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THE CLASSROOM ENVIRONMENT AND ITS EFFECTS ON THE PRACTICE OF TEACHERS

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Abstract

This study concerns the design of classroom environments and the impact of these environments on the practice of teachers. It involves data gathered from primary and secondary schools, using lesson observations and teacher interviews. Behavioural mapping instruments were developed for the school-based data collection, and subsequent analysis is both qualitative and quantitative. A number of constructs have been developed, defined and used to evaluate what happens within classrooms. Some of these constructs are physical (modes of layout), some are pedagogic (child-centred), and some involve combinations of data. The findings from the analysis of teachers' classroom behaviour have been related to the issues emerging from their interviews. This enabled examination of behaviour alongside statements of attitudes and beliefs about the role of the classroom environment. These data inform questions about teachers' awareness of their surroundings; the extent to which this awareness impacts on their teaching, and the extent to which teachers feel they have control over the features of their classrooms. The article concludes by making the case for the importance of environmental awareness in the training and retraining of teachers. Environmental competence is an important constituent of the skilled teacher.

Introduction

This study explores relationships between the classroom environment and the practice of teachers. Progressively, during the early stages of this research, the relationship between the *designed environment* and the *behaviour and practice of teachers* became the core of the study. It does not attempt to describe 'ideal' learning environments, but rather to describe and analyse the effects of existing learning environments on the practice of teachers. It also looks at and seeks to understand how teachers behave in a classroom environment. It is left for education experts to review the data and make judgements about the quality of education in that setting.

What is the classroom environment?

When we go into a classroom, what do we first see? We see people doing things: sitting, standing, moving, talking, in silence, writing, drawing, pointing, singing, fidgeting, crying, laughing, whispering, or even sleeping. But one person (the teacher) seems to be dominating the setting somehow, giving directions that are usually carried out. And communication seems to be always present, either by talking or writing, or through gestures like the raising of an arm (Adams & Hiddle, 1970). A classroom environment is much more than a place to house books, desks and materials.

A classroom is a system and can be better understood if it is seen that way. There is a complex relationship between the physical structure and arrangement of the room, the teacher, the students and the distribution of space (Rivlin & Rothenberg, 1976; Gump, 1987). We cannot ignore the fact that classrooms are both physical and organizational units and that the physical characteristics of a setting can influence both behaviour and educational programme (Rivlin & Weinstein, 1984). The environment of the classroom is a direct expression of the educational philosophy and it takes an active part in the educational process (Proshansky & Wolfe, 1975). It also has a preconceived cultural image (David, 1975) and this image is embedded in our society.

The role of the teacher

Roles involve sets of expected behaviours, but behaviours are not always performed as expected since individuals differ. They differ according to their competence, their motivation, their personal needs and their values. Different individuals will perform differently in the same role, because role requirements interact with personal characteristics (Hayman, 1975). At the same time, the teacher's role is constantly changing from providing direct teaching to planning, designing and organizing learning experiences for the students (Zalantino & Sleeman, 1975). More recent developments encourage teachers to take the role of co-learner and mentor as well (Dick, 1997).

The teacher, as much as children, has to accommodate and adapt to the environment but the teacher's role requires that he/she manipulates the environment for others. The teacher has to somehow create conditions under which certain stimulation becomes salient to the pupils. The teacher receives the same stimulation from the environment, changes it for the use of pupils and receives feedback from pupil's behaviour. The teacher has then to process that information in relation to the educational purposes and make sure that the behaviour will bring about desirable pupil responses (Adams & Hiddle, 1970).

Teaching is necessarily interactive and people centred (Johnson, 1990). This interaction is frequently mediated by equipment and materials and teachers adapt their teaching to the supplies and equipment available (Johnson, 1990). The physical environment is not a substitute for effective teaching and educational planning. As an example, a well planned reading area will not eliminate either the need for effective teaching of reading or indeed, reading problems (Proshansky & Wolfe, 1975). Every teacher, though, as David and Wright (1975) suggests, should become a designer, responsible for preparing the environment to achieve his or her objectives.

The teacher's role creates the learning environment within an architectural facility. This view recognises the teacher-designed environment as an active influence on the lives of children and teachers throughout the school day. In the processes of teaching and learning, the physical environment arranged by the teacher provides the setting for learning and at the same time acts as a participant in teaching and learning (Loughlin & Suina, 1982).

Teacher's environmental awareness and competence

The learning environment can be a powerful teaching instrument at the disposal of the teacher, or it can be an undirected and unrecognized influence on the behaviours of both children and teachers. As Loughlin and Suina (1982) state, informed attention to the arranged environment and the conscious use of it to support teaching and learning goals, have not been widespread in schools, but understanding environmental influences is important for all teachers, no matter what the age of the students or how formal or informal the methods. Lack of awareness of physical and spatial needs in the classroom environment can interfere with the optimal functioning of the classroom. Proshansky and Wolfe (1975) found that a great deal of attention is generally given to lesson plans but little attention is given to space planning.

In a seminar report by the Organisation for Economic Co-operation and Development (OECD) about the quality of the physical environment of the school and the quality of education, participants expressed many opinions on the subject. Some of these are reported here and they were either based on research or on personal opinions, but were all reported in an official document by OECD (1988). They report that teachers are responsible for spaces for teaching and learning and should attempt to make them exciting and stimulating and be prepared to develop them. They also mentioned that a lack of awareness of the potential of an environment could be rectified through staff training in issues concerning the environment, including architecture and design. The participants speculated that by raising such standards amongst teachers, teachers would impart this knowledge to their pupils who, in later life, would apply this understanding in their own environments.

This raises questions about how teachers should be trained to perceive the environment as part of the learning process, not just as furnishing, equipment and walls. Teachers have the ability to affect a wide range of environmental qualities within their classroom such as personalization and ownership and providing places for social interaction.

In a study by Lackney (1997), it emerged that teachers feel that some environmental qualities are in part their responsibility even if they are unable to control them. This again raises questions about the need for educators to become more aware of the potential and opportunities that the physical setting presents to them. Knowledge of the relationships between physical surroundings and actions should

be a practical tool the teacher can use. Loughlin and Suina (1982) believe that a well trained teacher can predict behaviour in classroom settings. This seems to be another piece of evidence leading to the need for teachers to understand space. The ability to predict behaviour in certain settings would probably mean that teachers could arrange settings to promote particular actions. It will be interesting to see in this study, the extent to which teachers can deliberately use organized space to facilitate children's movement and support activities for learning.

Methodology

The research questions for this study provided a structure for planning the work and the methods to be applied. The main question: 'What are the effects of the classroom environment on the practice of teachers?' led to several secondary levels of questioning. There are questions associated with *teaching* and the *role of the teacher*: 'What is the structure of lessons in terms of blocks of activity and the differing uses of the classroom environment?'; questions associated to the *physical organization* of the classroom: 'How is the room being used during the structured elements of the lesson?'; questions associated with teachers' feeling of *control* over the *physical environment* of the classroom: 'To what extent are teachers in control of their physical setting? Do they use it deliberately?'; and questions concerning the *implications* of the study: 'Is it possible to support or improve the design and use of classroom spaces?'

These questions led to the development of research instruments. The focus will always be on the *teacher* and on the *classroom physical environment.*

Data was gathered through teachers in their working environment, that is, through observation of lessons and through interviews with the teachers in the classroom. The work explores what teachers do in the classroom, identifying the relationships between teaching, activities and use of space.

Developing the research instruments was a challenging and organic process. It was clear that a plan of the room would be necessary in order to identify what was going on in the space. Having a grid on which I could sketch the room and locate the teacher and the pupils in the room was, therefore, the first step. I explored the technique of *behavioural mapping* used by environment–behaviour researchers such as Proshansky and colleagues (Proshansky & Altman, 1979; Proshansky & Fabian, 1987; Proshansky & Wolfe, 1975; Proshansky *et al.*, 1976; Rivlin and Rothenberg, 1976; Rivlin and Weinstein, 1984; Rivlin and Wolfe, 1985; Sommer, 1972; Ittleson *et al.*, 1974, 1976). The end result of the development process has been a combination of methodologies that has created a unique set of instruments and some unique data analysis approaches for an empirical study. The instruments are divided in two groups: behavioural mapping and interviews.

The analysis of the data developed constructs which were cross-referenced generating a series of trend relationships. The interviews were then analysed in order to enrich and validate the results of the observation data.

The sample

The educational context in the U.K. National Curriculum (5–16 years old) and U.K. schools is divided into primary and secondary schools. In primary schools the teaching spaces are normally general while in secondary schools they become specialized. Therefore, since I was interested in the complete range of 5–16, the logic was to sample *year groups* in primary schools and *subjects* in secondary.

A total of 61 lessons were observed in 12 different schools (24 in primary schools and 37 in secondary schools). A total of 39 teachers were interviewed (13 primary teachers and 26 secondary teachers).

The numbers chosen were judged to be sufficient to collect a significant quantity of data in a variety of settings to be analysed through the framework established. The data collection took one whole school year with dates of collection scattered throughout the year.

Lesson observations data analysis

Constructs and definition of terms

The analysis developed for this research generated a series of constructs that produced tools for a deeper examination of the data. These constructs and definitions need to be clarified before further examination of the data. The constructs are bonded with the research instruments and the findings becoming a unique way of visually 'seeing' a lesson. They are an important component of this research, as the technique becomes a tool for a visually descriptive instrument both of how teachers structure their lessons, and of the areas of the room that they use with that specific structure.

Clusters of activities
All the lessons observed were classified in *clusters of activities* that characterize a lesson independently of the subject or type of room. There are five identified clusters as follows:

1. *Introduction*. Activities usually present at the beginning of each lesson which include pupils arriving and registration;
2. *Teacher teaching*. The focus of attention is the teacher; usually the whole class is focused on the teacher;
3. *Pupils on task*. The focus of the activity is on pupils working either individually or in-groups. Most teacher–pupil(s) interactions occur in this cluster;
4. *Transition*. The focus is dispersed, there is usually a lot of movement in the class as pupils are completing tasks and sharing work with peers and teacher;
5. *Conclusion*. The focus is on cleaning up the tables, tidying up and packing. Pupils leave the room and it is the end of the class.

These are the focus of the lessons at specific times during the observations (minute by minute time sampling).

Lesson profiles
The *clusters of activities* described are used in the analysis to identify what the focus of attention is at a determined time of the lesson. There are five identified clusters but they are not necessarily present in every single lesson. The presence or not of a cluster can inform a certain pedagogy used by the teacher and that can be illustrated by a *lesson profile*. A *lesson profile* is created by plotting the amount of time spent in each cluster and coded to illustrate the distribution of clusters during the period of a lesson (Figure 1), thus creating a profile. Sixty-one lesson observations generated 61 different *lesson profiles*.

Cluster columns

The clusters of activities also generated *cluster columns*. A *cluster column* is a construct created by plotting the percentages of time spent in each cluster during the lesson, informing what proportion of the lesson was spent in each cluster (Figure 2).

Teacher teaching and pupils on task

The five lesson clusters demonstrate that most of the duration of a lesson is spent on *teacher teaching* and *pupils on task* at varying points in the lesson. The lessons that are focused (for 50% or more of the time) on the teacher teaching have been labelled as having a teacher-centred pedagogy. The ones focused (for 50% or more of the lesson time) on pupils on task have been labelled as having a child-centred pedagogy. It was found that not every teacher fell in either category. Of the total number of teachers observed (61 observations), 16 were neither teacher centred nor child centred creating a middle group in which teachers have a dominantly 'balanced' pedagogy.

The 'shape' of lessons

The lesson profiles were grouped into five different structures of lessons. These pictures illustrate the order in which events took place in a lesson informing visually the type of lesson that occurred. The first type is the 'Conventional' profile. Lessons follow the conventional order, that is, an introduction period, followed by the teacher teaching the whole class and setting up an activity, followed by the activity being pursued by the pupils (pupils on task) and then the conclusion of the lesson. Transition periods might be present or not.

The second type is the 'Teacher initiated iterative' profile. Here, lessons begin with teacher directed input and follow intermittent teacher teaching and pupils on task activities. The teacher sets up tasks in smaller steps. There is an interaction of pupil activity and teacher activity. There usually is an introduction period and a conclusion period while *transitions* might be present or not.

The third type encountered is the inversion of the second; that is, it follows a 'Pupil initiated iterative' profile. In this case, pupils usually know what the task is when arriving in the class. As they arrive,

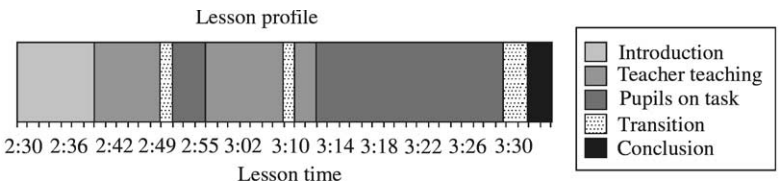


FIGURE 1. The lesson profile.

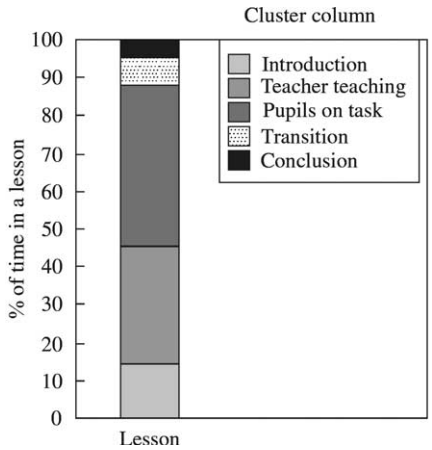


FIGURE 2. The cluster column.

they start working on the task autonomously. Then, following teacher intervention, there are intermittent pupils on task and teacher teaching activities. Here again, there usually is an introduction period and a conclusion period while transitions might be present or not.

The essential difference between the 'Teacher initiated iterative' profile and the 'Pupil initiated iterative' profile is the original source of activity (the teacher or pupil). The fourth and fifth profiles are similar in that they do not have one of the main clusters present (either teacher teaching or pupils on task). One follows the 'Teacher dominated' profile: that is, there are no pupils on task present. The whole lesson is focused on the teacher teaching. The other follows the 'Pupil dominated' profile, that is, there is no teacher teaching present, the whole lesson is focused on the pupils on task.

Hierarchy of designability

The hierarchy of designability is a construct that measures the degree of control of change that teachers have over the physical elements of the classroom setting. In examining teachers use of the classroom space, architectural elements have been classified in terms of hard (fixed features) and soft architecture (semi-fixed, semi-flexible and flexible features). The classification is a further development of Steele's (1973) division of space.

Hard architecture. There are elements in the classroom that cannot normally be changed by a teacher. Hard architecture elements are fixed features of the environment, the shell of the room, walls, windows, and doors. Teachers generally perceive these features as unchangeable and feel that they have no control or little control of change over them.

Soft architecture. There are elements in the classroom that can be changed in varying degrees. These are features of the soft architecture. These can be semi-fixed, changeable with some effort (e.g. built-in furniture, sinks, sockets, and radiators, in general, the services concerning water, electricity and gas). Semi-flexible features are heavy elements (e.g. filing cabinets, bookshelves) often perceived by teachers as relatively fixed. Flexible features are elements that can be easily moved (e.g. chairs, tables).

Figures for each of the features have been generated through the layout of the room. The elements of the environment were classified according to the features described. The total area of the room was then calculated as well as the area of semi-fixed, semi-flexible and flexible features. The free floor area was also included in these calculations.

Flexibility factor

Classrooms are physical entities that have both fixed and flexible features as described above, that is, there are elements within a room that are movable by the teacher and elements that are fixed. The percentages of these were calculated in relation to the total area of the room. With these data, it was possible to measure the flexibility factor of each classroom. The sum of the semi-flexible and flexible features plus the floor space results in the flexibility factor. The flexibility factor is the total area in each room that allows change to be made by the teacher with varying degrees of effort.

Mobility factor

The floor plan of the classrooms provided a starting point for the development of the behavioural maps. A grid layout was used to identify and classify the physical elements within the room and the teacher's movement was tracked and recorded (Figure 3) together with the activity and personal interactions. The observations were continuous throughout the duration of the lesson. The tracking was coded according to the cluster of activity (Introduction, Teacher teaching, Pupils on task, Transition and Conclusion). This identifies where the teacher was within the room during a specific focus.

The teacher was the focus of the observation and the combined data show the route taken by the teacher within the room. The total area covered by the teacher (in square metres) during the lesson is summed. This is the mobility factor. A percentage is then calculated in relation to the total area of the room.

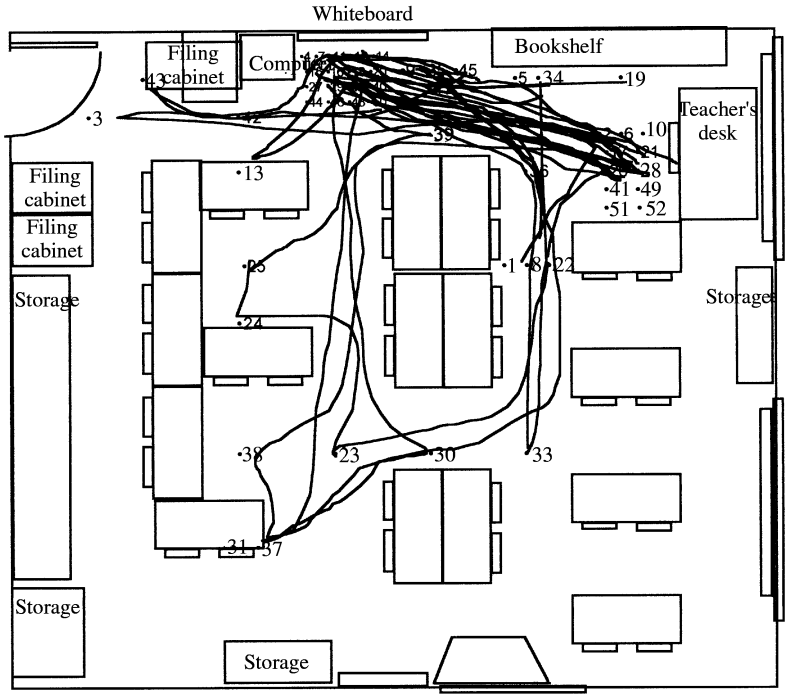


FIGURE 3. Teacher's movement tracked during a lesson.

Density

The amount of space per pupil in a classroom is the density of the room. It is measured in square metres per pupil.

Degree of centredness

Teachers have a tendency to spend extended periods of time at specific locations in the room. Certain areas were identified as being more used than others. The percentage of time spent in each square metre where the teacher was located was calculated in relation to the total time of the lesson.

Selecting the higher percentage in each classroom, that is, the square metre in each classroom where the teacher spent the higher percentage of time in relation to the rest of the room, we have the degree of centredness. Where a teacher spends at least 20% of their time at a specific square metre of the room has been defined as 'centres' and they can be either single or double. If neither, they are non-centred.

Single centred teachers are the ones that have chosen a specific 'centre' in the classroom where a great part of the duration of the lesson is spent. Double centred teachers were found to have two centres, that is, there were two different areas in the room where the teacher spent at least 20% of the total time of the lesson. Non-centred teachers did not spend 20% or more of the lesson time at any specific area of the room. They are the 'all over the place' teachers.

The degree of centredness then is defined as being the time spent by the teacher at specific locations as a percentage of the total lesson time.

Interactions

Part of the data collected included the teacher interactions at each specific time of observation during the lesson. Teachers could interact with the whole class, with an individual pupil, with a group of pupils, with some other person like a visitor at the door or have no interpersonal interaction. The amount of time spent on each interaction and the percentage in relation to the whole time of the lesson was calculated.

Layout classification

Room layouts have been analysed using two factors:

(1) in terms of the way children are seated; and
(2) in terms of the special resources and functions of the room required for teaching.

The way children sit and work is directed by the teacher's view of an effective layout. The specialist

functions of the room influence the equipment, services and other features that are additional to the seating plan. These two factors generate different combinations of the structure of the layout of the room.

The four types of seating arrangement encountered in the observations done are:

(1) Rows. The room is organized in rows, usually, tables facing one direction and/or facing the teacher;
(2) Groups. The room is organized in groups;
(3) Combination. The room had both rows and groups combined;
(4) Horseshoe or Circle. The room is organized in an open or closed circle, with an open inner area.

The three types of layout of the resources and facilities encountered in the rooms observed are:

(1) Multiple activities room. The room has different areas for specialist activities such as a reading corner or a wet area;
(2) Single specialist room. The room has specialist facilities of a single kind such as a computer or a science lab;
(3) General room. If tables and chairs are removed only storage or general purpose furniture would be left.

Each room is classified as a combination of the two factors above, for example, the classroom in Figure 4 is a multiple activities room organized in groups. Features of the seating arrangement are generally flexible. Features related to the resources and functions of the room are varied (semi-fixed, semi-flexible and flexible) as it becomes more specialized.

Results of observations

With all of the constructs and definitions explained, it is possible to demonstrate how powerful these instruments are when looking at them together. The classroom in Figure 5 was a teacher-centred lesson with 79% of the lesson time spent on the teacher teaching the whole class. There is no Pupils-on-task cluster of activities present in this lesson, characterizing it as a Teacher dominated profile. The teacher's location remained stable at the front of the class with a mobility factor of 20% and a degree of centredness of 50%. The layout is in rows and it is a general space with a flexibility factor of 99%.

The instrument, as seen, can be useful for both researchers and teachers. A teacher could self assess herself/himself in the use of the classroom setting and reflect on her/his lesson, her/his pedagogy related to the setting, her/his mobility, the layout, her/his chosen routes and a combination of all these. These few images have an numerous array of information for the teacher, the school, the

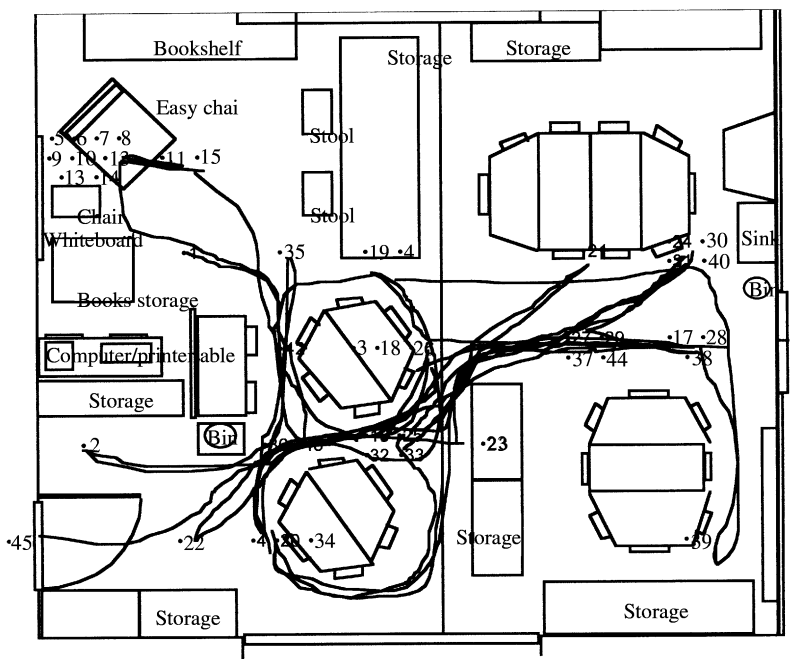


FIGURE 4. The example is a multiple activities centres classroom organised in groups with the teachers mobility tracked.

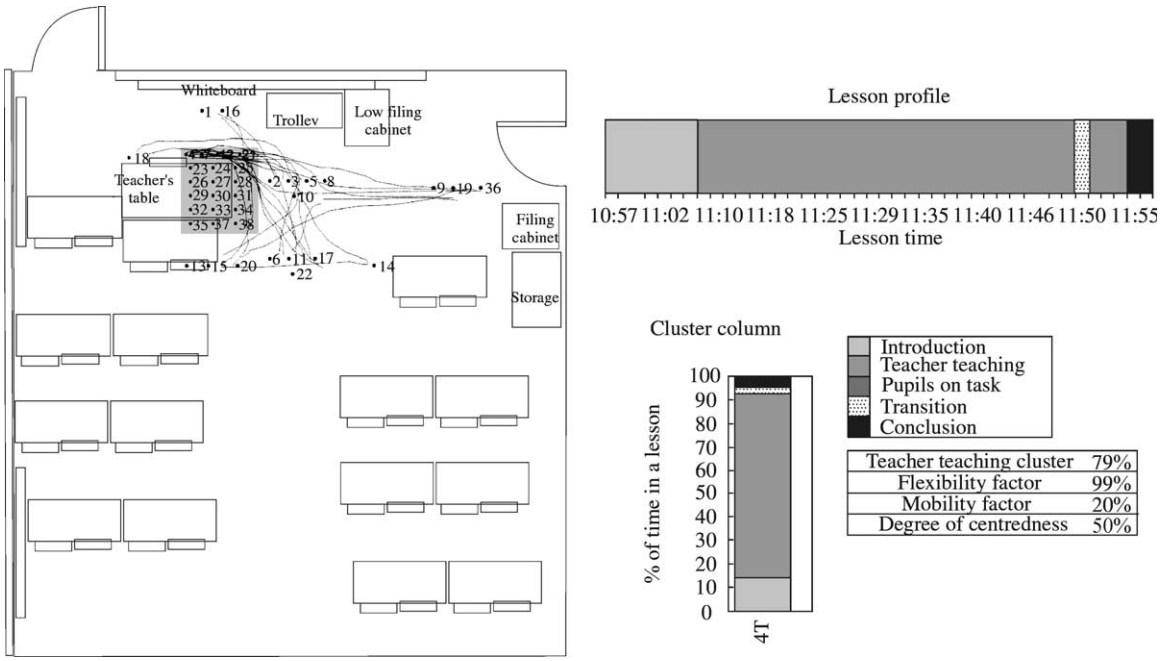


FIGURE 5. An example of a classroom visual data including maps, profiles and cluster columns.

researcher and whoever wants to be informed on how classrooms are used.

Trend relationships in teachers' use of the classroom environment

The use of constructs generated a large amount of data. The results could not all be presented here. The most significant relationships that emerged are described below.

Flexibility. The flexibility factor encountered varied from 56 to 99% in the 61 rooms analysed. Of these, 88% of the rooms have a flexibility factor of over 80% of the total area. This might appear a very high figure and indeed it is because by these definitions, quite a high proportion of the classroom is actually adjustable.

The least flexible rooms tend to be of a single activity-centre nature (single specialist) while the most flexible rooms tend to be general spaces. General spaces are characterized as having less semi-fixed features while single specialist facilities have a higher proportion of these features present in the classroom (Horne, 1999).

It was found that in the primary school classrooms observed, as flexibility increases, there is a tendency for teacher's mobility to increase as well (Figure 6) with a Pearson correlation (r) of 0·46.

Mobility. The mobility factor encountered varied from 7 to 68% of the area of the classrooms in the observed lessons.

The main mobility trend relationship found was that the more the teacher moves in the room, the denser the class is. Or we could say that the more space a child has, the less the teacher moves (Figure 7). On the face of it, this might appear counter intuitive; however, one might explain it by suggesting that in more tightly packed rooms, it is more difficult for pupils to move. In order to make more contact, the teacher tends to be more mobile whereas when pupils can be move, they 'go' to the teacher and consequently, the teacher tends to be less mobile.

There is a relationship between the nature of the interactions of the teacher and mobility, which is consistent with what we would intuitively expect. Where teachers address the whole class, they are less mobile with an inverted Pearson correlation ($r = -0{\cdot}42$). Where teachers address groups or individual pupils, they are more mobile with a positive correlation ($r = 0{\cdot}41$).

Pedagogy. Lessons with the highest proportions of pupils on task are the ones that have the most space, and are the least dense. On the other hand, an inverse relationship exists between the 'teacher teaching' cluster and density. The denser the

Classroom	Mobility (%)	Flexibility (%)
8T	29	83
9T	38	84
11T	23	87
10T	28	87
41T	41	87
32T	38	88
33T	68	88
40T	37	94
44T	52	96
42T	36	96
31T	48	96
39T	44	97
38T	52	98
35T	39	98
43T	44	98
37T	46	98
36T	48	98
34T	57	98
Pearson (r)		0.46

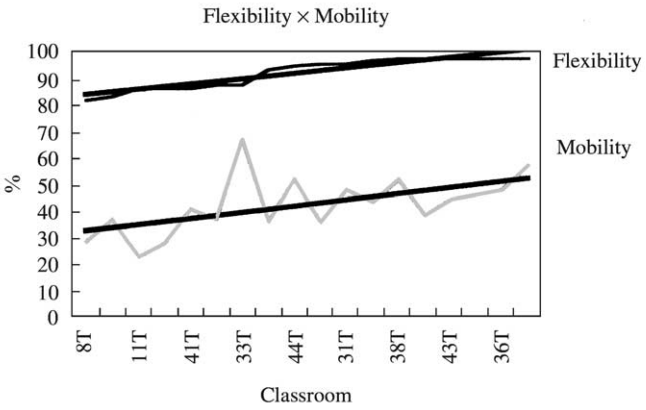


FIGURE 6. As flexibility increases, so does mobility in primary schools.

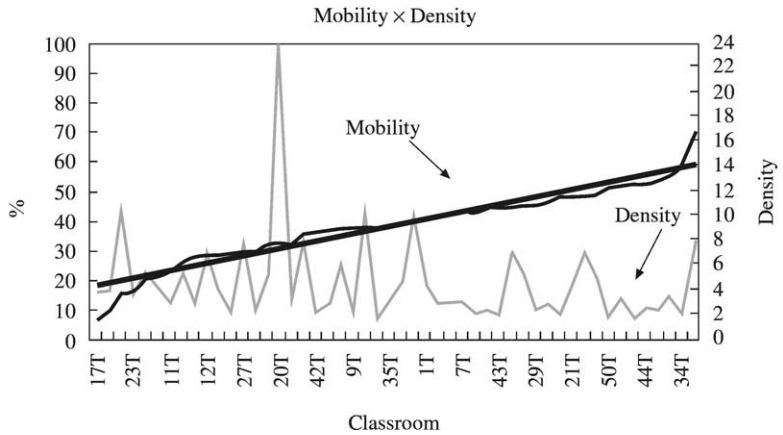


FIGURE 7. The more the teacher moves, the denser a classroom is.

classroom, the tendency is to have a more teacher centred lesson ($r = -0{\cdot}68$).

The most 'teacher-centred' classrooms are organised as circles/horseshoe. Again, this appears counter intuitive as we tend to think of circles as 'inclusive', but they are really controlling. The circle could be considered as one long continuous row and that would explain why the pedagogy that occurs in these settings tends to be teacher centred.

Most child-centred lessons in secondary schools tend to occur in multiple activities facilities classrooms while the least child centred lessons tend to occur in single activity centre facilities.

When teachers interact more often with groups or individual pupils, rooms tend to be organized in groups and be multiple activities centres facilities. When the pedagogy is child-centred, rooms tend to be organized in groups and to be multiple activities centres facilities which is consistent with the groups and individual pupils interactions.

These findings related to layout lead me to speculate as to whether teacher-centred teachers create row type classrooms or whether row type classrooms lead teachers to teach in a teacher-centred mode. When interviews are analysed later in this article, some other issues emerge related to the organization of the classrooms. These issues lead to teachers' awareness of space.

Practical subjects vs academic subjects. 'Practical' subjects have been defined as the ones that are usually taught in workshops/studios and 'academic' subjects are the ones that are generally taught in general classrooms which is consistent with the Department for Education and Employment (DfEE, 1996) definition in their most recent area guidelines.

The data identified a relationship between the rising density of the room and the amount of time focused on the teacher. The evidence suggests a trend that when the focus is on the teacher teaching, the lesson tends to happen in more dense classrooms and more 'academic' subjects. The inverse relationship occurs between rising pupil autonomy, the density of the room and the practicality of the subject in the observed classrooms. The evidence suggests that child centred lessons tend to happen in less dense classrooms and more 'practical' subjects. Figure 8 illustrates this trend found in the data.

Teachers in 'academic' subjects tend to be more mobile and the classrooms denser. As the subject gets 'practical', there is an inversion in the trend; teachers are less mobile while rooms are less dense (Figure 9). There is more space per pupil. When organizing these data for analysis, these subjects were not separated by their 'academic' or 'practical' characteristics. These results come from analysis of mobility and density and the order in which the subjects emerged.

'Academic' classrooms tend to be more flexible rooms than 'practical' workspaces. The proportion of semi-fixed, semi-flexible and flexible features in the rooms can explain this. 'Practical' classrooms require the use of fixed, wired or plumbed equipment and services that are either semifixed or semi-flexible features causing a decrease in the flexibility factor.

Interview data analysis

Whether the pedagogy used by teachers is linked to the way the rooms are organized, or whether the

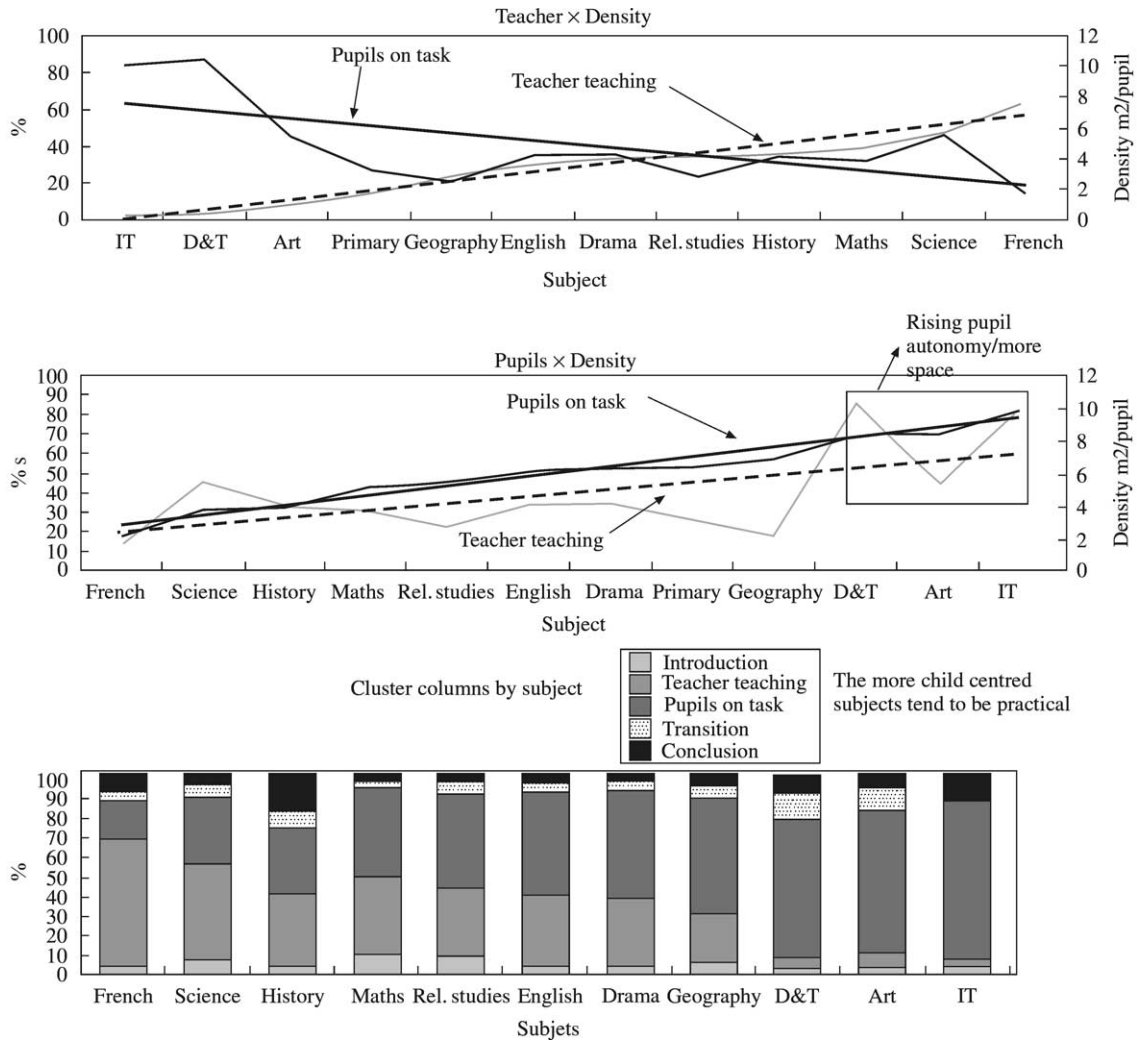
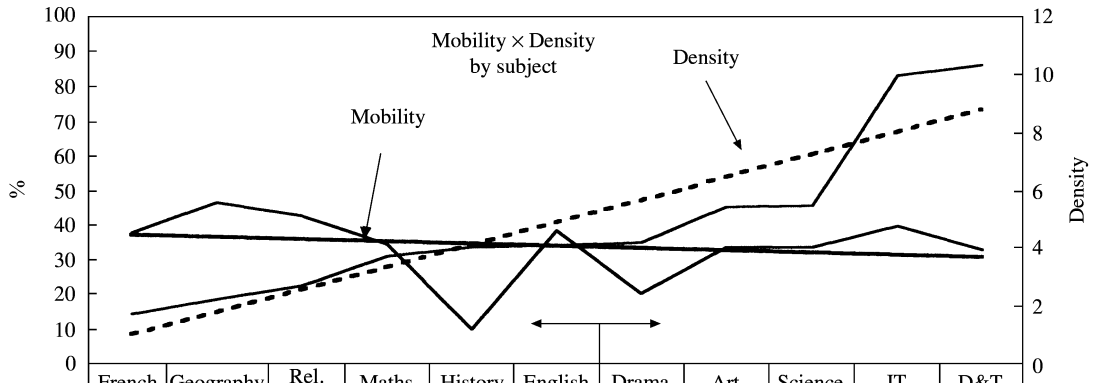


FIGURE 8. The data suggests a trend that when the focus is on the teacher teaching, the lesson tends to happen in more dense classrooms and more 'academic' subjects. The inverse relationship occurs between rising pupil autonomy, the density of the room and the practicality of the subject. *Child-centred* lessons tend to happen in less dense classrooms and more 'practical' subjects.



	French	Geography	Rel. studies	Maths	History	English	Drama	Art	Science	IT	D&T
Mobility (%)	38	47	43	35	10	39	21	34	34	40	33
Density(m/pupil)	1.7	2.3	2.8	3.8	4.1	4.1	4.2	5.4	5.5	10.0	10.4

FIGURE 9. Teachers in 'academic' subjects tend to be more mobile and the classrooms denser. As the subject gets 'practical', there is an inversion in the trend; teachers are less mobile while rooms are less dense.

teachers organize the rooms to support their practice and their chosen styles of teaching could not be identified by the observations alone. The only way to get at these was to interview teachers about their use of the classroom and their perceptions of their relationship with the space. Using the constructs described and explained above, teachers' interviews were analysed and explored in order to enrich the findings and to better understand these complex relationships.

Classroom satisfaction. Teachers were asked if the classrooms that they taught in were suitable for their teaching to take place and if they were satisfied with the environment. Forty-one percent of the teachers interviewed were satisfied with their classroom environment.

> ... this room is exactly how I want it to be. (Secondary Science teacher)

Twenty-one percent of the teachers interviewed had mixed feelings towards their classroom setting.

> It is not perfect ... the board: I would like it further over ... It needs to be further over so that all (pupils) can see without me being in the way. ... When it was redesigned they were very good in asking what I wanted. I wanted something flexible, so the furniture is all movable ... (Secondary Science teacher)

Twenty percent of the teachers interviewed demonstrated being unsatisfied with their rooms.

> ... it's too formal, it's **too** in rows and what you actually find with that is that the girls would tend to congregate to one side and the boys congregate on the other or you get the front-to-back split ... (Secondary English teacher)

Could it be that one of the factors contributing to teacher dissatisfaction is a sense of remoteness from their problems? They are the professionals in the classroom responsible for the amount and type of learning which occurs; however, they have very little input concerning school appearance (Jones, 1981). I would add to Jones' argument that the lack of involvement in planning the environment might result from teachers not knowing how to deal with the environment, and consequently, not being able to be involved in any kind of planning or input.

Mobility. Some teachers made comments about their own mobility in the classroom and these were linked with the circulation of the room. But interestingly these movements were related with their own teaching style as the example below illustrates. We can then attempt to say that the mobility of the teacher is related to the chosen pedagogy.

> What I also change is my position in the room, so for a lot of the time I don't stay at the front of the classroom. I come to my desk usually to talk to the class because everybody can see me from the way the furniture's laid out, ..., but if I don't need that situation, then the tables are regrouped or removed so that the children can sit in a semi-circle or something like that. (Secondary English teacher)

Lesson planning. Teachers were asked about how they perceived the impact of the classroom setting on their planning or even if they took into consideration the space in which they would teach before actually planning their lessons. Fifty-four percent of the teachers expressed that the classroom environment has an impact on the planning of their lessons

while 21% believed there was no impact or no relation between the classrooms and their planning.

Teaching style vs layout. Teachers were asked if they believed that their teaching style was influenced by their setting and what they thought were the features that affected their teaching. There was a general consensus of the relationship between the classroom environment and the teaching style.

> ... fundamentally because I designed the room to be like me, so it's got to be that way, doesn't it, and if I want to teach in a certain way, then I will just move the classroom. (Secondary Science teacher)

Teacher-centred/child-centred. Teachers that use a teacher-centred pedagogy tend to believe that there is a relationship between their teaching style and the layout of the room (86% of the teacher-centred teachers). Although they do demonstrate this perception of impact on their teaching style, they state that they do not take into consideration the environment when planning their lessons.

Teachers that use a child-centred pedagogy have a different response to teachers that use a teacher-centred pedagogy. While there is a tendency for teacher-centred teachers to believe that the room has no impact on their planning, child-centred teachers do believe there is an impact (58%). This impact can be either positive or negative. The teacher below, for instance, uses her planning in a very positive approach.

> ... I've got some lessons that are content based that work very specifically on the arrangement of the classroom, in particular like a drama, something on how gas works, for example, and ... we'd use a piece of drama about gas particles and how they move, and in order to represent the sealed con tainer, these (teacher is pointing the furniture) four desks block ... that one, that one, that one and that one are the sealed container and the children are the particles moving around, inside ... but it has to work round me rather than the other way round. (Secondary Science teacher)

The child-centred teachers that do not believe they take into account the rooms when planning their lessons have mixed perceptions in terms of the interference of effects that the layout of the room has on their teaching style. They quote both positive and negative perceptions on the fact.

Child-centred teachers also tend to believe that their teaching style is related to the layout of their rooms (69%).

> ... My whole teaching style has changed as a result of having the library because I taught very formally before ... as the time goes on and as I become more established within the school, then I look to change my styles because I want the children to develop a more adult learning style, a more mature learning style so of course you have to model the behaviour and so forth ... (Secondary English teacher)

There are some teachers that responded both positively and negatively to this issue. They demonstrate a confused perception of how the environment affects their teaching but still express the feeling of a relationship between the way they teach and the organization of the room.

Teachers that use a balanced pedagogy tend to believe that the room has an impact on their planning and this impact tends to be positive (82%).

> ... You mean do I take into account the layout (when planning)? ... I'm lucky that being able to move furniture around as the class requires is not really a big worry ... and rather than change my lesson to suit the room, I can change the room to suit my lesson. (Secondary Science teacher)

Teachers that use a balanced pedagogy find that there is a relationship between their teaching style and the layout of the room (73%).

> ... I will change the format of the classroom depending on the type of lesson that I want to teach. (Secondary Maths teacher)

Lesson planning vs layout vs teacher style. From the evidence exhibited above we can see different patterns of teachers' attitudes depending on their style. Teacher centred teachers tend to believe that the environment has no impact on the planning of their lessons. Child centred teachers, on the other hand, believe there is an impact, either positive or negative. Teachers that use a balanced pedagogy tend to believe that the room has a positive impact on their planning.

When it comes to questioning whether there is a relationship between their chosen styles and the organization of their rooms, they all agree there is a relationship even though the responses on their planning vary in nature.

Hierarchy of designability. The hierarchy of designability is a construct that *measures the degree of control of change* that teachers feel they have over the physical elements of the classroom setting. Teachers sense of control have been scored in two ways. The first one scans across all teachers' responses in relation to the elements of control (semi-fixed, semi-flexible and flexible features). The second examines teachers' individual responses in terms of the degree of control scores. The higher the score (0–3), the higher the degree of control of change a teacher

perceives himself/herself having over the classroom setting.

As one might expect, the interviews confirmed that the degree of control of change that teachers feel they have over the features of the classroom environment increases, as the flexibility of the features increases (Figure 10). In other words, most teachers perceive having control over flexible features of the classroom environment. Some teachers perceive having control over semi flexible features while very few teachers perceive having control over the semi-fixed features of their rooms.

When we examine teachers' perception of semi-flexible features, we find they have mixed understandings of how to deal with these features. Although these features are movable and changeable, teachers demonstrated different perceptions of change. Some teachers feel they have control over semi flexible features while others feel no control of change over these same features. By definition, semi flexible features are clearly movable although heavy and are perceived by some teachers as being movable, as they are, and by others as being fixed.

Teachers that have control over semi-flexible features tend to have mixed feelings or to be unsatisfied with their classrooms. They also tend to have both positive and negative comments on the circulation of their rooms. Being more critical about their own surroundings may mean that these teachers are more aware of their own surroundings and are more likely to make changes as they feel more empowered in terms of their degree of control.

There was also a tendency for teachers of practical subjects (usually taught in workshops/studios, for example, Design and Technology and Art) to be more in control of these features. The relationship between their teaching style and layout is also generally agreed here. These teachers also tend to use a child-centred pedagogy as their teaching style.

Teachers have also been individually scored in their degree of control of change according to their statements given on the interviews. Teachers that scored '0' have no control over any feature of the architecture. Teachers that scored '1' have control over one feature of the soft architecture (always the flexible features). Teachers that scored '2' have control over two features of the soft architecture (semi-flexible and flexible features). Teachers that scored '3' have control over all features of the soft architecture (semi-fixed, semi-flexible and flexible features). Figure 11 illustrates that most of the teachers follow the expected behaviour of feeling in control over the flexible features of soft architecture but not the other features within the hierarchy of designability.

A striking difference was found when the data is split between practical and academic subjects. The higher number of teachers in practical subjects score a degree of control '2' while in academic subjects score a degree of control '1' (Figure 12). It can be said then that teachers that teach practical subjects tend to have a higher degree of control of change than teachers do in academic subjects. They teach subjects that sensitize them to their environment.

Teachers that are satisfied with their classroom settings and the ones that have mixed positive and negative perceptions or are simply unsatisfied with their rooms have similar results to the difference encountered between practical and academic subjects' teachers. The higher number of satisfied teachers score a degree of control '1' while when they are not, scored a degree of control '2' (Figure 13). This demonstrates that satisfied teachers tend to have a more limited degree of control of change

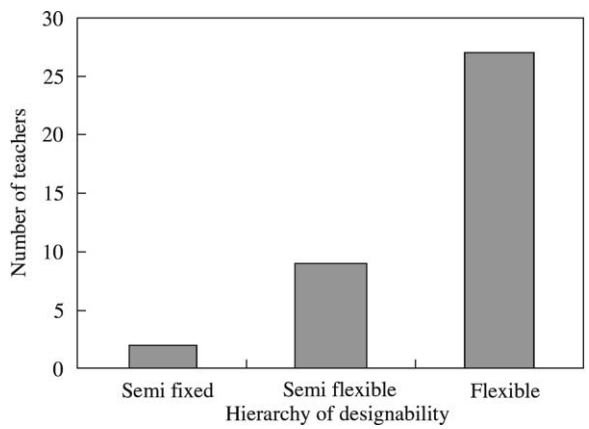


FIGURE 10. Teacher's hierarchy of designability.

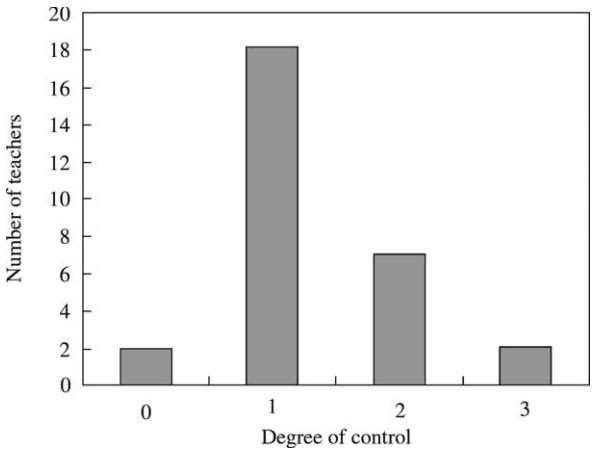


FIGURE 11. Teachers' degree of control of change.

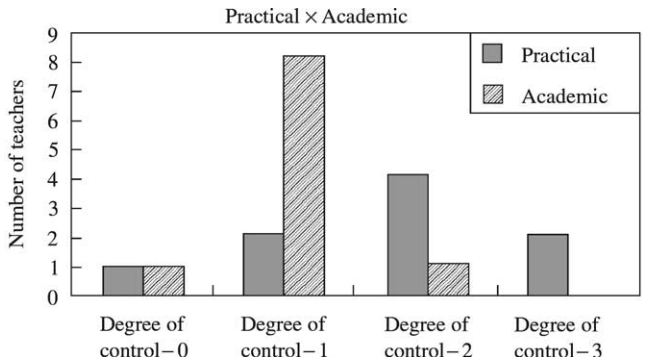


FIGURE 12. Practical and academic subjects' teachers' degree of control of change.

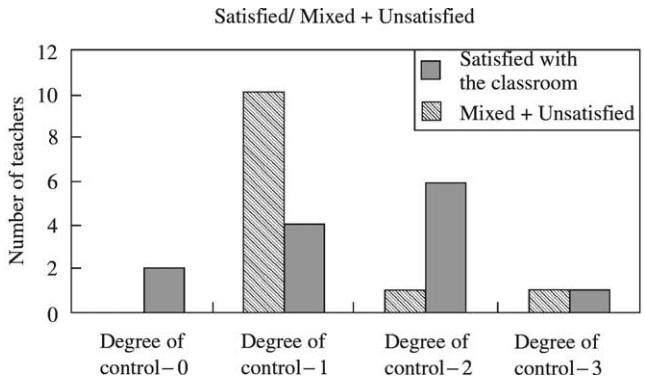


FIGURE 13. Difference on the degree of control of change between teachers that are satisfied with their settings and teachers that are not.

than the ones that find more problems with their settings. Perhaps, dissatisfaction with the classroom physical environment is the first step towards taking control over it.

But can we say that unsatisfied teachers tend to teach practical subjects or that teachers that teach practical subjects tend to be unsatisfied? We cannot generalize but we can say that practical teachers that score high (degree of control 2 or 3) tend to be unsatisfied or have mixed feelings in relation to their classroom setting. But being unsatisfied does not mean that the teacher teaches a practical subject, it means that the teacher tends to question more about the setting.

Summary of results

What can we say about teachers' perceptions of the use of their classroom settings? How do teachers react towards their physical space? Do teachers feel empowered or defeated by their environments? How do different perceptions demonstrate different attitudes towards the space?

Teacher-centred lessons in the classrooms observed tended to occur in classrooms with less space and higher density of pupils. There was also a tendency for the classrooms where these lessons took place to be general spaces and the seating arrangements were mostly organised in rows. Also, teachers of 'academic' subjects tended to work towards a more teacher-centred pedagogy. Strikingly, these same teacher-centred teachers tended to be proportionally more mobile as the classrooms were denser. It seems to be that teacher-centred teachers tended not to take into consideration their physical space when planning, contradicting their comments on how they felt that the rooms affected their teaching style.

Child-centred lessons in the classrooms observed tended to occur in the rooms with a higher proportion of space per pupil. There was also a tendency for the classrooms where these lessons took place to be multiple activities facilities when seating arrangements tended to be organized in-groups. Also, it was found that teachers in 'practical' subjects tended to work towards a child-centred pedagogy and proportionally were less mobile (than teacher-centred teachers) in more spacious classrooms. An argument for this finding is that when pupils have more space to move around the setting, teachers tend to move less. A great percentage of child-centred teachers were found to take into consideration their teaching space when planning their lessons and that their teaching style was definitely affected by their settings.

The interviews revealed that hard architecture seems to be taken as immutable as teachers would not even comment on it. It is seen as just a shelter and what is inside is more reachable for teachers in terms of possible change. This fortifies the argument of concentrating the study on the soft architecture where teachers would feel more in control of different features. Teachers seem to be aware that the setting affects their teaching styles and a large proportion of teachers take into account their classroom spaces when planning their lessons. What seems to be controversial among teachers is their perception of control over different features of the soft architecture, mixed and confused perceptions especially when semi flexible features are concerned.

The data identifies a link between teacher satisfaction with their settings and their feeling of control. The tendency is that the higher the degree of

control, the more dissatisfied the teacher seems to be. And unsatisfied teachers had a tendency to be child-centred teachers, teaching practical subjects, and aware of the impact of their rooms on both planning and teaching style. But it is important to note that not all unsatisfied teachers fell in the categories above.

When I examine teachers' environmental awareness, I could indicate three types of attitudes. I found teachers that do not perceive their surroundings in a constructive way and do not seem to perceive how much impact that setting is having on his/her teaching and class. These teachers, consequently, do not act when a problem arises. I also found teachers who were aware of the impact of the settings on themselves and on the children. Some of these teachers were victims of their own classroom settings, as they knew something was not working well but they could not do anything to find a solution. Then we also find teachers that are aware of their surroundings and deliberately use them. These are the environmentally aware teachers but they are not as common place as ideally we might wish.

Discussion

The imprisoned, the free and the simply confused

The imprisoned:

> ... there's so little room to move ...
> ... we can't do large work very easily because there's hardly anywhere to put it ...
> ... the floor slopes and everything rolls off the tables ...
> ... there's nowhere for drawing or preparation work ... (Secondary Art teacher)

The confused:

> No, do I take the classroom into account as an environment (when planning). Not at all. (Primary teacher)

Then this same teacher contradicts herself:

> In fact I start the year by changing the classroom lots of times until you get to know the children. Usually I have two long tables in a group. This year in the autumn term I have actually changed like this (shows the room). In fact I had all of their desks in rows because I find this year group is quite poor and they didn't complete a lot of their work and that they would talk to each other and not complete their work so I tried it in rows. Now I actually find that very very intimidating because all the children are looking that way ... (Primary teacher)

Then once more she contradicts herself:

> I don't find it (the room) interferes at all (with my teaching) ... (Primary teacher)

The free:

> The thing I would say is that nothing is impossible within a room, you know ... It is just the vision of the teacher, I think, it's important ... and the forward thinking of the teacher as well. (Secondary Design and Technology teacher)

Progressively, I have become interested in the environmental awareness that teachers display. It seems reasonable to assert that teachers would prize wisdom above ignorance. At least, therefore, I would hope and expect that teachers would wish to be aware of the relationships that have been identified in this study between their behaviour in the classroom and the design of it. I also assume that they would like to be autonomous professionals making deliberate choices in their teaching, rather than having their hand forced, and their behaviour controlled, by the chance allocation of an inherited classroom. Habitual ways of seeing and thinking about classrooms create an obstacle to seeing alternative possibilities. Loughlin and Suina (1982) argued that schools are behind in the process of accepting the influences that the environment has on those who occupy it. These influences have already been recognized by professionals in other fields such as supermarkets, museums and offices. Studies by Adams and Hiddle (1970), Sommer (1972), and David and Wight (1975) observed how the arrangements of space influence interactions and could predict patterns of participation in class activities, patterns of which teachers were not aware. In later studies by Lackney (1997), he found that teachers felt that environmental qualities are in part their responsibility even when they are unable to control them or do not know how to tackle the problems which relate to some of the findings of this study.

Reflecting over the data and findings, it is clear that teachers that question more about their own settings have a tendency to be less satisfied with their classrooms. When a teacher does not recognise the role of the environment, it is unlikely that change will occur. On the other hand, dissatisfaction with the environment seems to be a first step towards change. The positive recognition that the environment could be better planned is a first step to the empowerment of the teacher. The data presented here suggests that although some teachers question and tend to recognize problems with their

setting, they may stop once that recognition is made, not taking any further step towards being more proactive in changing the space. This attitude might be described as awareness without competence.

There seems to be a need for teachers to learn how to question their settings in a constructive way, looking for solutions and being proactive in feeling in control of change over the changeable features. Taking a proactive attitude would permit the teacher to experiment, and with experimenting find out what works and what does not work, since each teacher and each group of students will be different. The classroom cannot be allowed to exist as a static feature. It needs to be questioned, challenged and transformed. According to Trancik and Evans (1995), the ability to control the environment leads to feelings of accomplishment and independence whereas a lack of control may result in helplessness. When teachers realise that they have control, they can feel empowered by the same environment that once would have defeated them.

Awareness can make a person sensitive to subtle aspects of the environment and bring to light the adverse effects of a bad environment. In a sense, the goal in developing environmental awareness is to reach a new understanding of how the environment relates to human activity.

But awareness, by itself is not enough. A teacher might be able to identify problems occurring in a setting but be unable to use this knowledge to carry on a meaningful dialogue with the environment to transform it to fit their requirements. Awareness is the first step, but may not prompt any movement away from passivity. It may not be enough to provoke teachers to take action and rearrange a setting. Moving from awareness to competence requires that we overcome passivity, making active choices and experimenting with a variety of spatial alternatives. This enables the teacher to challenge and develop the environment.

The title of this study refers to the 'practice of teachers'. The practice of teachers is their pedagogy, and as I have demonstrated in this study, there is a relationship between the teaching environment and the teachers' pedagogy. The examples below (Figure 14) illustrate these relationships. These are extreme examples and the data from this research show that there is a continuum between these extremes, but I use them here to demonstrate how influential these relationships are. The example shown is based on extremes in classroom organization, mobility, and degree of centredness and shows the link with pedagogy. One of the cases is teacher-centred and the other is child-centred, and they are very much related to how the classroom is organized, and how the teacher moves within this arrangement.

Furniture arrangements, aesthetic appeal, the presence or not of windows show non-significant difference in terms of student achievement in research undertaken by Weinstein (1979). On the other hand, there is enough evidence that the physical environment can affect 'non-achievement' behaviour and attitude of both teacher and pupils as found in research by Weinstein (1979), Garbarino (1980), Moore and Lackney (1993), Johnson (1990) and Lackney (1994). As Moore and Lackney (1993) reflect over their findings, it is not unreasonable to suggest that more positive attitudes and behaviours on the part of both teachers and children may reflect positively on improved academic achievement, therefore the environment seen as having an indirect effect on achievement. Johnson (1990) also found that the impact of the school's physical setting on the teachers affect their desire to continue teaching.

I would hope that teachers in their classrooms learn to understand their environments, redesigning them to fit their requirements. To that extent, every teacher becomes a designer, responsible for preparing the environment to achieve his or her educational purposes.

This study illuminates the relationship that exists between teachers' practice and the environment in which they operate. I have argued that teachers should be self aware of these relationships and that this awareness should not be left to chance but rather should be deliberately developed in them. The training of teachers in understanding the effects that the classroom has on them is therefore clearly a matter of importance. However, it appears that it is not an official requirement in the U.K. In neither the standards for new teachers or subject leaders (TTA, 1998*a*, *b*, *c*) are there any significant mention of the impact of the classroom environment on teaching. The only mentions are either highly generalised or relate to health and safety. None of these references relate to understanding the setting and learning about the relationships that exist between the setting and the practice of teachers. Since so little understanding is required, it is reasonable to suppose that there is equally little training for teachers in this area. It can be argued, however, that without it, they will be professionally impoverished and pedagogically impaired.

As referred in the Introduction, this study aimed to describe and analyse the effects of existing learning environments on the practice of teachers

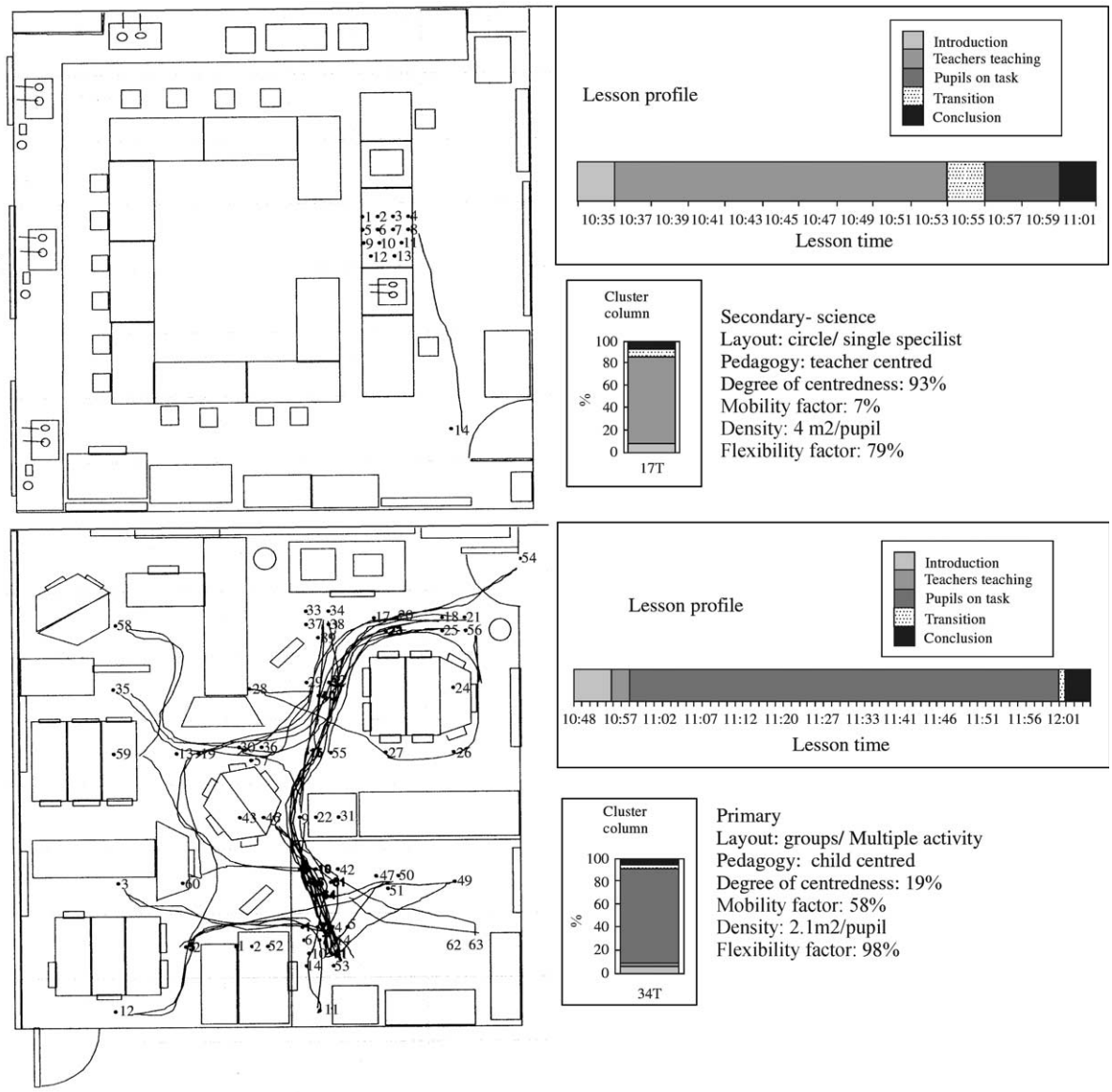


FIGURE 14. Extremes in the use of the classroom environment.

seeking an understanding of how teachers behave in a classroom environment. It was beyond the scope of the study to prepare a training programme for teachers to enable them to become more aware and more competent in their design of the classroom environment. Nonetheless, some suggestions are clearly open in terms of the use of the developed research instruments. Auditing the space is a useful exercise for teachers as they realize how much of their rooms is actually flexible (using the semi-fixed, semi-flexible and flexible scale). It would not be difficult to develop instruments specifically for teacher training using the ones developed during this research. Teachers could also evaluate their own perceptions of the space with the use of these instruments. They would permit teachers to learn how to observe; how to see space from different perspectives, gaining a fresh understanding of the space.

Every teacher and every child in every lesson is in some kind of classroom. It is an inevitable part of the educational scene. I believe that a professional teacher should know how to use it effectively.

Notes

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