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Establishing trend relationships in teachers' use of the classroom environment

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Abstract
The ways teachers use their classrooms reflect on different kinds of pedagogy. Classrooms are physical entities that have both fixed and flexible features; that is, there are elements within a room that are movable by the teacher and elements that are fixed. The impacts teachers have over the physical features of the classroom vary according to their personal awareness and sense of control. Lessons (primary and secondary) have been observed and analysed into clusters of activity leading to the creation of distinctive lesson profiles for each teacher. Classroom and teaching variables (e.g. flexibility, density, mobility, and centredness) are identified and analysed. Important relationships exist between these constructs of use of the classroom and illustrate the need for teachers to understand the effects of the classroom design on their practice.

Keywords: classroom environment, teacher training, teachers' mobility, classroom design, classroom use

1. Introduction
Teachers are immersed in the physical classroom on a daily basis, intuitively modifying the space to improve the overall learning environment. They inherit spaces either in new buildings or old ones but no matter the condition of these spaces, they have to deal with the facilities in a way that permits their practice to take place. The classroom is no more than an enabling factor in terms of effectiveness of the learning. It does not create the ideal learning space but it enables or disables the teacher in their approach to create it. The ultimate success of a learning space depends far more on what the teacher does with the room itself (Dick, 1997).

But how do teachers use this environment? How do teachers perceive the relationships of space with their choice of lesson? Are teachers aware of how they are moving and using this setting?

In an attempt to identify how teachers move about, what areas are mostly used, whether there is a pattern of movement, 62 classrooms have been systematically observed during whole lessons (approximately 100 hours).

Behavioural maps have been built demonstrating specific behaviours of movement (Ittelson, 1976). This paper examines the relationship between the physical arrangement of the room and the pedagogy used by the teacher. Features analysed include flexibility, density, mobility, centredness, and layout. A series of relationships between these analysis constructs has been identified. These give valuable insights into the way teachers use their settings, helping teachers to develop their awareness of the effects that the classroom environment has on their practice.

2. The Classroom
What does one see in a classroom? First you see a room with some furniture in, a finite space, so many square metres, windows and doors. Then you start seeing people. "Some sit, some stand, some move about, some talk, some keep silent, some write, some draw, point, sing, fidget, cry, laugh, whisper" (Adams and Hiddle, 1970:8). But among these people, one appears to dominate and exerts a

*Behaviour always occurs in some place, within the limits of some physical surroundings. Recognition of the importance of this self evident fact has led to a growing number of studies relating various aspects of behaviour to the physical spaces in which they are observed. Any data of this kind can be thought of as constituting a behavioural map.
controlling influence, the teacher. Also, as Weinstein suggests (Weinstein and David, 1979), nowhere else but in the classroom, are large groups of individuals packed so closely together for so many hours, yet expected to perform at peak efficiency and interact harmoniously.

A lot happens in a classroom simultaneously but the focus of this research is on the teacher and on behaviours that are related to the physical setting of the room. The observations and further analysis generated constructs and ways of visualising some of these.

3. Clusters of Activities and Profiles
All lessons observed were classified in clusters of activities that characterise a lesson independently of the subject or type of room. These clusters were identified by the observations themselves as common features of the lessons. 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 clusters 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 colour coded to illustrate the distribution of clusters during the period of a lesson (Figure 1). It is the shape of the lesson.

The 62 observations made originated 62 different profiles. These profiles have characteristics that can be grouped in 5 types of lessons. 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 (Figure 1).

The second type is the “Teacher initiated iterative” profile. Here, lessons begin with teacher directed input and follow intermittent teacher teaching and pupil on task activities. The teacher sets up tasks in smaller steps and pupils work, then the teacher goes back into whole class teaching and then into another task. There usually is an introduction period and a conclusion period while transitions might be present or not (Figure 2).

The third type encountered is the inversion of the second; that is, it follows a “Pupil controlling influence, the teacher. Also, as Weinstein suggests (Weinstein and David, 1979), nowhere else but in the classroom, are large groups of individuals packed so closely together for so many hours, yet expected to perform at peak efficiency and interact harmoniously.

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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 and as they arrive, they start working on it autonomously. Then, following teacher intervention, there are the intermittent pupils on task and teacher teaching activities. Here again, there is usually an introduction period and a conclusion period while transitions might be present or not (Figure 3).

The essential difference between the "Teacher initiated iterative" profile and the "Pupil initiated iterative" profile is derived from "the teacher to pupil" activity as against "to pupil to teacher" activity.

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 (Figure 4). 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 (Figure 5).

4. Teacher Teaching and Pupils on Task

The 5 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 on 50% or more of the time on the teacher teaching have been classified as having a teacher centred pedagogy (25% of the total number of lessons). The ones focused 50% or more of the time on pupils on task have been classified as having a child centred pedagogy (49% of the total number of lessons). Figures 6 illustrates the percentages for all lessons. Twenty six percent (26%) of the teachers did not fall in either category; that is, they fall in the middle, which is dominantly a balance between a teacher centred, and a child centred pedagogy.

5. Flexibility Factor

Classrooms are physical entities that have both fixed and flexible features; that is, there are elements within a room that are movable by the teacher and elements that are fixed. To be able to explain these principles in a
clearer way, a hierarchy of designability was developed as part of the framework for analysis of this research. The space was divided into two major groups (hard and soft architecture). The degree of impact that teachers have over these elements varies. There are elements in the classroom that cannot be changed by a teacher. These are elements of the hard architecture that are fixed (e.g. walls, windows). But there are elements that can be changed in varying degrees. These are features of the soft architecture and the ones that are related to the flexibility factor of the room. These can be semi-fixed, changeable with some effort (e.g. built-in furniture, sinks, and radiators, in general, the services concerning water, electricity and gas). Semi-flexible features are heavy elements (e.g. filing cabinets, bookshelves) often perceived as relatively fixed. Flexible features are elements that can be easily moved (e.g. chairs, tables). Figure 7 is a classroom that has been classified according to these categories.

The area of each room was calculated in square metres as well as the area occupied by the semi-fixed, semi-flexible and flexible features. The free floor area was also included in these calculations as part of the flexible space. The percentages of these were then calculated in relation to the total area of the room (table in Figure 7). With these data, it was then possible to measure the flexibility factor of the 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 done by the teacher with varying degrees of effort.

The flexibility factor encountered varied from 56% to 99% in the 62 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 classrooms are actually adjustable.

6. Mobility Factor

The floor plan of the classrooms provided a starting point for the development of behavioural maps. A grid layout was used to identify and classify the physical elements within the room. The teacher’s movement was tracked and recorded (Figure 8) together with the focused activity and interactions (e.g. with pupils). The observations were continuous during the length of the lesson. These were recorded on data sheets designed for quick use by the observer. The tracking was colour coded according to the cluster of activity. This informs where the teacher was within the room during a specific focus of the lesson.

The layouts of the rooms were scaled sketched within the grid. The observation sheets were completed for every lesson at an average of 2-minute intervals throughout the length of the lesson (which varied from 45 minutes to one and half-hours). The teacher was the focus of the observation. The route taken by the
teacher was observed within the room. The numbers on the grid represent the location of the teacher at each time interval observed. The way the space is structured determines paths and, in turn, determines movement or traffic. The total area covered by the teacher (in square metres) during the length of the lesson is summed. A percentage is then calculated in relation to the total area of the room. In figure 8, during the lesson observed, the teacher covered 38% of the available classroom space. This is the mobility factor.

7. Density
The amount of space per pupil in a classroom is the density of the room. It is measured in square metres per pupil. The average density encountered in the classrooms observed was 4.6 square metres per pupil.

8. Density x Mobility Relationships
There is a clear relationship between the mobility factor and the density of the classroom. The trend data suggests that the more densely packed the classroom, the more the teacher tends to move (Figure 9). This behaviour occurs both in primary and secondary schools.

9. Secondary School subjects
The curriculum in secondary schools is more specialised and subjects are separated and taught in different classrooms. These can be workshops (e.g. Design and Technology), studios (e.g. Art), laboratories (e.g. Science), and general classrooms (e.g. Maths, History). Flexibility, mobility and density have been examined in each subject to find out if the trend behaviour of these factors is different from the general trends. The general trend that the more densely packed the pupils, the more mobile the teachers, can be applied to the different subjects. When you add flexibility to the equation, the trend is that science laboratories are less flexible than any other room used for any other subject.

When subjects in secondary schools are sorted (Figure 10) by the amount of time spent on either teacher teaching or pupil on task, the
findings show a trend between "practical" subjects (e.g. Design and Technology, Art) and "academic" subjects (e.g. Maths, History). "Practical" subjects tend to be more child centred in nature while "academic" subjects tend to be more teacher centred. "Practical" subjects have been defined as the ones that are usually taught in workshops/studios (e.g. Design and Technology, Art). Academic subjects are the ones that are generally taught in general classrooms (e.g. Maths, History, and English). When relating mobility, flexibility and density to these subjects, there is more space in "practical" lessons than in "academic" lessons, meaning that "academic" classrooms are denser than "practical" workspaces (Figure 11).

On the other hand, "academic" classrooms are also more flexible rooms than "practical" workspaces (Figure 11). 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 semi-fixed or semi-flexible features causing a decrease in the flexibility factor. The mobility behaviour is related to density as a trend suggested previously. The less dense "practical" classrooms show less teacher mobility. In the more dense "academic" classrooms, teachers tend to be more mobile (Figure 12). On the face of it, this might have counted as counter intuitive; however, one might explain it by suggesting that in more tightly packed rooms, it is more difficult for pupils to move, and in order to make more contact, the teacher is more mobile.

10. Degree of Centredness
Teachers have a tendency to spend extended periods of time at specific locations of the room. Certain areas were identified as being more used than others. Teacher "centres" were identified as areas where teachers spend at least 20% of their time (Figure 13). These centres can be either single or double. If neither, they are non-centred. The degree of centredness is calculated as being the time spent by the teacher at specific locations as a percentage of the total lesson time. The degree of centredness found varies from 9% to 93% of the time of a lesson. Possible reasons for the creation of these bases by the teacher are the need for comfort and security that the "ownership" of a spot can provide within the setting.

11. Layout classification
The arrangements of space influence interactions in any setting (David, 1975) and affects the social interactions of the people within the setting (Gifford, 1987). It can also communicate expectations for behaviour (Weinstein, 1987).

The placement of chairs and desks will "state"
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<th>Teacher's location sorted</th>
<th>% in each location</th>
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<td>41</td>
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<tr>
<td>B4</td>
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<td>C6</td>
<td>3</td>
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<td>D3</td>
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<td>G3</td>
<td>12</td>
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Figure 13 Classroom 1S4T - Single centred teacher

an expected behaviour. Classrooms 62T and 43T (Figure 14) are both primary school classrooms but the images of behaviour at these two layouts are very different. The formality of the layout in classroom 62T and the group formation/activity centres of 43T create different expectations on how one might be expected to behave.

Each room is found to be a combination of seating arrangements (rows, groups, a combination of rows and groups and a circle) and resources (multiple activity centres, single activity centres and general space). Figure 15 illustrates these different types of layout. The data suggest that teacher centred teachers’ rooms tend to be organised in rows and be a general space while child centred teachers’ rooms tend to be organised in-groups and have multiple activity centres.

12. Conclusion

The overall analysis has revealed interesting repetitive patterns of movement. People who use environments redesign them; they adapt to existing settings. Every teacher becomes a designer, responsible for preparing the environment to achieve his or her educational objectives. The fact that teachers inherit classrooms and they are not formally trained to deal with their surroundings, creates a tendency of a passive acceptance. This raises important issues for initial teacher training and professional development, since part of the teacher’s job is to take responsibility for the design of the classroom. They need to be

Figure 14 Different layouts, different expectations of behaviour
prepared and empowered, not defeated and trapped by the environment. Such awareness should enable the teacher to analyse the learning spaces more critically and become autonomous in their control over the setting.

Moore and Lackney (1994) stated that there is considerable evidence that the physical setting directly affects both teacher and student attitudes. They further argued that the impact of the physical environment on the behaviour and attitudes of teachers and pupils has a mediating effect on achievement. The physical environment factors affect educational outcomes by affecting teaching practices, which impact achievement outcomes through mediating factors. Accepting this framework suggests that it is not unreasonable to say that teachers' increase of environmental awareness can create positive attitudes and behaviours.

My own work is concerned with how the classroom environment affects the practice of teachers. This paper is a working document and illustrates ways of assessing the use of the classroom by teachers. Identifying teachers' awareness of the space and developing an environmental competence in dealing with this space is an important issue that is further being considered in the development of this study.

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