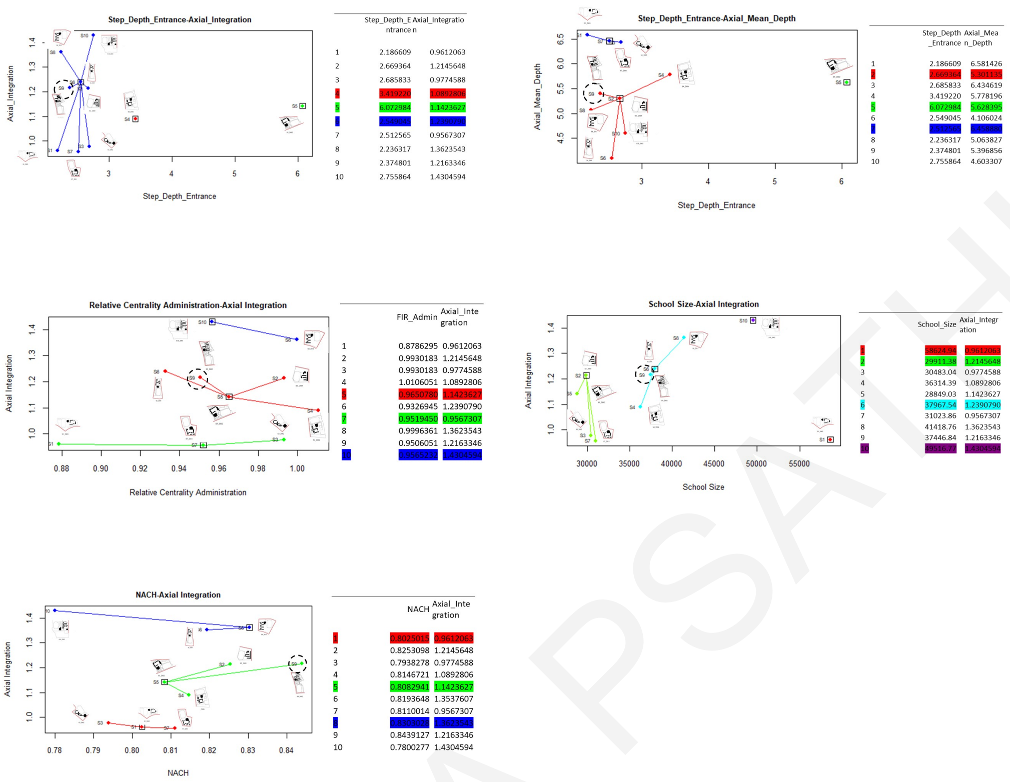


FIGURE 7.8: Affinity Propagation Clustering: Strong School Community

Last, the final assumptions-based clustering model investigates the socio-educational potentiality of schools to cope with changes. It forms hypotheses that are related to the school's ability to cope with future changes, adopt different educational styles, and afford flexible education (table 7.3). Figure 7.9 visualises the groups formed and shows that there are pretty diverse groups of schools. In particular, in this final assumption-based clustering, both hierarchical-based and courtyard-based schools are grouped together. In addition to that, a pair of schools appears very often together in the same group (S6 and S8). Specifically, in 6 out of 7 models, the two schools are featured in the same group, suggesting that those two schools share similar socio-educational potential.

Overall, the consideration of schools based on their socio-educational potential highlights that:

- Schools do share some structuring properties, but they have particularly diverse building potentials.
- Schools that belong to both school types (courtyard-based and hierarchical-based) are often associated both spatially as well as in respect to their socio-educational potential (inter-type relationships).

HYPOTHESES: School Design & Potentiality of Use			
C. Socio-Educational Issues			
A/A	VAR.1	VAR.2	HYPOTHESIS
H1a	NACH	FIR Classrooms (axial centrality)	Relatively centrally located classrooms and high movement options reduce the framing, since the pedagogical process is exposed (Sailer, 2015) and thus can easily adapt to changes in pedagogy
H1b	NACH	FIR Special Classrooms (axial centrality)	
H2	School Size	Axial Intelligibility	Smaller schools and highly intelligible perform better in many aspects such as ability to cope with changes (Tagushi & Kishimoto, 2014)
H3	FIR Special Classrooms (axial centrality)	FIR Classrooms (axial centrality)	The higher the difference between the relative centrality of special classrooms and general classrooms, the stronger the classification in school and differentiation between subjects and thus less ability to adapt to changes
H4	School Size	Axial Integration	Smaller schools and less integrated tend to be more flexible in adapting different educational styles (Tagushi & Kishimoto, 2014)
H5a	FIR Classrooms (axial centrality)	Axial Integration	Isolated and independent classrooms and weak circulation system tend to afford flexible education (Tagushi & Kishimoto, 2014)
H5b	FIR Circulation (axial centrality)	School Size	

TABLE 7.3: Table for Assumptions-Based Clustering: Socio-Educational Implications

- Some schools appear to have very strong ties between them since they are featuring in a lot of associations. For instance, S6,S7 and S8 are all extremely poros schools, S3 and S7 seems that they illustrate similar school community potentials and lastly S6 and S8 seems that share similar potentials as regards the school's ability to change.
- Some schools appear to be related to many other schools (i.e, S2 acts as an exemplar in many clusterings performed).

7.3 Schools' Relationships Network: Identifying relationships between schools' design and potentiality of use

Based on the conditions mentioned above, this section collects insights from both types of analysis in order to render schools' relationships both in respect to their school layout as well as in respect to their socio-educational potential. In particular, the total amount of times a school has belonged to a group with another school (in both types of analysis section 7.1 and section 7.2) have been mapped. Hence, a two-mode matrix of the relationships have been created and visualised through a two-mode network. In essence, the two-mode network visualises the commonalities and difference between school, both as regards their design as well as their building potential (see also chapter 4 for additional methodological insights). Only relationships above 15 are visualised to be able to identify more easily the structuring

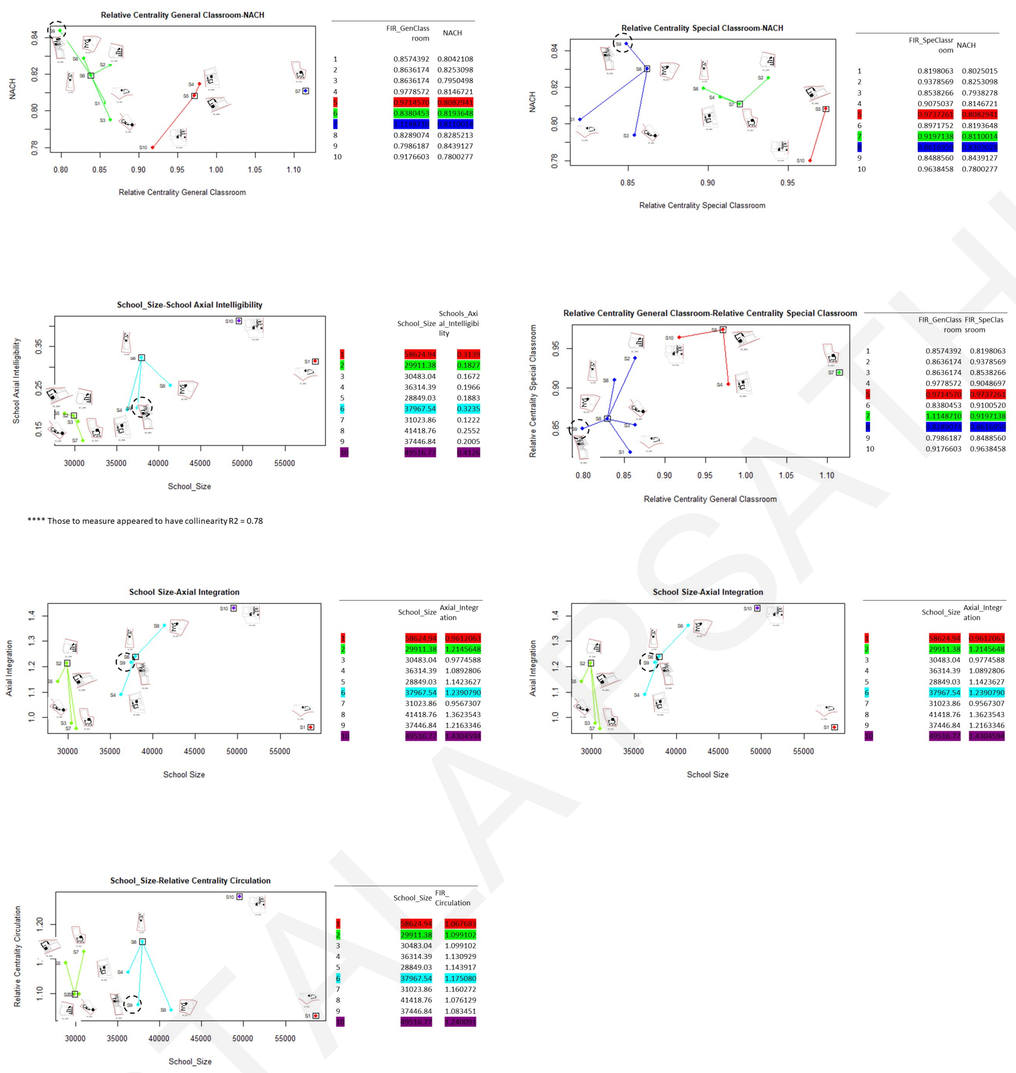


FIGURE 7.9: Affinity Propagation Clustering: Socio-Educational Issues

relationships between schools. This process could assist in rendering the actual relationships between schools based on their layout similarities and thus their socio-educational potential.

Figure 7.10 captures the structuring relationships between schools, both as regards their design and their building potential. By looking at the network diagram, it can be seen that there are only Type-1 schools on the upper part of the network (courtyard-based schools). On the other hand, the lower part of the diagram is composed of all hierarchical-based schools.

S2 is placed relatively centrally in the network as also illustrated in **??** since it operates as an exemplar in many relationships. This suggests that it shares spatial and functional properties with both types of schools. Specifically, S2 is related directly to S9, S3, S5 and S4. Hence, it is indicated that S2, despite being classified in chapter 5 as a hierarchical-type of school,

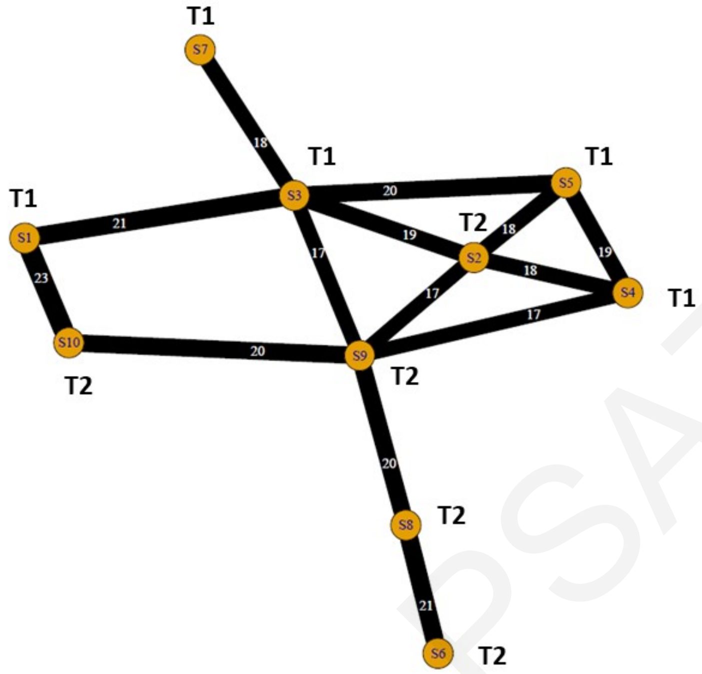


FIGURE 7.10: Network of the Relationships Between Schools

also shares properties with courtyard-based schools. This could resonate well with the fact that S2 illustrates primarily medium values across all space syntax metrics, as highlighted in chapter 5. School9 is another school that illustrates inter-type relationships and is placed relatively centrally in the network of relationships. In particular, it has a strong relationship with S3 and S4, both being courtyard-based schools, and thus expecting similar building potentials.

S7 is mainly connected with S3, suggesting a particular strong relationship between those two schools and thus a similar building potential. This is also expected since in both types of analysis those two schools have been grouped together a lot of times. Additionally, the strength of their relationship has also been rendered by the comparative reading achieved in chapter 5. Specifically, the comparative reading has highlighted that those two schools are the most maze-like schools of the sample and thus might face difficulties with school control and navigation.

S6 is mainly connected with S8 and S8 with S9. This condition denotes that the two schools do relate to each other, yet they might illustrate a unique building potential due to the limited connections with other schools. Lastly, a strong connection also exists between S1 and S10. Notably, this relationship can be traced back to the fact that those two schools have the biggest plots of the sample (as concluded in chapter 5) which seems that it influences a lot of aspects of their overall design as illustrated in section 7.1.

7.4 Teachers' perception in the light of schools' consistencies: Actual use of space and layout design

Based on the consistencies between schools' spatial, morphological, and functional properties and their building potential, this section reflects on teachers' perceptions. Specifically, this section hypothesises that school space is not merely a background to human activity but may influence space usage and thus users' perceptions about their environment. Hence, it further explores the schools' commonalities with teachers' perceptions and explores three broad themes: issues with school control, the strength of the school community, and the school's adaptation to change.

7.4.1 General Description of Data

All 10 schools are taken into account for this investigation. In particular, statistical models have been used to assess the extent to which school layouts play a role in school practices and school reality. In order to investigate teachers' perceptions in relation to schools' spatial characteristics, an explanatory factor analysis has been implemented by utilising by teachers' questionnaires. At the beginning, the relationships between statements have been examined, and it appears that there are several significant correlations between variables that ensure the grouping of variables.

It has also been checked whether all requirements are satisfied so as to run a factor analysis (i.e., normal distribution, all scale variables etc), and then the factor analysis has been implemented. Initially, the KMO has been 0.64. Hence, some variables with low KMO have been taken out of the model to ensure having a KMO above 0.80. Finally, the principal component analysis has suggested the grouping of variables into 3 factors: **Issues with School Control, Strong School Community, and School's Adaptation to Changes such as Covid-19** (the complete list of variables that are grouped under each factor can be found in appendix F). The factors have then been considered with a varimax rotation. Also, a reliability test has been implemented to check the model's reliability (cronbach's alpha has been above 0.70 for all variables). Overall, the first parameter explains 48% of the variation, the second 30% and the third 22%.

Following the factor analysis, firstly a Kruskal-Wallis analysis explores the mean values of teachers' answers per school and then various multiple regression models [33] are developed.

[33]Multiple regression is the statistical procedure that predicts the dependent variable based on a collection of independent variables. Multiple regression models are used in order to develop a single equation to predict the performance of the dependent variable from the set of predictors (independent variables).

Multiple regression analysis is used in order to identify whether teachers' answers (perceptions about the actual use of space) could be linked back to particular properties of space.

In order to implement multiple regression analysis, only schools with representative response rates have been considered (i.e above 15% teachers' response rate), which is found in S1,S2,S7,S9, and S10 (n=73). For this investigation, all scale variables that have been derived by chapter 5 and chapter 6 are considered. Additionally, categorical variables (i.e, school community type) have been recoded and dummy variables have been created. The variables used in all models have been firstly tested for co-linearity. In other words, it has been firstly examined whether some variables correlate with each other and thus cannot be used together in the same model. For each of the models, the assumptions are tested by firstly plotting the standardised residuals, and secondly by using the *gvlma package* in R. In particular, this package provides an interface for examining whether the model satisfies the criteria needed for multiple regression analysis (i.e skewness, kurtosis of the residuals, homoscedasticity etc). Additionally, the outliers are identified by using the *outlierTest* from the package *car* in R. In some cases, the dependent variable (i.e, issues with school control) has been also transformed to achieve a normal distribution (x^3).

All three themes (i.e, issues with school control, strong school community, and school adaptation) are investigated based on the list of hypotheses used for the assumptions-based clustering (section 7.2) and are enhanced with additional hypotheses that are derived by the collection of other types of data (i.e interviews and informal discussions with school users).

7.4.2 Issues with School Control

The first theme that is discussed in the light of the school's layout is the extent to which the school faces issues with school control. At first, in order to understand the differences and similarities in teachers' responses regarding school control, a Kruskal-Wallis [34] test is implemented. Kruskal-Wallis is considered the appropriate method to test the mean values per school due to the fact that some of the schools do not have a representative response rate (few responses per school).

Kruskal-Wallis analysis shows that there are statistically significant differences between schools ($x^2 = 43.22p < .01$). Additional checks on the usage of Mann-Whitney U and the Boferroni correction highlight that there are statistically significant differences between between five (5) groups of schools. In particular, there are statistically significant differences between S3, S5, S7, S10 and all the remaining schools (S1,S2,S4,S6,S8,S9). This indicates that S1,S2,S4,S6,S8,S9 have more or less similar issues with school control even though they belong to different building types. S10 has recorded the lowest mean, suggesting that S10 faces fewer problems with school control compared to all other schools in the sample. On

[34] Kruskal-Wallis is a non-parametric method that examines the distribution of values. The parametric equivalent of the Kruskal–Wallis test is the one-way analysis of variance (ANOVA)

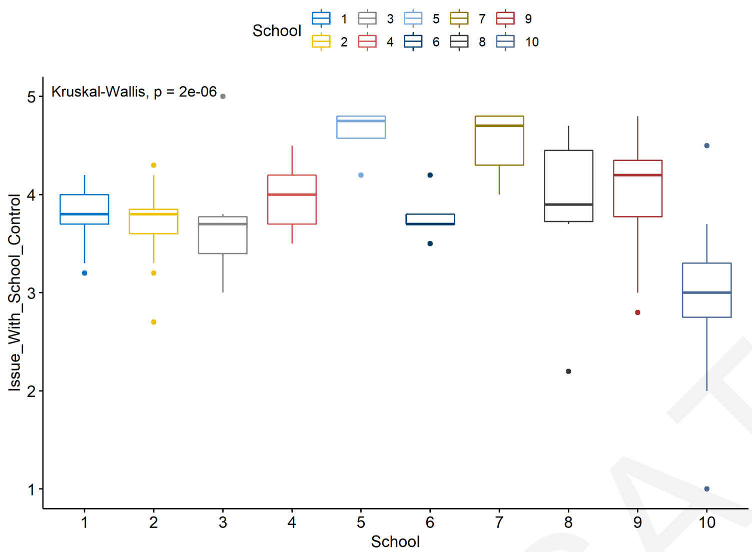


FIGURE 7.11: Kruskal Wallis Analysis of Teachers' Perceptions: Issues with School Control

the contrary, it appears that S5 and S7 have more problems with school control compared to all other schools.

This can be further understood in the light of the schools' relationship network that has been presented earlier (fig. 7.10). S7 not only has recorded the highest mean value as regards issues with school control but also it appears as rather segregated in the overall network. This shows that it has a unique spatial structure that is directly related to S3 and via S3 to S5.

To shed additional light on the differences between schools and the spatial conditions that might be related to problems with school control, this section examines statistically a set of various hypotheses. More precisely, it is hypothesised that:

- H1: Relatively high school porosity and high movement potential can contribute to schools that have issues with school control and with students who disobey the rules;
- H2: Relatively high school porosity and relatively segregated sports area can contribute to schools that have issues with school control and with students who disobey the rules;
- H3: Relatively high school porosity and relatively deep school layout can contribute to schools that have issues with school control and with students who disobey the rules;
- H4: The more segregated the sports area is in relation to the administration, the less control teachers feel that they have of the school;

- H5: A non-intelligible layout with high building density on the ground floor and deep school layout at the entrance can contribute to schools that have issues with school control and with students who disobey the rules;
- H6: A school with less axial control, less density of the ground can contribute to schools which have more issues with school control and with students who disobey the rules;
- H7: A school with a less intelligible layout and a collection mode where there is a dominant separation and differentiation of school users can contribute to schools which have more issues with school control and with students who disobey the rules;

Table 7.4 summarises all models satisfying all criteria for regression analysis (i.e avoid colinearity of variables etc) and have significant results. The analysis shows promising results and indicates a strong connection between schools' configuration and issues with school control. All models are able to explain from 46% to 59% of the variation of teachers' answers regarding issues with school control (i.e students' delinquency, need to do a lot of, effort to make students to follow the rules, they face difficulties to control students etc).

In more details, the **1st model** suggests that **relatively high school porosity and high movement potentiality can provide indications of a school which faces problems with school control**. In this model, 53% of the variation of teachers' perceptions can be explained by considering the school's interface with the adjacent street network and the movement potential offered by the school layout (NACH). Hence, the results could suggest that particularly exposed schools with high movement potential might also face more problems with school control. At last, it should also be noted that in this model normalised angular choice (NACH) is the most important factor (B = 429.27) in predicting issues with school control.

The second model explains 46% of the variation of teachers' answers. In this model, it appears that the most essential factor in predicting teachers' perception of control is the intelligibility value. This model in essence, it suggests that schools with higher intelligibility and lower porosity tend to have less issues with school control, since the school's layout is easily understandable from its parts and at the same time is not influenced by external parameters (i.e exposure to the street).

The 3rd model explains the highest percentage of the variation of teachers' answers (59%). The model examines jointly the amount of axial control that is offered by means of the spatial layout with the density of the scheme on the ground floor. The model suggests that schools with higher axial control and higher density on the ground floor have fewer issues with control and generally students tend to follow the school rules.

Lastly, model4 investigates whether the educational code of the school, as it has been classified in chapter 6 could potentially explain, to a certain extent, teachers' perceptions. Interestingly the model4 can explain 50% of the variation of teachers' answers and highlights

Dependent Variable: Issues with school control					
MODEL 1 - H1	R2 = 0.53	p-value =0.05			
	B	SE	t value	p value	
Constant	-335.17	87.99	-3.809	0.0003	***
School Porosity	0.798	0.1091	7.313	0.00000	***
NACH	429.27	107.9167	3.978	0.00010	***
MODEL 2 - H3	R2 = 0.46	p-value =0.00			
	B	SE	t value	p value	
Constant	46.66	14.27	3.269	0.0016	**
Axial Intelligibility	-83.37	31.42	-2.653	0.00900	**
School Porosity	0.5939	0.14	4.038	0.00010	***
MODEL 3 - H6	R2 = 0.59	p-value =0.00			
	B	SE	t value	p value	
Constant	4237.6	429.8	9.858	0.00000	***
Axial Control	-4148.5	426	-9.739	0.00000	***
GSI	-610.8	118.7	-5.148	0.00000	***
MODEL 4 - H7	R2 = 0.50	p-value =0.00			
	B	SE	t value	p value	
Constant	110.51	6.574	16.811	0.00000	***
Axial Intelligibility	-161.7	24.37	-6.633	0.00000	***
IntegrationVsCollection	-19.68	4.67	-4.215	0.00000	***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

TABLE 7.4: Multiple regression analysis exploring issues with school control, significant models

that in integration code [35] schools that are highly intelligible, there are less problems with school control.

Hence, it could be argued that the first two regression models highlight that the school's interface with the street is an essential factor when considering issues with school control. However, it is only important when it is considered jointly with other factors such as the school's movement potential (NACH) and school's axial intelligibility. Additionally, model no.3 shows that the ground space index (GSI) or the compactness of the scheme on the ground floor should be considered jointly with the school's axial control [36]. Thus, the density of the school should be considered jointly with the amount of immediate connections the school's configuration offers. Model 4 also shows that the school's educational code

[35]Integration code is defined in chapter 6 of this thesis and refers to schools that thrive of openness. It is also characterised by weak classification and framing as explained in section 2.3.3. The educational code is a categorical variables and thus has been re-coded having as a reference group integration code.

[36]'Control measures what degree of choice each space represent for its immediate neighbours as a space to move to' (Space Syntax, 2021)

(suggested in chapter 6) is also important when considering problems with school control. Yet, only when it is considered jointly with the layout's ability to be intelligible. However, by considering the t-statistics, it can be argued that axial control and school porosity are the most important predictors. More precisely, both variables have a particularly higher association (-9.373, 7.31, respectively) with the outcome variable compared to all the other spatial variables that are tested.

Lastly, it appears that the hypotheses that have been proven are the following:

- H1: Relatively high school porosity and high movement potential can contribute to schools that have issues with school control and with students who disobey the rules;
- H3: Relatively high school porosity and relatively deep school layout can contribute to schools that have issues with school control and with students who disobey the rules;
- H6: A school with less axial control, less density of the ground can contribute to schools which have more issues with school control and with students who disobey the rules;
- H7: A school with a less intelligible layout and a collection mode where there is a dominant separation and differentiation of school users can contribute to schools which have more issues with school control and with students who disobey the rules;

7.4.3 School Community: Positive Relationships Between School Users, Trust and Support School Culture

Secondly, the relationships between school users, the degree to which a school promotes a trust and support culture, and thus, the teachers' perception of a strong school community is investigated.

Kruskal-Wallis analysis (fig. 7.12)shows that there are statistically significant differences between schools ($x^2 = 17.71 p = 0.03$). Additional checks on the usage of Mann-Whitney U and the Boferroni correction highlights significant differences between six (6) groups of schools. In particular, there are statistically significant differences between S1, S2-S9, S3-S4-S8-S10, S5, S6, S7. School2 and school9 have recorded among the strongest school community based on teachers' responses. This can be further understood in the light of the schools' relationship network that has been presented earlier (fig. 7.10). Both schools are particularly central in the relationships network and have the most inter-type relationships of the sample. On the other hand, schools 1 and 10 have among the lowest mean values, suggesting that the strength of the community in those schools is significantly weaker compared to all the other schools. Interestingly, those two schools have illustrated many connections in section 7.1 which depicts their similar spatial structure which could ebe argued that is reflected to a certain extent on teachers' perceptions. In particular, they have the biggest plot of the sample and overall lots of connections between them as illustrated in fig. 7.10.

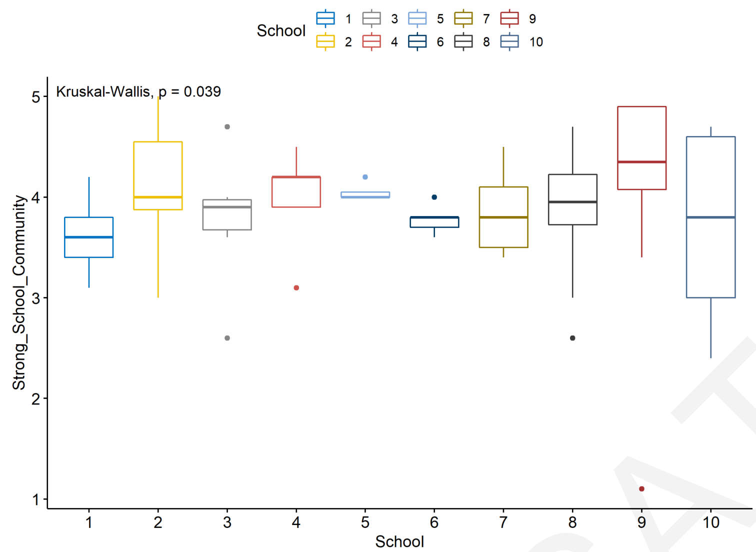


FIGURE 7.12: Kruskal Wallis Analysis of Teachers' Perceptions: Strong School Community, Trust and Support School Culture

S6 and S7 also recorded among the lowest mean values and interestingly, as located on two segregated edges of the relationships' network, which reveals their unique spatial structure.

Drawing on existing research in the field and by collecting insights from the informal discussion with school users, it has been hypothesised that:

- H1: Relatively deep school structure can contribute to a strong correspondence model (Hillier and Hanson, 1984),while a relatively shallow school to a strong non-correspondence model of the school community;
- H2:An integrated school where the administration area is centrally located can offer higher potential for accidental meetings and thus a stronger school community;
- H3: Smaller schools and less segregated can enhance social interaction and cooperation between school users (Moore, 1986);
- H4: Higher school accessibility can contribute to denser incidental interactions among students and thus, a stronger school community (Pasalar, 2003);
- H5: A school with a higher local choice of movement offers more local potential for accidental meetings while moving and thus is perceived by teachers as a stronger school community;
- H6: In smaller, integrated schools that belong to the integration educational mode, teachers tend to perceive that the strength of the school community is higher;
- H7: In integrated schools that have high movement potential users tend to meet more often with each other and thus teachers tend to perceive that the strength of the school community is higher;

In an effort to explore the list of hypotheses above, a series of multiple regression models has been developed. The table 7.5 illustrates the best produced models that illustrate the best fit. However, all models only explain 20% of the variation of teachers' answers. The first model assumes that when a school layout offers high movement potential and high integration might provide a stronger community. Despite the fact that the model proves the hypothesis, only 20% of the variation can be explained. The model also suggests that the most important factor in predicting the strength of the school community is the NACH value, thus the movement potentials that are offered by the school's layout (t=3.49).

Dependent Variable: Strong School Community					
MODEL 1 -H7	R2 = 0.20	p-value =0.000			
	B	SE	t value	p value	
Constant	-404.54	125.7	-3.218	0.002	**
Axial Integration	42.83	18.24	2.348	0.02190	*
NACH	515.85	147.81	3.49	0.00088	***
MODEL 2 - H4	R2 = 0.20	p-value =0.00			
	B	SE	t value	p value	
Constant	24.794	10.9894	2.256	0.0273	*
Segment Integration	0.4884	0.1188	4.113	0.00010	***
MODEL 3 - H5	R2 = 0.21	p-value =0.00			
	B	SE	t value	p value	
Constant	3.1028	0.4873	6.239	0.000	***
Axial Choice R3	0.01588	0.0057	2.784	0.00700	**
Visual Integration	-0.0003	0.0168	-0.015	0.98800	
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

TABLE 7.5: Multiple regression analysis exploring the strength of school community, significant models

The second model considers only segment integration and explains 20% of the variation. Specifically, this model suggests that teachers tend to evaluate their school community as stronger in schools with higher segment integration.

Lastly, model 3 proves that choice metrics are also important when considering the strength of the school community. Specifically, model 3 explains 21% of the variation of teachers' answers, and the most essential factor in this prediction is the local axial choice (R3). Therefore, this suggests that schools which offer more options at a local scale, namely, more often an axial line lies on the shortest topological path between any pair of axial lines locally, are also perceived by teachers as having a stronger school community.

Conclusively, although this analysis does not illustrate high impact results, yet, it may suggest that the most important spatial factors predicting the strength of the community are segment integration and NACH (t=4.11, 3.49, respectively), thus school's overall integration and movement potential. Subsequently, it could be argued that the school layout's ability of providing a permanent form of co-presence by means of integration and a temporal form of co-presence by means of movement appears to be particularly important when considering the strength of the school community. Lastly, it appears that the hypotheses that have been proven are the following:

- H4: Higher school accessibility can contribute to denser incidental interactions among students and thus, a stronger school community (Pasalar, 2003);
- H5: A school with a higher local choice of movement offers more local potential for accidental meetings while moving and thus is perceived by teachers as a stronger school community;
- H7: In integrated schools that have high movement potential users tend to meet more often with each other and thus teachers tend to perceive that the strength of the school community is higher;

7.4.4 School Adaptation to Changes

Lastly, the teachers' perception regarding the school's ability to cope with changes is discussed. Firstly, in order to understand the differences and similarities in teachers' responses, a Kruskal-Wallis test is implemented (fig. 7.13). Kruskal-Wallis analysis shows that there are statistically significant differences between schools ($x^2 = 23.20p = 0.005$). Additional checks on the usage of Mann-Whitney U and the Boferroni correction highlight significant differences between the six (6) groups of schools. In particular, there are statistically significant differences between S1-S2-S4-S9-S10, S3, S5, S6, S7, and S8. Schools 2,3, and 6 have among the highest mean values. In contrast, teachers' from S7 have evaluated their school with the lowest mean value of the sample. This implies that S7 struggles the most with adaptation to changes in comparison with all the other schools of the sample. Interestingly, S7 has also recorded the highest mean value regarding issues with school control (discussed in section 7.4.2) and is among the most segregated schools of the sample as illustrated in fig. 7.10. This shows, that S7 is the school that has performed the worst in many respects and has the most unique spatial structure of the sample.

In order to investigate the school's spatial characteristics that might be related to teachers' perceptions regarding the school's ability to cope with changes, the following list of hypotheses is developed: The particular set of hypotheses examined is:

- H1: Relatively centrally located classrooms and high movement options reduce the framing, since the pedagogical process (Sailer, 2015) is exposed and thus can easily adapt to changes in pedagogy;
- H2: Smaller schools and highly intelligible tend to be more adaptable to changes (Kishimoto and Taguchi, 2014);

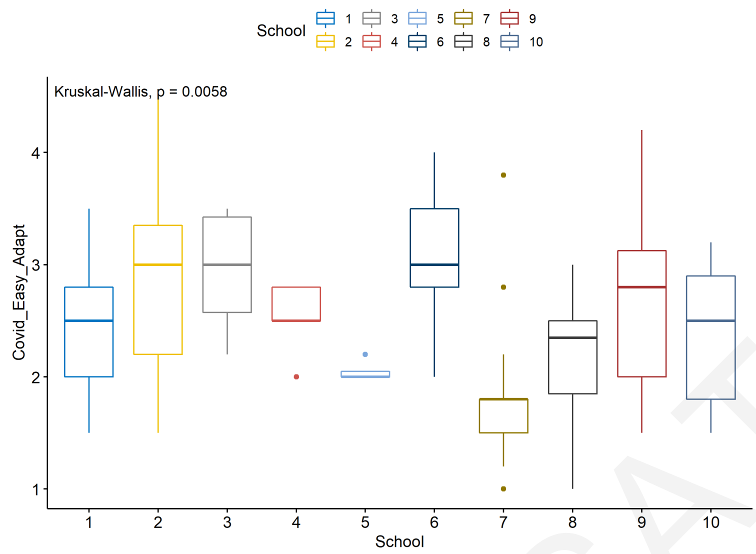


FIGURE 7.13: Kruskal Wallis Analysis of Teachers' Perceptions: Strong School Community, Trust and Support School Culture

- H3: The higher the difference between the relative centrality of special classrooms and general classrooms, the stronger the classification in school and differentiation between subjects and thus the less ability to adapt to changes;
- H4: Smaller schools and less integrated tend to be more flexible in adapting different educational styles (Kishimoto and Taguchi, 2014);
- H5: Isolated and independent classrooms and weak circulation system tend to afford flexible education (Kishimoto and Taguchi, 2014);
- H6: Schools that tend to have less centrally located general classrooms tend to be more adaptable to changes;
- H7: Schools that tend to be more integrated, are smaller and have fewer issues with school control tend to be more adaptable to changes;
- H8:Schools that tend to have more density on the ground floor, higher intelligibility and less visual step depth from entrance tend to be more adaptable to changes;
- H9:Schools that tend to have more density on the ground floor, less interface with the street, less visual step depth from entrance and fewer issues with school control tend to be more adaptable to changes;
- H10: Schools that tend to be more integrated, smaller, and have an integration code tend to be more adaptable to changes;

The best produced significant models but with rather small response variability are presented in table 7.6. Across the models, a range of 15% to 17% of the variation of teachers' answers regarding the school's ability to cope with changes can be explained. The 1st model, by solely considering the centrality of the general classrooms in the school, explains 15% of the variation. Hence, it suggests that the more centrally the classrooms are located in the school, the more difficult it is for teachers to cope with changes (i.e, the changes that are produced due to covid-19).

The second model considers the integration of the school along with the school's size (number of students) and the educational code (as it is classified in chapter 6). The second model by considering the above factors explains 17% of the variation. In that sense, it could be claimed that an integration code school that thrives from openness but at the same time it is small and has low segment integration can be more easily adapted to changes than a highly integrated and collection code school with more students.

Dependent Variable: Easy Adaptation to Changes (i.e Covid-19)					
MODEL 1 - H6	R2 = 0.15	p-value =0.000			
	B	SE	t value	p value	
Constant	5.225	0.7834	6.667	0.0000	***
Centrality of General Classr.	-2.998	0.8607	-3.483	0.00087	***
MODEL 2 - H10	R2 = 0.17	p-value =0.00			
	B	SE	t value	p value	
Constant	2.2485	0.6651	3.381	0.00122	**
Segment Integration	-0.044	0.01924	-2.291	0.02517	*
Number of Students	0.0065	0.003527	1.857	0.06779	
IntegrationVsCollection Code	2.7047	0.95927	2.82	0.00630	**
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

TABLE 7.6: Multiple regression analysis exploring the adaptability of school to change, significant models

Conclusively, despite the fact that none of the models have managed to explain much of the variation of teachers' perceptions about school ability to cope with changes, spatial indicators such as the centrality of the classrooms, the overall integration of the school as well as its educational code suggested by the layout appear to be some of the most important factors for predicting teachers' perceptions. Lastly, the results suggest that classrooms' centrality is the most essential factor (t=-3.483) in predicting teachers' perception of the school's ability to cope with changes. Hence, the hypotheses that have been proven by this analysis are the following:

- H6: Schools that tend to have less centrally located general classrooms tend to be more adaptable to changes;
- H10: Schools that tend to be more integrated, smaller, and have an integration code tend to be more adaptable to changes;

7.5 Conclusions

To conclude, as regards teachers' perceptions of facing issues with school control, S7 and S5 appear to have more issues with school control compared to all other schools. In particular, in comparison to all other schools, S7 has recorded the highest means value about issues with school control. This school has also been pointed out on the network diagram in section 7.3 as rather segregated and directly connected only with S3, suggesting that it is spatially different from all the other schools of the sample. By tracing back to the best-produced model regarding issues with school control S7 has also recorded the lowest axial control of the whole sample and relatively moderate GSI value. S7 also has the lowest axial intelligibility of the sample and the highest percentage of school interface with the street (100% poros school). On the other hand, S10 that has recorded the lowest value for having issues with school control, has among the highest axial control values and the highest intelligibility of the sample. Interestingly, from the relationships network (section 7.3) it appears that S10 shares properties with both hierarchical-based and courtyard-based schools, since it is connected with schools from both types (S1, S9).

Secondly, as regards the strength of the school community, it appears that S2 and S9 have the highest mean values. Both schools have illustrated particularly strong connections in the network diagram, thus suggesting a similar spatial configuration and thus building potential. At the same time, both schools are particularly central in the schools relationships' network which shows that they do share a lot of properties with other schools. Not only, S2 has been an exemplar in many assumption-based clusterings which suggests that it has a structure that shares propeorties with both types of schools.

S9 also has a strong connection with S10, which also has among the strongest school communities based on teachers' answers. Interestingly, all 3 schools belong to the hierarchical type of schools, but it seems that they also share properties with the courtyard type of schools (as illustrated in the schools' network diagram). Hence, this might suggest that schools that have shared properties with both types of schools (i.e courtyard-based and hierarchical-based) are more inclined to illustrate a stronger school community.

Lastly, regarding the school's ability to cope with changes, S7 has significantly lower mean values compared to all other schools. Interestingly, as it is concluded by chapter 5, S7 is the only school of the sample that has centrally located classrooms. At the same time, it has among the lowest segment integration values and among the highest number of students of the sample. Thus, its spatial structure is particularly unique and it does not seem that shares many common properties with other schools. On the other hand, S2 and S3 have recorded the highest mean value. S2 and S3 have also illustrated significantly strong ties between them in the relationships network diagram (section 7.3) which highlights that their spatial configurations have similarities which might be reflected on teachers' perceptions.

Conclusively, it can be argued that S7 is the school that has performed the worst in respect to

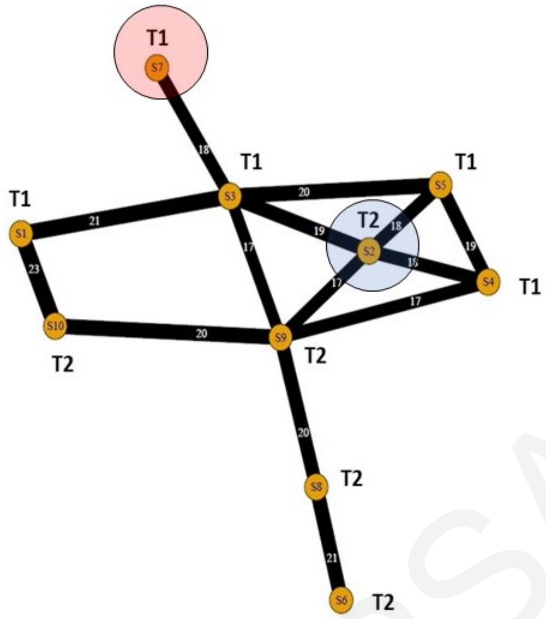


FIGURE 7.14: Network of the relationships between schools, unique and similar spatial characteristics

all themes that have been explored. Namely, it has recorded a significantly high mean value as regards issues with school control, among the lowest as regards the strength of the school community, and the lowest as regards the school's ability to cope with changes. This is also reflected on the fact that is among the most segregated schools of the sample in the fig. 7.14 which reveals its unique spatial structure. On the other hand, S2 seems that performs the best in many respects in comparison to the other schools. Specifically, it has recorded among the lowest mean values regarding issues with school control, among the highest mean value regarding a strong school community, and the highest mean value regarding the school's ability to cope with changes.

Chapter 8

Reflections on School Life, Actual Use of Space, Spatial Layout and Students' Perceptions

Schools are particularly interesting examples for investigating space usage patterns since they are characterised by entirely different dynamics depending on the time. At the same time, collective behaviours that involve more than one individual, like students who form small or large groups, talk to each other, talk to teachers, exchange information, and coexist in space with others are particularly important for the examination of mechanisms of solidarity in schools.

As it is discussed in chapter 2, mechanisms of solidarity might be spatial or transpatial. Specifically, spatial solidarity may arise by means of proximity and co-presence, while transpatial solidarity by means of kindship, affiliation or profession (Hillier and Hanson, 1984; Sailer and Penn, 2009). Based on the distinction between spatial and transpatial relationships, Hillier and Hanson (1984) defined the concepts of correspondence and non-correspondence models. A non-correspondence school community might arise when spatial encounters are reinforced by transpatial solidarity, while a non-correspondence school community may be achieved when transaptial solidarity overcomes spatial proximity. Thus, a correspondence school community could be considered as primarily characterised by exclusivity, local strength, and boundaries. On the other hand, a non-correspondence school community could be considered as characterised by openness, equality, global strength, and inclusivity (Sailer, 2015). Hence, it can be argued that the presence and co-presence of users in open-air school buildings might be considered the mechanisms through which spatial solidarity is achieved in school space and can be distinguished in two types: permanent and temporal. The first one may arise by means of synchronic co-presence in space (permanent form) and the second through movement flows.

Hence, this chapter builds on all previous chapters that have classified schools based on their unique socio-spatial characteristics in relation to building potential and the school community, and aims at enriching previous conclusions with empirical evidence. In particular, this chapter aims:

- To understand more in-depth space usage patterns in schools;
- To offer an empirical validation of the concepts investigated in other chapters (i.e, educational codes and school community type that has been presented in chapter 6);
- To investigate the role of the school's spatial layout in space usage patterns;
- To shed additional light on the spatial conditions that contribute to a particular school community type;
- To use this empirical knowledge in order to understand students' perceptions.

In order to achieve the overarching aims, this chapter elaborates on the school's life and students' perceptions to understand the interplay between the school's socio-spatial structure with students' perceptions. In essence, it draws on observational data through route tracing, snapshots and the 'walk and talk' method (see also chapter 4 for more methodological insights) as well as on students' qualitative feedback through online standardised questionnaires from two schools (S2 and S9).

Hence, this chapter is composed of two main parts. The first part (section 8.1) discusses empirically school life and space usage patterns. More specifically, it discusses the two different types of school community that can be found in the two schools under investigation. Firstly, it evaluates the two different forms of co-presence by considering firstly the movement patterns and secondly the intensity of various stationary activities (i.e, sit, stand, play, etc.). Then, it uses students' qualitative feedback to shed light on the ways in which the actual use of space might be related to the way students' express themselves about their school.

The second part (section 8.2), attempts to understand more precisely the driving forces behind students' positive attributes towards their school. More specifically, by correlating insights from students' qualitative feedback with spatial data that are derived from the spatial analysis, it provides a socio-spatial understanding of students' positive attributes towards school.

8.1 Space Usage Patterns, School Community and Students' Perceptions

The first part of this section sets out to explore the temporal forms of co-presence in two schools (S2 and S9) through the analysis of the collective patterns of movement. Based on the insights retrieved from chapter 3, two distinctive types of movement are identified and discussed 'programmed' and 'un-programmed' types of movement. Through the study of visualisations that are grouped according to the school's programme, this section evaluates where and how movement flows are generated. It also discusses parameters defining these two types of movement (section 8.1.1).

A second section, 8.1.2, discusses stationary activities during school breaks and forms of permanent co-presence (synchronic co-existence in space). School breaks are considered a vital source of information as regards young adolescents' school life, since it is the time when they informally socialise and interact with their friends and with the whole school community. At last, the final section synthesises the conclusions and reflects on students' qualitative feedback (section 8.1.3).

8.1.1 Collective patterns of movement: Temporal forms of co-presence

This section discusses the patterns of movement flows in the two schools under investigation (S2 and S9). It aims to understand movement patterns in the two schools and to investigate whether the school's configurational logic (Pasalar, 2003), the school's functional distribution (Sailer, 2010) as well as various organisational rules (Capille and Psarra, 2014; Hillier and Penn, 1991) might shape movement patterns.

Movement in both schools is presented in fig. 8.1 and fig. 8.2 and it can be seen that it is mainly concentrated on the schools' ground floors. This is reasonable since the ground floor hosts most of the functions as well as the entrance and exit points. In both schools, no movement trails are recorded in the outdoor sports area, since both headteachers forbid the use of the sports area and only controlled access is allowed during gymnastics classes as already explained in chapter 6. In order to understand further the movement flows in both schools, the movement trails are examined within their very specific time frame (firstly for S2 and secondly for S9).

Based on the distinctive time frame in which it is generated, movement in schools in Cyprus can also be classified into 'programmed' and 'un-programmed'. More specifically, as explained in chapter 3, a typical school day is divided in five (5) distinctive time frames: entrance, module, transfer, break and exit hour. Thus, the 'programmed' types of movement could address the movement patterns that are to a certain extent orchestrated based on distinct origins and destinations. For instance, during the entrance or exit hours, all students move from or towards the entrance-exit of the school. Also, during transfers, students move in-between modules by having a particular origin (i.e their general classrooms) and a specific destination(i.e music classroom). On the contrary, 'un-programmed' movement happens mainly during breaks, where students can freely move within the school [37].

Hence, it can be understood that the above movement types differ significantly both on their logic as well as on their duration. Thus, due to their diverse nature, the different types of movement are studied differently and through different methods. The **'programmed'** type

[37] Even with the Covid-19 measures that were applied during the observations' period, students were allowed to move freely within the school without any particular restriction.

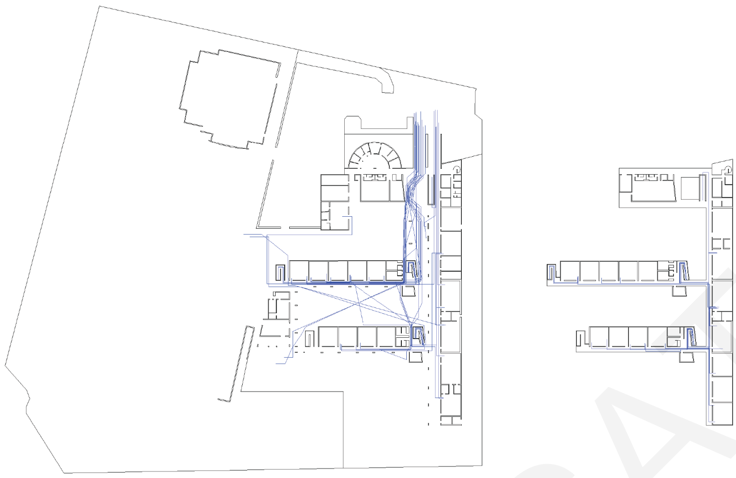


FIGURE 8.1: Flow of Students' movement in school2

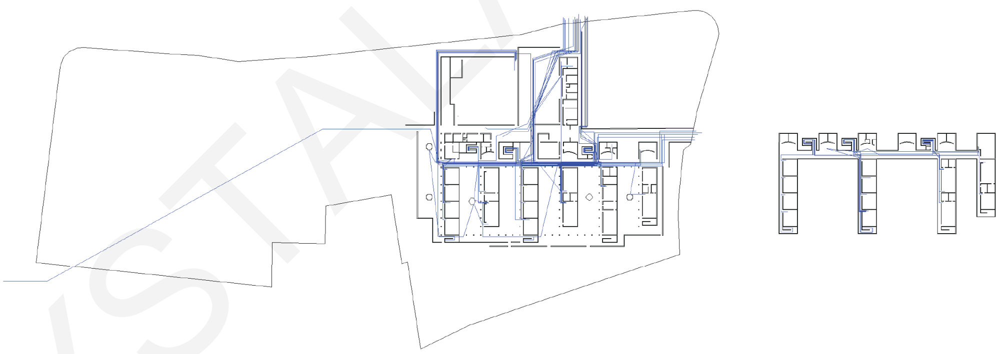


FIGURE 8.2: Flow of Students' movement in school9

of movement is studied through movement traces that are able to capture the particular origin and destination of the user and thus the independence of the movement pattern with the school's timetable. On the other hand, due to the fact that the **'un-programmed'** type originates from everywhere and lead to everywhere in the school, it is studied through snapshots (see also chapter 4 for a more detailed explanation of the methods) that offer a more holistic image of the distribution of the users within the school.

8.1.1.1 'Programmed' Movement

In an attempt to understand the 'programmed' types of movement, movement patterns during entrance, transfers and exit are considered. Firstly, fig. 8.3 and fig. 8.4 capture the movement patterns during the **entrance hour**. At a first glance, it can be seen that during this time of the school day, both schools operate more like an 'open waiting area' where students select areas close to their classrooms for sitting or hanging out with their friends prior to the school's official starting hour. Students' entrance in the school building normally starts from 7:00 until 7:35 a.m which is the official school starting hour. The entrance hour in both schools is characterised by a gradual students' arrival and movement trails that originates from one or more entrances.

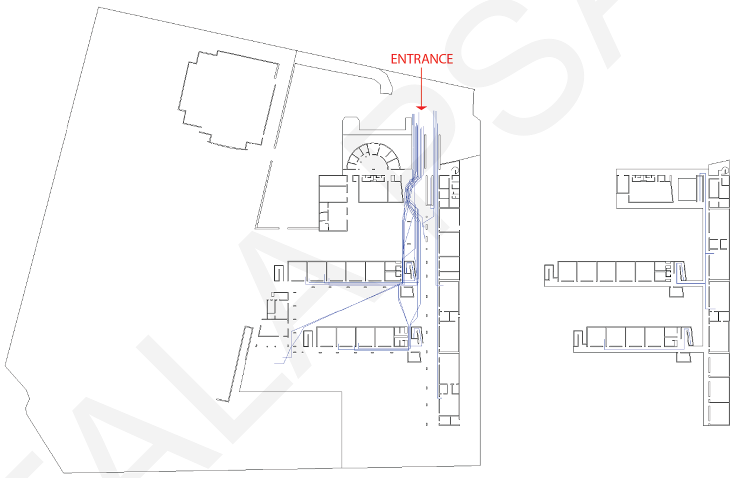


FIGURE 8.3: Flow of Students' movement in school2 (Entrance Hour)

Movement in **S2 during entrance hour** as it is shown in fig. 8.3 initiates from one main source, the main school entrance, and there is an increased congestion in this area. The observations also highlight that the students entering the school earlier than the official starting hour usually select a location near or adjacent to the classrooms they are attending during the 1st educational period. What is interesting is that students' moving towards the locations that are in close proximity with their classrooms do not follow strictly the movement spine of the school, but instead, they select various informal paths parallel to the main movement structure and some informal paths which cross diagonally through the courtyard area. Additionally, despite the fact that the movement traces during the entrance hour are observed primarily on the ground floor, the staircase that is selected most often is the central staircase in the middle of the building rather than the staircase that is located next to the entrance.

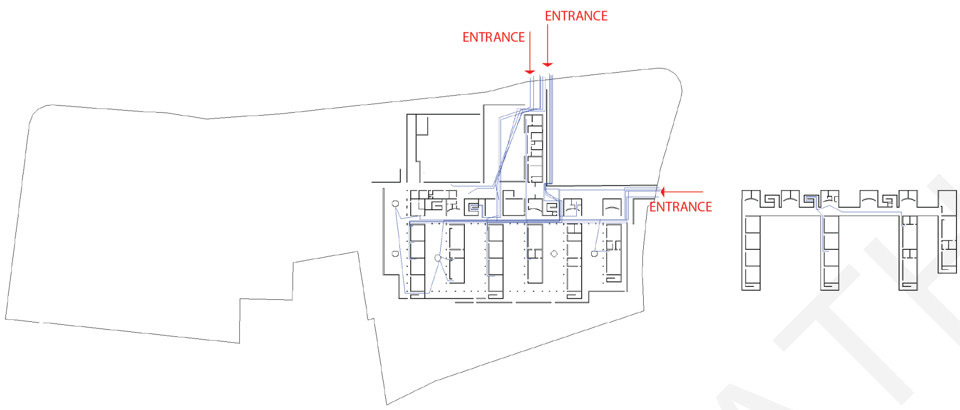


FIGURE 8.4: Flow of Students' movement in school9 (Entrance Hour)

On the other hand, **S9 has more equally distributed origin points during the entrance hour** , since it has three (3) entrance points, two next to each other and another one on the other side of the plot. What is also interesting in S9 is that the movement trails mainly follow the main movement structure of the school. Very few instances can be observed where students have adopted informal paths crossing diagonally the courtyard areas (the one next to the entrance). In addition, in S9 the movement patterns during the entrance hour happen primarily on the ground floor. However, when students move vertically, they tend to use the staircase that is in the middle of the building rather than the one that is next to the entrance.

Secondly, **during transfer hour**, movement patterns in both schools are primarily generated from one classroom to another. This type of movement is particularly quick and programmed, since there is an almost orchestrated movement from a very specific function to another very specific function in the school. Therefore, only a few traces per school have been able to be recorded, since in the majority of cases only one trace per student and per transfer has been captured.

During transfers, school life in S2 is significantly different in comparison to the entrance hour, since students are released from all locations of the building and move to all the remaining parts of the building depending on the school programme. At a first sight it can be seen that there is no predominant movement structure but rather sparse movement flows at the centre of the building. During transfers, three out of five staircases are highly used, while the overall movement patterns seem that follow to a certain extent the movement structure of school. Also, there are several informal crossings through the courtyard in the middle of the school. Interestingly, no students' movement trails are recorded on the upper part

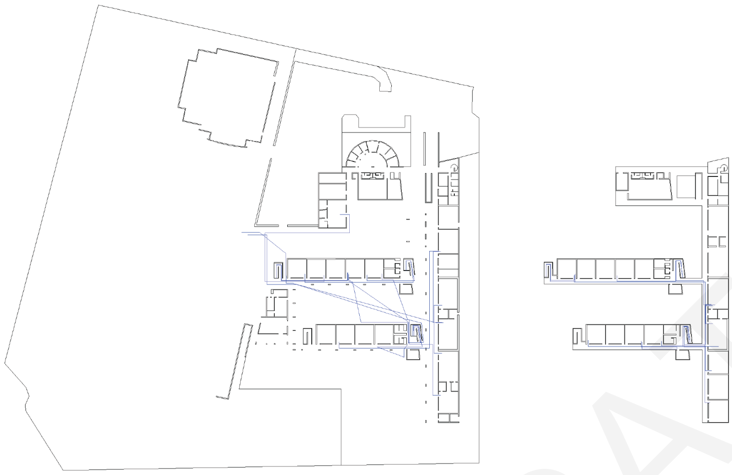


FIGURE 8.5: Flow of Students' movement in school2 (Transitions), each line represents one student moving from an origin to a destination point

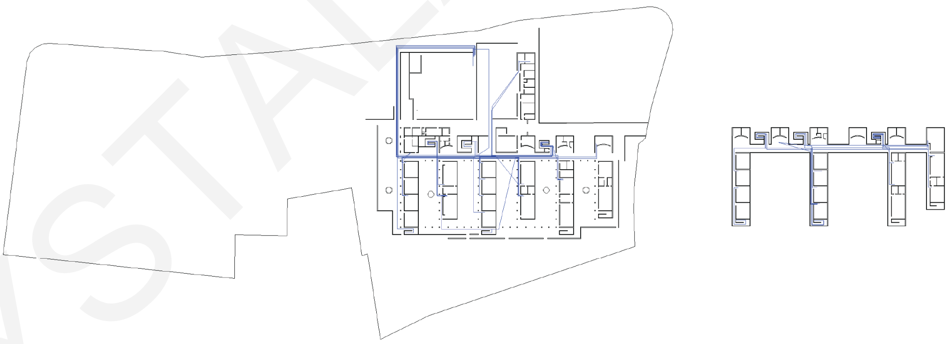


FIGURE 8.6: Flow of Students' movement in school9 (Transitions), each line represents one student moving from an origin to a destination point

of the building. This resonates well with the fact that this upper part of the building hosts administrative functions (both on ground floor and first floor) as well as the library area (on the first floor) (see also chapter 5). This suggests that the strategic positioning of functions orchestrates movement in schools, since it specifies the potential zones of operation for students.

The movement flows during transfers in S9 have a much more hierarchical structure which seems to follow to a great extend the main movement structure of the building. The main movement corridor, on both floors, seems to attract the majority of the movement flows. Thus, all three staircases that are attached to this central corridor are highly used as opposed to the other four staircases at the end of the perpendicular functional units. Also, unlike S2, movement flows in S9 are deployed along the whole building, since there are no particular functional stripes in the building that do not host functions dedicated to learning apart from the area next to the cantine area (see also chapter 5 for functional composition). There are also in this case some informal movement crossings through courtyards, but in the majority of cases movement flows are much more hierarchical and structured and primarily follow the circulation system.

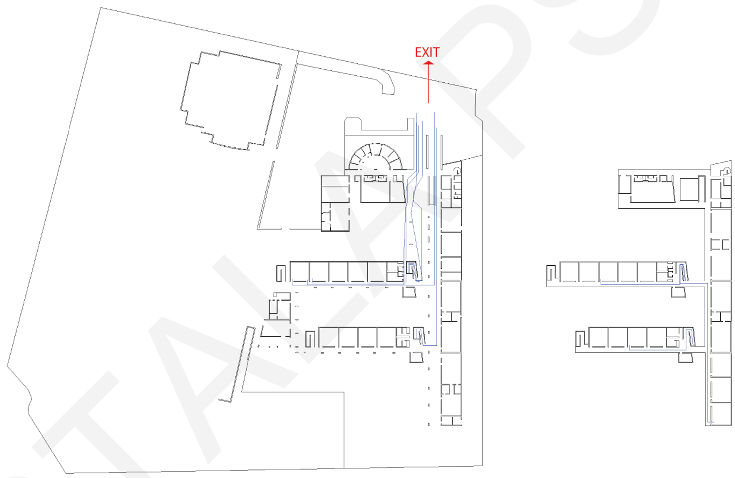


FIGURE 8.7: Flow of Students' movement in school2 (Exit Hour)

Exit hour is a significantly quick period (5 minutes long) which happens only once a day. **Exit trails in S2** illustrate similar patterns as the movement flows that have been recorded during the entrance hour. The two central staircases in the middle of the building are highly used despite the fact that there is a staircase right next to the entrance-exit. As observed in the entrance hour, movement flows towards the exit are generated parallel to the main movement structure instead of following the main movement structure.

Similarly, **in S9, movement flows towards the exit** have more or less similar structure as the movement flows during the entrance time. The three central staircases concentrate all movement trails from the 1st floor to the ground floor and the main movement corridor on both floors attracted the majority of movement. There are also some informal crossings

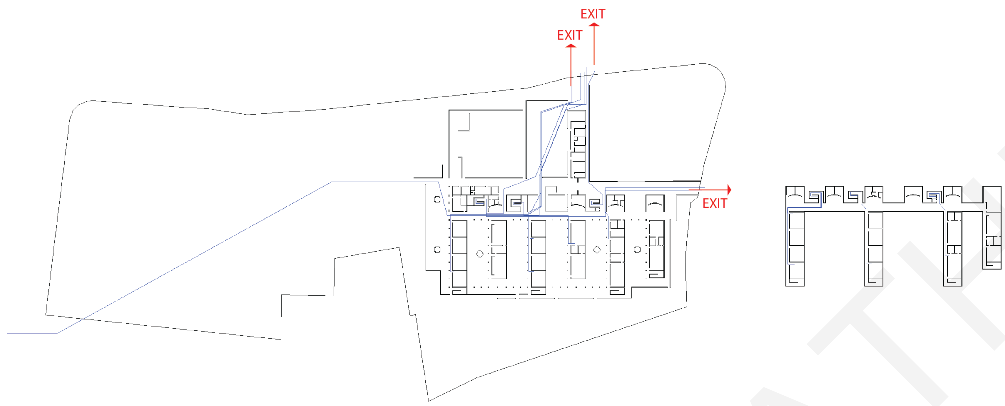


FIGURE 8.8: Flow of Students' movement in school9 (Exit Hour)

through the courtyard that is next to the exit as observed in fig. 8.8. An interesting trail penetrates the sports area; this is the only trail that is recorded, since the observed group of students has discovered a hole in the surrounding fencing of the school and use this disruption as a shortcut to access the street that is located behind the sports area.

8.1.1.2 'Un-Programmed' Movement

Another type of movement observed in open-air schools is the 'un-programmed' type of movement during breaks, where students move freely within the school with no predefined schedule. Even with covid-19 restrictions, students have been allowed to move within the school freely and define their own routes. An aggregate picture of movement across observations during breaks is illustrated in fig. 8.9 and fig. 8.10.

Un-programmed movement in school 2 as it is shown in fig. 8.9 is distributed across all the open-air parts of the school where students are allowed to use (parking, sports and back yard are closed for all school users). As regards the ground floor, moving individuals can be found almost everywhere. Despite the fact that there are dedicated circulation areas, movement patterns on the ground floor are much more complexly formed and it seems that do not follow the circulation system of the school but are rather freely distributed across the school. What is also particularly interesting is the fact that students tend to penetrate the courtyard areas diagonally on the ground floor forming particularly diverse patterns. On the first floor movement patterns coincide with the main circulation system. An enhanced movement densification is found on the two smaller functional stripes that host all functions

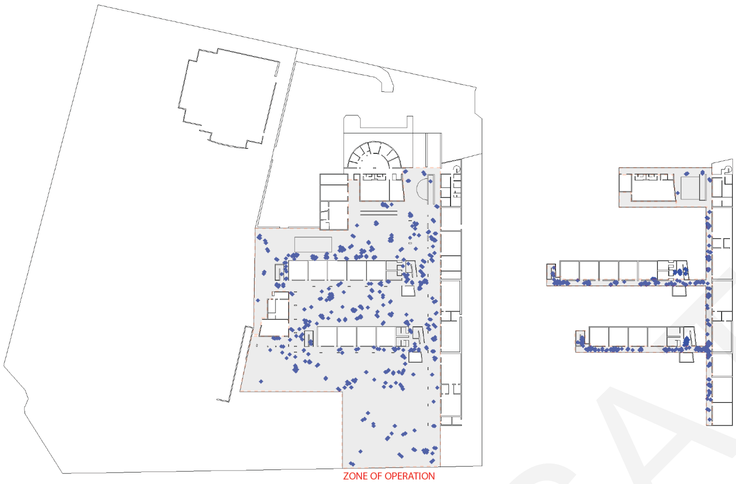


FIGURE 8.9: Location and density of 'un-programmed' students' movement in school2 (Break). Blue spots illustrate moving individuals (students, teachers)

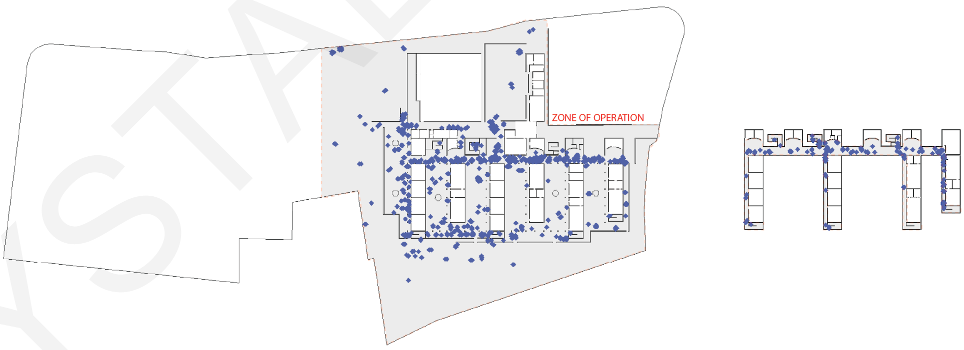


FIGURE 8.10: Location and density of 'un-programmed' students' movement in school9 (Break), Blue spots illustrate moving individuals (students, teachers)

that are dedicated to learning (i.e classrooms and special classrooms) (see also chapter 5 for functional composition).

Un-programmed movement in school 9 seems to be much more structured compared to S2 (fig. 8.10). The main movement corridor that connects the parts of the building together attracts the majority of movements. This suggests that the majority of un-programmed movement patterns are concentrated at the center of the building. Moving individuals are also observed in other parts of the building and significantly on the movement corridor which is parallel to the main movement corridor. No particular informal crossings through the courtyards are observed, while the wider zone of operation that is offered to students in comparison to S2 allows a much more dispersed concentration of movement across the school. Increased movement is also observed in the courtyard, which is adjacent to the cantine area. Movement on the 1st floor is largely structured linearly along the corridors and mainly in the central movement corridor that connects the various parts of the building together.

8.1.1.3 Spatial configuration, configuration in-use and the shaping of collective patterns of movement and temporal co-presence

Patterns of movement, both programmed and un-programmed, in both schools have already been discussed in the previous two sections. 'Programmed' movement seems to be highly influenced by the distribution of functions as well as by social agency and headteachers' decisions. For instance, S2 has a whole part of the school which is movement free, since in this particular areas there are no functions that are dedicated to learning. This highlights that 'programmed' movement can be fully understand by examining the functional distribution and the programme that is given by the school's administration since they both generate task-bound movement (Koutsolampros, 2021). In fact, it has been illustrated that 'programmed movement' is determined to a certain extent by social agency and headmasters' decisions such as the total exclusion of sports area from the rest of the school or the school's programme, the allocation of the classrooms in the schools and thus the materialisation of the school programme. It can thus be argued that strategies of distribution of school resources (i.e, how to design the detailed timetable of the school) in the available building stock may have an effect on the 'programmed movement' patterns in schools. In that sense, the configuration-in-use (Sailer, 2010) could be considered as determining to a great extent the spatial potential of 'programmed movement' patterns in schools since it creates the potential for task-bounded movement. Lastly, the location of entrance-exist seems that operates as one of the most important origin and destination points that either sends or receives movement flows.

Secondly, as regards 'un-programmed' movement patterns, the analysis has shown that they are distributed differently in the two schools under investigation. The configuration of the building seems to have determined to a certain extent, where people can walk and which routes can be used. Specifically, from the visual examination of space usage patterns in S9 it seems that the main movement corridor which is depicted in chapter 5 as the main choice core of the building, (thus it offers the highest movement potentials), concentrates the majority of 'un-programmed' movement. Such an observation however has not been the case in S2 where the 'un-programmed' movement is much more complexly formed and does not seem to follow so much the configurational logic of the layout or the routes depicted in chapter 5 as potentially the areas with the highest movement potentials.

The argument, however, can be strengthened by systematically testing and discussing whether un-programmed movement flows in both schools follow particular configurational properties and coincide with the routes that are depicted as offering the highest potential of being chosen as movement pathways in chapter 5. In order to examine the above hypothesis, the number of individuals walking is aggregated per functional polygon and tested against the spatial metrics (choice metrics that have been uses to describe school buildings moving potentials) discussed in chapter 5.

Density of Moving Individuals:Temporal Co-Presence			
	Segment Choice	**Axial Choice**	**NACH**
S2	insign. results	insign. results	insign. results
S9	R2 = 0.62***	insign. results	insign. results
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1			

TABLE 8.1: Correlation of Density of Moving Individuals with Spatial Variables

From the correlations of moving behaviour with spatial metrics, it appears that only S9 reveals significant results. In particular, 62% [38] of the variation of school movement can be addressed by considering segment choice. This conclusion not only shows that movement patterns in S9 follow primarily the configurational structure but also suggests that in schools as highly hierarchical as S9 with particularly centralised movement potentials the metric of segment choice can be particularly useful in addressing movement potentials.

Arguably, S9 is dominated by through-movements compared to the movement patterns in S2, which are much more complexly formed and return insignificant results on all the choice measures that are considered in table 8.1. Instead, movement patterns in S2 have a significant rather than moderate correlation with VGA connectivity ($R^2 = 0.29$) which shows that movement patterns in S2 are primarily formed by visual relationships [39]. It might be the case that S2 does not have such a centralised movement potential as inscribed in S9 by its

[38] the regression models were produced by aggregating spatial and behavioural values per functional polygon and by excluding the sports area which was banned by both principals of the schools

[39] The VGA model which is used excludes the sports area, since sports area is prohibited for students during breaks

design. It might also be the case that the circulation structure in S2 is deployed in accordance with very wide courtyards and thus allows multiple routes and choices in comparison to S9.

8.1.2 Stationary activities: Permanent forms of co-presence

As already mentioned, patterns of co-presence may arise both from moving activities and mainly from stationary activities. Hence, this section explores the distribution, type and intensity of different types of activities in different parts of the school buildings in order to elaborate more on the types and forms of co-presence that can be found in open-air schools during breaks. The fig. 8.11 and fig. 8.12 below give an overview of activities and a comparative image between the two schools. Since this dissertation aims at understanding and evaluating patterns of presence and co-presence, very basic activities are considered as the foundation for more complex phenomena. Thus, the activities presented in the figures below are distinguished in observations as: people standing, sitting, moving, playing and reading. The activities about playing and reading refer solely to students, while all the other activities refer to both teachers and students. Patterns of interaction between students as well as between students and teachers are discussed separately in the section 8.1.2.3. This analysis is implemented by using the snapshots [40] created by repeatedly observing the school units during all three breaks per observation day. This method allows to capture the location and type of activities within the schools. Lastly, a normalised number of people stand, sit, move, play and read is calculated by dividing the overall number of people in the functional polygon divided with the school population (table 8.2).

FIGURE 8.11: Location and density of stationary activities in school2 (Break)

[40] snapshots are only used during breaks and address all the potential area where students are allowed to use

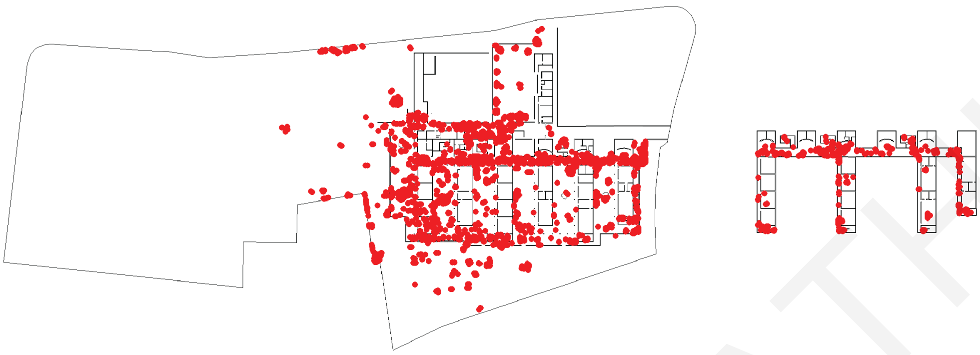


FIGURE 8.12: Location and density of stationary activities in school9 (Break)

8.1.2.1 Density and types of activities

The visual investigation of all different activities in fig. 8.11 and fig. 8.12 highlights that all activities generated during breaks in both schools are concentrated in the open-air areas of the two schools. This is primarily due to the fact that students are not allowed to use the classrooms during breaks and generally want to hang out with their friends. This is a rule that is common between the two schools and generally a rule that has been given centrally by MOEC. It can be also observed that in S2 all open-air areas (all potential areas they can use) are very densely populated as opposed to S9 in which there are some areas that have very sparse activities.

Activities in Schools 2 and 9

Normalised Value with School Population

ActivityType	S2_Courtyard	S2_Circulation	S2_Outdoors	S2_SportsOut	S2_Stairs	S9_Courtyard	S9_Circulation	S9_Outdoors	S9_SportsOut	S9_Stairs
play	0.317	0.030	0.242	0	0.000	0.311	0.528	0.114	0.041	0.000
read	0.166	0.211	0.075	0	0.000	0.041	0.280	0.010	0.000	0.010
sit	2.325	0.981	1.811	0	0.121	2.642	2.850	0.839	0.249	0.653
stand	6.551	4.543	4.136	0	0.106	2.187	4.052	0.881	0.487	0.249
walk	2.385	5.630	2.008	0	0.483	1.337	4.870	0.953	0.332	0.259

TABLE 8.2: Overview of Activities in School 2 and School 9 during Break per Functional Type

In order to understand further the density of activities as well as the types of activities, a normalised value of activities in each functional polygon is produced. The table 8.2 provides an overview of all different types of activities along with the intensity in different functional areas of the two schools under investigation. The normalised values are produced by dividing the number of users with the school population and thus provide a comparative understanding within and between schools. From the comparative table, it can be seen that the two schools operate differently and generate significantly different intensities of use in different parts of the schools.

Firstly, by considering the courtyard areas of both schools, it can be seen that there is a great mix of activities, since all 6 types of activities can be found in those areas. However, there are significant differences as regards the predominant activities in those areas. In S2, the majority of users are standing and a vast amount of users sit or walk around. This is due to the fact that the courtyards in this school do not have any kind of sitting area and thus mainly students informally appropriate building niches as sitting areas or they even sit on the ground. On the other hand, in S9 the predominant activity in courtyards is sitting. In S9, there are a lot of benches and sitting areas in the smaller courtyards with shaded green areas and thus students tend to sit in those areas. A vast number of students also uses these areas just for standing. Lastly, as regards the number of students playing in courtyards, it is more or less the same in both schools. However, what is particularly different between schools is the number of students reading informally, which in S2 is more or less 4 times bigger than in S9.

As regards the circulation areas, the predominant activities in both schools are walking and standing. What is particularly different, however, between schools is the number of users sitting in circulation areas. In S9, the number of users sitting is almost triple the number of users sitting in S2. In addition, what is also particularly interesting is that in both schools the number of users reading in circulation is the highest compared to all the other areas of the two schools. This suggests that students in both schools tend to read more in circulation areas than in any other space, highlighting the educational importance of the circulation area beyond their practical role. Lastly, students in S9 tend to play much more in circulation areas than in any other space of the school, which apparently is not the case in S2, since a trivial number of students play in circulation areas.

The distribution of activities in outdoor areas of S2 seems to follow the same pattern with the courtyard areas. Namely, the majority of users primarily stand in these areas, while almost half of the students walk and sit. It might be the case that the outdoor areas of S2 are very well defined and structured by the boundary of the school, as happens with the courtyard areas of the school and thus operate in a very similar way as courtyards. On the other hand, in S9 there is a more equal distribution of activities, since almost equal number of students sits, stands, and walks in these areas. Additionally, it can be seen that the overall normalised number of students in these areas in S9 is significantly lower than in S2, a fact that is also obvious from the visual inspection of the fig. 8.12 which captures very wide open areas completely empty in the case of S9.

The outdoor sports facilities are closed for school users in both schools. For this reason, no activity has been observed in sports outdoor areas of S2. However, in S9 there is a small portion of sports outdoor which is still available for use during breaks. Thus, in this area, students primarily sit on informal niches around the edges of the school plot as it is highlighted on fig. 8.12. Some users also stand or walk in this area.

Staircases are also an important space in schools, since they facilitate access between floors but also are places where students hangout, sit, or stand during breaks. In S2, staircases are mainly used for walking and very few students stand or sit there. On the other hand, in S9, students primarily tend to sit on the staircases and hand out with their friends during breaks. As they mentioned "We like it here, it is quiet, we can sit on the steps, read with our friends and hang out". Thus, it could be argued that staircases in S2 have more or less practical purpose, as opposed to S9 in which they operate also as another area available for students during the break that can offer a certain degree of isolation from the rest of the school.

Thus, it could be concluded that the two schools, despite the apparent commonalities found in their spatial, functional, and morphological structures and captured through the schools' network diagram (section 7.3) they do operate differently in many respects. In S2, there is a much more dense and equal use of all outdoor spaces and there are no leftover spaces with unequal distribution of students, as is the case in S9.

8.1.2.2 Synchronic Co-Presence

So as to understand more precisely the differences and similarities between the actual use of schools' space, this section elaborates on the degree of co-presence fostered in the school environments. Specifically, the synchronic co-presence of users doing all sorts of activities in all open-air areas of the school during breaks, through an aggregated number of users in each functional type and it is generated for both schools. In this investigation, only functional types that students are allowed to use during breaks are considered and an aggregated normalised value of people synchronicaly co-presence in space is calculated to compare and contrast the two schools. The normalised number is generated by considering the total number of people per functional polygon and is derived from the overall school population.

From the analysis, it can be seen that in S2 there is an almost similar number of people in circulation, courtyards, and general outdoor areas. On the contrary, in S9 the majority of students aggregate in the circulation areas and almost half of them in courtyard areas. In addition, what is particularly interesting is that an almost doubled number of students use staircases for stationary and moving activities in S9 than in S2. Therefore, it could be argued that S9 is a 'moving type' of school where co-presence is temporal and is formed mainly on

Synchronic_Copresence in Schools 2 and 9 Normalised Value with School Population		
Ftype	**S2_StudentsNo**	**S9_StudentsNo**
Circulation	2.86	3.16
Courtyard	2.94	1.63
Outdoors	2.09	0.70
SportsOutdoor	0.00	0.28
Stairs	0.18	0.29

TABLE 8.3: Synchronic Copresence in School 2 and 9 (Break)

the movement corridors. On the other hand, S2 seems to foster a more permanent type of co-presence by means of synchronic co-presence in all open-air areas of the school.

8.1.2.3 Group Formation and Interactions

Figure 8.13 and fig. 8.14 capture the distribution of the different user groups i the two schools. What is particularly interesting by visually examining the distribution of the 3 main user categories (girls, boys, and teachers) in both schools is that there is a great degree of blending between the various categories of users in the open-air areas. This condition is illustrated in all the open-air areas of S2 since all courtyards as well as the outdoor area are used by both genders of students as well as teachers. Only the lower of the school plot is occupied primarily by male students, but still the overall area is occupied by both genders and teachers. In S9, this great mixture between all 3 different user groups happens primarily in the main circulation corridor, where all 3 different categories of users mingle and have a synchronic co-presence. In other cases, such as in the area (S9: E) as captured in fig. 8.14 there are no teachers present but also only single gender groups are formed.

The visual examination of users' distribution and group formation can also be informed by informal observations during the 'walk and talk' method in the schools since they can offer a more qualitative reading of the schools' reality. What has been particularly obvious by the observation of the area S9:E fig. 8.14 in S9 is that particular students' groups occupy the same locations every break. For example, the group of students that is spotted in the area S9:A is composed by girls who belong to a particular ethnic minority group. This is also the case with the two mixed groups that occupy the other parts of the sports outdoor area of the plot boundaries (S9: B,C). In this school, occasions have been also observed where students might sit alone during all school breaks, all days of observation (S9: D). On the other hand, in S2, all areas of the school are mixed gender with only some instances on the lower left part of the plot where mainly male students occupy this corner of the plot (S2: A).

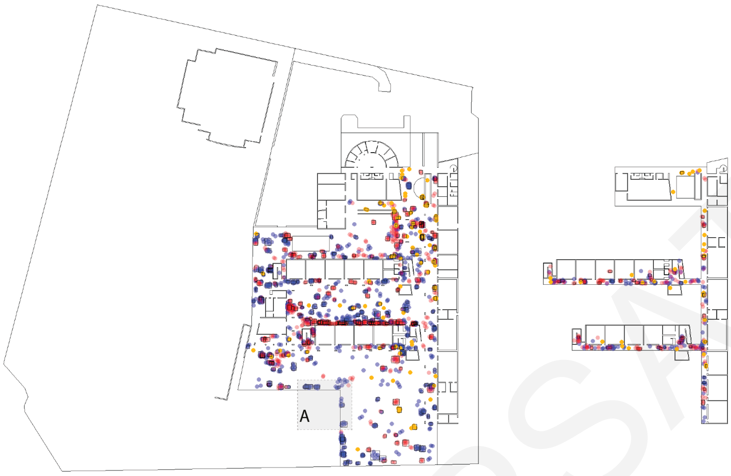


FIGURE 8.13: School Users Location, School 2, Blue: Boys, Red: Girls, Yellow:Teachers, Black Rectangular: Interacting Group)

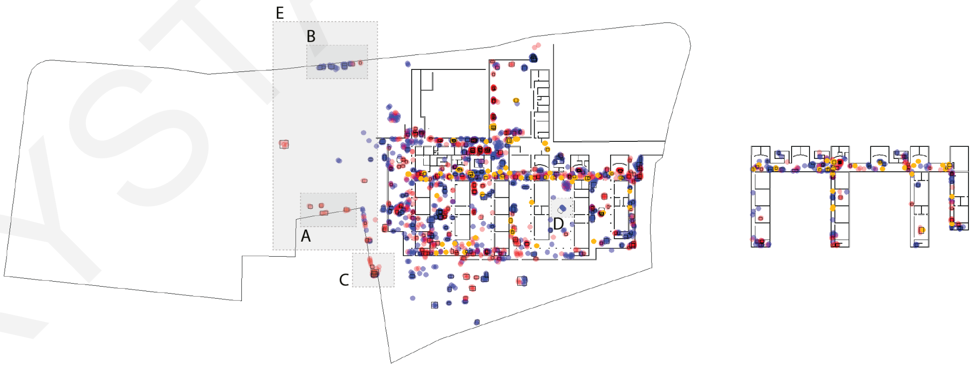


FIGURE 8.14: School Users Location, School 9, Blue: Boys, Red: Girls, Yellow:Teachers, Black Rectangular: Interacting Group)

As regards the **interactions** between users, an aggregated image of interactions in both schools has been generated showing both the size and the location of interactions. The number of interacting individuals per functional polygon has been calculated and normalised by the school population to compare and contrast between cases (fig. 8.15 and fig. 8.16).

FIGURE 8.15: Location and density of Interactions in School2 (Break)

FIGURE 8.16: Location and density of Interactions in School9 (Break)

At a first glance, it can be seen through the visual study of both schools that the majority of interactions happen on the ground floors of the two schools, which are also the most densely populated floors during breaks. As regards the intensity of interactions, it can be seen that in school 2 the interactions are more intense in the courtyard in the middle of the school (that is associated with the cantine area). In S9, there is a more equal intensity of interaction almost in all areas where students and teachers can be found.

By looking more precisely, the intensity of interactions in table 8.4 and table 8.5 a more detailed image can be traced. Specifically, as regards S2, it can be seen that primarily most instances of interaction happen in courtyards (2.07). In addition, a vast number of interactions between students happens in circulation (1.28) and outdoor areas (1.49). Interactions between teachers and students are less frequent and happen primarily in outdoor areas, circulation, and courtyards.

Interactivity in Schools 2

Normalised Value with School Population

Ftype	Students-Students	Students-Teachers
Circulation	1.28	0.011
Courtyard	2.07	0.004
Outdoors	1.49	0.019
SportsOutdoor	0.00	0.000
Stairs	0.06	0.000

TABLE 8.4: Interactivity Ratios in School2 (Break)

Student-student interactions in S9 happen predominately in circulation areas (2.42). This suggests that circulation areas are not only movement spaces but valuable areas for social interaction in open-air schools. A vast amount of interactivity instances between students can also be found in the courtyard area, while outdoor areas have recorded significantly lower interactions (0.61) both compared to circulation and courtyards in S9 as well as in comparison to interactions in the outdoor areas of S2. An almost equal number of interaction instances between students can be found in the sports outdoor area and staircases. What is interesting, however, is that an almost tripled number of students interact in staircases in S9(0.28) in comparison to S2(0.06).

As regards teacher-student interactivity is trivial for both schools. However, in S2 this can be found in more spaces (i.e, circulation, courtyard, and outdoors), while in S9 it can be observed only in circulation areas. Equally important, the total number of interactions between students and teachers in S2 is higher (0.034) compared to S9 (0.026). From the ethnographic

Interactivity in Schools 9 Normalised Value with School Population		
Ftype	**Students-Students**	**Students-Teachers**
Circulation	2.42	0.026
Courtyard	1.48	0.000
Outdoors	0.61	0.000
SportsOutdoor	0.25	0.000
Stairs	0.28	0.000

TABLE 8.5: Interactivity Ratios in School9 (Break)

observations, it has also noted that not only students in S2 interact with their teachers more often compared to S9 but they also share with them very personal issues as compared to S9, where their discussions have had primarily a practical purpose.

As regards the size of the interactivity groups in both schools, in school 9, the mean number of students interacting is 3, while the max is 8. In S2, the mean number of students interacting is 3.62, while the max is 12.

Interactivity Mean and Max in Schools 2 and 9 Across Time Frames of Observations				
TimeFrames	**S2_Interactivity_Mean**	**S2_Interactivity_Max**	**S9_Interactivity_Mean**	**S9_Interactivity_Max**
T_Frame1	3	10	3	6
T_Frame2	3	7	4	8
T_Frame3	4	8	3	8
T_Frame4	4	9	3	8
T_Frame5	4	8	3	6
T_Frame6	4	10	3	7
T_Frame7	4	8	3	5
T_Frame9	4	12	3	7

TABLE 8.6: Students-Students Interactivity Group Size Mean and Max Values

By considering more precisely the distribution of the group size across observation time

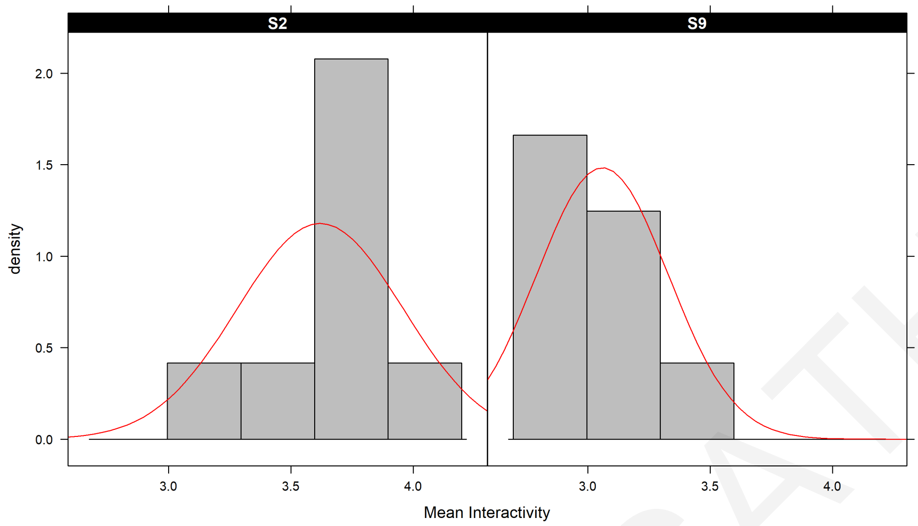


FIGURE 8.17: Histogram of Group Formation in both Schools (Mean number of students interacting)

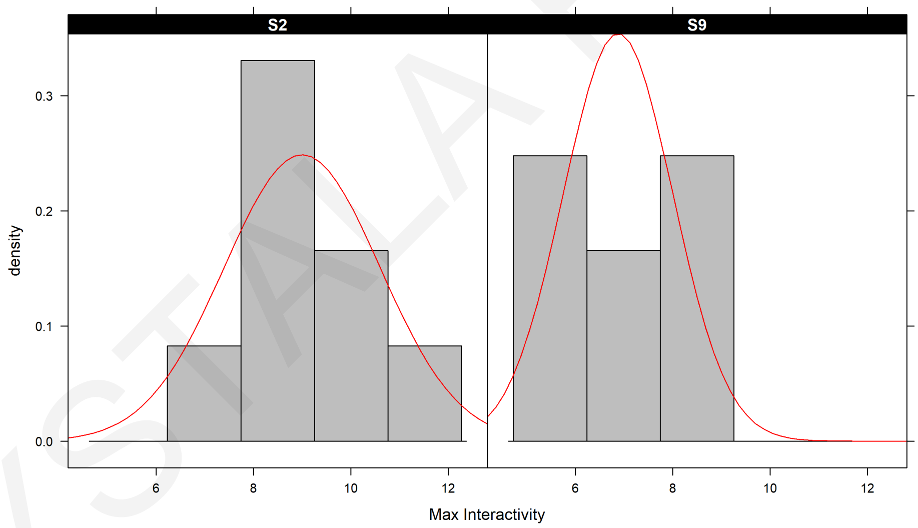


FIGURE 8.18: Histogram of Group Formation in both Schools (Max number of students interacting)

frames in both schools through histograms (fig. 8.17, fig. 8.18) both the size and the frequency of group formation can be seen to be significantly higher in S2, both as regards the mean as well as max number of students per group. Such an understanding suggests that students in S2 tend to form bigger groups compared to S9.

8.1.2.4 Spatial configuration and the shaping of stationary activities and permanent co-presence

Having understood the differences and similarities in the way the two schools articulate space usage patterns, it is of interest here to investigate the degree to which the spatial configuration shapes stationary activities and thus offers or not the potentials for permanent forms of co-presence between school users.

From a visual inspection of all stationary activities in the two schools, it can be concluded that a more equal distribution of stationary activities across school spaces exists in S2 compared to S9. At the same time, the significantly higher ratio of synchronic co-presence of school users in the outdoor areas of S2 compared to S9 suggests that the majority of the open-air structure of the school works as a potential area for students to interact and hang-out with their friends.

The argument can be strengthened by systematically testing and discussing whether stationary activities in both schools follow particular spatial patterns that coincide with the most lively areas that have been depicted in chapter 5. In essence, this section further examines whether spatial configuration can explain the density and location of stationary activities in schools by reflecting on spatial metrics used to discuss the building potential in chapter 5. In that sense, the number of individuals executing stationary activities (i.e sitting, standing, interacting etc) is aggregated per functional polygon against the spatial metrics discussed in chapter 5.

Density of Stationary Activities - Permanent Co-Presence			
	AMD	**VMD**	**Ax.Integration**
S2	R2 =0.20*	R2 =0.21**	R2 =0.20*
S9	insign. results	R2 =0.14**	insign. results
	V.Integration	**V.Connectivity**	**Ax.Connectivity**
S2	R2 =0.24**	R2 =0.40***	insign. results
S9	R2 =0.20***	R2 =0.17**	insign. results
	Seg.Integration		
S2	R2 = 0.28**		
S9	R2 = 0.14**		
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1			

TABLE 8.7: Correlation of Density of Stationary Activities with Spatial Variables

The correlation of space usage patterns with spatial variables has highlighted that divergent patterns can be identified in the two schools. Specifically, the spatial parameter that illustrates a positive moderate correlation with the density of stationary activities is visual connectivity and only in the case of S2. Visual connectivity is able to explain 40% of the variation of school users' distribution within S2 and more importantly, when the outliers are excluded 53% of the variation can be explained. Such an understanding therefore suggests that S2 operates primarily by means of local visual relationships. This is particularly important, since the design of S2 might be based on the idea of a hierarchical-based school (as concluded in chapter 5) but at the same time the creation of three wide open areas that are instantly perceived seems to drive the way stationary activities are deployed in space. Also, this particular property of the design may related S2 to the characteristics of courtyard-based schools as concluded by the network diagram of schools' relationships in chapter 7.

8.1.3 Reflections on forms of Co-Presence, School Community and Students' Perceptions

To conclude, this section focuses on forms of co-presence, it reveals that the two schools operate in a very different way. More particularly, it can be argued that S9 is more of a moving school which fosters primarily temporal co-presence between users and is characterised by smaller and less frequent interactive groups. Equally important, the movement patterns in this school are predominately shaped by the spatial configuration of the school, since an enhanced centralisation of movement is proposed by the school design itself. On the other hand, S2 seems to foster a more permanent form of co-presence between school users by allowing the equal distribution of activities across the school, by accommodating bigger and more frequent interactivity groups and generally by fostering increased synchronic co-presence between school users.

This can be further understood by considering the degree of overlap between movement and stationary activities in both schools. By visually evaluating the degree of overlap in S2 in fig. 8.19 it could be seen that there is a relatively high degree of overlap between movement and stationary activities on the 1st floor of the school. This is expected to a certain degree since users during breaks are not allowed to use the classrooms and thus there are only a few instances where students break the rule and enter the classrooms. Thus, circulation areas are highly used both for moving and stationary activities. As regards the ground floor of this school, there is a much more diverse and complex image, but it illustrates a relatively high degree of overlap between stationary and moving activities. Generally, school users are distributed across the whole school forming smaller and bigger groups in relatively big co-visible areas. What is also interesting is that in the majority of cases the stationary aggregation tends to follow the various niches and 'backs' of the building plot, while the movement happens primarily at the centre of open courtyards and is diagonally formed.

S9 illustrates a significantly different image compared to S2. Arguably, the movement patterns follow the spatial configuration as concluded in section 8.1.1. However, it seems that stationary activities follow a different logic, since only in a few cases across the building

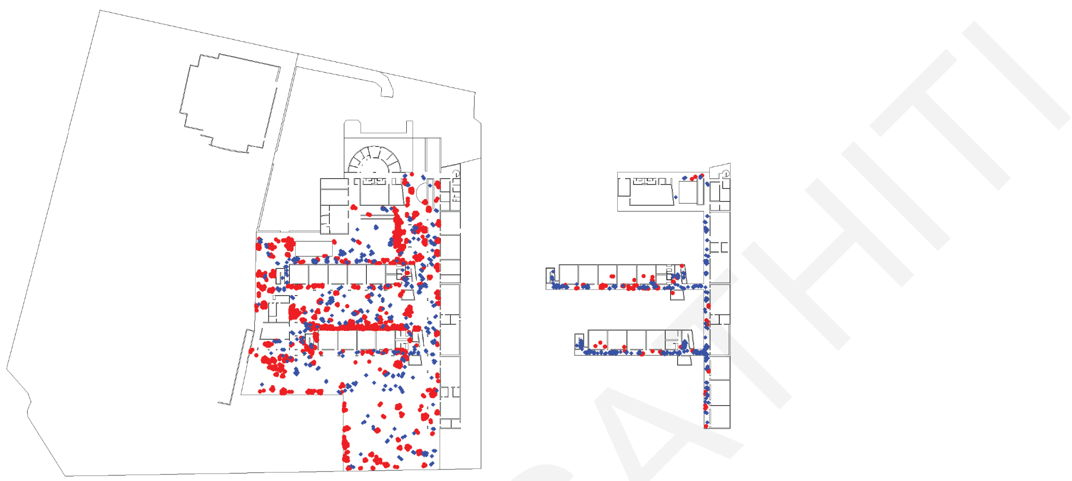


FIGURE 8.19: Degree of overlap between movement (blue) and stationary (red) activities in school2 (Break)

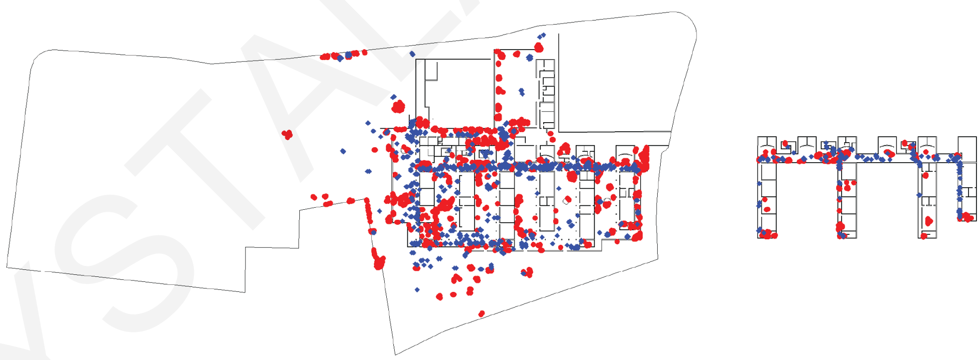


FIGURE 8.20: Degree of overlap between movement (blue) and stationary (red) activities in school9 (Break)

an overlap of moving and stationary activities can be found. This happens primarily in the main movement corridor that apparently tends to be used both for moving and stationary activities and thus offers both through movement potentials, while operating also as a destination in the system. Another interesting pattern in S9 is that sparse stationary activities can be found in various parts of the school with a rather reduced potentiality of users' co-presence.

Hence, it may be claimed that S2 offers a spatial layout that promotes interaction and co-presence among school users which constitute its school community. In essence, the school layout in S2 seems to bring users together by means of a permanent co-presence in space. On the other hand, in S9 the above condition happens solely in the main movement corridor and thus the school community in S9 could be characterised as more fragmented and localised compared to S2.

The argument can be also further understood by reflecting on students' perceptions about their school, with the main investigating theme being the extent to which school life relates to students' perceptions.

In order to reflect on students' qualitative feedback, three (3) open-ended questions answered by students are considered. Specifically, to understand the answers, text mining methods are employed as explained in chapter 4. Firstly, a world count method that counts the frequency of words in the answers and visualises them as a word diagram with the size corresponding to the frequency is considered to grasp the best thing about their school, the one thing they would like to change as well as their favourite place in school. Secondly, a sentimental analysis that addresses the emotions behind words has been used to address students' emotions about their school.

FIGURE 8.21: Word Count of Best Thing in School 2, Students Answers

Firstly, from the analysis regarding the single best thing about the school (fig. 8.21, fig. 8.22) it appears that the two most important aspects for students are the beak hour and their friends. This highlights the importance of interpersonal relationships in schools. Few students in both schools also mention learning and lessons as their single best thing. However, if the frequency of students' answers in the two schools is considered by means of the words' size, it can be seen that the dominant answer in S2 is friends, while in S9 is break highlighting that students in S2 prioritise friendship from generally the break hour. In addition to that,

FIGURE 8.22: Word Count of Best Thing in School 9, Students Answers

students in S2 have mentioned during the 'walk and talk' method that **' we are like a family here and our friends are the most important aspect about the school'**.

FIGURE 8.23: Word Count of Favorite Place in School 2, Students Answers

FIGURE 8.24: Word Count of Favorite Place in School 9, Students Answers

As regards their favourite places, quite diverse answers between schools can be found. More specifically, students in S2 point out the cantine area and courtyards as their favourite places. Interestingly, the cantine area is adjacent to the most densely populated courtyard and is relatively centrally located in the school. On the other hand, students in S9 name the sports area, their classroom, outdoor, and benches as their favourite places in school.

By looking more in detail students' answers, it can be seen that students from S2 specify areas in the school with specific characteristics for example 'benches next to cantine' or 'sitting area next to cantine'. This might highlight that there is a degree of attachment with spaces that allows them to name them and specify their characteristics. On the other hand, the answers of students from S9 are more generic and the level of detailing in their descriptions is limited compared to S2. This is might be the reason that students from S9 prioritise their classroom as one of their favourite places, since it is one of the spaces in the school that they could find themselves attached to. Furthermore, students in S9 mention to a great extent that they do not have a favourite place in school. This therefore, might suggest the students' disengagement with their school environment.

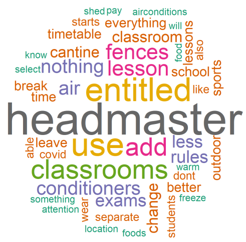


FIGURE 8.25: Word Count of Thing to change in School 2, Students Answers

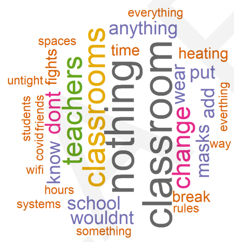


FIGURE 8.26: Word Count of Thing to change in School 9, Students Answers

Lastly, as regards what they want to change in their school, very diverse answers can be found between the two schools. Students from S2 point out that they want to change their headmaster. It might be the case that the headmaster in S2 is very involved in the school life and from the ethnographic observations it could be concluded that it has a very strong leadership in the school. Among the most frequent answers are also mobile phones (since the headmaster has banned the usage of mobile phones during the school hours). Students from S9 have more generic answers that focus mainly on electromechanical equipment and on various technical issues about the school.

However, in school 2, despite their apparent frustration with the headteacher, it appears from the emotional analysis of this answer that students in S2 use much more trusty words in their sentences compared to students from S9.

Thus, this analysis can potentially suggest that students in S2 despite their frustration with the headteacher, they form more meaningful connections with their school and prioritise the importance of friendship. Lastly, such an understanding is perfectly aligned with the conclusions that are revealed in the previous sections as regards space usage behaviour and school life.

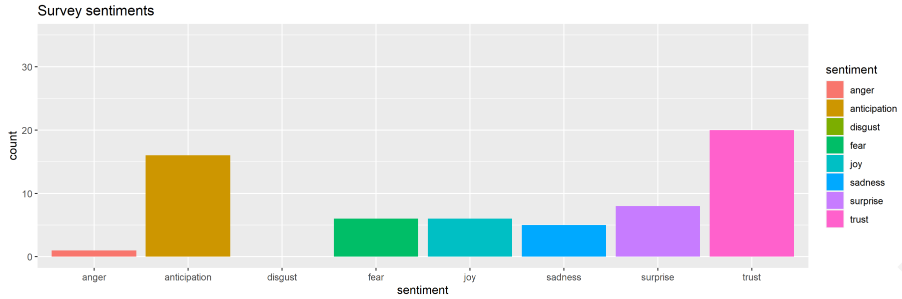


FIGURE 8.27: Thing to change in School 2 Emotional, Students Answers

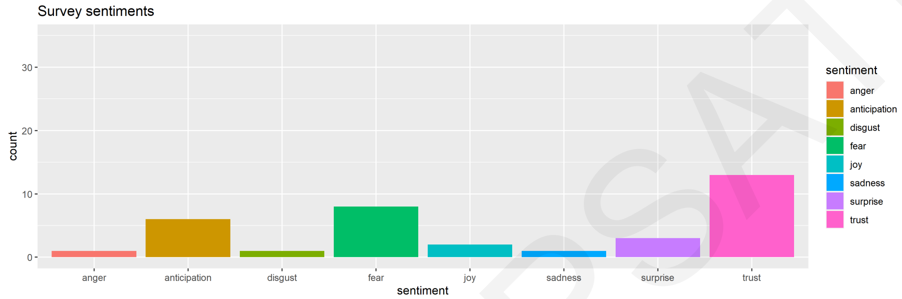


FIGURE 8.28: Thing to change in School 9 Emotional, Students Answers

8.2 Interplay between School Layout, School Life and Students' perceptions

Having understood school life and space usage patterns in both schools, this section explores more broadly the interplay between school layout, school life, and students' perceptions.

8.2.1 General Description of Data

Statistical models have been used to examine the relationship between school layout and students' perceptions. Firstly, in order to use students' answers (likert, scale questions only) for the most complex types of analysis, an explanatory factor analysis has been implemented since the general requirements for this analysis have been met. In particular, it has been checked whether all requirements are satisfied so as to run a factor analysis (i.e, normal distribution, all scale variables etc), and then the factor analysis has been implemented. Initially, the KMO has been 0.78, Hence, some variables with low KMO have been taken out from the model to ensure having a KMO above 0.80. Then, the principal component analysis has suggested the grouping of variables into 4 factors: **positive attribute towards school, covid pressure, meet friends despite covid measures, sitting alone influences learning**(the complete list of variables that are grouped under each factor can be found in appendix G). The factors have then been considered with a varimax rotation. The first parameter has explained 42% of the variation, the second 25%, the third 20% and the fourth 13%. Lastly, a reliability test has been implemented to check the model's reliability (cronbach's alpha has been above 0.70 for all variables).

Using data that are derived by factor analysis along with students' evaluation of their school performance in relation to their classmates, various multiple regression models have been generated.

8.2.2 Students' Perceptions: Comparison between schools and stages of adolescence

Firstly, in order to understand the differences and similarities between the students' perceptions of the two schools under investigation, a t-test analysis of variance has been used to examine whether there are statistically significant differences between schools. The analysis of variance (t-test) illustrates that there are no statistical differences between the two schools as regards students' positive attributes towards school and the influence of sitting alone due to covid-19 measures. Significant differences between schools, but with trivial size effects, have been observed in the variables related to feeling more pressure due to covid-19 measures ($R2 = 0.12$, $p=0.000$), meeting friends despite covid-19 ($R2 = 0.03$, $p=0.001$) and perceiving the school performance as higher in comparison to other classmates ($R2 = 0.03$, $p=0.0072$).

S2	**S9**
Positive Attr.Towards School	
insignificant resul.	
Covid Pressure	
3.49	2.84
p<0.0001	
Meet Friends Despite Covid	
3.72	3.32
p=0.011	
Sitting Alone Influences Learning	
insignificant resul.	
Students' Perception of Performance	
3.79	4.14
p=0.0072	

TABLE 8.8: Mean Values (t-test) of Students' Perceptions in accordance to SchoolID

The above results suggest that there are statistically significant differences between the two schools, since students from S2 have reported significantly higher pressure from covid-19 measures than students from S9. Interestingly, students from S2 despite the fact that they tend to feel more pressure, they also tend to meet more often with their friends despite the covid-19 measure compared to students in S9. However, as regards the perception of students regarding their school performance, it appears that students from S9 have reported higher mean values in relation to students from S2.

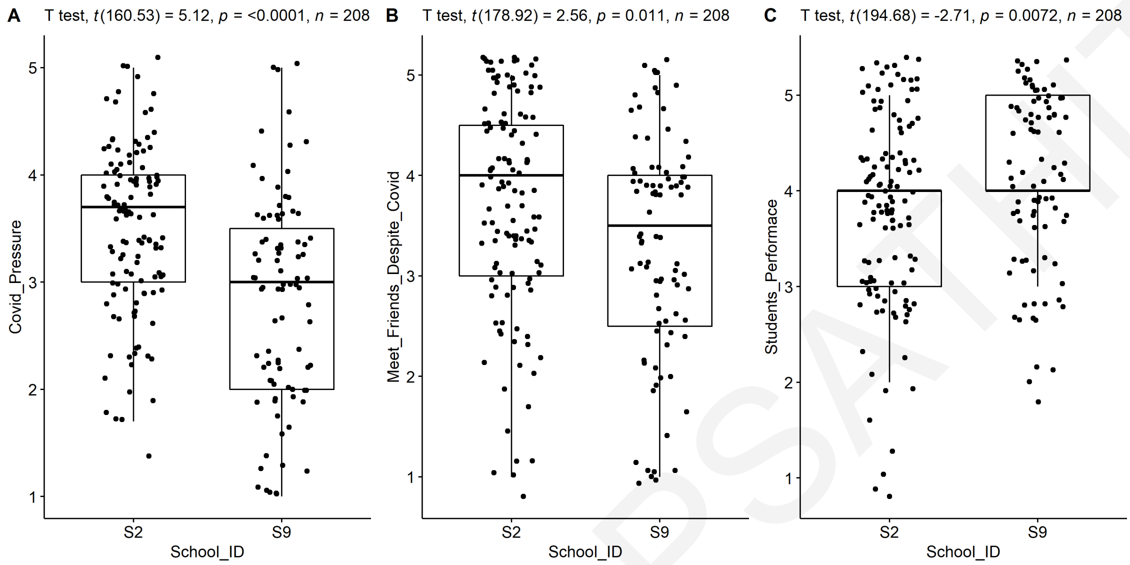


FIGURE 8.29: T-test of students answers, A: Pressure the feel from covid-19, B: The degree to which they meet their friends despite social-distancing measures, C: Students' Perception of Performance in Relation to their Classmates

Students' perceptions have been then considered across the different stages of adolescence. More specifically, students' perceptions are considered across the three (3) different levels of lower secondary education. The first grade students are defined as *new comers* in the school community and are within the stage of early adolescence, as mentioned in chapter 2. The **second grade** belongs neither to early nor to middle adolescence stage and finally third grade students could be considered as soon leavers from the school community and are within the middle adolescence stage (chapter 2).

The analysis of variance highlights where the differences between schools and ages lie. By looking at the *positive attribute towards school* across adolescence stages, it can be seen that schools illustrate significant differences across ages. Specifically, new-comers and soon leavers in S2 (4.27 and 3.42) have recorded a significantly higher mean value of positive attributes towards their school compared to S9 (3.83 and 2.62). In addition, what is common between schools is that positive attributes towards school drop with age.

Despite the fact that the observations of space usage behaviours in section 6.2.2 have revealed that students' space usage patterns are more or less the same before and during covid-19 measures (chapter 7), students from both schools have mentioned that they have felt more pressure during this period due to the additional rules that have been applied. Interestingly, unlike the positive attribute towards school which drops with age, the pressure

First Grade		Second Grade		Third Grade	
S2	**S9**	**S2**	**S9**	**S2**	**S9**
Positive Attr.Towards School					
4.27	3.83			3.42	2.62
p =0.001		insignificant resul.		p =0.002	
Covid Pressure					
3.40	2.74	3.51	2.87		
p =0.006		p =0.001		insignificant resul.	
Meet Friends Despite Covid					
		3.79	3.28	3.68	2.81
insignificant resul.		p =0.003		p =0.020	
Sitting Alone Influences Learning					
		3.04	2.69		
insignificant resul.		p =0.030		insignificant resul.	
Students' Perception of Performance					
		3.69	4.23		
insignificant resul.		p =0.008		insignificant resul.	

TABLE 8.9: Differences Between Schools as regards Students' Perception Across Stages of Adolescence (t-test analysis)

from external rules increases with age. Specifically, new comers in S2 have recorded significantly higher pressure than S9 students (3.40 compared to 2.74). This is also the case for middle school students (3.51 and 2.87). At the same time, despite the fact that students from S2 have recorded significantly higher pressure from covid-19 measures compared to S9, they also tend to meet more often with their friends despite covid-19 measures in comparison to students from S9.

As regards the influence of the fact that they no longer sit with their peers, the only level of education that has exhibited significant differences between schools is the 2nd grade. Second grade students from S2 have recorded significantly higher influence compared to students from S9. Thus, it can be assumed that 2nd grade students in S2 may value more peer relationships in comparison to students from S9. Furthermore, this particular age group has also significant differences as regards their perception of school performance in relation to their classmates. Students in the second grade in school 2 have recorded lower mean performance compared to middle class students in S9 (3.69 and 4.23). Interestingly, when looking more precisely at the perceptions of students' answers from this particular age group, valuable conclusions can be drawn. Specifically, it is the only age group that returns insignificant differences between the two schools as regards students' positive attributes towards school. Apparently, 2nd grade students from S2 feel more pressure because of covid-19 measures and they face more difficulties with the fact that they sit alone during the learning hour compared to S9 students. This resonates well with their reduced perception of performance compared to their classmates. Furthermore, the fact that they tend to meet more with their friends despite covid-19 measures than in S9, resonates well with the fact that the school layout of S2, as rendered in the previous sections, supports more widely interpersonal contact between various categories of users than S9.

8.2.3 Towards a socio-spatial understanding of Students' Positive Attributes Towards School

Having understood the differences and similarities between schools and bearing in mind the centrality of the issue of positive attributes and positive feelings of adolescents towards their school, it is of interest to this study to shed additional light on the factors that drive students' positive perceptions and feelings towards their school.

Specifically, this investigation stems from the existing body of literature that highlighted that (chapter 2) positive students' perceptions towards their school have also a positive impact on adolescents' school life and academic performance. Additionally, by elaborating on previous findings regarding school community and the importance of interpersonal contact in adolescence, it may be assumed that a non-correspondence school community which encourages mixing, interaction and interpersonal contact could potentially influence students' positive attribute towards their school. Lastly, this part of analysis is also inspired by a study of Taguchi and Kishimoto (2012) which points out that classrooms' depth as well as students' particular stage of adolescence (i.e age of students) or their gender may influence their distribution in the school (chapter 2).

Thus, based on the aforementioned insights and given the complexity of the issue, this study hypothesises that positive attributes towards school should be examined in accordance with various socio-spatial factors through a multiple regression analysis. Multiple regression analysis is able to explore students' positive attributes more precisely and address all factors that might determine students' positive feelings towards their school. Specifically, this study hypothesises that:

- H1a: Students' attributes towards school tend to be more positive when the school community thrives of openness and mixing of user categories where their classrooms are located in relatively low visual depth (VMD) and thus they are visually closer to the livelier parts of the school, when they tend to meet more often with their friends as well as they have a positive perception of their individual performance;
- H1b: Students' attributes towards school tend to be more positive when the school community thrives of openness and mixing of user categories, their classroom is located in a relatively low axial depth (AxialMD), and thus topologically closer to the school community life, they tend to meet more with their friends and they have a positive perception of their individual performance in school.

The location of the three different grades in the schools is identified and the mean spatial values (visual and topological depth) per level of education (i.e new-comers, middle class, and soon-leavers) are calculated and summarised in the table below. The table summarises the mean depths per level of education for the two schools. Interestingly, similar and divergent patterns can be identified. In both schools, the visual mean depth of middle class is higher compared to new comers and soon leavers. This therefore suggests that second year students in both schools are located in visually segregated locations in the schools compared to first year students and third year students. This resonated well with informal discussions with headteachers in which they have noted the importance of having the 1st graders and 3rd graders more visually central in the school. This has been considered necessary since on the one hand, 1st year students need more teachers' support and 3rd year students need more control to stick to the rules. This is also in line with the conclusions that have been extracted by the review of the existing literature and the particular developmental changes that happen during adolescents (chapter 2).

	S2		**S9**	
	Visual Mean Depth	**Axial Mean Depth**	**Visual Mean Depth**	**Axial Mean Depth**
1st Grade	3.43	4.02	3.66	4.23
2nd Grade	5.26	3.96	5.59	4.16
3rd Grade	4.74	3.88	5.27	4.24

TABLE 8.10: Mean depth per Level of Education in School2 and School9

As regards the axial mean depth, divergent patterns can be identified between schools. In school 9, the axial mean depth of new comers and soon leavers is almost identical and it is higher than middle class. In S2, new comers are placed in classrooms with the highest axial mean depth. Second grade and first grade have lower depths. In that sense, the allocation of classrooms topologically is more diverse than the allocation of classrooms visually.

Table 8.11 illustrates the best produced models that investigate the two aforementioned hypotheses and have returned significant results. In all models, the categorical variables (type of community and gender) are classified by considering the non-correspondence school community, and girls as the baselines, respectively. This means that the coefficient of the school community indicates its contribution in relation to a non-correspondence school community and the coefficient of gender indicates its contribution in relation to a girl student. The three (3) significant models differ in the sample used. Specifically, only one hypothesis has returned significant results when all students from both schools have been considered. When middle class students from both schools have been excluded from the investigation, both hypotheses have returned statistically significant results.

Overall, the models can explain to a great extent the variation of students' answers regarding their positive attributes towards school (32% to 45 % of the variation). Among all models, the most important factors for predicting students' positive attributes towards school are

Dependent Variable: Positive Attribute Towards School					
	Sample: All Students				
Model H1a	R2 = 0.32	p-value =0.00			
	B	SE	t value	p value	
Constant	9.22	3.19	2.88	0.0040	**
Corresp. Vs Non-Corresp.	-0.13	0.70	-0.18	0.8522	
Visual Mean Depth	-1.83	0.47	-3.85	0.0001	***
Meet Friends Despite Covid	1.11	0.30	3.63	0.0003	***
Students' Performance	2.24	0.35	6.26	0.0000	***
Boy Vs Girl	-1.24	0.53	-2.32	0.02000	*
Model H1b	insignificant results				
	Sample: New Comers & Soon Leavers				
Model H1a	R2 = 0.45	p-value =0.00			
	B	SE	t value	p value	
Constant	14.74	4.62	3.19	0.0018	**
Corresp. Vs Non-Corresp.	-2.37	0.87	-2.71	0.0078	**
Visual Mean Depth	-2.91	0.7	-4.15	0.0000	***
Meet Friends Despite Covid	1.36	0.36	3.74	0.0002	***
Students' Performance	2.12	0.47	4.5	0.0000	***
Boy Vs Girl	-2.02	0.66	-3.04	0.00290	**
Model H1b	R2 = 0.40	p-value =0.00			
	B	SE	t value	p value	
Constant	-101.59	43.13	-2.35	0.0208	*
Corresp. Vs Non-Corresp.	-9.76	3.67	-2.65	0.0090	**
Axial Mean Depth	25.59	11.05	2.31	0.0225	*
Meet Friends Despite Covid	1.62	0.3775	4.29	0.0000	***
Students' Performance	2.66	0.46	5.66	0.0000	***
Boy Vs Girl	-1.82	0.70	-2.60	0.0105	*
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

TABLE 8.11: Multiple Regression Models Investigating Positive Attribute Towards School

the depth of students' classrooms, interpersonal contacts with their friends, and perception of performance.

The first model explains 32% of the variation of students' positive attributes towards their school by considering school community type (S2 has been classified as a non-correspondence and S9 as a correspondence model), visual mean depth of classrooms per level of education, the degree to which they meet their friends despite Covid-19 measures, students' perception of performance in relation to their classmates and gender. In this model, students' perception of performance (2.24) and visual mean depth (-1.83) of students' classrooms appear to be the most important factors in predicting students' positive attributes towards school.

However, if only the 1st year and 3rd year students' answers are considered 45% of the variation of students' positive attributes towards their school can be explained. Interestingly, the most important factors of this model appear to be visual mean depth (-2.91), type of community (-2.37), students' perception of performance (2.12) and gender (-2.02). This indicates the fact that in a non-correspondence school community that thrives of openness and mixing and at the same time the classrooms are located visually central in the school, students could be more inclined to formulate a positive attribute towards their school. More specifically, with every one unit change in the classroom's visual mean depth results in 2.91 decrease of students' positive feelings towards their school.

Lastly, the 3rd model considers the axial mean depth instead of visual mean depth and investigates the effect of the topological depth of classrooms on students' positive attributes towards their school. This model explains 40% of the variation of students' answers and axial mean depth appears to be the most important factor. Specifically, with every one unit increase in the axial mean depth results in 25.59 increase in students' positive feelings towards their school.

By considering the models H1a and H1b comparatively, it can be seen that in the first model, the metric of the visual mean depth of students' classrooms contributes to the dependent variable negatively, while the axial mean depth of students' classrooms is positively associated with the dependent variable. This is quite controversial since both metrics try to capture the depth of classrooms, the first one by considering visual relationships and the second one by considering axial relationships. However, by considering jointly the t-statistics of the three (2) models, it appears that the visual mean depth of students' classrooms has a particularly higher significant association with the outcome variable (almost doubled). This suggests that the metric of visual mean depth is much more important than the axial mean depth. At the same time, it might suggest that visual mean depth captures more precisely the relationship of the classrooms with the immediate wide open areas of the school. Hence, it describes with a higher level of consistency the depth of the various classrooms within schools and contributes more effectively in the exploration of the dependent variable (positive attributes towards school).

8.3 Conclusions

Results of this chapter can be grouped under the spectrum of two broad themes:

- space usage patterns, school community and students' perceptions
- factors defining students' positive attributes' towards school

Specifically, space usage patterns have been considered in two different schools and suggest that S2 assembles a non-correspondence model which is characterised by mixing, intermingling, and interaction. As stated by students from school 2:

'We are a family here, we know everyone and we all hand out together, we don't fight, we don't have cliques. During the 1st grade there have been some cliques but we have gradually all became friends'.

On the other hand, it has been concluded that school 9 is characterised by a correspondence model where social segregation is supported by spatial segregation. In essence, in S9 the spatial layout does not encourage mixing apart from some locations such as the central corridor. This might be due to the enhanced fragmentation of the school's outdoor space and the wide array of wide open spaces that surround the building (fig. 8.30). In particular, as illustrated in the figure below, the outdoor areas in S2 are particularly structured and organised in association with the built spaces of the school and the courtyards. On the other hand, in S9, the outdoor spaces are loosely defined and particularly fragmented.

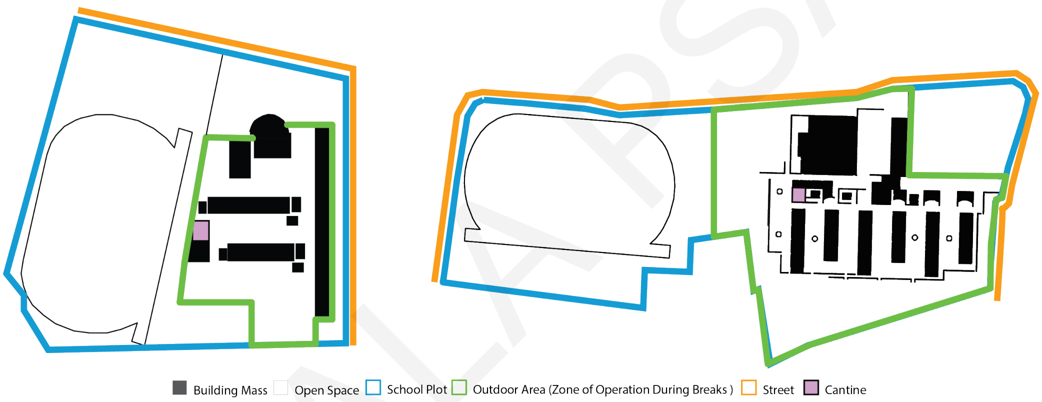


FIGURE 8.30: Diagram examining comparatively the spatial conditions in S2 and in S9

Therefore, the importance of such consideration is twofold. It firstly helps in understanding the importance of the left-over spaces when designing a school, since by comparing and contrasting the two schools it could be argued that the design and organisation of leftover spaces in schools is one of the most important factors that fosters the school community and forms of co-presence. Secondly, such an understanding offers an empirical validation of the conclusions drawn in chapter 6 that described school community type based on Bernstein's dimensions of classification and framing and classified S2 as a primary integration code school and S9 as a collection code school.

Lastly, the location of the cantine in S2 seems to support the mixing of users, since it attracts all the different users in the middle of the school. On the other hand, in S9, the cantine is placed relatively segregated. In particular, as it is characteristically mentioned by teachers, the location of the cantine in this school is particularly problematic since it is 'like the architectural design has placed the heart of the school in the legs instead of the chest'.

Additionally to the observed behavioural patterns and the school community that is identified, students' qualitative feedback is also considered in order to provide additional insights. In particular, the fact that students from S2 have reported higher pressure from covid-19 measures than students from S9 might resonate well with the fact that S2 offers a layout that supports interaction and co-presence and thus rules that limit to a certain extent this condition might be disturbing. What is more, students from S2 despite the fact that they tend to feel more pressure, they also tend to meet with their friends more despite the covid-19 measure compared to students from S9. Thus, it might be assumed that since the school community in S2 supports mixing and creates conditions for students to meet with their friends more often despite covid-19 rules. Therefore, it can be claimed that in a correspondence school community, such as S2, the impact of rules on students' perceptions might be more dominant than in schools that are already based on fragmentation and differentiation such as S9.

Secondly, it has been also assumed that various socio-spatial factors influence students' positive attributes towards school. Multiple regression models have suggested that visual mean depth of classrooms, perception of school performance, school community type, interpersonal contacts, and gender influence students' attributes towards school.

Going one step further, it may be assumed that this has wider implications, since the location of each particular class of the school is firstly defined by the design of the school and secondly by the responsible teacher that assigns the classrooms. Therefore, the location and the depth in which the agency decides to locate a classroom might influence to a certain extent students' positive attributes towards school.

Chapter 9

Discussion

This chapter aims to provide a summary of this thesis results and to examine them against the context of the current state of the art. Hence, it aims to provide a synthetic discussion, and thus, highlight the contribution of this research to the overall field.

9.1 Context and questions

This research has been set against the current state of the art in the investigation of school buildings and school practices. The review of the existing body of literature has highlighted that a vast array of factors, both spatial and socio-educational, are involved in this relationship. However, the current lack of empirical evidence and the overall fragmented approach to the investigation of school environments in the existing body of literature have failed to facilitate a broader understanding of the interplay between school building and school practices. At the same time, existing research has failed to address the role of agency and more precisely to explain the interplay between design and social agency in school environments. Hence,

Hence, this research aims to fill the gaps which have been identified by adopting a temporal socio-spatial integrated approach to the investigation of school environments. Specifically, the points mentioned above have let to the employment of a wide array of methods and processes to adequately explore the interplay between school building, school practices, and social agency.

The introduction of this thesis has set explicitly out a set of questions to address the extent to which the spatial layout and social agency of lower secondary school buildings which have been built in Cyprus after 2000, impact on pedagogy and social behaviour in schools. The questions have been grouped under three broad categories. The first one refers to the genotypical patterns between schools. The second explores the school as a temporal socio-spatial assemblage and the last one refers to the relationship between the school layout, actual use of space, and users' perceptions.

The first category broadly asks: To what extent do lower secondary school buildings built in Cyprus after 2000 illustrate morphological, spatial, and functional consistencies? (is investigated in chapter 5).

The second category hypothesises that the school building can be considered as a coherent whole constantly in the process of making. Thus, it aims to address the extent to which the school environment can be approached as an assemblage of various socio-educational codes that is continuously formed producing different forms of solidarity (is investigated in chapter 6). It also aims to address the extent to which a school's educational code can be shifted by means of social agency and rules application (is investigated in chapter 6).

Lastly, the third category sets to question: What are the implications of schools' characteristics on teachers' perceptions about the actual use of space? (investigated in chapter 7), how does socio-spatial conditions in school affect school life and school community? (investigated in chapter 8), and to what extent spatial, social and personal parameters can address students' positive attribute towards school? (is investigated in chapter 8).

9.2 Analysis overview

The analysis in this research has been characterised by the adoption of various methods at various scales and depths. The methods include analytical techniques from space syntax and other related fields with methods from social sciences (i.e, questionnaires, interviews, observations, 'walk and talk'). This approach has allowed a crosswalk between the type and depths of data and a more integrated investigation of the complex relationship between the school building and school practices. Besides the variation in depth and scale of analysis, different models and techniques have been used throughout the analytical chapters to address the complex relationship of school building with school practices.

The first three chapters of the analysis have investigated all 10 schools of the sample. Specifically, chapter 5 at first adopts a more morphological reading of the 10 schools under investigation, and then looks at the configuration and functional composition of the 10 schools. The analysis has concluded that school buildings in Cyprus could be classified into two distinctive building types. The 1st types refers to, courtyard-based schools that are primarily defined by one single courtyard. The second type refers to more hierarchical-based schools that are defined by various smaller courtyards and a hierarchical circulation system. Therefore, this chapter offers a classification of schools based primarily on visual inspection and basic consideration of each of the analysis separately. Chapter 6 utilises different sources of data in order to shed light on temporality, agency, school building, and educational code. It thus classifies the 10 school under investigation based on the educational code that is proposed by their layout.This classification has suggested that the majority of hierarchical schools embody an integration code and might point to a non-correspodence school community. On the other hand, it is illustrated that the majority courtyard-based schools suggest a collection code which complements a correspondence school community. However, this chapters has highlighted that the educational code that is suggested by the layout should be considered in a constant association with human agency (i.e headteachers decisions, rules, application e.t.c) in order to fully grasp the educational code of the school.

In essence, results of this chapter have suggested that school's educational code is continuously formed by mean of the interplay between the school building and social agency.Thus, human agency could potentially shift the educational code that is suggested by the school's layout. The following analysis chapter 7 explores further the commonalities and differences between schools by considering purely numerical associations between schools. In other words, it collects all values that have been derived by the two previous chapters and tries to visualise the relationships between schools more holistically through a two-mode relationships network. This third level of classification of schools not only considers all values that are derived by the various types of analysis in the previous two chapters but also reveals inter-type relationships (between courtyard-based and hierarchical-based schools) between schools. Also, this analysis has shown which schools have a rather unique spatial structure that is not related with the rest of the schools and which schools share similar spatial, functional, morphological and socio-educational patterns with most of the schools. Lastly, this analysis chapters reflects on teachers' perceptions and discusses the spatial conditions that are related with schools having issues with school control, strong school community and being able to cope with changes. At last, chapter 8 examines space usage patterns in the two selected schools (S2 and S9) and reflects on the school's life, school community and students' perceptions and in particular on students' positive attributes towards their school.

9.3 Open-air school as a socio-spatial assemblage: The role of agency in school buildings

The role of agency in school environments has been highlighted in different parts of this thesis. At first, the review of the existing literature in chapter 2 has demonstrated that school space is usually approached by various scholars as composed by various elements that extend from the school's physical structure to school's organisational structure. At the same time, it has been demonstrated that in many cases Lefebvre's spatial triad (Lefebvre, 1991) is used by scholar in order to fully grasp the different scales and dimensions of the school environment (Boys, 2010; Mulcahy, Cleveland, and Aberton, 2015; Bojer, 2019).

Hence, the findings of this study can be discussed here based on Lefebvre's spatial triad (Lefebvre, 1991) and reveal the role of social agency in different scales associated with the school environment. Firstly, at the scale of policy-making and general guidelines provision (*perceived space*), secondly at the scale of school design and architects' decisions (*conceived space*) and lastly at the level of school life (*lived space*) (Lefebvre, 1991).

Firstly, **at the level of *perceived space***, chapter 5 has highlighted that the particular emphasis given by the design guidelines to the courtyards' importance in school design, has defined the creation of two open-air school building types, the courtyard-based type that is composed mainly by one central courtyard and the hierarchical type which is composed by various smaller courtyards and linear circulation systems.

Results in chapter 5 have also suggested that the size of the school plot is defined to a great extent by various factors. In particular, the findings suggest that it is firstly defined by the standard size of the sports area and secondly by the fact that the TDMOEC states the necessity the sports area to be used by the wider community after school hours. Interestingly, this particular requirement has defined a school building type that is comprised of two different parts, the main school unit on one side and the sports area on the other side.

Results also suggest that the design guidelines provided by the TDMOEC and the size of the school plot have produced sparse school buildings with very small building density (FSI and GSI values) compared to other types of buildings. At the same time, in chapter 5 it has been found that the size of the school plot impacts on the overall configurational properties of the school design (conceived space), since it increases the segment length and in turn reduces the visual mean depth of the overall design.

Chapter 5 has also highlighted that all schools of the sample have their circulation areas particularly centrally located in the schools' layouts thus satisfying the guideline that are given by the authorities (is elaborated in chapter 3) that stated the importance of circulation areas for connecting the various parts of the schools together. Chapter 5 has also highlighted that the administration area in all ten schools is located next to the entrance and the parking area as a result of the guidelines that are provided by the authorities that specify this particular requirement (fig. 3.9).

Secondly, **at the scale of architects' decisions (*conceived space*)**, various implications of social decisions have been found. Chapter 7 highlights that during the design architects make various decisions that in turn have particular implications on the overall school design and thus to a certain extent on space usage behaviours (chapter 8). At first, by jointly considering results from chapter 5, and chapter 7 through the correlation of various spatial, morphological, and functional characteristics of the 10 schools under investigation, it is revealed that:

- The more square meters architects assign to the ground floor of the school, the less Normalised Angular Choice (NACH), and thus the less centralised and fewer movement potentials are given to the overall school design (i.e S10, S3, S7);
- The denser the design is on the ground floor, the less intelligible the overall design is with lower visual connectivity and integration. Thus, the density of the scheme seems that limits the visual properties and the overall 'readability' of the school layout (i.e S7, S3);
- Hierarchical schools tend to have higher segment values (segment choice, connectivity, integration) and lower step depth from the entrance, since the design is characterised by 'school promenades' that connect the various parts of the school linearly together (i.e S9, S10);

- The location where the architects decided to place the cantine is defined to a certain extent by the building type (hierarchical type schools have less centrally located cantine), axial length (i.e S9, S10, S8), the centrality of circulation and the centrality of special classrooms (schools with more centrally located circulation and special classrooms tend to have less centrally located cantine, i.e S6 and S10);
- Hierarchical type schools that were characterised by a more grid-like school organisation tend to have higher segment length but less centrally located courtyards, since they tend to have various smaller courtyards at various locations of the school (i.e S8, S9, S10);
- Designs that tend to have the circulation system particularly centrally located in the school have also special classrooms centrally located and thus the special education more at the center of the building (i.e S6, S10, S5, S7);
- The centrality of sports outdoor seems that is influenced by the density that the architects assigns, both on the ground floor as well as across floors (the higher the density the lower the centrality, i.e S3, S7);
- Schools with with bigger perimeter give more options to the architects and thus they articulates the sports indoor area more centrally in the school's overall layout (i.e S1, S10);
- However, the bigger plot size and perimeter seems that influence the centrality of vertical connections. It appears that the increased size of the school plot pushes the design to have less centrally located staircases (i.e, S1, S10);
- Lastly, the centrality of all secondary areas of the school seems that is influenced by the density that is assigned on the ground floor (the more density on the ground, the more centrally located secondary areas) as well as by the overall centrality given by design to the general outdoor areas of the school;

Additionally, results from by chapter 5 and chapter 8 can be used to explain that the way in which architects distribute the functions in the school is particularly important for space usage patterns. Specifically, the analysis of movement patterns in chapter 8 has highlighted that the strategic positioning of functions orchestrates 'programmed' movement patterns in schools since it specifies the potential zones of operation for students. In essence, it stipulates the places students can potentially visit during transfers. Notably, in chapter 8 it has been demonstrated that a whole part of S2 has had no movement patterns based on the above condition. Equally important, the areas that are assigned to school entrances operate as origin and destination points within the school that originate or attract movement.

Results from chapter 6 have also highlighted that the general design determines to a great extent the educational code produced and the degrees of framing and classification suggested by the layout (chapter 6). Therefore, it is highlighted that the decisions that are taken by the architects during the design process and generally the compromises they make influence firstly the educational code inscribed to the educational unit and thus the school's community type that is either characterised by openness and mixing or by boundaries and separation.

Thirdly, **at the level of school life (*lived space*)**, chapter 6 by examining space usage behaviours and users' distribution in S2 and S9 has highlighted that social agency has also spatial implications depending on the strength of the social rules that are applied. Specifically, results in chapter 6 have suggested that the social agency at the level of *lived space* has shifted the educational code that is proposed by the layout and thus differentiates the produced school community. In other words, the finding have suggested that the need for controlling the school as a whole, has forced the headteachers from S2 and S9 to isolate the open-sports area from the rest of the school and thus to prohibit students from using this area. In turn, this social rule has achieved shrinkage of the open space available for students while has also differentiated the relationship between built and unbuilt school space (Psathiti, 2018) and has influenced students' and teachers' zones of operation. It has also enhanced the schools' framing by controlling the interface between users and users' distribution within the school. In essence, although the school's built form appears to be stable regarding morphological terms, the social rules seem that could differentiate to a certain extent the configurational structure of the school and thus the buildings' space usage potential.

Organisationally, chapter 8 has demonstrated that the determination of a particular school timetable with correspondent classrooms orchestrates to a certain extent students' 'programmed' movement pattern within the school. Specifically, by constructing a school's specific timetable and by assigning certain classrooms that corresponds to particular modules, the headteacher or the responsible teacher assigns particular origin and destination points within the school. Thus, the closer examination of 'programmed' movement patterns in chapter 8 suggests that this hidden social ordering interacts with the school's spatial configuration and defines to a certain extent students' 'programmed' movement patterns.

In the same manner, it is shown that the particular location and depth of students' classrooms could drive to a certain extent students' positive attributes towards their school (chapter 8). Additionally, bearing in mind that the classrooms are centrally assigned to different grades, the power of social agency in defining to a certain extent students' perceptions towards their school can be revealed.

To summarise, at various parts of this thesis, and in chapter 6 in particular, it has been highlighted that social decisions could differentiate the socio-spatial dynamics within the school. More precisely, the results have demonstrated that the school's layout should be considered jointly with social agency in order to fully understand and decode the complex relationship of school layout and school practices. Therefore, such an understanding challenges the 'flat' ontologies to school space. In essence, by giving emphasise to the role of agency in school buildings it is highlighted that school "space [has to be considered] as constantly changing, as an outcome of the specific mutual relations between people and places and their contexts" (Tornaghi and Knierbein, 2015, p.244).

9.4 Importance of the wider context of learning in adolescence

The importance of the wider context of learning when examining school environments has been firstly stressed in chapter 2. Chapter 2 has discussed through various accounts, the ways in which the wider context of learning can be particularly important, especially for young adolescents. In particular, the importance of the school community, peer relationships and the sense of belonging to the school for students' emotional well-being and academic achievement has been stressed.

Based on the existing studies that are presented in chapter 2, it has been revealed that the wider context of learning can be particularly important especially for young adolescents who are in the process of shifting from family to peers (American Psychological Association, 2002; Kohlberg, 1981) for constructing their own self-identity (Erikson, 1968) and their role in the social groups they participate (Erikson, 1968). Hence, finding from this study can be used to support the argument that is already made in the existing body of literature that educational practices can no longer be considered as bounded to classrooms, but a wider consideration of school environments is needed (Sailer, 2018).

At first, findings in chapter 8 have demonstrated that S2 which happens to be classified as an integration code school in chapter 6 appears also to reassemble a non-correspondence school community and an organic solidarity that is to a certain extent reflected in the school's reality and users' perceptions. In particular, it is shown that, in comparison with S9, students in S2:

- Form more frequent interactions between them;
- Interact more frequently with their teachers and share with them personal matters;
- Form bigger groups;
- Know each other and exist in a synchronic co-presence in the outdoor area thus fostering a virtual community;
- Value more their friendships;
- Illustrate a greater degree of attachment to their school space, since they name explicitly the places they like and describe them with great level of detail;
- Illustrate significantly higher positive attributes towards their school (1st year and 3rd year students);
- Feel like a family and they know each other;

- Social (transpatial) labelling (i.e gender, ethnicity) does not appear to have a spatial reinforcement;

Therefore, it could be argued that this thesis empirical results have demonstrated that the wider context of learning is particularly important since it influences school life in many respects. Going one step further, the research findings could be further utilised so as to render the socio-spatial conditions through which a non-correspondence school community can be promoted by the school layout. In particular, the detailed list of spatial conceptualisations that are presented in chapter 6 could be used to suggest the school's spatial conditions by means of which a non-correspondence school community could be promoted by the school's layout. Hence, the dimensions could be summarised as follows:

- Higher density of functions on the ground;
- Lower separation between school floors;
- Higher movement potentials;
- Centrally located sports area;
- Integrated school as a whole;
- Centrally located administration area;
- Centrally located cantine area;
- Careful examination of the centrality of classrooms;
- Higher synchnronic co-presence - more instantly perceived spaces;

However, apart from the above conditions, through the in-depth comparison between S2 and S9 chapter 8 has demonstrated that the fragmentation of the outdoor space could also play a significant role for the conceptualisation of a non-correspondence school community. In particular, it has been found that in the case of S9 the highly fragmented outdoor areas or left-over areas that surround the main school building has contributed to a certain extent to the conceptualisation of a localised school community. School 2 in this respect spatially offers a different model, where the courtyard areas are developed in accordance with the few structured outdoor areas that surround the building and main circulation unites are to a certain extent an extension of the courtyard. This spatial condition has been enhanced even more by the school's headteacher who has defined even more precisely the exterior spatial structure by adding fences and thus excluding some parts of the school (fig. 8.30). At the same time, it seems that unlike a total courtyard-based school unit, the above spatial model offers options to its users without, however, fragmenting the overall school community. These findings, therefore, can more precisely address the concept of a well-defined school setting that have been firstly introduced by Moore's (1986) arguing that it could promote interaction and cooperation.

Therefore, based on additional insights from this research, it could be argued that a school layout that could suggest a non-correspondence school community could be additionally supported by the school's layout by considering:

- The degree of fragmentation of the general outdoor areas in relation to the main school unit. In essence, the case of S2 could suggest that lower fragmentation of the scheme can bring together social groups and school users by fostering synchronic co-presence;
- Thus, leftover spaces that surround the school building should be designed as precisely as the school building itself since they could define to a great extent co-presence in the space which is the material for the virtual community (Hillier and Hanson, 1984);
- It could also be hypothesised that schools that extensively share properties with both types of schools like S2, can possibly provide the right balance between individual options and inclusion in the school community;

9.5 Importance of school's layout on users' perceptions

Unlike existing studies in this field that either capture teachers' or students' perceptions, this thesis has collected insights from both user groups. Results from chapter 7 and chapter 8 have discussed the relationship of the school's layout with users' perceptions.

Chapter 8 has highlighted the factors that impact on **students' positive perceptions and general positive feelings towards their school**. The best produced model, which explain 45% of the variation, suggests that the type of school community (correspondence or non-correspondence), the visual mean depth of students' classrooms, the frequency of student-student interactions, students' performance and gender influence students' attributes towards their school. Thus, the results could demonstrate that a school design that can promote a non-correspondence community (i.e, in S2) and places students' classrooms in visual integrated locations in relation to the whole school community can potentially enhance students' positive perceptions towards their school. The importance of the depth of the classroom is also highlighted by other scholars in the existing body of literature suggesting that it could influence students' distribution within the school (Taguchi and Kishimoto, 2012).

From a teachers' perceptive, it has been found in chapter 7 that in integrated schools **teachers perceive to a certain extent that they have good relationships with students, meet and interact very often with students outside of teaching hours and generally that there is a trust and support culture**. Despite the small effect of the models (more or less 20%), the fact that all models have included metrics relating to the overall school integration suggests, to a certain extent, that an integrated school [41] could point towards a stronger school community, trust and support school culture. These findings are in line with other studies which argue that the highly accessible and integrated schools influence occupation and interaction in schools (Pasalar, 2003).

More elaborately, the best produced model that is presented in chapter 7 suggests that the most important spatial factor in contributing to teachers' positive perceptions is segment integration. Namely, the schools that have higher segment integration tend also to be rated by teachers as more supportive and generally with a stronger school community. Additionally, results in chapter 5 have shown that the hierarchical-based schools tend to have higher segment integration in comparison with courtyard-based schools. Hence, such a consideration could challenge the idea of courtyard-based schools as fostering a stronger school community.

In respect to **teachers' perception of facing issues with school control**, a relatively strong relationship with spatial variables has been identified by this thesis in chapter 7. The models have varying predictive power, statistical significance, and reliability in relation to the assumptions. The best produced model explains 59% of the variation of teachers' perceptions regarding facing issues with school control. This model suggests that schools that have higher axial control and simultaneously higher density of the ground floor (GSI) face fewer issues with school control. A second model has also highlighted that schools with higher school porosity, namely, high interface of the school plot with the street, and at the same time, higher and more centralised movement potential (NACH) can be perceived by the teachers as facing more issues with school control. A third model has revealed the importance of axial intelligibility in relation to school porosity for addressing teachers' perceptions of facing issues with school control. In particular, the model suggests that despite a school being exposed to the street network (school porosity) when it is characterised by high axial intelligibility, issues with school control can be moderated. The last model suggests that the educational mode along with axial intelligibility are powerful indicators that can address teachers' perceptions about school control. Specifically, it is suggested that more fragmented schools, which are classified as collection educational code, tend to be perceived as having more issues with school control.

Few and rather small effect conclusions have been generated in chapter 7 regarding the spatial conditions that **influence teachers' perception regarding school's ability to cope with changes**. However, despite the fact that the two best produced models have a particularly small effect, these are in line with the results suggested by Kishimoto and Tagushi (2014). Specifically, one of the two best-produced models suggests that centrally located classrooms have a negative effect on the school's ability to cope with changes (15% or the variation has been explained by this model). Likewise, Kishimoto and Tagushi (2014) have argued that isolated classrooms tend to afford more flexible education (chapter 2). A second model

[41] Integrated were the school that have a lot of connection between spaces, allow movement potentials and offer options to the users

also suggests that the overall integration of the school along with the educational code of the school explain 17% of the variation. Similarly, Kishimoto and Tagushi (2014) have suggested that when the school integration is low, more teachers perceive that it is easier for them to follow various educational styles.

9.6 Wider context of learning and positive school climate: Design guidelines for practising architects

In the existing body of literature *school climate* is usually associated with the "attribute or mood" and highlight the interdependence of four areas: safety, relationships among the school community users (i.e student-student, student-teacher), teaching and learning processes, as well as the school's institutional environment (physical surroundings, resources, organisational structure etc) (Gruenert, 2008). Hence, results from various chapters of this thesis could potentially offer a base to provide practising architects with design guidelines that give emphasis to the wider context of learning and render a positive school climate. However, given the complexity of this issue, there is no attempt to draw conclusions about causality but instead to offer key evidence that could highlight the link between school layout and issues related to an overall positive school climate. Hence, based on the four interdependent areas of school climate, the findings of this study could discuss the following related themes:

- Schools with less control issues;
- Schools with easy adaptation to changes;
- Schools that could promote trust and support culture and encourage interpersonal relationships
- Schools with a school layout that pomotes an integration educational code and a non-correspondence school community;
- Schools for positive students' attributes;

Through the discussion of the above, themes in chapter 6, chapter 7 and chapter 8 the following design parameters have been revealed as important:

- School porosity (interface with street) in relation to school's design;
- School's density on the ground in relation to the school layout's ability to have high axial control;
- Topological and visual centrality classrooms;
- School's overall integration and general fragmentation of the outdoor areas (left-over) that surround the school building;

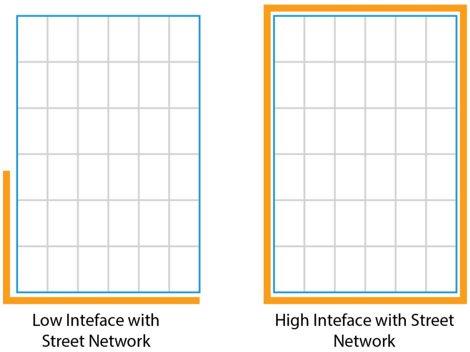


FIGURE 9.1: Diagram suggesting the spatial conditions for the degree to which a school is either highly exposed or not to the street network (school porosity)

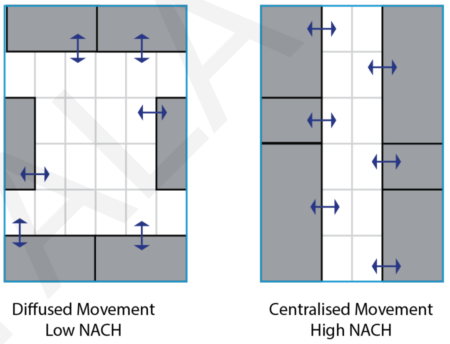


FIGURE 9.2: Diagram suggesting the spatial conditions for providing either diffused or centralised movement potential

School Porosity in relation to school's design

The **importance of school porosity in relation to school's design** has bee revealed in chapter 7. In particular, results from chapter 7 highlight that the plot's exposure to the street is particularly important (fig. 9.1). Results have also demonstrated that the exposure of the school's plot to the street should be jointly considered with the movement potentials offered (fig. 9.2) and the axial intelligibility of the school (fig. 9.3). This therefore suggests that when architects approach a school's plot that has high exposure to the street, they should also consider its readability, complexity, and fragmentation, properties that can influence the metric of axial intelligibility. In other words, when the exposure is high, the movement potential should be lower and the axial intelligibility should be higher.

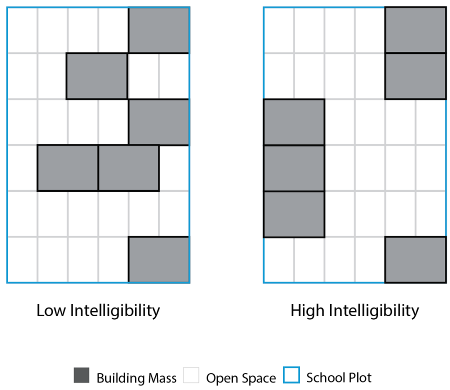


FIGURE 9.3: Diagram suggesting the spatial conditions for providing either high or low axial intelligibility

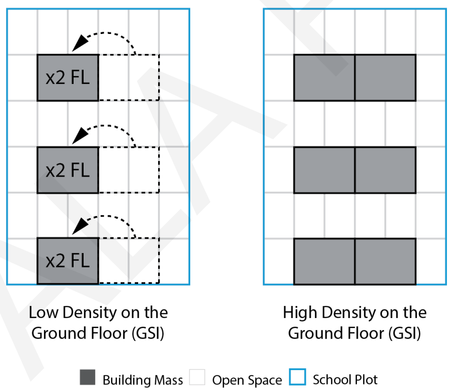


FIGURE 9.4: Diagram suggesting the spatial conditions for providing either low GSI or high GSI

School's density on the ground level

Secondly, the results of this thesis have revealed the **importance of the school's building density** in relation to the school's overall design. In particular, results suggest that the density of the school on the ground (fig. 9.4) should be considered jointly with the degree of axial control that the design offers. *Axial control* is a dynamic local measure, in space syntax terms, that captures the degree to which a space gives access to its immediate neighbours by taking into account the overall number of connection each neighbour has (Space Syntax, 2021). Thus, a corridor that provides access to various one-end spaces has relatively high axial control. On the other hand, a system in which all spaces provide equal access to its immediate neighbours has a more equally distributed axial control (fig. 9.5).

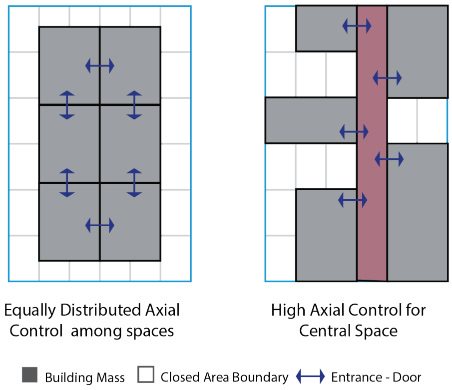


FIGURE 9.5: Diagram suggesting the spatial conditions for providing either high and centralised axial control or a more equally distributed axial control

Towards a better understanding of the concept above, S7 can be used as an example. School 7 has been reported by teachers as the school with the most issues with school control. Simultaneously, its design is characterised by a less clear synthetic composition, the lowest axial control and the highest GSI (density on the ground level). Design-wise, S7 is the only school of the sample with an outward-looking integration core (chapter 5), while its composition seems forced by the plot restriction rather than by a particular synthetic consideration. Lastly, it has the lowest intelligibility value among the sample.

Topological and visual centrality classrooms

Thirdly, the **centrality of classrooms** within the school has been found to be important for school design. Namely, results in chapter 7 propose that the positioning of classrooms within the school could influence to a certain extent teachers' perceptions regarding the ability of the school to cope with changes. Interestingly, results both from chapter 7 and chapter 8 could suggest that, based on teachers' views, classrooms should be placed relatively segregated topologically in the overall school layout. In particular, the schools that have recorded relative centrality of general classrooms close to 1 or above 1 appear to have among the lowest mean ability to cope with change (as summarised in section 7.4). In essence, despite the fact that results from chapter 7 have not such a high explanation power, still give an indication of the importance of considering the depth of classrooms. Hence, fig. 9.6 attempt to capture schematically the ways in which a classroom can be placed either relatively located in the school composition or relatively segregated topologically.

S7 can again be used as an example for a better understanding of the above conditions, since it is the only school of the sample that has particularly centrally located classrooms and is classified as the school with the lowest ability to cope with change.

However, research findings have suggested that students from classrooms that have had

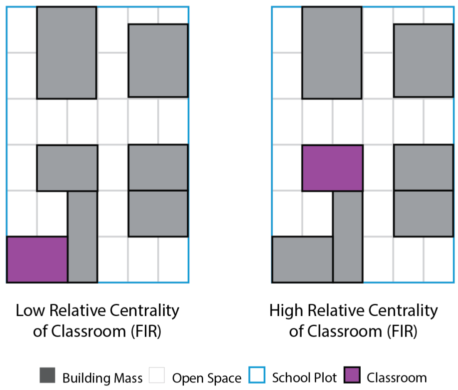


FIGURE 9.6: Diagram suggesting the spatial conditions for providing either centrally-located classrooms or more segregated classrooms

less visual mean depth have had a more positive attribute towards their school (fig. 9.7). Figure 9.7 captures schematically the properties of a classroom that is characterised by low VMD and is visually closer to all the other functions-areas of the school. Such an understanding therefore suggests that a more careful consideration of both topological and visual placement of classrooms within the school should be made during the design.

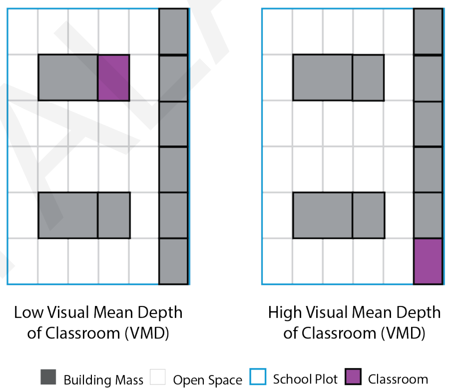


FIGURE 9.7: Diagram suggesting the spatial conditions for providing either low visual mean depth or high visual mean depth for classrooms

School's overall integration and general fragmentation of the outdoor areas

Fourthly, the **overall school's integration** [42] **and fragmentation of the general outdoor areas** have also been rendered as important. In particular, the overall segment integration of the school have been firstly stressed in chapter 7 for addressing teachers' perception of

[42]Integrated are the school that have a lot of connection between spaces, allow movement potentials and offer options to the users

strong school community. Specifically, based on the review of existing literature and results from chapter 7, it could be suggested that integrated schools might help, to a certain extent, teachers to form better relationships with students, meet and interact more often with their students outside of teaching hours and achieve an overall trust and support culture in the school. In that context, results from chapter 5 have also highlighted that hierarchical-based schools tend to have higher segment integration compared to courtyard-based schools. Hence, it can be suggested that hierarchical-based schools could have higher potential of fostering trust and support culture compared to a courtyard-based school.

However, in an integration code school (as it defined in chapter 6) high segment integration has a slightly negative effect on the school's ability to cope with changes (17% or the variation has been explained by this model). Namely, this might suggest to a certain extent that when the layout proposes an integration educational code, thus allowing the mixing of things, the overall integration of the school should not be that high in order for a school to be able to cope easily with changes and thus to accommodate various educational styles, paces and modes of teaching and learning. In this context, fig. 9.8 visualised ways in which a school layout can be characterised as highly complex and segregated or as simpler and more integrated.

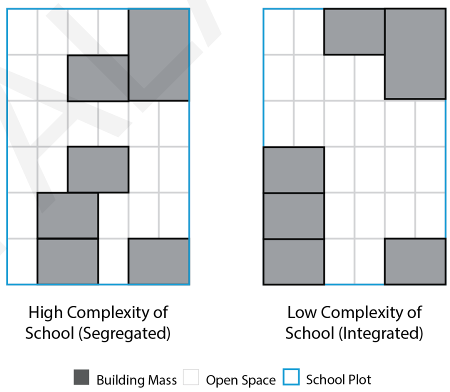


FIGURE 9.8: Diagram suggesting the spatial conditions for providing either highly complex and segregated school layout and or simpler and more integrated school layout

Lastly, finding from chapter 8 posit that the fragmentation of the overall outdoor area is crucial for the formation of a non-correspondence school community. Hence, the results could suggest that for a design to support more a non-correspondence school community, a more strategic and careful design of the outdoor space, the space between the school unit and the plot perimeter, should be considered (fig. 9.9). Apparently, a moderate fragmentation could provide the potential for a synchronic co-presence in which all school community could

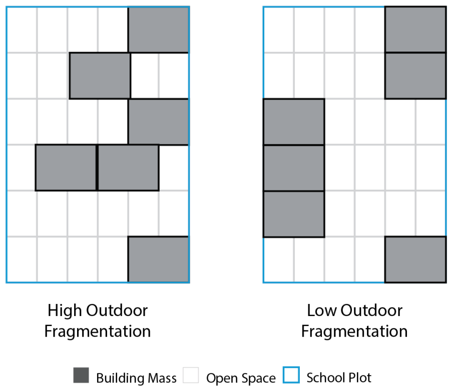


FIGURE 9.9: Diagram suggesting the spatial conditions for providing either highly or low fragmented outdoor areas

come together by means of co-presence (Hillier and Hanson, 1984). Figure 9.9 constitutes an attempt to capture schematically the ways in which high or low outdoors fragmentation can be achieved.

9.7 Evaluation of the design guidelines for lower secondary schools provided by MOEC

Results of this thesis have not only offered insights for understanding the interplay between school design and school practices but also insights for improving the existing design guidelines that are provided by the authorities. Simultaneously, the critical evaluation of the design guidelines in chapter 4 but also the critical reflection in the previous discussion chapters have pointed out some problematic aspects of the school's design guidelines and have challenged certain elements of the framework that is provided by the authorities.In particular, section 9.7 summarises the points that the authorities need to re-evaluate or specify.

Firstly, the diverse image that has been produced based on conclusions of section 5.1.1 suggest that there is currently no particular strategy regarding the desirable plot shape, size, and perimeter. Instead, due to the extreme differences between schools, it can be assumed that the selection of the school plot is rather a matter of availability in the area of interest rather than a strategic decision based on certain criteria.

All 10 cases examined in chapter 5 have demonstrated significant differences as regards the schools' porosity, since schools' interface with the street ranges from 28% to 100%. However, when the aforementioned spatial condition has been examined in the light of teachers' perceptions (in chapter 7) school porosity has been one of the most important factors that address teachers' perception of reporting issues with school control. Results from the multiple regression analysis in chapter 7 have pointed also out that school porosity should be considered jointly with school design in order to prevent issues with school control. Therefore,

A/A	Points to Re-evaluate and Specify
1	Plot Shape
2	Plot Size
3	Plot perimeter
4	Plot's interface with the street (Porosity)
5	Relationship of sports area with the main school unit
6	How the design of schools could cope with educational changes
7	To develop a particular strategy for left-over spaces that surround the school building

TABLE 9.1: Points to re-evaluate and specify for the design guidelines of lower secondary schools in Cyprus

a more careful determination of the acceptable range of school porosity should be considered by the TDMOEC. At the same time, a more careful mention should be made within the design guidelines in order to state explicitly that when the school porosity is high, the design should, for example, reduce slightly the movement potential or/and increase the axial intelligibility of the school unit.

Additionally, finding in chapter 5 have demonstrated that the requirements provided for the outdoor and indoor sports areas along with their restricted size have resulted in school plan organisations that are composed of two parts (sports area and main school unit). The findings from chapter 5 and chapter 6 have also suggested that the intention stated by the design guidelines (chapter 3) to open up the sports areas to the local community outside of school hours along with the need to ensure separate access for sports indoor and outdoor areas, have created a building type that is particularly sparse. Not only, they have created a school building which is characterised by a particularly big plot, high exposure (in some cases) to the street and a big areas that is rather separated from the rest of the school. The above principle is rendered by the findings of this thesis as particularly important especially when considering that in all cases half of the school plot perimeter is dedicated to sports area. Not only, this area is used only particular time of the school day. Thus, this resonates well with the decision of some headteachers to separate completely this area form the rest of the school so as to be able to control the school (chapter 8). Therefore, the findings of this study could be used to critically evaluate the need for this particular area or to achieve a more strategic consideration of the way this area could be attached and/or detached to the main school unit.

Going one step further, the conclusions above raise further concerns regarding the relationship of the school unit with its wider local community. Based on the insights derived from this thesis, the relationship of the school plot with the wider local community, both spatially and operationally should be critically evaluated by the TDMOEC.

In addition, existing guidelines could also be benefited by a more systematic consideration of the functional distribution in schools and its potential relationship with the actual use of space. Specifically, the results derived from the empirical evidence and have discussed in chapter 8 suggests that architectural decisions along with the organisational decisions regarding the distribution of functions define to a certain extent the students' programmed movement patterns. Therefore, a framework that could explain to architects how the distribution of functions could influence space usage patterns, could potentially help practitioners to be more conscious about their design decisions.

Lastly, in chapter 3 it has been highlighted that the relationship of school buildings' guidelines with the educational processes is clearly defined in the existing guidelines. More elaborately, despite the fact that in the design guidelines it is stated that the school building should be able to cope with future educational needs, the way this adaptation could be achieved is not defined. Additionally, the design standards do not explain the pedagogical principles behind certain decisions (such as the existence of courtyard areas as the focal point of the school). More importantly, the discussion in chapter 3 has demonstrated that the framework that is proposed for the design of lower secondary schools has remained pretty much stable since 2011. Specifically, despite the fact that major educational shifts have occurred in the last 10 years, there is no intention from the TDMOEC to describe the ways in which such changes could be incorporated spatially within the school unit.

The theoretical and methodological framework proposed by this thesis in chapter 6 could provide a base for the classification of schools based on their socio-educational code and offer a more meaningful connection of the school layout with educational practices. This thesis offers an integrated framework through which various assumptions could be considered jointly and the evaluation of the school's educational code could be achieved. The above framework is in line with multiple other studies (Peatross and Peponis, 1995; Sailer, 2015; Sailer, 2018; Mclane, 2015) that have concluded that Bernstein's theory of educational transmission could potentially offer a base for exploring the relationship of the school environment with educational processes.

Lastly, in regards to the wider context of learning, the findings of this thesis have highlighted the importance of the left-over areas in school design. In particular, the results in chapter 8 have demonstrated that the general outdoor areas that surround the school building should be as carefully designed as the primary school unit. Thus, this should be clearly stated in the design guidelines to make explicit that an increased fragmentation of the outdoor areas could point towards a correspondence school community which is characterised by boundaries and separation.

9.8 Approaching open-air schools with space syntax analytical tools

The lack of existing research studies on open-air schools has been stressed in chapter 2. In particular, the review of existing literature has shown that both empirical and analytical studies dealing with open-air schools are missing from the existing body of literature. Section 9.8 gives an overview of the space syntax metrics that appear to be useful for the investigation of open-air schools.

	Type of Analysis	**Purpose**
1	Axial and Segment Analysis	Understand the school's spatial structure
2	Segment Choice	Examine movement (62%) in designs that have a more centralised movement potential such as S9
3	Segment Integration	Examine stationary activities (28%) in designs that have a more centralised movement potential such as S9
4	Visual Connectivity	Moving (29%) and stationary activities (40%) in schools that share properties with both types of schools
5	Axial control, NACH, segment integration, local axial choice	Teachers' perceptions.
6	Visual Mean Depth from students' classrooms	Students' perceptions

TABLE 9.2: Approaching open-air schools with space syntax analytical tools

Results in chapter 5 have highlighted a particular challenge when studying the spatial configuration of open-air schools. In particular, it is highlighted that open-air schools in Cyprus are composed of two parts. One part of the plot, the sports area, is always particularly big, open, and instantly perceived. The other part of the plot accommodates the primary school unit and is highly fragmented, composed of various building units and open-air corridors connecting the various bits and pieces together. Thus, this unique particularity of open-air schools in Cyprus underscores the necessity for adopting a more exploratory approach for the consideration of the spatial structure of the schools.

Chapter 5 has suggested that visibility graph analysis, which has appeared to be particularly useful in the existing scholarly work (Sailer, 2015; Fouad and Sailer, 2017; Fouad and Sailer, 2019; Mclane, 2015) for explaining the spatial configuration of school buildings, it has not been that useful for describing the spatial layout of open-air schools. As it is summarised in chapter 2, in space syntax theory visually integrated areas are usually associated with the most liveable areas that attract high occupancy and often interactivity patterns. However, in the particular case of open-air schools the most visually integrated area which is instantly perceived is in all cases the sports area. However, by reflecting on school life (in chapter 8), it has been illustrated that the sports area constitutes a 'programmed' area that operates under certain conditions and particular times of the school day, and the most densely populated areas of the schools are located in the main school units instead of the sports area.

Therefore, this study, by reflecting on these challenges, has explored various alternative ways to study the spatial configuration of open-air schools (chapter 5). Specifically, it extensively utilises axial and segment analysis as well as some metrics that are derived by visibility graph analysis. Conclusions from chapter 7 and chapter 8, that have investigated different dimensions of school users' perceptions as well as the actual use of space, suggesting that certain types of analysis are particularly useful in addressing multiple socio-educational aspects in open-air schools.

In particular, results from chapter 8 demonstrate that the most useful spatial models for investigating space usage patterns in open-air schools are the ones that analyse the main school unit by excluding completely the sports area. Additional insights from chapter 8 have shown that the segment analysis and the values of segment choice (T1024 Choice) and segment integration are particularly useful for schools that share similar spatial organisation as S9. In particular, the spatial metric of segment choice has been able to explain to a great extent the movement flows in S9 (62% of the variation). Additionally, Segment Integration has been able to address to a certain extent stationary activities (28% of the variation). However, the above metric has been inconclusive in S2. Instead, in the case of S2, only visual properties of space have been managed to explain to a certain extent the space usage patterns in S2. In particular, the variation in both moving and stationary activities has been addressed to a certain extent by the visual connectivity of space, 29% and 40% of the variation respectively.

The above paradox can be further understood by looking at the results which have been produced by chapter 7 and chapter 5. Firstly, it has been found that the two schools illustrate significant differences as regards their segment values. Specifically, S9 illustrates significantly higher segment values compared to S2. At the same time, through the two-mode network of school relationships, it has been illustrated that S2 is particularly central in the network and shares properties with both types of schools. On the other hand, S9 is primarily characterised as hierarchical-based structure and has predominant relationships with hierarchical-based schools (i.e, S8, S10). Therefore, by synthesising the above conclusions, it may be argued that segment analysis can be more useful for hierarchical-based open-air schools, while VGA analysis can be more effective for either courtyard-based schools or for schools that share properties with both types of schools.

In respect to the particular space syntax metrics that have been useful for the examination of open-air schools in relation to school users' perceptions, the results from chapter 7 and chapter 8 can be particularly useful. The measures of axial control, NACH, segment integration, local axial choice as well as the joint measure of relative centrality of classrooms are among the most important metrics used in the models so as to explain teachers' perceptions.

Additionally, the exploration of students' positive attributes towards their school in chapter 8 has highlighted that the consideration of the visual mean depth of students' classrooms can be particularly useful when examining related aspects.

Lastly, results from chapter 5, chapter 6 and chapter 7 have demonstrated that the relationships between open-air schools can be traced in multiple ways. In particular, the identification of relationships between schools is firstly achieved through a visual inspection and a more qualitative reading (chapter 5). Secondly, the educational code that is proposed by Bernstein (1973) is used to classify schools in accordance to the way the school building is related to pedagogy. Lastly, a more quantitative reading is achieved by considering firstly the relationships between variables that are derived by all types of analysis and secondly through a assumption-based clustering.

Chapter 10

Conclusion

This chapter summarises the main findings of this thesis presented in this dissertation and discussed comparatively in the previous chapter. Secondly, some limitations of this study are presented, thus highlighting the issues that worth to be considered for future research. Lastly, an overview of this thesis contribution is presented in the last section.

10.1 Summary of Findings

This study has investigated the relationship between school's spatial configuration, school processes, and the role of agency in school life. After examining the existing body of literature, the context of the study, the selected case studies have been presented along with the methodology of this study. Four distinctive chapters of analysis have followed to achieve a broader understanding of the commonalities and differences between schools, classifying the schools based on their socio-spatial and socio-educational potentials and thus relating those potentials with teachers and students' perceptions as well as with the actual use of space.

Three distinctive ways of examining the commonalities and differences between schools have been proposed. Firstly, a comparative, primarily visual comparison has been presented based on the unique morphological, spatial, and functional properties of the schools. Therefore, two distinctive school building types have been identified based on the idea of courtyard arrangements in relation to enclosed spaces and open-air circulation units. Secondly, schools have been classified based on the educational code proposed by their spatial layout. Additionally, empirical results denote that the educational code can be shifted by social agency and power authorities. The third classification strategy utilises the raw data retrieved by all types of analysis (presented in chapter 5) and groups schools based on a correlation matrix and an assumption-based clustering. This two-fold strategy provides a nuanced understanding of commonalities and differences between schools and illustrates cross-type relationships that are not rendered neither by the schools' visual examination nor by the socio-educational groupings proposed.

Results suggest that more than 60% of the school plot is open in school buildings in Cyprus. This is a unique characteristic that defines open air schools in Cyprus. In addition, due to the open-air structure of the schools in Cyprus, the circulation system is among the shallowest areas of the spatial system. Such an understanding reveals the potentiality of those spaces to accommodate movement and occupation patterns. This suggests that corridors in open-air schools do not have only a practical reason but could potentially encourage a wide array of activities. Going one step further, it could also be considered that sometimes the essence of corridors in open air schools is dissolved when they are in a wide association with courtyards. This, for example, it is shown in chapter 8 where in S2 movement patterns are deployed almost parallel to the circulation system. In essence, in this case, the school design directly associates corridors and courtyards with the circulation system and thus almost dissolves the essence of corridors as separate design elements.

As regards the integration cores of the schools are primarily inward looking, possibly due to the increased need for security and privacy. Moreover, among all schools of the sample, it is highlighted that there is a particular separation of the primary school unit from the sports areas. Apart from that, sports areas occupy a large area parallel or next to the main school unit and the schools' integration cores very rarely reach this part of the school. It has also found that these consistencies appear to be related to a certain extent with the design guidelines provided and with the way architects make design decisions in relation to particular constrains (i.e, school plots, urban density around the school etc).

Results from this thesis have also suggested that the particular spatial, functional, and morphological characteristics of each school have a reciprocal relationship with school users' perceptions and school life. Firstly, the findings suggest that particular school characteristics illustrate a strong relationship with teachers' perceptions about school control. These results have pointed out the importance of the school's density on the ground, the school's porosity as well as the importance of spatial configuration for teachers' sense of controlling their school and having fewer issues with students disobeying the rules and generally students' delinquent behaviour.

As regards school life, it has been empirically validated that integration code schools tend to assemble an organic solidarity. An organic solidarity as rendered in chapter 8 is characterised by less boundaries and a non-correspondence school community that is characterised by openness and mixing of users, more frequent interactions, increased trust, and friendship. On the other hand, it has been revealed that a school that moves towards a collection code orchestrates a mechanical solidarity and a correspondence model where spatial locations follow a transpatial ordering and is characterised by boundaries and separation

Lastly, the results have shown that students' positive attribute towards school is not merely a personal matter but also depends on various socio-spatial conditions such as the visual mean depth of the classroom and the type of school community (i.e being a correspondence or a non-correspondence).

10.2 Limitations

Due to the exploratory nature of this study, there have been various limitations. Firstly, one of the greatest limitations of this study and most possibly one of its greatest strengths is that the observations of human spatial behaviours have been conducted within the covid-19 pandemic. Although a pilot study has been undertaken prior to covid-19 and has allowed valuable conclusions to be drawn regarding space usage patterns, the study could have been benefited by further research of space usage patterns after the covid-19 pandemic.

Secondly, only two schools have been selected for the in-depth study, and thus, space usage data have been collected only from two schools. Therefore, this study could have benefited from a larger sample size. However, this would have been impossible for one researcher to do because of the volume of data collection from both types of analysis (both cross-case analysis and in-depth studies).

Thirdly, the study has obtained limited teachers' answers from some schools. In particular, staff has been less willing to collaborate and participate in the study in some schools compared to others. Thus, due to the small response rate from some of the schools, it has not been possible to extract individualistic conclusions and include all schools in the multiple regression models. In general, this study would have benefited from the inclusion of additional qualitative information from all ten schools (i.e., an interview with all headteachers as well as students' questionnaires from students of all schools)

Fourthly, the link between school community, school belonging, positive feelings towards school, and students' perception of performance could have been investigated more thoroughly by controlling students' answers. More specifically, this thesis could have been benefited by having a representative sample of students from the whole spectrum of academic performance. This could offer a greater control of the sample and possible external parameters that might influence the analysis. However, this categorisation has been impossible due to ethical reasons and increased complexity in the sample selection.

Finally, this thesis has aimed to bring together a more explanatory approach that adopts a methodological perspective from different disciplines (from space syntax, education, spatial, functional, and morphological modelling). For this reason, in some cases, such as in the case of the sentimental analysis which is used in chapter 8 the methods have been used without extensive exploration of their underlying methodological and theoretical grounds.

10.3 Future research

Some of the limitations that have been mentioned above also serve to point towards new research avenues. Thus, future research could consider a larger sample size to collect empirical data from space usage patterns from all ten schools. Simultaneously, additional qualitative feedback from both students and teachers from all 10 schools could shed additional light on school users' perceptions and offer a grader validation of the concepts that are mentioned in the course of this dissertation (i.e strong school community, positive attributes towards' school, school's ability to cope with change etc). At the same time, the classification of schools based on their educational code that has been proposed in chapter 6 could be further tested in different school periods (i.e, winter, summer etc) and thus enhance even more the idea of school building as a socio-spatial whole constantly in change.

Equally important, the important role of functional allocation in school buildings has been stressed in many parts of this thesis. Specifically, it has been highlighted that the functional distribution and the particular timetable that is generated by the school's headteacher could orchestrate to a certain extent task-bounded movements. Therefore, this research would be further benefited by a more in-depth examination of how functional allocation can influence school life. Simultaneously, despite the fact that the intention of this thesis has been to study the whole school unit as a whole, this dissertation could have been benefited by a further examination of the classroom unit itself and the processes and interactions that occur within the locus of pedagogical praxis.

Lastly, the data and findings of this dissertation could be used in future research to further make suggestions for school design. Specifically, despite some initial suggestions for designing schools with a positive school climate that have been introduced in the discussion, still additional guidelines could benefit the design of schools. Moving towards this direction could be valuable to include in the investigation the architects' perspective. More specifically, architects' initial sketches, design intentions, and design concepts could potentially shed additional light on the decision making process and thus provide additional insights into the design of schools.

10.4 Contribution to Knowledge

The main contribution of this thesis is that it provides empirical data from the everyday life of secondary open-air schools and at the same time identifies the role of spatial layout and agency in socio-educational practices.

The importance of this study also stems from the development of an integrated framework through which school environments can be defined, approached, and analysed. Specifically, based on the fragmentary state of existing research on school buildings, this thesis has adopted an integrated approach that suggests that school buildings should be considered as socio-spatial constructs continuously in the process of making. At the same time, even though this research is departed primarily by the built environment, it is not bounded to the spatial dimension. Instead, it enriches the understanding of school environments by considering developmental, educational, and social aspects related to schools and adolescents. Additionally, it builds on existing scholarly work which incorporates Basil's Bernstein educational code in the investigation of school layout and school realities (Peatros & Peponis

1995; Sailer 2015). It also provides a temporal dimension to Basil Bernstein's framework, which results from the consideration of school space as a dynamic social-spatial whole instead of a mere physical structure. Thus, it offers a broader understanding of school environments by highlighting their complexity and temporality.

Methodologically, this thesis with the combination of bottom-up and top-down approaches enables both the collection of empirical data, and at the same time the testing of the hypothesis on a much bigger sample. This provides empirical data that can contribute to the existing lack of empirical evidence (Woolner et. Al. 2007) on school building research. It also contributes to the current space syntax knowledge about school buildings and more specifically open-air schools. In addition, it also offers multiple ways through which the commonalities and differences between school layouts can be traced and identified (i.e, through visual inspection, by piloting their socio-educational potential comparatively through a 2x2 matrix as well as by capturing their relationships through a two-mode network).

Equally important, this study proposes a way to utilise various dimensions of classification and framing for rendering the educational code of each school. At the same time, it offers an empirical verification of the educational code that is proposed by Bernstein (1973) and it is spatially translated by a wide array of scholars in the existing body of literature (Peatross and Peponis, 1995; Sailer, 2015; Sailer, 2018).

Valuable conclusions are also drawn on the relationships between school building and school life. Firstly, this study offers the grounds to achieve a more spatialised understanding of the school's positive climate and how the school's design may assist in achieving a positive school climate. Secondly, it highlights the interdependence of the school layout with the school community and underscores the spatial conditions that are related to teachers' and students' perceptions.

Unlike the existing body of literature in this field, this study rendered the importance of agency and social decision in school's design and school life. Specifically, considering the school building as socio-spatial constructs constantly in the process of making, it has pointed out the interdependence of socio-spatial conditions with particular social decisions.

Finally, this study is also significant for the specific context of Cyprus. It is critically engaged in the evaluation of existing secondary school buildings in Cyprus and offers a comparative understanding of the interplay between school realities and the school's socio-spatial structure. Therefore, this exploration is valuable for the critical evaluation of existing principles that are given by the authorities in Cyprus as well as for the design and development of secondary school buildings.

Appendix A

Appendix A: Matrix for Top-down Analysis

A.1 Matrix with all the metrics used for Top-down Analysis between the 10 schools under investigation

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
FSI	0.08	0.17	0.19	0.13	0.17	0.08	0.21	0.11	0.13	0.10
GSI	0.06	0.12	0.15	0.09	0.11	0.07	0.11	0.08	0.09	0.10
Ground_Floor_Size	3320.548	3508.292	4549.395	3293.010	3119.117	2503.585	3561.719	3243.758	3468.827	4910.239
L_Number_of_floors	1.35	1.49	1.25	1.39	1.54	1.26	1.80	1.43	1.38	1.00
Plot_Perimeter	1020.9400	677.7480	736.3479	785.9943	736.1398	935.9483	792.4130	824.2932	996.8276	1068.5695
Plot_Size	58624.94	29911.38	30483.04	36314.39	28849.03	37967.54	31023.86	41418.76	37446.84	49516.77
Street_Length	409.1172	308.5913	430.3101	221.5886	298.2719	823.4017	792.3538	824.2695	556.1161	489.6371
School_Porosity	40.07	45.53	58.44	28.19	40.52	87.98	99.99	100.00	55.79	45.82
Axial_Connectivity	2.411765	2.706897	2.600985	2.619792	2.482412	2.533333	2.508621	2.777778	2.800000	2.809249
Axial_Choice	1133.0294	977.3405	1097.7931	912.6354	916.4221	600.4933	1236.6293	946.8718	938.5070	619.7688
Axial_Choice_R3	31.78431	65.84914	38.80788	43.63542	51.50754	50.02667	44.17241	74.16239	74.37674	64.77457
Axial_Control	1.0000000	0.9913793	1.0000000	0.9978693	1.0000000	1.0000000	0.9827586	1.0000000	0.9906977	1.0000000
Axial_Integration	0.9612063	1.2145648	0.9774588	1.0892806	1.1423627	1.2390790	0.9567307	1.3623543	1.2163346	1.4304594
Axial_Mean_Depth	6.581426	5.301135	6.434619	5.778196	5.628395	5.030157	6.458880	5.063827	5.396856	4.603307
Axial_Length	18.83383	18.08900	17.69737	20.50168	16.98563	20.80823	16.27160	20.11791	19.32549	26.73160
Segment_Angular_ Connectivity	2.421955	2.583443	2.451024	2.497455	2.401059	2.488729	2.477851	2.570180	2.689814	2.609171
T1024_Choice	1745.981	2986.335	2275.035	2878.663	2359.966	2176.792	2637.834	3868.277	4095.132	3456.531
Segment_Length	10.073502	7.999351	8.103812	9.318134	7.458907	8.897747	7.448784	8.505086	7.671874	10.018149
T1024_Integration	50.31148	96.08080	66.48316	68.58729	62.50439	72.06928	66.23119	104.44345	117.77796	110.94150
NACH	0.8042108	0.8253098	0.7950498	0.8146721	0.8082941	0.8193648	0.8110014	0.8285213	0.8439127	0.7800277
VGA_Connectivity	24354.205	7542.915	9074.680	7733.102	5212.368	17107.147	8664.955	17204.815	10077.157	15165.559
Visual_Integration	22.868871	9.719835	10.889902	9.396869	7.003202	15.663891	8.582598	15.506916	8.953919	11.463877
Visual_Mean_Depth	1.768358	2.562616	2.404354	2.564367	3.069387	2.084404	2.788956	2.096795	2.692152	2.328983
Step_Depth_Admin	3.933337	3.580220	2.939365	3.397968	3.919506	3.055337	3.193414	2.979548	2.354684	2.766943
Step_Depth_Entrance	2.186609	2.669364	2.685833	3.419220	6.072984	2.549045	2.512565	2.236317	2.374801	2.755864
Step_Depth_Sports	1.429535	1.779811	1.826554	2.086499	2.288264	1.683558	2.069053	1.608377	2.111197	1.856254
VGA_Connectivity_WS	4464.5291	897.6018	1049.9586	4732.1230	1612.0398	1371.3333	1174.9652	2920.6031	1985.0568	1573.4199
VVisual_Integration_WS	10.299704	4.637396	4.841443	8.253302	5.713532	5.813247	4.873409	7.933872	6.043773	7.193302
Visual_Mean_Depth_WS	2.349498	3.614141	3.551142	2.718449	3.272823	3.137058	3.649098	2.702859	3.158605	2.733636
Step_Depth_Admin_WS	4.104551	3.586878	3.731153	3.244502	3.903717	3.190751	3.467583	2.986059	2.576782	2.532641
Step_Depth_Entrance_WS	2.167281	3.419519	3.258859	3.294230	6.256576	2.563437	3.434907	2.269584	2.600000	2.677004
Axial_Intelligibility	0.3139	0.1827	0.1672	0.1966	0.1883	0.3235	0.1222	0.2552	0.2005	0.4126
FIR_Admin	0.8786295	0.9930183	0.9773741	1.0106051	0.9650780	0.9326945	0.9519450	0.9996361	0.9506051	0.9563701
FIR_Cantine	1.0243184	1.0421291	0.9900154	1.0049719	0.8892533	0.8569461	0.9515438	0.9922447	1.0789427	0.7448983
FIR_Circulation	1.067683	1.099102	1.045620	1.130929	1.143917	1.175080	1.160272	1.076129	1.083451	1.239893
FIR_Courtyard	1.259534	1.111384	1.280861	1.185737	1.223146	1.194189	1.156839	1.072275	1.158080	1.010691
FIR_GenClassroom	0.8574392	0.8636174	0.8496079	0.9778572	0.9714570	0.8380453	1.1148710	0.8289074	0.7986187	0.9175134
FIR_Outdoors	1.0557395	1.1493564	1.0130923	1.0242134	0.8315404	1.1534400	1.1077794	1.0474579	1.1609093	1.0746700
FIR_Secondary	0.8144588	0.8538266	0.8299813	0.9699834	0.9586966	0.9130976	0.9459544	0.8681832	0.8298628	0.9736980
FIR_SpeClassroom	0.8198063	0.9378569	0.8959288	0.9048697	0.9737261	0.9100520	0.9197138	0.8616959	0.8488560	0.9636915
FIR_SportsIn	1.0770078	0.8214540	1.1174241	0.7921813	0.7693656	0.8600055	0.9839425	0.8712655	0.9861981	1.2534733
FIR_SportsOut	1.1994842	1.0193790	1.1253712	0.9987909	0.9101821	1.4308795	0.9470127	1.0603047	0.8907099	1.1615074
FIR_Stairs	0.9134097	1.0700166	1.0315429	1.1044057	1.0816787	1.0336704	0.9475117	1.0391539	1.0202506	0.8555891
Cypriot_Students	313	308	189	276	337	128	319	397	40	333
Stundents_Number	337	326	232	316	354	148	403	476	448	337
Teacher_Students_Ratio	8.22	8.79	7.56	8.63	8.52	7.47	9.31	9.12	8.77	9.06
Non_EU_Students	10	3	22	7	3	3	20	38	204	2
EU_Students	14	15	21	33	14	17	64	41	204	2
NACH_Max	1.06	1.20	1.10	1.13	1.15	1.18	1.14	1.16	1.23	1.16
Sports_Height	1.53	2.04	1.02	1.53	1.80	2.10	1.20	1.50	2.10	1.50
Jgraph_Degree	0.07	0.09	0.10	0.10	0.12	0.12	0.07	0.14	0.14	0.13
Jgraph_Betweenness	0.53	0.36	0.58	0.36	0.40	0.58	0.42	0.34	0.59	0.44

TABLE A.1: Metrics Used for Hypothesis-Based Clustering

Appendix B

Appendix B: Pilot Study: Survey Samples

B.1 Pilot Study: Students' Questionnaires

Pilot Study - Students' Questionnaire

Assessing educational environments: A temporal socio-spatial approach to lower secondary school building in Cyprus

*Required

Περιγραφή Ερωτηματολογίου

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Το ερωτηματολόγιο που έχετε στα χέρια σας, έχει συνταχθεί στα πλαίσια της διδακτορικής διατριβής με τίτλο 'Αποδοτικά εκπαιδευτικά περιβάλλοντα: Μελέτη της κοινωνικο-χωρικής δομής των σχολείων της δευτεροβάθμιας εκπαίδευσης στην Κύπρο'' που στόχο έχει να εξερευνήσει την πολύπλοκη κοινωνικο-χωρική φύση των σχολικών περιβαλλόντων της δευτεροβάθμιας εκπαίδευσης στην Κύπρο και να συνεισφέρει στην κατανόηση του ρόλου του σχολικού περιβάλλοντος στις εκπαιδευτικές διαδικασίες.

Σε κάθε περίπτωση:
• Διασφαλίζεται η ανωνυμία των συμμετεχόντων/ουσών
• Η συμμετοχή στην έρευνα είναι εθελοντική και οι συμμετέχοντες/ουσες μπορούν να αποχωρήσουν οποιαδήποτε στιγμή από την έρευνα χωρίς συνέπειες
• Τα δεδομένα που θα συλλέγουν θα χρησιμοποιηθούν μόνο για σκοπούς της συγκεκριμένης έρευνας

Θα σας παρακαλούσα να απαντήσετε με ειλικρίνεια.

Ευχαριστώ εκ των προτέρων για τη συνεργασία,

Χρυστάλα Ψαθίτη

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University of Cyprus, Department of Architecture

This questionnaire has been developed in the context of my PhD thesis with title ' Assessing Secondary Schools in Cyprus: A temporal socio-spatial approach' and
• Is concerned with the interplay between school environment and school practices.
• Seeks to understand and define school environments and at the same to identify the role of spatial layout and agency in socio-educational practices occur within the school environment.
• Illustrate the diversity and complexity in school buildings

This questionnaire,
• Ensures the anonymity of the participants
• The participation is voluntary and thus participants can regret to take part at any point
• The collected data will be used ONLY for the purpose of this PhD thesis

Thanks in Advance for you collaboration,

Chrystala Psathiti

Σχετικά με εσένα / About you

1. Φύλλο *

Mark only one oval.

- ⬭ Αγόρι / Boy
- ⬭ Κορίτσι / Girl

2. Χώρα Καταγωγής / Country of Origin *

____

3. Τάξη / Class *

Mark only one oval.

- ⬭ 1η Γυμνασίου / 1st Year
- ⬭ 2α Γυμνασίου / 2nd Year
- ⬭ 3η Γυμνασίου / 3rd Year

4. Σχολείο στο οποίο φοιτάς / Your school *

Mark only one oval.

- ⬭ Επαρχία Λευκωσίας, Γυμνάσιο Κοκκινοτριμιθιάς / Gymnasium Kokkinotrimithias
- ⬭ Επαρχία Λευκωσίας, Γυμνάσιο Αγ. Ιωάννη Χρυσοστόμου / Gymnasium Agiou Ioanni Chrysostomou
- ⬭ Επαρχία Λεμεσού, Γυμνάσιο Αγ. Νεοφύτου / Gymnasium Agiou Neofytou
- ⬭ Επαρχία Λεμεσού, Γυμνάσιο Ζακακίου / Gymnasium Zakakiou
- ⬭ Επαρχία Λεμεσού, Γυμνάσιο Αγ. Φυλάξεως / Gymnasium Agias Filaxeos
- ⬭ Επαρχία Λάρνακας, Γυμνάσιο Αθηένου / Gymnasium Athienous
- ⬭ Επαρχία Λάρνακας, Γυμνάσιο Πετράκη Κυπριακού / Gymnasium Petraki Kyprianou
- ⬭ Επαρχία Λάρνακας, Γυμνάσιο Λιβαδιών / Gymnasium Livadion
- ⬭ Επαρχία Πάφου, Γυμνάσιο Παναγίας Θεοσκέπαστης / Gymnasium Panagias Theoskepastis
- ⬭ Επαρχία Αμμοχώστου, Γυμνάσιο Ειρήνης & Ελευθερίας / Gymnasium Eirinis & Eleutherias

5. Πόσο καλά πιστεύεις ότι τα πηγαίνεις στο σχολείο σε σχέση με τους συμμαθητές σου; / How well do you think you are doing at school compared to your classmates? *

Mark only one oval.

- Πάρα πολύ καλά / Very goo
- Καλά / Good
- Μέτρια / Moderate
- Κακά / Bad

6. Περίγραψε την παρέα σου στο σχολείο / Describe your friend at school *

Δραστηριότητες στο Σχολείο / School Activities

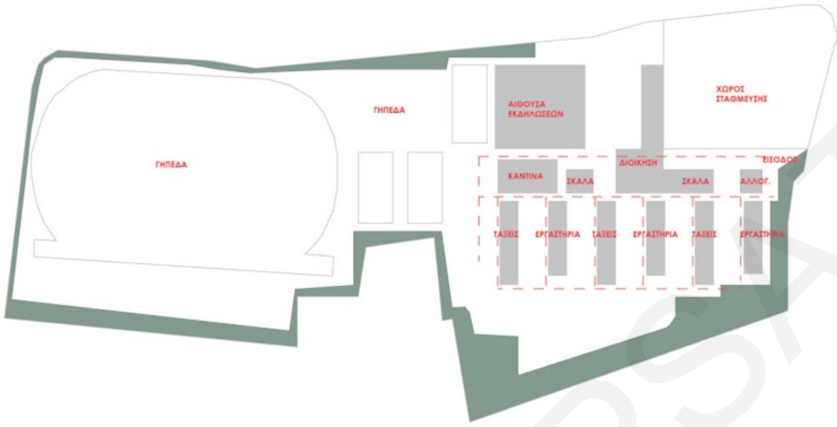
7. Πόσο συχνά κάνεις τις πιο κάτω δραστηριότητες στο σχολείο σου; / How often do you do the following activities in school? *

Mark only one oval per row.

	Κάθε Μέρα / Everyday	Συχνά/ Often	Σπάνια / Rarely	Ποτέ / Never
Συνομιλείς με τους καθηγητές σου την ώρα του διαλειμματος / I speak with my teachers during breaks				
Συνομιλείς με συμμαθητές σου από άλλα τμήματα την ώρα του διαλλείματος / I speak with students from other classes during breaks				
Διαβάζεις εκτός της τάξης μόνος/μόνη ή με φίλους / Read alone during breaks				
Συναντιέσαι με τους φίλους σου / Meet with your friends				
Συμμετέχεις σε ενδοσχολικές δραστηριότητες που διοργανώνει το σχολείο / Take part in school activities				

8. Παρατήρησε το χάρτη του σχολείου και σημείωσε σε ποιους χώρους κάνεις τις ακόλουθες δραστηριότητες: / Observe the plan of the school and name the area in which you do the following activities: *

(μπορείς να σημειώσεις περισσότερες από μια επιλογή σε κάθε σειρά)



Tick all that apply.

	Κεντρική Αυλή / Central courtyard	Στους Διαδρόμους / Corridors	Στην τάξη / Classrooms	Χώρος γηπέδων / Sports area	Ανοιχτό χώρο ανάμεσα στις τάξεις / Open-air areas in between classrooms	Κοντά στην καντίνα / Close to cantine	Σ A
Συχνάζεις τις περισσότερες φορές τα διαλείμματα / You hang out during breaks	☐	☐	☐	☐	☐	☐	
Συνομιλείς με τους καθηγητές σου / Chat with your teachers	☐	☐	☐	☐	☐	☐	
Συνομιλείς με συμμαθητές σου από άλλα τμήματα / Chat with students from other classes	☐	☐	☐	☐	☐	☐	
Διαβάζεις μόνος/μόνη / Read alone	☐	☐	☐	☐	☐	☐	
Συναντιέσαι με τους φίλους	☐	☐	☐	☐	☐	☐	

σου / Meet with friends						
Συναντιέσαι με ολόκληρη την κοινότητα του σχολείου / Meet with the whole school community	☐	☐	☐	☐	☐	☐
Συμμετέχεις στις δραστηριότητες που διοργανώνει το σχολείο σου / Take part in the school's activities	☐	☐	☐	☐	☐	☐
Διαβάζεις με φίλους / Read with friends	☐	☐	☐	☐	☐	☐

Σχολικό Περιβάλλον / School Environment

9. Το σχολείο μου είναι ένας χώρος στον οποίο: / My school is a place where: *
(μπορείς να σημειώσεις περισσότερες από μια επιλογή)

Tick all that apply.

- ☐ Νιώθω ασφάλεια / I feel safe
- ☐ Νιώθω ότι ανήκω / I feel that I belong
- ☐ Νιώθω οικεία / I feel cosy
- ☐ Νιώθω παραμελημένος/νη / I feel neglected
- ☐ Νιώθω υποστήριξη / I have support
- ☐ Νιώθω πίεση / I feel pressure
- ☐ Κάνω φίλους / I make friends
- ☐ Νιώθω δημιουργικός/κή / I feel creative
- ☐ Νιώθω μοναξιά / I feel alone

10. Ποιο είναι το καλύτερο χαρακτηριστικό του σχολειό σου και γιατί (π.χ οι εγκαταστάσεις, οι καθηγητές, το 'κλίμα' του σχολείου, οι σχέσεις με τους συμμαθητές σου ή άλλο); / What is the single best thing about your school? *

11. Ποιος είναι ο αγαπημένος σου χώρος στο σχολείο και γιατί; / Which is your favorite place at school and why? *

12. Αν θα άλλαζες κάτι στο σχολείο σου τι θα ήταν; / If you could change anything at your school what would be? *

Αποδοτικό Σχολείο / Effective School

Πόσο συμφωνείς ή διαφωνείς με τις πιο κάτω θέσεις; / How much do you agree or disagree with the following statements?:

13. Στο σχολείο μου μπορούμε εύκολα με τους καθηγητές μου να αλλάξουμε τα θρανία και τη διαρρύθμιση στην τάξη. / In our school we can easily change the classrooms' organization with our teachers. *

Mark only one oval.

	1	2	3	4	5	
Διαφωνώ Απόλυτα / Totally Diagree						Συμφωνώ Απόλυτα / Totally Agree

14. Στο σχολείο μου μας επιτρέπεται να μαθαίνουμε με διάφορους τρόπους (μόνος/νη, σε ομάδες, με τη βοήθεια των συμμαθητών μας, με τη βοήθεια των καθηγητών μας κ.α.). / Our school allows us to learn with multiple ways (i.e alone, with team etc). *

Mark only one oval.

	1	2	3	4	5	
Διαφωνώ Απόλυτα / Totally Disagree						Συμφωνώ Απόλυτα / Totally Agree

15. Στο σχολείο μου υπάρχει εύκολη πρόσβαση από τις αίθουσες γενικής διδασκαλίας στα εργαστήρια (π.χ τεχνολογία, μουσική κ.α) / In our school there is an easy access from the general classrooms to special classrooms (i.e music, technology etc) *

Mark only one oval.

	1	2	3	4	5	
Διαφωνώ Απόλυτα / Totally Disagree	◯	◯	◯	◯	◯	Συμφωνώ Απόλυτα / Totally Agree

16. Το σχολείο μου έχει αρκετούς χώρους για να συναντηθώ με τους φίλους μου / Our school has a lot of spaces to hang out with my friends *

Mark only one oval.

	1	2	3	4	5	
Διαφωνώ Απόλυτα / Totally Disagree	◯	◯	◯	◯	◯	Συμφωνώ Απόλυτα / Totally Agree

17. Το σχολείο μου έχει αρκετούς χώρους για να διαβάσω μόνος/μόνη εαν χρειάζομαι απομόνωση / In our school there are a lot of places where i can read alone *

Mark only one oval.

	1	2	3	4	5	
Διαφωνώ Απόλυτα / Totally Disagree	◯	◯	◯	◯	◯	Συμφωνώ Απόλυτα / Totally Agree

18. Το σχολείο μου χαρακτηρίζεται από ισχυρή σχολική κοινότητα καθώς νιώθω πολύ δεμένος/νη με τους συμμαθητές/τριες μου και τους καθηγητές μου / My school is characterized by a strong school community as I feel very attached to my classmates and teachers. *

Mark only one oval.

	1	2	3	4	5	
Διαφωνώ Απόλυτα / Totally Disagree	◯	◯	◯	◯	◯	Συμφωνώ Απόλυτα / Totally Agree

19. Ποια χαρακτηριστικά κατά τη γνώμη σου πρέπει να έχει ένα σχολείο για να θεωρείται αποδοτικό (να βοηθάει τους μαθητές να μάθουν, να έχει καλές εγκαταστάσεις, να βοηθάει τους καθηγητές να διδάσκουν με πολλούς τρόπους, να μπορεί εύκολα να το διοικήσει ο διευθυντής κ.α.); / What characteristics do you think a school should have in order to be considered effective (i.e to help students learn, to have good facilities, to help teachers to teach in many ways, to be easily managed by the principal, etc.)? *

Σας Ευχαριστώ ! / Thank you!

B.2 Pilot Study: Teachers' Questionnaires

Pilot Study - Teachers' Questionnaire

Assessing educational environments: A temporal socio-spatial approach to lower secondary school building in Cyprus

*Required

Περιγραφή Ερωτηματολογίου

ΟΝΟΜΑ ΕΡΕΥΝΗΤΗ:
Χρυστάλα Ψαθίτη
Τηλ: +35799829971 / Email: cpsath01@ucy.ac.cy

ΟΝΟΜΑ ΤΟΥ ΦΟΡΕΑ (κάτω από την εποπτεία του οποίου θα γίνει η έρευνα):
Πανεπιστήμιο Κύπρου
Νάτια Χαραλάμπους
Επίκουρη Καθηγήτρια Τμήματος Αρχιτεκτονικής
Τηλ: +35722892965 / Email: charalambous.nadia@ucy.ac.cy

Το ερωτηματολόγιο που έχετε στα χέρια σας, έχει συνταχθεί στα πλαίσια της διδακτορικής διατριβής με τίτλο 'Αποδοτικά εκπαιδευτικά περιβάλλοντα: Μελέτη της κοινωνικο-χωρικής δομής των σχολείων της δευτεροβάθμιας εκπαίδευσης στην Κύπρο' που στόχο έχει να εξερευνήσει την πολύπλοκη κοινωνικο-χωρική φύση των σχολικών περιβαλλόντων της δευτεροβάθμιας εκπαίδευσης στην Κύπρο και να συνεισφέρει στην κατανόηση του ρόλου του σχολικού περιβάλλοντος στις εκπαιδευτικές διαδικασίες.

Σε κάθε περίπτωση:
- Διασφαλίζεται η ανωνυμία των συμμετεχόντων/ουσών
- Η συμμετοχή στην έρευνα είναι εθελοντική και οι συμμετέχοντες/ουσες μπορούν να αποχωρήσουν οποιαδήποτε στιγμή από την έρευνα χωρίς συνέπειες
- Τα δεδομένα που θα συλλέχθούν θα χρησιμοποιηθούν μόνο για σκοπούς της συγκεκριμένης έρευνας

Θα σας παρακαλούσα να απαντήσετε με ειλικρίνεια.

Ευχαριστώ εκ των προτέρων για τη συνεργασία,

Χρυστάλα Ψαθίτη

....

RESEARCHER:
Chrystala Psathiti
Tel: +35799829971 / Email: cpsath01@ucy.ac.cy

UNIVERSITY:
University of Cyprus, Department of Architecture

This questionnaire has been developed in the context of my PhD thesis with title ' Assessing Secondary Schools in Cyprus: A temporal socio-spatial approach' and
- Is concerned with the interplay between school environment and school practices.
- Seeks to understand and define school environments and at the same to identify the role of spatial layout and agency in socio-educational practices occur within the school environment.
- Illustrate the diversity and complexity in school buildings

This questionnaire,
- Ensures the anonymity of the participants
- The participation is voluntary and thus participants can regret to take part at any point
- The collected data will be used ONLY for the purpose of this PhD thesis

Thanks in Advance for you collaboration,

Chrystala Psathiti

Σχετικά με εσένα / About you

1. Φύλλο / Gender *

   Mark only one oval.

   - Άνδρας / Male
   - Γυναίκα / Female

2. Ποιο είναι το επίπεδο εκπαίδευσης σας; / Level of Education *

   Mark only one oval.

   - Διδακτορικός Τίτλος / PhD Title
   - Μεταπτυχιακός Τίτλος / Master Title
   - Πτυχίο / Bachelor Title
   - Other: ____________________

3. Σχολείο στο οποίο διδάσκεις / School You are teaching *

   Mark only one oval.

   - Επαρχία Λευκωσίας, Γυμνάσιο Κοκκινοτριμιθιάς / Gymnasium Kokkinotrimithias
   - Επαρχία Λευκωσίας, Γυμνάσιο Αγ. Ιωάννη Χρυσοστόμου / Gymnasium Agiou Ioanni Chrysostomou
   - Επαρχία Λεμεσού, Γυμνάσιο Αγ. Νεοφύτου / Gymnasium Agiou Neofytou
   - Επαρχία Λεμεσού, Γυμνάσιο Ζακακίου / Gymnasium Zakakiou
   - Επαρχία Λεμεσού, Γυμνάσιο Αγ. Φυλάξεως / Gymnasium Agias Filaxeos
   - Επαρχία Λάρνακας, Γυμνάσιο Αθηένου / Gymnasium Athienous
   - Επαρχία Λάρνακας, Γυμνάσιο Πετράκη Κυπριακού / Gymnasium Petraki Kyprianou
   - Επαρχία Λάρνακας, Γυμνάσιο Λιβαδιών / Gymnasium Livadion
   - Επαρχία Πάφου, Γυμνάσιο Παναγίας Θεοσκέπαστης / Gymnasium Panagias Theoskepastis
   - Επαρχία Αμμοχώστου, Γυμνάσιο Ειρήνης & Ελευθερίας / Gymnasium Eirinis & Eleutherias

Κοινωνική Συναναστροφή στο Σχολείο / Social Interaction at School

4. Πόσο συχνά συνεργάζεσαι με άλλους καθηγητές για να παράξετε διδακτικό υλικό? / How often do you collaborate with other teachers to prepare educational material at school?

Mark only one oval.

	1	2	3	4	5	
Κάθε Μέρα / Every Day	⬭	⬭	⬭	⬭	⬭	Ποτέ / Never

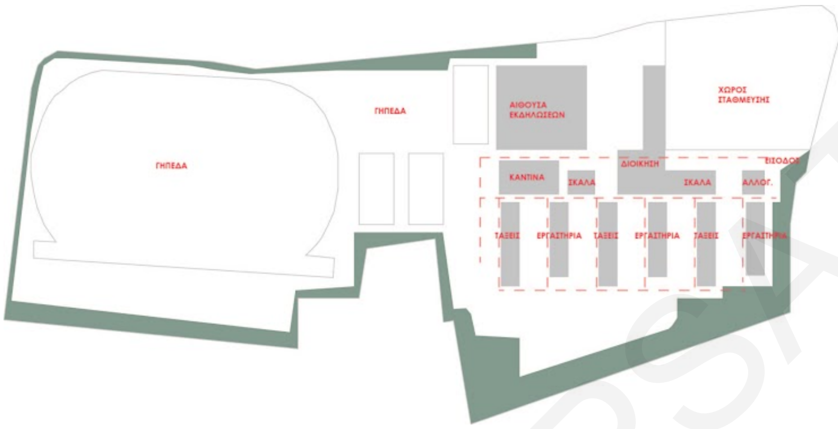
5. Πόσο συχνά κάνεις τις πιο κάτω δραστηριότητες στο σχολείο στο οποίο διδάσκεις αυτή τη στιγμή; / How often do you do the following activities at school? *

Mark only one oval per row.

	Κάθε Μέρα / Every Day	Συχνά / Often	Σπάνια / Rarely	Ποτέ / Never
Συνομιλείς με τους μαθητές την ώρα του διαλείμματος / Chat with students during breaks	⬭	⬭	⬭	⬭
Συνομιλείς με τους συναδέλφους σου την ώρα του διαλείμματος / Chat with your colleagues during breaks	⬭	⬭	⬭	⬭
Ετοιμάζεις διδακτικό υλικό μόνος/μόνη ή με συναδέλφους / Prepare educational material by yourself or with you colleagues	⬭	⬭	⬭	⬭
Συναντιέσαι με την διεύθυνση του σχολείου / Meet the school's headteacher	⬭	⬭	⬭	⬭
Συναντιέσαι με γονείς μαθητών / Meet parents	⬭	⬭	⬭	⬭

6. Παρατήρησε το χάρτη του σχολείου και σημείωσε σε ποιους χώρους κάνεις τις ακόλουθες δραστηριότητες: / Observe the map and name the areas in the school you usually do the following activities: *

(μπορείς να σημειώσεις περισσότερες από μια επιλογή σε κάθε σειρά)



Tick all that apply.

	Κεντρική Αυλή / Central Courtyard	Στους Διαδρόμους/Corridors	Στην τάξη / Classrooms	Χώρος γηπέδων / Sports areas	Ανοιχτό χώρο ανάμεσα στις τάξεις / Open space in-between clasrooms	Κοντ στην καντί / Clos to cantir
Συνομιλείς με τους μαθητές σου / Chat with students	☐	☐	☐	☐	☐	☐
Συνομιλείς με τους συναδέλφους σου / Chat with colleagues	☐	☐	☐	☐	☐	☐
Ετοιμάζεις διδακτικό υλικό / Prepare educational material	☐	☐	☐	☐	☐	☐
Συναντιέστε με ολόκληρη την κοινότητα του σχολείου	☐	☐	☐	☐	☐	☐

/ Meet the whole school community						
Συναντιέστε με τους γονείς / Meet parents	☐	☐	☐	☐	☐	☐

Σχολική Κοινότητα / School Community

7. Το σχολείο στο οποίο διδάσκω αυτή τη στιγμή είναι ένας χώρος στον οποίο: / My school is a place where: *

(μπορείς να σημειώσεις περισσότερες από μια επιλογή)

Tick all that apply.

- ☐ Νιώθω ασφάλεια / I feel safe
- ☐ Νιώθω ότι 'ανήκω' στην διδακτική κοινότητα του σχολείου / I feel i belong
- ☐ Νιώθω οικεία / I feel cosy
- ☐ Νιώθω παραμελημένος/νη / I feel neglected
- ☐ Νιώθω υποστήριξη από τη διοίκηση / I have support
- ☐ Νιώθω δημιουργικός/κη / I feel creative
- ☐ Νιώθω πίεση / I feel pressure
- ☐ Νιώθω μοναξιά / I feel lonely
- ☐ Υπάρχει αίσθηση 'ελέγχου' απο τη διεύθυνση / There is control by the headteacher

Σχολικό Περιβάλλον / School environment

8. Ποιο είναι το καλύτερο χαρακτηριστικό του σχολείου στο οποίο διδάσκεις αυτή τη στιγμή και γιατί (π.χ οι εγκαταστάσεις, τα παιδιά, το κλίμα του σχολείου, οι σχέσεις με τους συναδέλφους ή άλλο); / What is the single best thing about your school? *

9. Ποιος είναι ο αγαπημένος σου χώρος στο σχολείο στο οποίο διδάσκεις αυτή τη στιγμή και γιατί; / Which is your favorite place at school and why? *

10. Αν θα άλλαζες κάτι στο σχολείο στο οποίο διδάσκεις αυτή τη στιγμή τι θα ήταν; / If you could change anything at your school what would be? *

Αποδοτικό Σχολείο / Effective School

11. Πώς θα αξιολογούσες το επίπεδο των μαθητών που φοιτούν σ' αυτό το σχολείο όσο αφορά τη σχολική επίδοση; / How do you evaluate students' level of performance in your school?

Mark only one oval.

	1	2	3	4	5	
Πολύ Χαμηλό / Very low	○	○	○	○	○	Πολύ Υψηλό / Very high

12. Πώς θα αξιολογούσες το επίπεδο της ηγεσίας στο σχολείο σχετικά με την αποτελεσματικότητα της; / How do you evaluate the effectiveness of the administration?

Mark only one oval.

	1	2	3	4	5	
Πολύ Χαμηλό / Very low	○	○	○	○	○	Πολύ Υψηλό / Very high

Πόσο συμφωνείς ή διαφωνείς με τις πιο κάτω θέσεις; / How much do you agree or disagree with the following statements?

13. Σ' αυτό το σχολείο μπορούμε εύκολα με τους μαθητές να αλλάξουμε τα θρανία και τη διαρρύθμιση της τάξης / In our school we can easily change the classrooms' organization with our students. *

Mark only one oval.

	1	2	3	4	5	
Διαφωνώ Απόλυτα / Totally disagree	○	○	○	○	○	Συμφωνώ Απόλυτα / Totally agree

14. Σ' αυτό το σχολείο υιοθετούμε διάφορους τρόπους διδασκαλίας (π.χ με διάλεξη, με συζήτηση κ.α) / In our school we use multiple teaching methods *

Mark only one oval.

	1	2	3	4	5	
Διαφωνώ Απόλυτα / Totally disagree	◯	◯	◯	◯	◯	Συμφωνώ Απόλυτα / Totally agree

15. Σ' αυτό το σχολείο υπάρχει εύκολη η πρόσβαση από τις αίθουσες γενικής διδασκαλίας στα εργαστήρια (π.χ τεχνολογία, μουσική κ.α) / In our school there is an easy access from the general classrooms to special classrooms (i.e music, technology etc) *

Mark only one oval.

	1	2	3	4	5	
Διαφωνώ Απόλυτα / Totally disagree	◯	◯	◯	◯	◯	Συμφωνώ Απόλυτα / Totally agree

16. Αυτό το σχολείο έχει αρκετούς χώρους για να συναντηθώ με τους μαθητές μου εκτός μαθήματος / Our school has a lot of spaces to hang out with students outside of the classroom *

Mark only one oval.

	1	2	3	4	5	
Διαφωνώ Απόλυτα / Totally disagree	◯	◯	◯	◯	◯	Συμφωνώ Απόλυτα / Totally agree

17. Αυτό το σχολείο χαρακτηρίζεται από ισχυρή σχολική κοινότητα (τόσο τα παιδιά μεταξύ τους όσο και με τους εκπαιδευτικούς έχουν πολύ καλές και στενές σχέσεις) / My school is characterized by a strong school community as I feel very attached to my students and colleagues.

Mark only one oval.

	1	2	3	4	5	
Διαφωνώ Απόλυτα / Totally disagree	◯	◯	◯	◯	◯	Συμφωνώ Απόλυτα / Totally agree

18. Ποια χαρακτηριστικά κατά τη γνώμη σου πρέπει να έχει ένα σχολείο για να θεωρείται αποδοτικό (να βοηθάει τους μαθητές να μάθουν, να έχει καλές εγκαταστάσεις, να βοηθάει τους καθηγητές να διδάσκουν με πολλούς τρόπους, να μπορεί εύκολα να το διοικήσει ο διευθυντής); / What characteristics do you think a school should have in order to be considered effective (i.e to help students learn, to have good facilities, to help teachers to teach in many ways, to be easily managed by the principal, etc.)? *

Σας Ευχαριστώ ! / Thank you!

Appendix C

Appendix C: Final Study: Survey Samples

C.1 Final Study: Students' Questionnaires

Final Study - Students' Questionnaire

Assessing educational environments: A tremporal socio-spatial approach to lower secondary school buildings in Cyprus

*Required

Περιγραφή Ερωτηματολογίου

ΕΡΕΥΝΗΤΗΣ:
Χρυστάλα Ψαθίτη
Τηλ: +35799829971 / Email: cpsath01@ucy.ac.cy

ΟΝΟΜΑ ΤΟΥ ΦΟΡΕΑ (κάτω από την εποπτεία του οποίου γίνεται η έρευνα):
Πανεπιστήμιο Κύπρου, Τμήμα Αρχιτεκτονικής

Το ερωτηματολόγιο έχει συνταχθεί στα πλαίσια της διδακτορικής διατριβής με τίτλο 'Assessing Secondary Schools in Cyprus: A temporal socio-spatial approach' που στόχο έχει να εξερευνήσει την πολύπλοκη κοινωνικο-χωρική φύση των σχολικών περιβαλλόντων της δευτεροβάθμιας εκπαίδευσης στην Κύπρο και να συνεισφέρει στην κατανόηση του ρόλου του σχολικού περιβάλλοντος στις εκπαιδευτικές διαδικασίες.

Σε κάθε περίπτωση:
- Διασφαλίζεται η ανωνυμία των συμμετεχόντων/ουσών
- Η συμμετοχή στην έρευνα είναι εθελοντική και οι συμμετέχοντες/ουσες μπορούν να αποχωρήσουν οποιαδήποτε στιγμή από την έρευνα χωρίς συνέπειες
- Τα δεδομένα που θα συλλέχθούν θα χρησιμοποιηθούν μόνο για σκοπούς της συγκεκριμένης έρευνας

Ευχαριστώ εκ των προτέρων για τη συνεργασία,
Χρυστάλα Ψαθίτη

....

RESEARCHER:
Chrystala Psathiti
Tel: +35799829971 / Email: cpsath01@ucy.ac.cy

UNIVERSITY:
University of Cyprus, Department of Architecture

This questionnaire has been developed in the context of my PhD thesis with title ' Assessing Secondary Schools in Cyprus: A temporal socio-spatial approach' and
- Is concerned with the interplay between school environment and school practices.
- Seeks to understand and define school environments and at the same to identify the role of spatial layout and agency in socio-educational practices occur within the school environment.
- Illustrate the diversity and complexity in school buildings

This questionnaire,
- Ensures the anonymity of the participants
- The participation is voluntary and thus participants can regret to take part at any point
- The collected data will be used ONLY for the purpose of this PhD thesis

Thanks in Advance for you collaboration,

Chrystala Psathiti

Σχετικά με Εσένα / About you

1. Φύλο / Gender *

   Mark only one oval.

   - 1. Αγόρι / Boy
   - 2. Κορίτσι / Girl
   - 3. Δεν θα ήθελα να προσδιορίσω / I dont want to specify

2. Επίπεδο Εκπάιδευσης / Level of Education *

   Mark only one oval.

   - 1. 1η Γυμνασίου / 1st Year
   - 2. 2α Γυμνασίου / 2nd Year
   - 3. 3η Γυμνασίου / 3rd Year

3. Ο αριθμός του τμήματος σου είναι: / Your class number is: *

   Mark only one oval.

   - 1
   - 2
   - 3
   - 4
   - 5
   - 7
   - 8
   - 9

4. Σχολείο στο οποίο φοιτάς / Your School *

   Mark only one oval.

   ◯ 1. Επαρχία Λευκωσίας, Γυμνάσιο Αγ. Ιωάννη Χρυσόστομου / Gymnasium Agios Ioannis Chrysostomos

   ◯ 2. Επαρχία Πάφου, Γυμνάσιο Παναγίας Θεοσκέπαστης / Gymnasium Panagias Theoskepastis

5. Ανήκεις σε μετακινούμενο τμήμα; / Do you belong to a movable classrooms *

   Mark only one oval.

   ◯ Ναι / Yes

   ◯ Όχι / No

6. Πόσο καλά πιστεύεις ότι τα πηγαίνεις στο σχολείο σε σχέση με τους συμμαθητές σου; / How well do you think that you perform at school? *

   Mark only one oval.

	1	2	3	4	5	
Όχι πολύ καλά / Not so good	◯	◯	◯	◯	◯	Καταπληκτικά / Excellent

Δραστηριότητες στο Σχολείο / School Activities

Πόσο συχνά κάνεις τις πιο κάτω δραστηριότητες στο σχολείο σου; / How often do you do the following activities in your school?

7. *

Mark only one oval per row.

	1. Ποτέ / Never	2. Σπάνια / Rarely	3. Μερικές Φορές / Sometimes	4. Συχνά / Often	5. Κάθε Μέρα / Every Day
Συνομιλώ με τους καθηγητές μου την ώρα του διαλείμματος / Speak with my teachers during break					
Συνομιλώ με συμμαθητές μου από άλλα τμήματα την ώρα του διαλείμματος / Speak with students from other classrooms during break					
Διαβάζω με τους φίλους μου την ώρα του διαλείμματος / I read during school breaks with my friends					
Παίζω με τους φίλους μου στον εξωτερικό χώρο / I play with my friends					
Διαβάζω μόνος-νη μου κατά τη διάρκεια του διαλείμματος / I usually read by my self during breaks					

Σχολική Κοινότητα / School Community

Πόσο συμφωνείς ή διαφωνείς με τις πιο κάτω θέσεις; / How much do you aggree of disagree with the following statements?

Στο σχολείο μου / In my school:

8. *

Mark only one oval per row.

	1. Διαφωνώ απόλυτα / Totally disagree	2. Διαφωνώ / Disagree	3. Ούτε Συμφωνώ ούτε Διαφωνώ / Neither Agree not Disagree	4. Συμφωνώ / Agree	5. Συμφωνώ απόλυτα / Totally Aggree
Νιώθω Πίεση / I feel Pressure	⬭	⬭	⬭	⬭	⬭
Νιώθω οικεία / I feel cozy	⬭	⬭	⬭	⬭	⬭
Νιώθω χαρούμενος-νη / I feel happy	⬭	⬭	⬭	⬭	⬭
Έχω υποστήριξη / I have support	⬭	⬭	⬭	⬭	⬭
Ακολουθώ τους κανόνες / I follow the rules	⬭	⬭	⬭	⬭	⬭
Νιώθω ότι μαθαίνω / I am learning	⬭	⬭	⬭	⬭	⬭
Νιώθω χαρούμενος-νη και μου αρέσει να έρχομαι / I feel happy and i like coming	⬭	⬭	⬭	⬭	⬭
Νιώθω ότι μπορώ εύκολα να διακινηθώ / I feel that i can easily find my way around	⬭	⬭	⬭	⬭	⬭
	⬭	⬭	⬭	⬭	⬭

Νιώθω ασφάλεια / I feel safe

Σχολική Κοινότητα & Covid-19 / School Community & Covid-19

Η πανδημία Covid-19 επέφερε σημαντικές αλλαγές σε κάθε πτυχή της ζωής μας συμπεριλαμβανομένου και του τρόπου λειτουργίας των σχολείων. Θα σας παρακαλούσα θερμά να απαντήσετε στα ακόλουθα ερωτήματα υπό το φως των εμπειριών σας στο σχολείο και σύμφωνα με τους νέους κανόνες που επιβλήθηκαν λόγω του Covid-19 / The Covid-19 pandemic has brought about significant changes to every aspect of life including how schools are running, so please answer the following in the light of your experiences with your school under the new Covid-19 rules

Πόσο συμφωνείς ή διαφωνείς με τις πιο κάτω θέσεις; / How much do you aggree of disagree with the following statements?

9. *

Mark only one oval per row.

	1. Διαφωνώ απόλυτα / Totally disagree	2. Διαφωνώ / Disagree	3. Ούτε Συμφωνώ ούτε Διαφωνώ / Neither Agree not Disagree	4. Συμφωνώ / Agree	5. Συμφωνώ απόλυτα / Totally Aggree
Η μέρα μου στο σχολείο διαφοροποιήθηκε αρκετά λόγω των νέων μέτρων για τη διαχείριση του κορωνοϊού/ My school day has significantly change due to the measure taken for the prevension of covid-19	⬭	⬭	⬭	⬭	⬭
Οι επαφές με τους φίλους μου διαφοροποιήθηκαν σημαντικά λόγω των νέων μέτρων για τη διαχείριση του κορωνοϊού/ The contacts i have with my friends have been differentiated due to covid 19 rules	⬭	⬭	⬭	⬭	⬭
Προτιμώ που τώρα έχω το δικό μου θρανίο / I prefer that now I have my own desk	⬭	⬭	⬭	⬭	⬭
Παρά τους κανόνες που εφαρμόσαμε λόγω των νέων μέτρων για τη διαχείριση του κορωνοϊού, καταφέρνω να βρίσκομαι με τους	⬭	⬭	⬭	⬭	⬭

φίλους μου απο άλλα τμήματα στα διαλείμματα / Despite the covid-19 rules i manage to meet my friends from other classrooms during breaks					
Παρά τους κανόνες που εφαρμόσαμε λόγω των νέων μέτρων για τη διαχείριση του κορωνοϊού, καταφέρνω να βρίσκομαι με τους φίλους μου απο άλλα τμήματα κατά τις μετακινήσεις μας στις αίθουσες διδασκαλίας/ Despite the covid-19 rules, I manage to meet my friends from other classrooms during transfers					
Η χρήση μάσκας επηρεάζει κατα πολύ την συγκέντρωση μου στην τάξη / The fact that i am wearing a mask disturbs my concentration in class					
Το γεγονός ότι τώρα κάθομαι μόνος-νη μου με εμποδίζει απο το να μάθω απο τους συμμαθητές μου / The fact that i am sitting by myself prevents me from					

learning from my classmates					
Λόγω των νέων μέτρων που εφαρμόσαμε για τη διαχείριση του κορωνοϊού, τώρα κάνουμε και μαθήματα σε εξωτερικούς χώρους / Due to the covid-19 measures, now we are doing lesson in the outdoor spaces of the school					
Παρά τους κανόνες που εφαρμόσαμε λόγω των νέων μέτρων για τη διαχείριση του κορωνοϊού, νιώθω ότι υπάρχουν αρκετοί χώροι για να συναντηθώ με τους φίλους μου / Despite the covid-19 rules, I feel that there are a lot of places to hang around with my friends					

Γενικά / In general

10. Ποιο είναι το καλύτερο πράγμα στο σχολείο; / What is the single best thing about the school? *

11. Ο αγαπημένος μου χώρος στο σχολείο είναι: / My favorite place at school is: *

12. Αν θα άλλαζες κάτι στο σχολείο σου τι θα ήταν; / If you could change something at the school what would be? *

Σας Ευχαριστώ ! / Thank you!

C.2 Final Study: Teachers' Questionnaires

Final Study - Teachers' Questionnaire

Assessing educational environments: A tremporal socio-spatial approach to lower secondary school buildings in Cyprus

*Required

ΕΝΤΥΠΟ ΕΝΗΜΕΡΩΣΗΣ ΓΙΑ ΣΥΜΠΛΗΡΩΣΗ ΕΡΩΤΗΜΑΤΟΛΟΓΙΟΥ

ΟΝΟΜΑ ΕΡΕΥΝΗΤΗ:
Χρυστάλα Ψαθίτη
Τηλ: +35799829971 / Email: cpsath01@ucy.ac.cy

ΟΝΟΜΑ ΤΟΥ ΦΟΡΕΑ (κάτω από την εποπτεία του οποίου θα γίνει η έρευνα):
Πανεπιστήμιο Κύπρου

Με το παρόν έντυπο θα ήθελα να σας ενημερώσω σχετικά με τη έρευνα που διεξάγεται στα πλαίσια της διδακτορική διατριβή με τίτλο 'Αξιολόγηση εκπαιδευτικών περιβαλλόντων: μια κοινωνικο-χωρικη προσέγγιση στα κτίρια της δευτεροβάθμιας εκπαίδευσης στην Κύπρο' η οποία στόχο έχει να εξερευνήσει την πολύπλοκη κοινωνικο-χωρική φύση των σχολικών περιβαλλόντων της δευτεροβάθμιας εκπαίδευσης στην Κύπρο και να συνεισφέρει στην κατανόηση του ρόλου του σχολικού περιβάλλοντος στις εκπαιδευτικές διαδικασίες. Αναφορικά με τη συμμετοχή σας στην έρευνα αξίζει να σημειωθούν τα ακόλουθα:

1. Η συμμετοχή στην έρευνα είναι εθελοντική και οι συμμετέχοντες/χουσες μπορούν να αποχωρήσουν οποιαδήποτε στιγμή χωρίς συνέπειες
2. Η έρευνα προϋποθέτει τη σύμφωνη γνώμη σας
3. Τα δεδομένα που θα συλλεχθούν θα χρησιμοποιηθούν μόνο για σκοπούς της συγκεκριμένης έρευνας και θα ληφθούν όλα τα απαραίτητα μέτρα για την ασφαλή φύλαξη των δεδομένων της έρευνας
4. Θα διασφαλιστεί η ανωνυμία των συμμετεχόντων/ουσων αφού κανένα προσωπικό στοιχείο των συμμετεχόντων/ουσων δεν καταγράφετε από την έρευνα αυτή
5. Θα χρειαστεί να αφιερώσετε μόνο 10 λεπτά
6. Σε περίπτωση που υπάρχουν απορίες μπορούν να υποβληθούν στο ερευνητή. Τα στοιχεία επικοινωνίας βρίσκονται στην αρχική σελίδα

Ευχαριστώ εκ των προτέρων για τη συνεργασία,
Χρυστάλα Ψαθίτη
....

RESEARCHER:
Chrystala Psathiti
Tel: +35799829971 / Email: cpsath01@ucy.ac.cy

UNIVERSITY:
University of Cyprus, Department of Architecture

In this paper I would like to inform you about the research conducted in the framework of the doctoral dissertation entitled 'Assessing educational environments: A socio-spatial approach to lower secondary school buildings buildings in Cyprus' which aims to explore the complex socio-spatial nature of secondary school environments in Cyprus and to contribute to the understanding of the role of the school environment in educational processes. Regarding your participation in the research, it is worth noting the following:

1. Participation in the survey is voluntary and participants can leave at any time without consequences
2. The survey requires your consent
3. The data collected will be used only for the purposes of this research and all necessary measures will be taken to securely store the research data.
4. The anonymity of the participants / subjects will be ensured since no personal data of the participants / subjects are recorded from this research
5. You will only need to spend 10 minutes
6. If there are any questions they can be submitted to the researcher. Contact details are on the home page

Thanks in Advance for you collaboration,
Chrystala Psathiti

ΣΥΓΚΑΤΑΘΕΣΗ ΕΚΠΑΙΔΕΥΤΙΚΩΝ, ΔΙΕΥΘΥΝΤΗ/ΤΡΙΑΣ ΓΙΑ ΣΥΜΠΛΗΡΩΣΗ ΕΡΩΤΗΜΑΤΟΛΟΓΙΟΥ / CONSENSE FOR THE COMPLETION OF THE QUESTIONNAIRE

1. *

Mark only one oval.

- Δηλώνω Υπέυθυνα ότι διάβασα τα παραπάνω και θα ήθελα να συμμετέχω στην συγκεκριμένη έρευνα / I state honestly that I am consensus for the completion of this questionnaire

2. Ημερομηνία / Date *

Example: 7 January 2019

Σχετικά με Εσένα / About You

3. Φύλο *

Mark only one oval.

- 1. Άνδρας / Male
- 2. Γυναίκα / Femal
- 3. Δεν θα ήθελα να προσδιορίσω / I don't want to specify

4. Σχολείο στο οποίο διδάσκεις / Your School *

Mark only one oval.

- 1. Επαρχία Λευκωσίας, Γυμνάσιο Κοκκινοτριμιθιάς / Gymnasium Kokkinotrimithias
- 2. Επαρχία Λευκωσίας, Γυμνάσιο Αγ. Ιωάννη Χρυσόστομου / Gymnasium Agiou Ioanni Chrysostomou
- 3. Επαρχία Λεμεσού, Γυμνάσιο Αγίου Νεοφύτου / Gymnasium Agiou Neofytou
- 4. Επαρχία Λεμεσού, Γυμνάσιο Ζακακίου / Gymnasium Zakakiou
- 5. Επαρχία Λεμεσού, Γυμνάσιο Αγίας Φυλάξεως / Gymnasium Agias Filaxeos
- 6. Επαρχία Λάρνακας, Γυμνάσιο Αθηένους / Gymnasium Athienous
- 7. Επαρχία Λάρνακας, Γυμνάσιο Πετράκη Κυπριανού / Gymnasium Petraki Kyprianou
- 8. Επαρχία Λάρνακας, Γυμνάσιο Λιβαδιών / Gymnasium Livadion
- 9. Επαρχία Πάφου, Γυμνάσιο Παναγίας Θεοσκέπαστης / Gymnasium Panagias Theoskepastis
- 10. Επαρχία Αμμοχώστου, Γυμνάσιο Ειρήνης & Ελευθερίας / Gymnasium Eirinis & Eleutherias
- Other: ______________________

5. Θέση *

Mark only one oval.

- 1. Διευθυντής/τρια / Headteachers
- 2. Καθηγητής/τρια - Μόνιμο Προσωπικό / Teacher - Permanent Staff
- 3. Καθηγητής/τρια - Συμβασιούχο Προσωπικό / Teacher - Temporal Staff

Σχολικό Κτίριο & Σχολική Ζωή / School Building & School Life

Πόσο συμφωνείς ή διαφωνείς με τις πιο κάτω θέσεις σε σχέση με το σχολείο σου; / How much do you agree or disagree with the following statements?
(Επέλεξε ένα κύκλο για να δείξεις ποσο συμφωνείς ή διαφωνείς με την κάθε θέση

6. *

Mark only one oval per row.

	1. Διαφωνώ απόλυτα / Totally disagree	2. Διαφωνώ / Disagree	3. Ούτε συμφωνώ ούτε διαφωνώ / Neither Agree not Disagree	4. Συμφωνώ/ Agree	5. Συμφωνώ Απόλυτα / Totally agree
Έχω πολύ καλές σχέσεις με τους μαθητές / I have good relationships with our students	◯	◯	◯	◯	◯
Κάθε μέρα συναντιέμαι με τους μαθητές στην πορεία μου απο τις τάξεις στο σύλλογο / Everyday i meet students during my transfers from classrooms to administration	◯	◯	◯	◯	◯
Συχνά συζητώ με τους μαθητές κατά τη διάρκεια του διαλείμματος / I often chat with our students during breaks	◯	◯	◯	◯	◯
Έχουμε κουλτούρα εμπιστοσύνης και υποστήριξης με τους συναδέλφους και μαθητές /	◯	◯	◯	◯	◯

We have a culture of trust and support in our school					
Νιώθω πολύτιμος-μη / I feel valuable	◯	◯	◯	◯	◯
Μπορώ με ευκολία να μοιραστώ κάτι που με προβληματίζει / I feel comfortable to share my problems	◯	◯	◯	◯	◯
Οι μαθητές συχνά μοιράζονται μαζί μου τις ανησυχίες τους / Often our students share their problems with me	◯	◯	◯	◯	◯
Είμαστε καλή ομάδα / We are a good team	◯	◯	◯	◯	◯
Νιώθω υποστήριξη / I feel support	◯	◯	◯	◯	◯
Βοηθάω αλλά και βοηθιέμαι από συναδέλφους στην παραγωγή διδακτικού υλικού / I help and get help from my colleagues in school for the preparation of	◯	◯	◯	◯	◯

educational material					
Η πλειοψηφία των μαθητών καταγράφει υψηλές επιδόσεις / The majority of students in school has high scores					
Κάθε χρόνο οι μαθητές του σχολείου παίρνουν βραβεία / Every year our students get awards					
Υπάρχουν πολλοί μαθητές που χρειάζονται υποστήριξη ή δεν μπορούν να ανταποκριθούν στις απαιτήσεις του σχολείου / There are a lot of students in the school that need support					
Οι μαθητές πιο συχνά υιοθετούν διαφορετικούς τρόπους μάθησης στις αίθουσες ειδικής διδασκαλίας απο ότι στις αίθουσες γενικής διδασκαλίας / Students					

usually adopt
varying
learning
methods in
special
classrooms
that in general
classrooms

Σχολική Ασφάλεια / School 's Safety

Πόσο συμφωνείς ή διαφωνείς με τις πιο κάτω θέσεις σε σχέση με το σχολείο σου; / How much do you agree or disagree with the following statements in relation to your school?

(Επέλεξε ένα κουτί για να δείξεις ποσο συμφωνείς ή διαφωνείς με την κάθε θέση

7. *

Mark only one oval per row.

	1. Διαφωνώ απόλυτα / Totally disagree	2. Διαφωνώ / Disagree	3. Ούτε συμφωνώ ούτε διαφωνώ / Neither agree not disagree	4. Συμφωνώ / Agree	5. Συμφωνώ Απόλυτα / Totally agree
Το σχολείο διαθέτει ένα καλά οργανωμένο σχέδιο εκκένωσης / The school has a good evacuation plan	⬭	⬭	⬭	⬭	⬭
Είμαι πολύ ικανοποιημένος/νη από το σχέδιο ασφάλειας και υγείας που μας δόθηκε από το Υπουργείο / I am very pleased with our school's health and safety plan	⬭	⬭	⬭	⬭	⬭
Το σχολικό κτίριο είναι πολύ απλωμένο και δεν μπορούμε να το ελέγξουμε εύκολα / Our school is spread all over the school plot and we cant control it	⬭	⬭	⬭	⬭	⬭
Το σχολικό κτίριο έχει αυξημένη επαφή με τον δρόμο και αυτό μας δυσκολεύει στην επιτήρησή του / The school is	⬭	⬭	⬭	⬭	⬭

very exposed to the adjacent street and this makes it difficult to control it					
Πιστεύω είναι καλύτερα το σχολείο να έχει μια μόνο είσοδο/ έξοδο / I believe is better our school to have one entrance and one exit					
Στο σχολείο μας έχουμε περιστατικά με ναρκωτικά, αλκοολ και γενικότερα παραβατική συμπεριφορά των μαθητών / In our schools we have instances with drugs, alcohol and general delinquent behavior					
Ο εξωτερικός χώρος των γηπέδων πρέπει να κλείνει κατά τη διάρκεια του διαλείμματος / I believe that the sports area should be closed during breaks					

Αλλαγές λόγω Κορωνοϊού / Changes due to Covid-19	Η πανδημία Covid-19 επέφερε σημαντικές αλλαγές σε κάθε πτυχή της ζωής μας συμπεριλαμβανομένου και του τρόπου λειτουργίας των σχολείων. Θα σας παρακαλούσα θερμά να απαντήσετε στα ακόλουθα ερωτήματα υπό το φως των εμπειριών σας στο σχολείο και σύμφωνα με τους νέους κανόνες που επιβλήθηκαν λόγω του Covid-19 / Covid-19 pandemic has changed a lot of aspects of our life included and the way schools work. Please answer the following questions having in mind your experience in your school during this period and in the context of the new rules that have been applied to the schools due to this condition.

Πόσο συμφωνείς ή διαφωνείς με τις πιο κάτω θέσεις σε σχέση με το σχολείο σου; / How much do you agree or disagree with the following statements in relation to your school?

(Επέλεξε ένα κουτί για να δείξεις ποσο συμφωνείς ή διαφωνείς με την κάθε θέση

8. *

Mark only one oval per row.

	1. Διαφωνώ απόλυτα / Totally disagree	2. Διαφωνώ / Disagree	3. Ούτε συμφωνώ ούτε διαφωνώ / Neither agree nor disagree	4. Συμφωνώ / Agree	5. Συμφωνώ Απόλυτα / Totally agree
Οι κανόνες που εφαρμόσαμε λόγω του κορωνοϊού άλλαξαν τελείως τη ζωή στο σχολείο / The rules we applied due to covid-19 pandemic have changed every aspect of our school life	⬭	⬭	⬭	⬭	⬭
Μπορέσαμε εύκολα να ανταποκριθούμε στα νέα υγειονομικά πρωτόκολλα για τη διαχείριση της πανδημίας του κορωνοϊού / We have easily adapted to the new rules that have been applied in our school due to covid-19 pandemic	⬭	⬭	⬭	⬭	⬭
Η αρχιτεκτονική δομή του σχολείου μας βοήθησε να καθορίσουμε εύκολα τους διαφορετικούς χώρους για κάθε ομάδα στα διαλείμματα / Our school's	⬭	⬭	⬭	⬭	⬭

layout helped us to define the different areas for the different groups of students					
Προβληματίζομαι περισσότερο με την ασφάλεια και υγεία των μαθητών τώρα απο ότι παλαιότερα / I am more concerned now with health and safety issues than before	⬭	⬭	⬭	⬭	⬭
Καταβάλλουμε πολλή προσπάθεια να κάνουμε τους μαθητές να ακολουθήσουν τους κανόνες / We try a lot to make students follow the rules	⬭	⬭	⬭	⬭	⬭
Έχω περισσότερο εργασιακό στρές απο τότε που εφαρμόστηκαν τα υγειονομικά πρωτόκολλα για τη διαχείριση της πανδημίας του κορωνοϊου στο σχολείο μας / I have more work-related stress now than before	⬭	⬭	⬭	⬭	⬭
Είναι δύσκολο να ελέγξουμε τους μαθητές που πηγαίνουν και έρχονται / It is difficult to control	⬭	⬭	⬭	⬭	⬭

our students where they go					
Το μάθημά μου είναι πιο ευέλικτο τώρα απο πριν / My lesson is more flexible now than before					
Παρά τους κανόνες που εφαρμόσαμε με βάση τα νέα υγειονομικά πρωτόκολλα για τη διαχείριση του κορωνοϊού, είναι εύκολο να λειτουργήσω στην τάξη και να διαχειριστώ τα μαθήματα και τους μαθητές μου / Despite the rules we applied due to covid-19 pandemic it is easy to operate in the classroom					
Παρά τους κανόνες που εφαρμόσαμε με βάση τα νέα υγειονομικά πρωτόκολλα για τη διαχείριση του κορωνοϊού, είναι εύκολο να ανταποκριθώ στις ανάγκες του κάθε μαθητή-τριας / Even with the covid-19 rules, it is easy for me to attend the needs of and instruct each individual student					

Ανεξάρτητα απο τους κανόνες που εφαρμόσαμε με βάση τα νέα υγειονομικά πρωτόκολλα για τη διαχείριση του κορωνοϊού, θα προτιμούσα να είχα την δική μου τάξη για όλα τα επίπεδα διδασκαλίας / Regardless the covid-19 rules, I would prefer to have my own classroom for all grades					
Είναι πιο εύκολο να καθοδηγήσω τους μαθητές μου τώρα που έχουν τα δικά τους θρανία / It is easier now to guide our students, since they are sitting alone					
Με τα ατομικά θρανία, είναι ευκολότερο για τους μαθητές να αναπτύξουν τις δικές τους ιδιαίτερες ικανότητες / With the single desks, it is easier for students to develop their potential abilities					
Μέσα στις καθορισμένες περιοχές διαλείμματος, οι μαθητές συχνά επιλέγουν					

. απομονωμένους χώρους για να διαβάσουν μόνοι τους ή με τους φίλους τους στα διαλείμματα / In the predefined break area for each grade, students select remote locations to read by themselves or with their peers					
Μέσα στις καθορισμένες περιοχές διαλείμματος, οι μαθητές συναθροίζονται συνήθως σε μικρές παρέες που αποτελούνται μόνο από αγόρια ή μόνο κορίτσια / In the predefined break area for each grade, students usually mingle in small same-gender groups	◯	◯	◯	◯	◯
Κατά τη διάρκεια του διαλείματος και παρά τους αυστηρούς κανόνες οι μαθητές από διαφορετικές τάξεις βρίσκουν τρόπους να συναντιούνται / During breaks, students from different grades find ways to mingle regardless covid-19 school rules	◯	◯	◯	◯	◯

Οι μαθητές από διαφορετικές τάξεις συχνά μιλούν μεταξύ τους κατά τις μετακινήσεις τους στις αίθουσες διδασκαλίας / Students usually speak with students from other grades or classrooms during transfer between classrooms / Students usually speak with students from other grades or classrooms during transfers					
Λόγω του κορονωϊού, τώρα χρησιμοποιούμε αποδοτικά και τον εξωτερικό χώρο για μαθήματα / Due to covid-19 we now use more often the school's outdoor areas for lesson					

Σας Ευχαριστώ! / Thank you

Appendix D

Appendix D: Headteachers Interview Questions Template

Final Study - Headteacher's Interview

Assessing educational environments: A tremporal socio-spatial approach to lower secondary school buildings in Cyprus

*Required

ΕΝΤΥΠΟ ΓΙΑ ΕΝΗΜΕΡΩΣΗ ΔΙΕΥΘΥΝΤΗ/ΤΡΙΑΣ ΓΙΑ ΑΝΟΙΧΤΗ ΣΥΖΗΤΗΣΗ

ΟΝΟΜΑ ΕΡΕΥΝΗΤΗ:
Χρυστάλα Ψαθίτη
Τηλ: +35799829971 / Email: cpsath01@ucy.ac.cy

ΟΝΟΜΑ ΤΟΥ ΦΟΡΕΑ (κάτω από την εποπτεία του οποίου θα γίνει η έρευνα):
Πανεπιστήμιο Κύπρου

Με το παρόν έντυπο θα ήθελα να σας ενημερώσω σχετικά με τη έρευνα που διεξάγεται στα πλαίσια της διδακτορική διατριβή με τίτλο 'Αξιολόγηση εκπαιδευτικών περιβαλλόντων: μια κοινωνικο-χωρικη προσέγγιση στα κτίρια της δευτεροβάθμιας εκπαίδευσης στην Κύπρο' η οποία στόχο έχει να εξερευνήσει την πολύπλοκη κοινωνικο-χωρική φύση των σχολικών περιβαλλόντων της δευτεροβάθμιας εκπαίδευσης στην Κύπρο και να συνεισφέρει στην κατανόηση του ρόλου του σχολικού περιβάλλοντος στις εκπαιδευτικές διαδικασίες. Αναφορικά με τη συμμετοχή σας στην έρευνα αξίζει να σημειωθούν τα ακόλουθα:
1. Η συμμετοχή στην έρευνα είναι εθελοντική και οι συμμετέχοντες/χουσες μπορούν να αποχωρήσουν οποιαδήποτε στιγμή χωρίς συνέπειες
2. Η έρευνα προϋποθέτει τη σύμφωνη γνώμη σας
3. Τα δεδομένα που θα συλλεχθούν θα χρησιμοποιηθούν μόνο για σκοπούς της συγκεκριμένης έρευνας και θα ληφθούν όλα τα απαραίτητα μέτρα για την ασφαλή φύλαξη των δεδομένων της έρευνας
4. Θα διασφαλιστεί η ανωνυμία των συμμετεχόντων/ουσων αφού κανένα προσωπικό στοιχείο των συμμετεχόντων/ουσων δεν καταγράφετε από την έρευνα αυτή
5. Θα χρειαστεί να αφιερώσετε μόνο 10 λεπτά
6. Σε περίπτωση που υπάρχουν απορίες μπορούν να υποβληθούν στο ερευνητή. Τα στοιχεία επικοινωνίας βρίσκονται στην αρχική σελίδα

Ευχαριστώ εκ των προτέρων για τη συνεργασία,
Χρυστάλα Ψαθίτη
....
RESEARCHER:
Chrystala Psathiti
Tel: +35799829971 / Email: cpsath01@ucy.ac.cy

UNIVERSITY:
University of Cyprus, Department of Architecture

In this paper I would like to inform you about the research conducted in the framework of the doctoral dissertation entitled 'Assessing educational environments: A socio-spatial approach to lower secondary school buildings buildings in Cyprus' which aims to explore the complex socio-spatial nature of secondary school environments in Cyprus and to contribute to the understanding of the role of the school environment in educational processes. Regarding your participation in the research, it is worth noting the following:
1. Participation in the survey is voluntary and participants can leave at any time without consequences
2. The survey requires your consent
3. The data collected will be used only for the purposes of this research and all necessary measures will be taken to securely store the research data.
4. The anonymity of the participants / subjects will be ensured since no personal data of the participants / subjects are recorded from this research
5. You will only need to spend 10 minutes
6. If there are any questions they can be submitted to the researcher. Contact details are on the home page

Thanks in Advance for you collaboration,
Chrystala Psathiti

ΣΥΓΚΑΤΑΘΕΣΗ ΔΙΕΥΘΥΝΤΗ/ΤΡΙΑΣ ΓΙΑ ΣΥΜΜΕΤΟΧΗ ΣΕ ΑΝΟΙΧΤΗ ΣΥΖΗΤΗΣΗ / CONSENSE FOR PARTICIPATION IN THE INTERVIEW

1. *

Mark only one oval.

- [ ] Δηλώνω Υπέυθυνα ότι διάβασα τα παραπάνω και θα ήθελα να συμμετέχω στην συγκεκριμένη έρευνα / I state honestly that I am consensus for the completion of this interview

2. Ημερομηνία / Date *

Example: 7 January 2019

Σχολικό Κτίριο, Σχολική Ζωή & Κανόνες / School Building, School Life & Rules

3. Πιστεύετε ότι οι κανόνες που επιβλήθηκαν με βάση τα νέα υγειονομικά πρωτόκολλα για τη διαχείριση της πανδημίας του κορωνοϊού άλλαξαν την σχολική ζωή; Αν ναι πώς και σε ποιο βαθμό; / To what extent do you think that the rules that have been applied due to covid-19 pandemic have changed your school life? *

4. Ποιες ήταν οι κύριες προκλήσεις που είχατε να αντιμετωπίσετε πριν την πανδημία του κορωνοϊού όσο αφορά την αποδοτική διαχείριση της σχολικής μονάδας; / Which challenged you have faced due to covid-19 pandemic in the school's operation? *

5. Κάνατε κάποιες ενέργειες για να μπορέσετε να διασφαλίσετε την ασφάλεια στο σχολείο πριν τα έκτακτα μέτρα του κορωνοϊού; Αν ναι ποιες ήταν αυτές οι ενέργειες και γιατί θεωρήθηκαν απαραίτητες; / Did you take any steps to ensure the safety of the school before covid-19 pandemic? If so, what were these actions and why were they considered necessary? *

6. Υπάρχει κάποια πρακτική που εφαρμόστηκε με βάση τα νέα μέτρα για τη διαχείριση του κορωνοϊού και θεωρείτε ότι θα ήταν καλό να διατηρηθεί και μετά; / Is there any practice that has been implemented based on the new covid-19 measures and are worth to be maintained in the future? *

7. Σε ποιο βαθμό πιστέυετε ότι η δομή του σχολικού κτίριου μπορεί να καθορίσει καποιες αποφάσεις που παίρνετε (π.χ επιβολή κανόνων κ.α) ; / To what extent do you believe that the school's layout can determine some of the decisions you make (eg enforcing rules, etc.)? *

8. Ποιο θεωρείτε τον πιο σημαντικό παράγοντα στην διαμόρφωση ενός σχολείου; / Based on your own experience and personal belief which do you think is the more important parameter when designing school? *

Σας Ευχαριστώ / Thank you

Appendix E

Appendix E: Approval from KEEA to Execute Research in Public Schools in Cyprus

ΚΕΝΤΡΟ ΕΚΠΑΙΔΕΥΤΙΚΗΣ ΕΡΕΥΝΑΣ ΚΑΙ ΑΞΙΟΛΟΓΗΣΗΣ

ΑΝΑΛΥΤΙΚΟ ΣΧΕΔΙΟ ΕΡΕΥΝΑΣ

ΚΩΔΙΚΟΣ: 175496

Στάδιο: ΥΠΟ ΓΝΩΜΟΔΟΤΗΣΗ ΥΠΠ **Δημιουργία:** 28/09/2020 09:51:02 **Υποβολή:** 28/09/2020 10:25:32 AM

Όνομα ερευνητή/ερευνήτριας:
Ψαθίτη Χρυστάλα

Ιδιότητα:
Διδακτορική Φοιτήτρια, Τμήμα Αρχιτεκτονικής Πανεπιστήμιο Κύπρου

Μέλη ερευνητικής ομάδας:
Χρυστάλα Ψαθίτη

Επιστημονικός φορέας:
Πανεπιστήμιο Κύπρου

Διευθύνσεις ΥΠΠ στις οποίες θα διεξαχθεί η έρευνα:
Μέσης,

Ταχυδρομική διεύθυνση ερευνητή/ερευνήτριας:
Άντη Παπαδοπούλου, 8 Α, 8020 Πάφος, ΠΑΦΟΣ

Διεύθυνση ηλεκτρονικού ταχυδρομείου:
c.psathiti@gmail.com

Τηλέφωνα / τηλεμοιότυπο (fax):
99829971 /

Τίτλος έρευνας:
Αξιολόγηση εκπαιδευτικών περιβαλλόντων: Μια κοινωνικο-χωρική προσέγγιση στα κτίρια της δευτεροβάθμιας εκπαίδευσης στην Κύπρο.

Σκοπός -ερευνητικά ερωτήματα/υποθέσεις:

Στόχος της έρευνας είναι η ανάδειξη της δυναμικής και σχεσιακής φύσης του σχολικού περιβάλλοντος και ο καθορισμός μιας διευρυμένης προσέγγιση η οποία εκτείνεται πέρα από το αυτοαναφορικό χωρικό-φυσικό πλαίσιο του σχολείο και να καταδείξει ένα μεθοδολογικό πλαίσιο με το οποίο μπορούν να εξεταστούν τέτοια περιβάλλοντα.

Τα ερευνητικά ερωτήματα και η υποθέσεις έρευνας αυτής της διατριβής είναι τα πιο κάτω:

• Πώς επηρεάζει η χωρική διάταξη των κτιρίων δευτεροβάθμιας εκπαίδευσης που κτίστηκαν στην Κύπρο μετά το 2020, την παιδαγωγική διαδικασία και τις κοινωνικές συμπεριφορές στο σχολείο; και σε ποιο βαθμό τα κτίρια της δευτεροβάθμιας εκπαίδευσης που χτίστηκαν στην Κύπρο μετά το 2020 δείχνουν χωρικές, λειτουργικές και οργανωτικές ομοιότητες;
• Σε ποιο βαθμό το σχολικό περιβάλλον μπορεί να προσεγγιστεί ως έα σύνολο διαφόρων κοινωνικο-εκπαιδευτικών κωδικών που διαμορφώνονται συνεχώς κατά τη διάρκεια διαφορετικών σχολικών περιόδων; και σε ποιο βαθμό υπάρχουν διαφορές στη διαμόρφωση του 'εκπαιδευτικού κώδικα' (Benrstein's concept of educational code) μεταξύ διαφορετικών σχολικών ωρών (δηλαδή διαφορετική ώρα μιας σχολικής ημέρας ή διαφορετική σεζόν);
Σε αυτό το πλαίσιο, η έρευνα υποθέτει ότι οι 'εκπαιδευτικοί κώδικες' που προτείνονται από το έργο του Basil Bernstein (1973) μαζί με το θεωρητικό πλαίσιο που προτείνεται από τη θεωρία της κοινωνικής συνάθροισης (Social Assemblage) μπορούν να εξεταστούν από κοινού για να βοηθήσουν στη σύλληψη της πολυπλοκότητας και της χρονικότητας του σχολικού περιβάλλοντος.
• Πόσο διαφορετικές χωρικές μετρήσεις όπως η χωρική ενσωμάτωση (spatial integration), το αξονικό μέσο βάθος (Axial Mean Depth) και η χωρική κατανόηση (spatial intelligibility) επηρεάζουν τις σχολικές διαδικασίες; Και ποιες μέθοδοι απο το συντακτικό του χώρου (space syntax) είναι πιο κατάλληλες κατά την ανάλυση ανοιχτού τύπου σχολείων όπως τα κυπριακά σχολεία;
• Σε ποιο βαθμό διαφορετικές χωρικές και κοινωνικές συνθήκες στο σχολείο παράγουν διαφορετικές μορφές αλληλεγγύης;
• Πώς σχετίζεται η χωρική διάταξη των κτιρίων της δευτεροβάθμιας εκπαίδευσης που χτίστηκαν στην Κύπρο μετά το 2020 με κοινωνικές δράσεις-αποφάσεις και με διάφορες μορφές αλληλεγγύης στο σχολείο;
• Σε ποιο βαθμό το υψηλό πορώδες του σχολικού κτιρίου προς το δρόμο και η χωρική διασπορά του σχολείου συμβάλλουν σε μια σχολική λειτουργία που βασίζεται σε κανόνες;
• Σε ποιο βαθμό η χωρική και λειτουργική σύνθεση του σχολείου επηρεάζει τις αποφάσεις και τους κανόνες που δύναται να επιβληθούν από τον διευθυντή στο σχολείο;
• Σε ποιο βαθμό το θετικό σχολικό κλίμα επηρεάζει την αντίληψη των μαθητών για τη σχολική τους απόδοση;

Πιο συγκεκριμένα οι στόχοι της διατριβής αυτής είναι:
- Να αποκωδικοποιήσει και να ορίσει αποδοτικά εκπαιδευτικά περιβάλλοντα;
- Να εξερευνήσει την πολύπλοκη κοινωνικο-χωρική φύση των σχολικών περιβαλλόντων της δευτεροβάθμιας εκπαίδευσης στην Κύπρο;
- Να συνεισφέρει στην κατανόηση του ρόλου του σχολικού περιβάλλοντος στις εκπαιδευτικές διαδικασίες;
- Να αναπτύξει ένα μεθοδολογικό και αναλυτικό πλαίσιο ικανό να καταδείξει το βαθμό στον οποίο μεταβλητές της κοινωνικο-χωρικής δομής του σχολικού περιβάλλοντος αλληλεπιδρούν με τον τρόπο που οι εκπαιδευόμενων και οι εκπαιδευτικοί βιώνουν τη σχολική μονάδα, με τις εκπαιδευτικές διαδικασίες αλλά και με τα εκπαιδευτικά αποτελέσματα.

ΚΕΝΤΡΟ ΕΚΠΑΙΔΕΥΤΙΚΗΣ ΕΡΕΥΝΑΣ ΚΑΙ ΑΞΙΟΛΟΓΗΣΗΣ

ΑΝΑΛΥΤΙΚΟ ΣΧΕΔΙΟ ΕΡΕΥΝΑΣ

ΚΩΔΙΚΟΣ: 175496

Χρησιμότητα-αναγκαιότητα της έρευνας:

Η συνεισφορά αυτής της διδακτορικής διατριβής ανάγεται στον καθορισμό μιας εναλλακτικής προσέγγισης στη μελέτη και κατανόηση εκπαιδευτικών περιβαλλόντων η οποία εν δυνάμει μπορεί να προσφέρει ένα εννοιολογικό και μεθοδολογικό πλαίσιο στο σημείο διαπλοκής των πεδίων της αγωγής και του δομημένου περιβάλλοντος το οποίο αποτελεί ένα σημαντικά υποβαθμισμένο τομέα έρευνας στην Κύπρο αλλά και το εξωτερικό. Ταυτόχρονα, η υφιστάμενη γνώση σχετικά με την επίδραση του δομημένου περιβάλλοντος στις παιδαγωγικές διαδικασίες στην Κύπρο, αλλά και στο εξωτερικό, είναι σημαντικά υποβαθμισμένη και περιορίζεται σε μελέτες που υιοθετούν μια πιο ντετερμινιστική προσέγγιση. Γι' αυτό το λόγο, η διδακτορική αυτή διατριβή αντιλαμβάνεται το εκπαιδευτικό περιβάλλον ως μια περίπλοκη κοινωνικο-χωρική δομή η οποία είναι άμεσα συνυφασμένη με τις παιδαγωγικές πρακτικές. Με αυτό τον τρόπο, η διερεύνηση αυτής της σχέσης στο Κυπριακό σκηνικό θα βοηθήσει στην αξιολόγηση των υφιστάμενων σχολικών δομών καθώς επίσης και των γενικών κατευθυντήριων γραμμών που δίνονται από το Υπουργείο Παιδείας και Πολιτισμού για το σχεδιασμό σχολικών μονάδων (π.χ αυλή στο κέντρο της σχολικής μονάδας κ.α).

Ταυτόχρονα, αυτή η διατριβή θα βοηθήσει την υφιστάμενη έλλειψη εμπειρικών δεδομένων (Woolner et. Al. 2007) απο σχολικά κτίρια αφου θα αντλήσει δεδομένα από την ίδια την ανθρώπινη συμπεριφορά στο χώρο, χωρίς ωστόσο να θίγει ή να σκιαγραφεί την προσωπικότητα του κάθε μαθητή.

Μεθοδολογικά, αυτή η διατριβή θα συνεισφέρει στην υφιστάμενη έρευνα που συντελείται από το συντακτικό του χώρου αναφορικά με σχολικές δομές (Space Syntax Theory, Bartlett School of Architecture) ενώ ταυτόχρονα θα προσφέρει ένα διευρυμένο πλαίσιο εξέτασης εκπαιδευτικών περιβαλλόντων.

Διαδικασία συλλογής δεδομένων:

Σε συνέχεια της αίτησης με αριθμό νο. 143749 που αφορούσε την πιλοτική βάση της έρευνας, σε αυτό το στάδιο γίνεται υποβολή για την τελική συλλογή δεδομένων. Η τελική συλλογή δεδομένων και η μεθοδολογία έρευνας τελειοποιήθηκαν μετά την πιλοτική φάση της έρευνας.

Η μελέτη αυτή εστιάζεται σε γυμνάσια που κτίστηκαν μετά το 2000 (συνολικός αριθμός 10 σχολεία σε όλη την Κύπρο). Η επιλογή του δείγματος αυτού έχει να κάνει με τον τρόπο που κατανοεί και ορίζει αυτή η διατριβή το σχολικό περιβάλλον ως μια περίπλοκη κοινωνικο-χωρική δομή η οποία εκτείνεται τόσο σε τοπικό όσο και υπερτοπικό επίπεδο. Δεδομένου λοιπόν ότι η διδακτορική αυτή διατριβή εκλαμβάνει την σχολική μονάδα ως κοινωνικά προσδιορισμένη (π.χ από τα πρότυπα στην εκπαίδευση) επιλέγει σχολεία που κτίστηκαν με βάση τις τρέχουσες αντιλήψεις για την εκπαίδευση στην Κύπρο και την στροφή στην πιο ενεργητική μάθηση, προς την τάξη ως εργαστήριο ζωής και το σχολείο ως μια ενεργή μονάδα διδασκαλίας. Σε αυτό το πλαίσιο, η έκτακτη συνθήκη του κορονοϊού και οι αλλαγές που δημιουργήθηκαν στις σχολικές κοινωνίες λόγω της επιβολής κανόνων ενδυναμώνει το επιχείρημα αυτής της διδακτορικής διατριβής ότι δηλαδή το σχολικό κτίριο δεν μπορεί να θεωρείται μια απλή φυσική δομής αλλά ώς μια κοινωνικο-χωρική δομή που συνεχώς διαμορφώνεται.

Αναφορικά με την μεθοδολογία της διατριβής αυτή συνδυάζει top-down με bottom-up προσεγγίσεις. Πιο συγκεκριμένα, η έρευνα εφαρμόζει top-down αναλυτική προσέγγιση σε 10 σχολεία τα οποία αναλύει μέσα από τη χωρική διαρρύθμισης τους με μεθοδολογικά εργαλεία που παρέχει η θεωρία του συντακτικού του χώρου (space syntax theory) καθώς και μέσα από την ανάλυση της κατανομής των διαφόρων λειτουργιών της σχολικής μονάδας. Επιπρόσθετα, ερωτηματολόγια δίνονται στους διευθυντές και καθηγητές (με μορφή google forms) μέσα από τα οποία θίγονται θέματα που αφορούν τη φυσική, κοινωνική και ψυχολογική διάσταση του σχολικού περιβάλλοντος. Αυτή η προσέγγιση, δίνει την δυνατότητα για εξέταση όλων των σχολικών μονάδων που κτίστηκαν έχοντας ως γνώμονα την τρέχουσα φιλοσοφία στην εκπαίδευση (student-centered education).

Σε δεύτερο επίπεδο, επιλέγονται 2 σχολικές μονάδες οι οποίες αναλύονται σε βάθος μελετώντας την ανθρώπινη συμπεριφορά στο χώρο (bottom-up methodological approach). Σε αυτές τις σχολικές μονάδες μελετάται συστηματικά η συμπεριφορά των χρηστών χωρίς ωστόσο να καταγράφεται το όνομα ή άλλα προσωπικά στοιχεία πέρα από τη θέση, τη διαδρομή και τις πιθανές δραστηριότητες τους. Επιπρόσθετα, σε αυτά τα 2 σχολεία γίνεται και συλλογή ερωτηματολογίων απο μαθητές αφού εξασφαλιστούν βεβαιώσεις γονέων. Στη συνέχεια, τα εμπειρικά δεδομένα συνδυάζονται με τα δεδομένα από τη χωρική και την λειτουργική δομή των σχολικών μονάδων προκειμένου να εξαχθούν συμπεράσματα εξετάζοντας συνδυαστικά τις δύο ειδών μεθοδολογικές προσεγγίσεις έτσι ώστε να επιτευχθεί γενίκευση των συμπερασμάτων.

ΚΕΝΤΡΟ ΕΚΠΑΙΔΕΥΤΙΚΗΣ ΕΡΕΥΝΑΣ ΚΑΙ ΑΞΙΟΛΟΓΗΣΗΣ

ΑΝΑΛΥΤΙΚΟ ΣΧΕΔΙΟ ΕΡΕΥΝΑΣ

ΚΩΔΙΚΟΣ: 175496

Δειγματοληψία:

Η μελέτη αυτή εστιάζεται σε γυμνάσια που κτίστηκαν στην Κύπρο μετά το 2000 (no. 10). Η επιλογή του δείγματος αυτού έχει να κάνει με τον τρόπο που κατανοεί και ορίζει αυτή η διατριβή το σχολικό περιβάλλον ως κοινωνικο-χωρική δομή. Δεδομένου λοιπόν ότι η διδακτορική αυτή διατριβή εκλαμβάνει την σχολική μονάδα ως κοινωνικά προσδιορισμένη (π.χ από τα πρότυπα στην εκπαίδευση) επιλέγει σχολεία που κτίστηκαν με βάση τις τρέχουσες αντιλήψεις για την εκπαίδευση στην Κύπρο και την στροφή στην πιο ενεργητική μάθηση, προς την τάξη ως εργαστήριο ζωής και το σχολείο ως μια ενεργή και ανοιχτή μονάδα διδασκαλίας. Η αναλυτική λίστα των σχολείων που θα επιλεγούν βρίσκεται πιο κάτω:

Τα 10 σχολεία που επιλέγηκαν και θα εφαρμοστεί σε αυτά το top-down μεθοδολογικό πλαίσιο είναι:

- Περιφερειακό Γυμνάσιο Κοκκινοτριμιθιάς
- Γυμνάσιο Αγίου Ιωάννου του Χρυσοστόμου
- Γυμνάσιο Αγίου Νεοφύτου (Κάτω Πολεμίδια)
- Γυμνάσιο Ζακακίου
- Γυμνάσιο Αγίας Φυλάξεως
- Γυμνάσιο Αθηένους
- Γυμνάσιο Πετράκη Κυπριανού
- Περιφερειακό Γυμνάσιο Λιβαδιών
- Γυμνάσιο Παναγίας Θεοσκέπαστης (Δυτικά της Πάφου)
- Γυμνάσιο Ειρήνης & Ελευθερίας

Τα 2 σχολεία που επιλέγηκαν για το bottom-up μεθοδολογικό πλαίσιο είναι το Γυμνάσιο Αγίου Ιωάννη του Χρυσόστομου στην Λευκωσία και το Γυμνάσιο Παναγίας Θεοσκέπαστης στην Πάφο. Η επιλογή έγινε μετά απο μια συστηματική ανάλυση των ομοιοτήτων και διαφορών που παρουσιάζουν τα 10 σχολεία στην χωρική τους διαμόρφωση.

Τέλος, αναφορικά με τη συλλογή ερωτηματολογίων αυτά είναι 2 ειδών: α) Ερωτηματολόγιο καθηγητών διευθυντών που αποστέλνεται και για τα 10 σχολεία και αφορά όλους τους καθηγητές και διευθυντές/τριες των σχολικών μονάδων και β)ερωτηματολόγιο μαθητών (όλων των μαθητών των 2 σχολικών μονάδων που επιλέχθηκαν για το bottom-up μεθοδολογικό πλαίσιο).

Ερευνητικά εργαλεία:

Συνοπτικά τα ερευνητικά εργαλεία:

- Επιτόπου παρατήρηση της ανθρώπινης συμπεριφοράς (όλων των χρηστών) στο σχολικό περιβάλλον και επι-τόπο καταγραφή μέσα από συστηματικές μεθόδους παρατήρησης που προτείνονται από τη θεωρία του συντακτικού του χώρου (βλέπε το επισυνημμένο έγγραφο). Πιο συγκεκριμένα, χρησιμοποιείται η μέθοδος των Snapshots σε επιλεγμένα μέρη του σχολείου (σχολική αυλή, διάδρομος έξω από την τάξη κ.α). Σε αυτή την διαδικασία, ο ερευνητής σημειώνει την θέση, την δραστηριότητα και τον ρόλο του κάθε χρήστη (δηλαδή αν είναι μαθητής, καθηγητής κ.α.). Επιπρόσθετα χρησιμοποιείται η μέθοδος των Route Traces η οποία καταγράφει την κίνηση των μαθητών από τις αίθουσες γενικής διδασκαλίας προς τις αίθουσες ειδικής διδασκαλίας και τους χώρους εκτόνωσης. Σε καμία περίπτωση δεν καταγράφεται το όνομα ή άλλα προσωπικά στοιχεία του υποκειμένου πέρα από τη θέση, τη διαδρομή και τις πιθανές δραστηριότητες του.
- Ερωτηματολόγια: Τα ερωτηματολόγια είναι 2 ειδών. Ερωτηματολόγιο καθηγητών και διευθυντών (και για τα 10 σχολεία) και ερωτηματολόγιο μαθητών που αποστέλνεται στους μαθητές των 2 σχολείων που επιλέγηκαν για το bottom-up μεθοδολογικό πλαίσιο. Και τα 2 ερωτηματολόγια είναι υπό μορφή google forms το οποίο κάνει πιο εύκολη την συλλογή των δεδομένων αφού μπορούν να απαντηθούν μέσα από τους υπολογιστές που υπάρχουν στις τάξεις. Και τα 2 ερωτηματολόγια στόχο έχουν να καταδείξουν τη σημασία του σχολικού περιβάλλοντος ως κοινωνικο-χωρική δομή στις εκπαιδευτικές διαδικασίες. Καμία από τις ερωτήσεις δεν αφορά προσωπικά στοιχεία του μαθητή πέρα από την βαθμίδα εκπαίδευσης στην οποία φοιτά. Για τα διεξαγωγή των ερωτηματολόγιων χρειάζεται η γραπτή συναίνεση των γονέων μέσα από το ειδικό έντυπο που ετοίμασε ο ερευνητής και επισυνάπτεται. Στα ερωτηματολόγια συμπεριλήφθηκε και η Αγγλική γλώσσα καθώς στα σχολεία πλέον υπάρχουν και αλλόγλωσσοί μαθητές κάτι που παρατηρήθηκε ώς αδυναμία στην πιλοτική φάση της έρευνας.
- Ανοιχτή Συζήτηση με τη διεύθυνση των 2 σχολείων σχολείων που επιλέγηκαν για το bottom-up μεθοδολογικό πλαίσιο

Παρακαλώ βρείτε επισυνημμένα όλα τα ερευνητικά εργαλεία (ερωτηματολόγια, έντυπα παρατήρησης κλπ) καθώς και τη βεβαίωση του ακαδημαϊκού υπευθύνου.

ΚΕΝΤΡΟ ΕΚΠΑΙΔΕΥΤΙΚΗΣ ΕΡΕΥΝΑΣ ΚΑΙ ΑΞΙΟΛΟΓΗΣΗΣ

ΑΝΑΛΥΤΙΚΟ ΣΧΕΔΙΟ ΕΡΕΥΝΑΣ

ΚΩΔΙΚΟΣ: 175496

Χρόνος απασχόλησης:

Ο χρόνος απασχόλησης για τη συμπλήρωση ερωτηματολογίων υπολογίζεται στα 10 λεπτά για κάθε χρήστη. Τα υπόλοιπα δεδομένα θα συλλεχθούν από τον ερευνητή χωρίς να χρειάζεται η εμπλοκή των χρηστών.

Χρονική περίοδος έρευνας και αναμενόμενος χρόνος αποτελεσμάτων:

Η Χρονική περίοδος συλλογής δεδομένων είναι 3-4 μέρες για κάθε σχολείο. Η συλλογή δεδομένων θα γίνει Μέσα Οκτωβρίου 2020 με μέσα Νοεμβρίου 2020. Ο αναμενόμενος χρόνος υποβολής των αποτελεσμάτων της πιλοτικής φάσης της έρευνας και της τελική φάσης συλλογής δεδομένων στο ΚΕΕΑ είναι μέχρι της αρχές του 2022 (Ιανουάριος 2022 - μετά την ολοκλήρωση του διδακτορικού τίτλου).
2. Η υποβολή των αποτελεσμάτων στο Υπουργείο Παιδείας και πολιτισμού (μέσω του συνοπτικού δελτίου έρευνας – ΣΔΕ) θα γίνει αρχές Ιανουαρίου 2022.
Αναμενόμενος χρόνος υποβολής αποτελεσμάτων:20/12/2021

ΘΕΜΑΤΑ ΗΘΙΚΗΣ ΚΑΙ ΕΡΕΥΝΗΤΙΚΗΣ ΔΕΟΝΤΟΛΟΓΙΑΣ:

Α. ΣΥΝΕΙΔΗΤΗ ΣΥΝΑΙΝΕΣΗ ΓΙΑ ΣΥΜΜΕΤΟΧΗ ΣΤΗΝ ΕΡΕΥΝΑ

Όταν οι συμμετέχοντες είναι ενήλικες:

1. Έχουν ληφθεί τα απαραίτητα μέτρα για την ενημέρωση των συμμετεχόντων σχετικά με: το σκοπό της έρευνας, τις διαδικασίες συλλογής δεδομένων, το περιεχόμενο των εργαλείων συλλογής δεδομένων και τον απαιτούμενο χρόνο για τη συλλογή των δεδομένων.[ΝΑΙ]
2. Έχει ληφθεί πρόνοια για ενημέρωση των συμμετεχόντων σχετικά με την εθελοντική συμμετοχή τους στην έρευνα;[ΝΑΙ]
3. Έχει ληφθεί πρόνοια για ενημέρωση των συμμετεχόντων σχετικά με το δικαίωμα απόσυρσης από την έρευνα οποιαδήποτε στιγμή το επιθυμήσουν;[ΝΑΙ]
4. Προτίθεστε να εξασφαλίσετε τη συγκατάθεσή τους για την καταγραφή των δεδομένων (π.χ. μαγνητοφώνηση, βιντεοσκόπηση) πριν τη διεξαγωγή της έρευνας;[ΔΙ]

Όταν οι συμμετέχοντες είναι μαθητές:

5. Προτίθεστε να εξασφαλίσετε γραπτή συγκατάθεση από τους γονείς/κηδεμόνες των παιδιών για τη συμμετοχή τους στην παρούσα έρευνα;[ΝΑΙ]
6. Έχει ληφθεί πρόνοια για ενημέρωση των γονέων/κηδεμόνων για τον σκοπό της έρευνας, τις διαδικασίες συλλογής δεδομένων, το περιεχόμενο των εργαλείων συλλογής δεδομένων και τον απαιτούμενο χρόνο για τη συλλογή των δεδομένων;[ΝΑΙ]
7. Έχει ληφθεί πρόνοια για ενημέρωση των γονέων/κηδεμόνων ότι η συμμετοχή των παιδιών τους στην έρευνα είναι εθελοντική;[ΝΑΙ]
8. Έχει ληφθεί πρόνοια για ενημέρωση των γονέων/κηδεμόνων σχετικά με το δικαίωμα απόσυρσης του παιδιού τους από την έρευνα οποιαδήποτε στιγμή το επιθυμήσουν χωρίς οποιεσδήποτε συνέπειες για το παιδί;[ΝΑΙ]
9. Προτίθεστε να εξασφαλίσετε γραπτή συγκατάθεση των γονέων/κηδεμόνων για την καταγραφή των δεδομένων (π.χ. μαγνητοφώνηση, βιντεοσκόπηση), πριν τη διεξαγωγή της έρευνας;[ΔΙ]
10. Στην περίπτωση συνέντευξης/προσωπικής επαφής με το παιδί, έχει ληφθεί πρόνοια για την παρουσία εκπαιδευτικού του σχολείου στη συνέντευξη;[ΔΙ]
11. Έχει ληφθεί πρόνοια για ενημέρωση των ίδιων των παιδιών για τον σκοπό και το περιεχόμενο της έρευνας;[ΝΑΙ]
12. Έχει ληφθεί πρόνοια για ενημέρωση των παιδιών ότι η συμμετοχή τους στην έρευνα είναι εθελοντική;[ΝΑΙ]

Β. ΠΡΟΣΒΑΣΗ ΣΤΙΣ ΣΧΟΛΙΚΕΣ ΜΟΝΑΔΕΣ

13. Έχουν ληφθεί τα απαραίτητα μέτρα για ενημέρωση της διεύθυνσης του σχολείου για τη διεξαγωγή της παρούσας έρευνας;[ΝΑΙ]
14. Έχουν ληφθεί τα απαραίτητα μέτρα για ενημέρωση του εκπαιδευτικού προσωπικού του σχολείου για τη διεξαγωγή της παρούσας έρευνας;[ΝΑΙ]

Γ. ΠΙΘΑΝΗ ΕΚΘΕΣΗ ΣΕ ΣΩΜΑΤΙΚΟ Ή ΨΥΧΟΛΟΓΙΚΟ ΚΙΝΔΥΝΟ

15. Έχουν ληφθεί τα απαραίτητα μέτρα έτσι ώστε η μεταχείριση των υποκειμένων της έρευνας να γίνεται με τον ελάχιστο δυνατό κίνδυνο, ώστε να μην κινδυνεύσει η σωματική τους ακεραιότητα ή η ψυχική τους υγεία;[ΝΑΙ]
16. Η έρευνα προβαίνει σε έκθεση των υποκειμένων σε κατάλληλα για την ηλικία τους ερεθίσματα (π.χ. το περιεχόμενο των εργαλείων συλλογής δεδομένων είναι κατάλληλο);[ΝΑΙ]
17. Η έρευνα προβαίνει σε έκθεση των υποκειμένων σε κατάλληλα για την ιδιότητά τους (π.χ. γονείς, εκπαιδευτικούς) ερεθίσματα;[ΝΑΙ]

Δ. ΠΡΟΣΤΑΣΙΑ ΑΝΩΝΥΜΙΑΣ ΚΑΙ ΔΕΔΟΜΕΝΩΝ

18. Έχουν ληφθεί τα απαραίτητα μέτρα για την προστασία της ανωνυμίας των συμμετεχόντων;[ΝΑΙ]
19. Έχουν ληφθεί τα απαραίτητα μέτρα για τη φύλαξη των δεδομένων που θα συλλεχθούν στα πλαίσια της παρούσας έρευνας;[ΝΑΙ]
20. Έχουν ληφθεί τα απαραίτητα μέτρα έτσι ώστε τα δεδομένα που θα συλλεγούν να μη χρησιμοποιηθούν για οποιοδήποτε άλλο σκοπό;[ΝΑΙ]

Ε. ΕΝΗΜΕΡΩΣΗ ΣΥΜΜΕΤΕΧΟΝΤΩΝ ΓΙΑ ΤΑ ΑΠΟΤΕΛΕΣΜΑΤΑ ΤΗΣ ΕΡΕΥΝΑΣ

21. Έχει ληφθεί πρόνοια για ενημέρωση των συμμετεχόντων σχετικά με τα αποτελέσματα της έρευνας;[ΝΑΙ]

ΑΙΤΙΟΛΟΓΗΣΗ ΣΗΜΕΙΩΝ «ΟΧΙ»

ΑΛΛΑ ΘΕΜΑΤΑ ΗΘΙΚΗΣ ΚΑΙ ΔΕΟΝΟΤΟΛΟΓΙΑΣ

ΑΡΧΕΙΑ ΠΟΥ ΕΠΙΣΥΝΑΦΘΗΚΑΝ:

HEADTEACHER_INTERVIEW _ WITH CONSENT_GR ONLY.PDF (13/10/2020, 12:01:16, 180 KB)
LETTER FOR PARENTS.PDF (13/10/2020, 12:01:24, 133 KB)
LETTER FOR SCHOOL HEADTEACHER_GENERAL INFO.PDF (13/10/2020, 12:01:32, 186 KB)

20/10/2021 11:27:09 AM

ΚΕΝΤΡΟ ΕΚΠΑΙΔΕΥΤΙΚΗΣ ΕΡΕΥΝΑΣ ΚΑΙ ΑΞΙΟΛΟΓΗΣΗΣ

ΑΝΑΛΥΤΙΚΟ ΣΧΕΔΙΟ ΕΡΕΥΝΑΣ

ΚΩΔΙΚΟΣ: 175496

OBSERVATION DRAWING.PDF (13/10/2020, 12:01:42, 151 KB)
PSATHITIS_SCHOOLS_ACADEMIC LETTER.PDF (13/10/2020, 12:01:48, 58 KB)
RESEARCH OUTLINE.PDF (13/10/2020, 12:01:58, 176 KB)
STUDENTS' QUESTIONNAIRE _ GR AND EN.PDF (13/10/2020, 12:02:08, 548 KB)
TEACHERS' QUESTIONNAIRE _ WITH CONSENT_GR ONLY.PDF (13/10/2020, 12:02:18, 368 KB)

Appendix F

Appendix F: Teachers' Questionnaires Factor Analysis

The principal component analysis of teacher answers has suggested the grouping of variables into 3 factors: **Issues with School Control, Strong School Community, and School's Adaptation to Changes such as Covid-19**.

The variables that are grouped together under the factor of **Strong School Community** are:

- We have good relationships with students in this school
- Every day we meet students during transfers
- We talk to our students during breaks
- We have a trust and support culture in this school
- I feel valuable
- I share my problems with my colleagues
- We are a good team
- I have support
- We prepare educational materials collaboratively with other colleagues

The variables grouped together under the factor of **Issues with School Control** are:

- We have issues with students' delinquent behaviours
- We have had to add rules in order to cope with covid-19 restricting protocols
- We make a lot of effort to get students to follow the rules
- I have more work-related stresses now because of the extra rules we have applied
- It is difficult to control students

- Despite the rules we have applied, students find ways to break them (i.e meet with their friends despite covid-19 measures)

The variables grouped together under the factor of **School Easy Adaptation** are:

- Our school has adapted very easily to the changes that have been required to implement in the context of covid-19 measures
- Our modules are more flexible now since our students have their own desks
- The fact that our students now have their individual desks helps us to guide them better

Appendix G

Appendix G: Students' Questionnaires Factor Analysis

The principal component analysis of students' answers has suggested the grouping of variables into 4 factors: **positive attribute towards school, covid pressure, meet friends despite covid measures, sitting alone influences learning** .

The variables that are grouped together under the factor **positive attribute towards school** are:

- I feel cosy in my school
- I feel happy in my school
- I have support in my school
- I follow the rules
- I feel that i am learning
- I like coming to school

The variables that are grouped together under the factor **Covid Pressure** are:

- I feel pressure
- Covid-19 measures have changed my school day
- Covid-19 measures have changed the frequency I see my friends

The variables that are grouped together under the factor **Meet Friends Despite Covid-19 Measures** are:

- I meet my friends during transfers despite covid-19 measures
- I meet my friends during break despite covid-19 measures

The variables that grouped together under the factor **Sitting Alone Influences Learning** are:

- I do not like the fact that I have my own desk
- I think that the fact that I sit alone may prevent me from learning from my peers

Appendix H

Appendix H: Sample Details

SCHOOL 1

FIGURE H.1: School 1 in its immediate surroundings

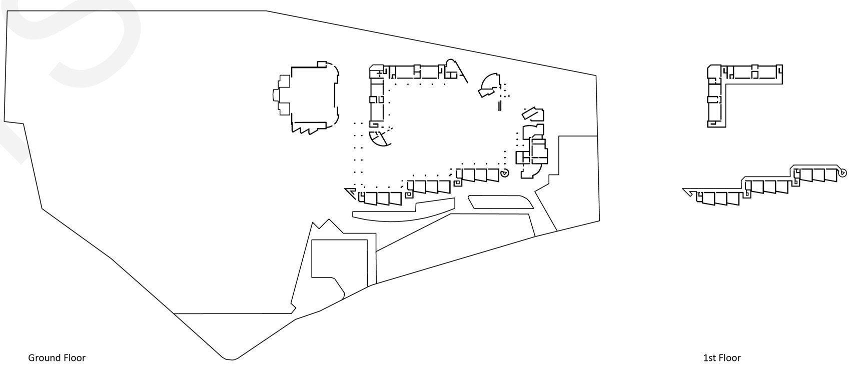


FIGURE H.2: School 1: School Plan

Date	No.Students	No.Teachers	S-T Ratio	Location	City	Density
2003	347	57	6.09	suburban	C1	medium

SCHOOL 2

FIGURE H.3: School 2 in its immediate surroundings

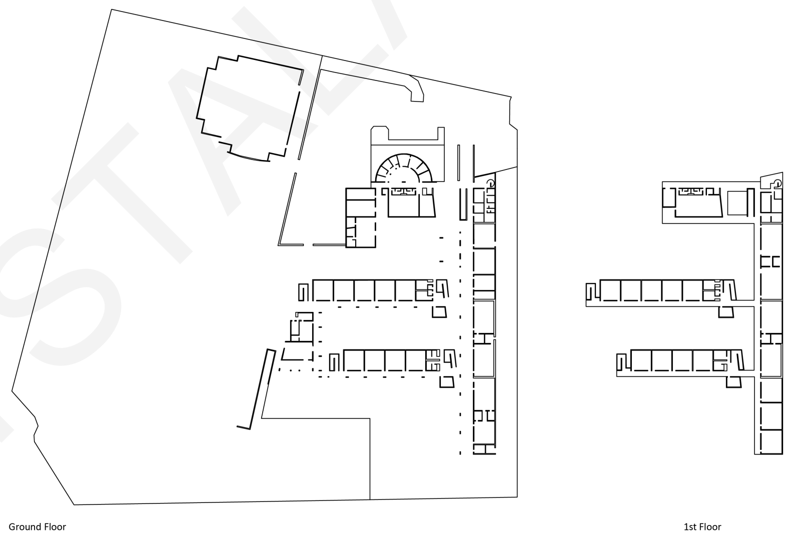


FIGURE H.4: School 2: School Plan

Date	No.Students	No.Teachers	S-T Ratio	Location	City	Density
2005	265	47	5.94	urban	C1	low

SCHOOL 3

FIGURE H.5: School 3 in its immediate surroundings

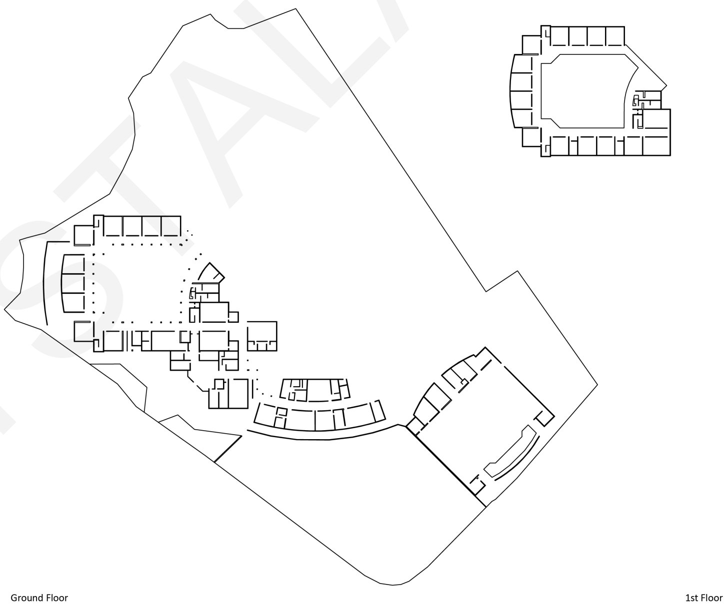


FIGURE H.6: School 3: School Plan

Date	No.Students	No.Teachers	S-T Ratio	Location	City	Density
2002	292	48	6.08	urban	C2	high

SCHOOL 4

FIGURE H.7: School 4 in its immediate surroundings

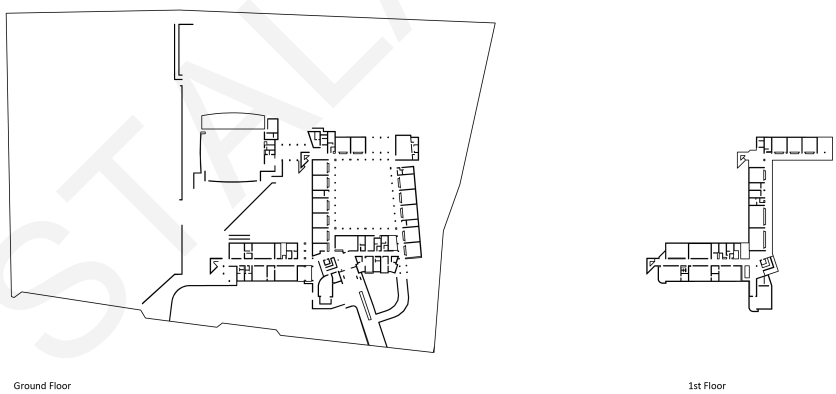


FIGURE H.8: School 4: School Plan

Date	No.Students	No.Teachers	S-T Ratio	Location	City	Density
2006	286	48	5.96	urban	C1	high

SCHOOL 5

FIGURE H.9: School 5 in its immediate surroundings

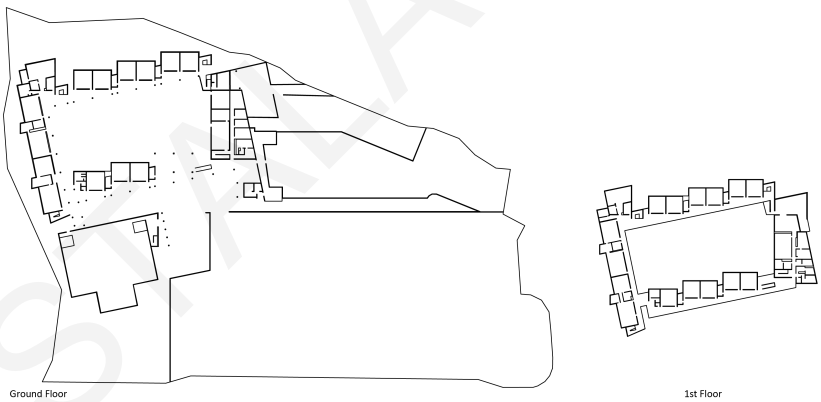


FIGURE H.10: School 5: School Plan

Date	No.Students	No.Teachers	S-T Ratio	Location	City	Density
2002	368	51	7.22	urban	C2	high

SCHOOL 6

FIGURE H.11: School 6 in its immediate surroundings

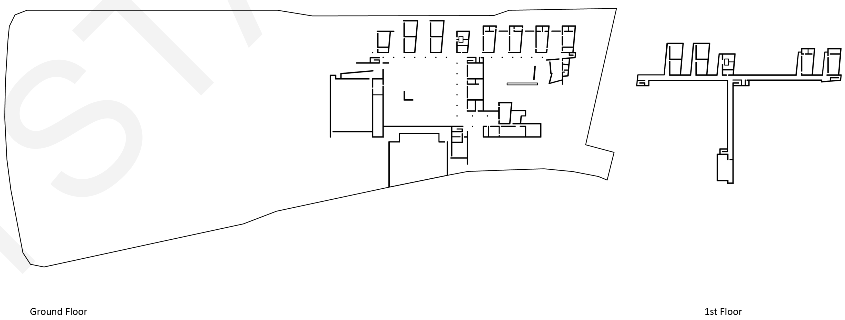


FIGURE H.12: School 6: School Plan

Date	No.Students	No.Teachers	S-T Ratio	Location	City	Density
2009	210	32	6.56	suburban	C3	low

SCHOOL 7

FIGURE H.13: School 7 in its immediate surroundings

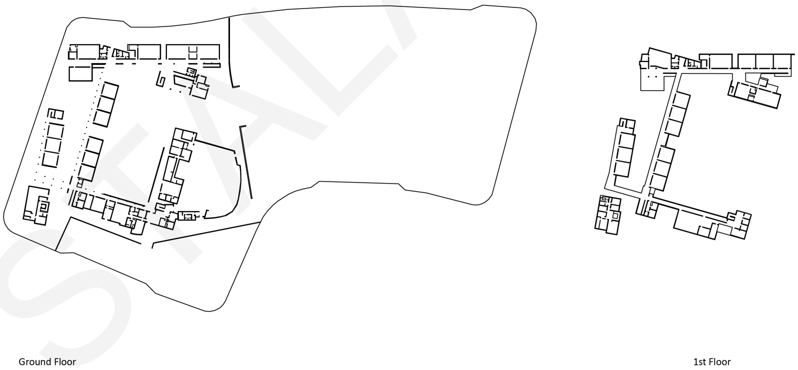


FIGURE H.14: School 7: School Plan

Date	No.Students	No.Teachers	S-T Ratio	Location	City	Density
2011	430	55	7.82	urban	C3	high

SCHOOL 8

FIGURE H.15: School 8 in its immediate surroundings

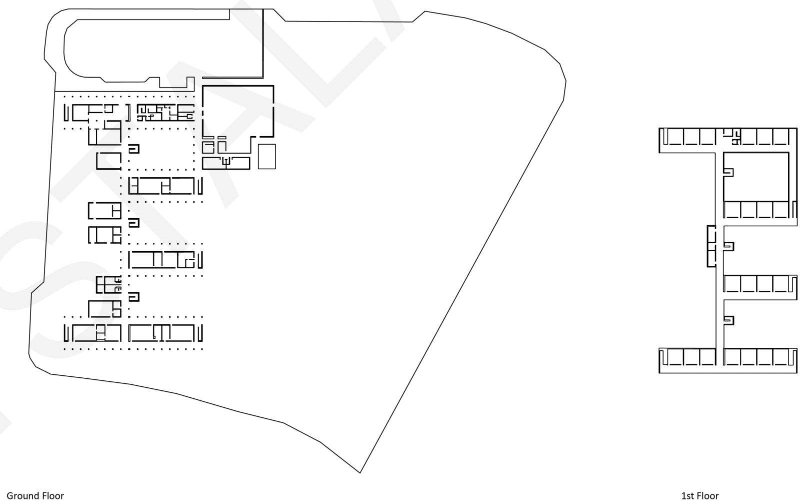


FIGURE H.16: School 8: School Plan

Date	No.Students	No.Teachers	S-T Ratio	Location	City	Density
2011	498	68	7.32	urban	C3	high

SCHOOL 9

FIGURE H.17: School 9 in its immediate surroundings

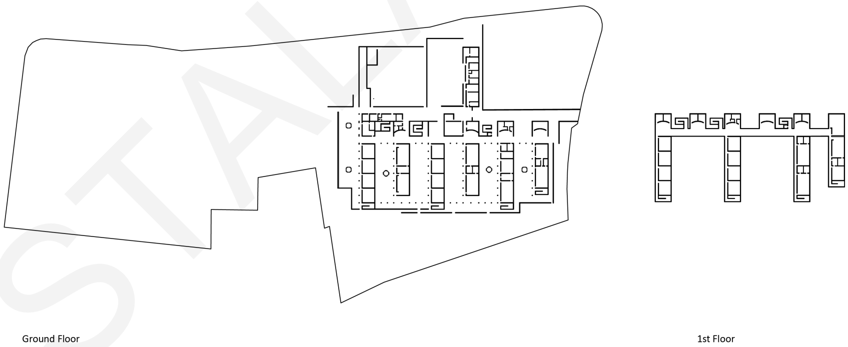


FIGURE H.18: School 9: School Plan

Date	No.Students	No.Teachers	S-T Ratio	Location	City	Density
2002	386	60	6.43	urban	C4	medium

SCHOOL 10

FIGURE H.19: School 10 in its immediate surroundings

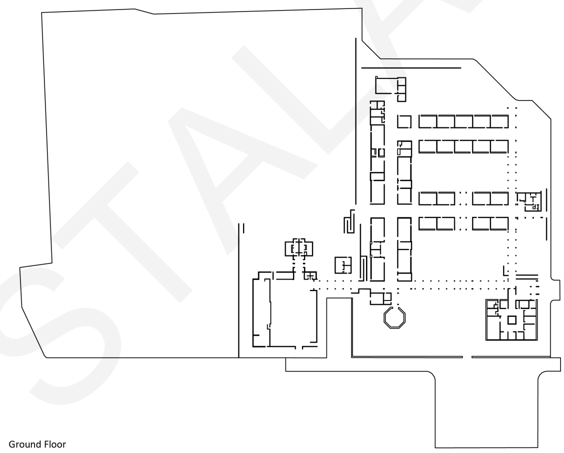


FIGURE H.20: School 10: School Plan

Date	No.Students	No.Teachers	S-T Ratio	Location	City	Density
2003	414	63	6.57	urban	C4	low

Appendix I

Appendix H: Field Work

The specific methods that have been employed for observations are snapshots that capture stationary activities and movement traces that have been used to investigate movement patterns in the two selected schools (S2 and S9). In total, **90 hours of observations with 33 rounds of observations for stationary activities and 50 rounds of observations for route traces at different points in time** were executed.

Snapshots have been recorded of all school outdoor spaces. Snapshots capture where people sit, stand, move, interact, read, or play during breaks. In order to be able to observe the whole school unit during the limited time of a school break, the floor plans have been divided into areas that could be easily observed from a single point. During this method, the observer is placed in all different areas at repeated times throughout the regular school days. The information from all the individual territories is overlaid on all distinct rounds of observations to give an overall image of the behaviours, interactions, density, and dynamic behaviours happening within the school.

Movement traces have been conducted at three different points in time (entrance hour, transition in between courses, and exit hour) and capture the movement path of students, where students come from and move to. Only students' movement traces have been recorded since teachers' movement is primarily programmed and originates or leads to the administration area. At the same time, during the minimal time of transfer between modules, there is no adequate time to trace more than one individual at a time. Thus, to be able to have a sufficient number of traces, only students' trails have been recorded.

SCHOOL 2

FIGURE I.1: Raw file of School 2 Snapshots

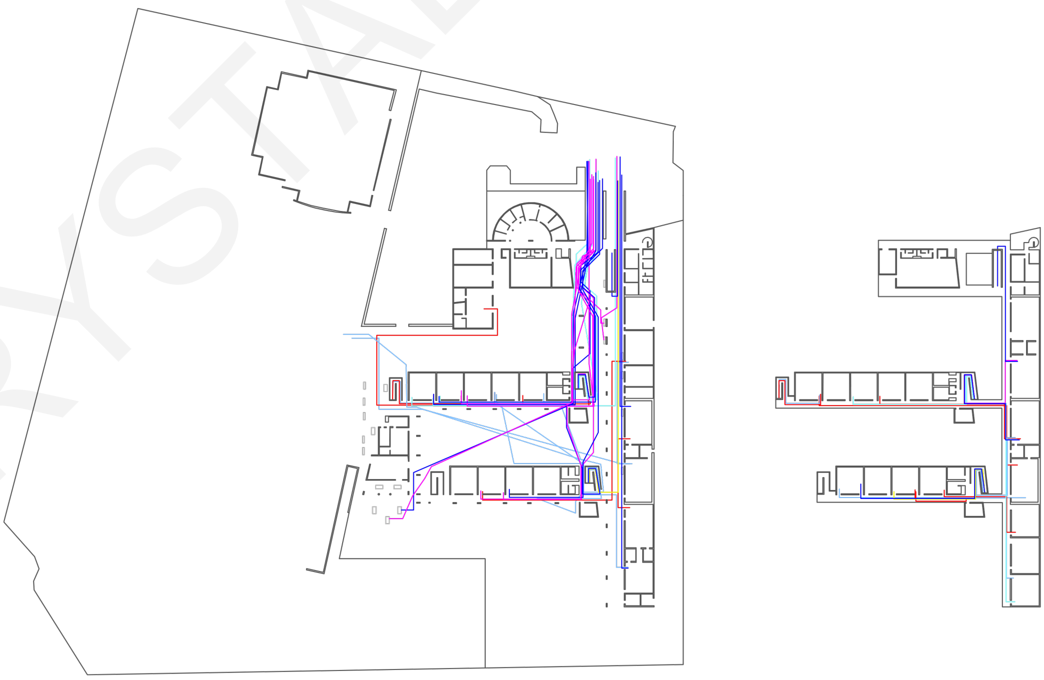


FIGURE I.2: Raw file of School 2 Route Traces

SCHOOL 9

FIGURE I.3: Raw file of School 9 Snapshots

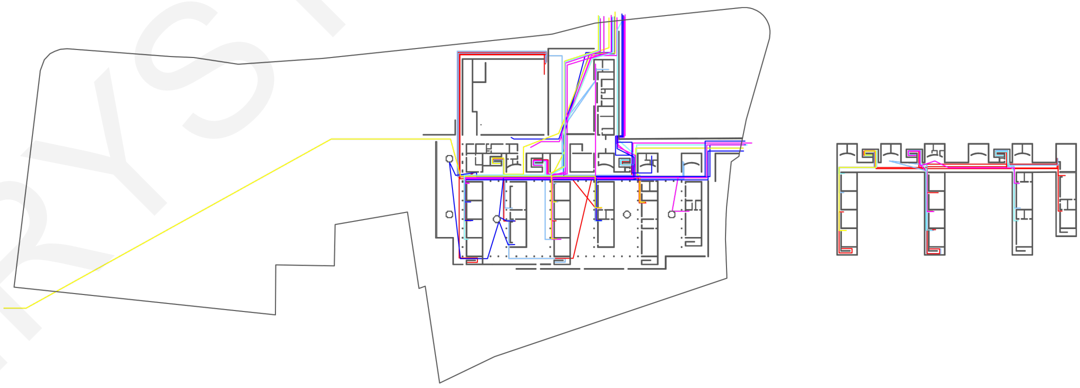


FIGURE I.4: Raw file of School 9 Route Traces

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