

The Elementary School Classroom: A Study of Built Environment

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Abstract

This study, based upon the responses of 800 students and 400 teachers in the region of Greater Montreal, analyses the physical environment of the classrooms. The spatial, thermal, luminous and aural factors are considered. Many correlations have been found between them and the attitudes of the respondents. Correlations have also been found between the foregoing and cultural, social and other factors. It is concluded that the school populations are under many environmental influences. Further research is required to make quantitative recommendations.

Introduction

This study is an attempt to explore various factors which, in one way or another, can affect man's perception and appreciation of his physical environment, and can influence his behavior therein.

Although many scholars have pointed out the importance of the effects of the man-made surroundings in such buildings as schools, a general unawareness of these effects persists among architects and educators alike. Moreover existing research has always dealt with individual factors, but almost never with the totality of the environment.

This study, showing the complexity of the problem, does not provide answers, but it raises many questions. The reader is urged to consider the findings hypothetical.

Methodology

This study is based upon a survey of 32 elementary schools built between 1950-1963 in the region of Greater Montreal. They belonged in equal numbers to the French & English-Canadians & were spread over lower, lower-middle, middle and upper income level districts, and urban, semi-urban and suburban localities.

Architects and principals have been interviewed. Half a day was spent in each school to visit the premises and to attend a regular class

of the highest grade (11-13 years old).

800 students and 400 teachers have filled-in questionnaires concerning the various physical aspects of their schools.

The thesis made use of a portion of the collected material, namely, that part which pertained to the classroom.

Part One - The Spatial Environment

1. The Environmental Factors

Area is the first environmental factor to be studied, and no classroom (CR) can be evaluated as "big" or "small" without taking into consideration the number of children in the CR, the type of activity therein, as well as psychological and anthropological factors. The actual dimensions of the room seem to be less significant compared to the above factors.

The 32 CR's ranged between 650 and 860 square feet, with an average of 725. These CR's included 26 completely enclosed rooms, 3 with operable partitions and 3 without partitions. It was found in general that the more densely populated CR's were the larger rather than the smaller rooms, the latter providing 1.5 times greater surface area per student than the former.

Enrollments ranged between 16 and 35 students, with an average of 28, while per capita area ranged between 41 and 19 square feet, with an average of 26.

Dissatisfaction with the CR area seemed to be general feeling on all levels of the school population. Thus 53% of students required larger area, 2% smaller area. 49% of teachers deemed their CR area barely adequate or inadequate. As to the principals, 20 out of 32 were dissatisfied with the area one way or another.

Although there were large demands by the students for "bigger" CR's in schools which did not have either the smallest CR's or the biggest CR enrollments, in general the greatest satisfaction occurred in CRs with smaller enrollments

(25.75 students, average), and larger percapita areas (27.75 square feet, average) as compared to the CRs which caused the least satisfactions (29.5 students, 25.75 square feet/student, average).

No. of students/CR	16-26	27-30	31-35
Ave. area, Sq.ft.	715	715	750
Ave. area/ST Sq.ft.	30	25	23
% of Students satisfied with area	54	45	34

Note ST = student

TABLE 1 Spatial Environment - (Students)

The shape of the CR is another important factor which seems to affect children's appreciation of the CR area. The higher satisfactions are evoked in square rooms, where for the majority of the students sightlines have equal length. As sightlines increase in long-rectangular rooms satisfactions decrease, while they become lowest in wide-rectangular rooms where sightlines are excessively shortened.

Another spatial factor which seems to affect children's satisfaction with the CR area is their orientation. They are less satisfied when they face the wall opposite the windows, than when they are in any other position which enables them to see outdoors.

Teachers too, as it was mentioned, are dissatisfied with the CR area (51% rate it "adequate"), as well as with the storage space (only 42% rate it "adequate"). However, a higher proportion (63%) of them is satisfied with the number of students in the CR. Very strong relationships are found between these 3 factors, i.e., as satisfactions increase with any one of these, they do so with the other two factors too.

Percentage of teachers rating "adequate"	No. of ST per CR	Storage area
8 Schools with max. (84.5%) "adequate" responses to area	78	61.5
8 Schools with min. (19 %) "adequate" responses to area	43.75	25.5

TABLE 2 Spatial Environment - (Teachers)

When comparing the responses of the students and the teachers, the most striking evidence is that a greater proportion of the latter are satisfied with their CR area. Are children more sensitive to the confinement of the physical environment than their elders? One wonders.

2. The Attitudes

Students' attitudes were examined through the two following questions:

- Do you like being in your CR?
- If asked to remain longer in school, would you be glad, would you not mind, or would you

be sad?

It is interesting to note that the first question roused much more positive responses than the second. Moreover, a very strong relationship is found between the two questions. Positive attitudes in one are accompanied with positive attitudes in the other.

Keeping always in mind that these attitudes are conditioned by a multitude of factors, specially non-environmental ones, which are outside the scope of our study, we observe certain mutual effects between the spatial factors and the attitudes.

Thus, the CR area and the students' attitudes are in inverse proportions. The more positive attitudes are found in smaller CR's, the least in larger ones, and conversely, the smallest CR's evoke more positive attitudes than the largest ones. This is in line with the fact that the smaller CRs provide larger per capita space. Also, children are happier in less congested CRs than in more congested ones. In addition, a very strong and direct relationship exists between attitudes and satisfaction with CR area.

		ave. area	ave. no. of ST/CR	ave. area /ST sq.ft	% satisfied with area	
Being in the CR	"remain" & "glad"	ave. area sq. ft.	ave. no. of ST/CR	ave. area /ST sq.ft	% satisfied with area	
9 CRs with max. "like"resp's (87 %)		22.5	700	25	28.5	52.5
9 CRs with min. "like"resp's (40.75%)		8	760	30	25.5	36.75

TABLE 3 Attitudes: Spatial Env. - (Students)

Teachers were consulted about the adequacy of their CRs vis-a-vis their teaching method (TM), the physical health of their students (PH) and their mental health (MH).

We notice that teachers are most critical of the first question and least critical of the last one.

As it was observed in the case of the student responses, when teachers' opinions about one of these 3 issues become more or less favorable, then their opinions about the other two vary in the same way.

And again direct and strong relationships are found between the above opinions and the responses to the environmental factors. The more the teachers are satisfied, say with the CR area, the more they consider the CR adequate for TM, etc., & vice versa, i.e., the higher the "adequate" responses to "TM", etc., the more the satisfaction with area.

Teaching Method	% of Teachers Rating "adequate"				Store.
	PH	MH	Area	No. of ST	
Note: SC = school					
8 SC's w/max. "adeq."resp's (87 %)	80.75	92.50	76.75	79.00	54.50
7 SC's w/min. "adeq."resp's (30.5%)	50.25	67.75	29.50	48.50	30.50

TABLE 4 Attitudes: Spatial Env.-(Teachers)

These are clear indications that our opinions about the general adequacy of our physical environment, can be strongly affected by the way we evaluate its different components.

3. Cultural and Other Factors

Several factors such as the socio-economic background, the location of the schools, the age of the children, etc., were considered. Significant results were obtained however only from "Language" and "Age of the School Building".

a) Language

The population of Montreal is basically composed of 60% French-Canadians and 40% of English-Speaking Canadians (English, Scottish, Irish, etc.). In the region of Greater Montreal the proportion of French-Canadians is greater. Big masses of French-Canadians live in the East End of the Island in less favorable socio-economic conditions than the English who mostly dwell in the West End. The upper middle income districts (the suburbs specially) have as much French as English-Canadian residents.

The educational system is based upon religious denomination, with Catholic School Commissions (mainly the Montreal Commission) taking care of the educational needs of almost all the French-Speaking community, and the Protestant School Boards (mainly the Montreal Board), of almost all the English-Speaking community, including most of the non-catholic minorities.

The results of the analyses show that there is a marked difference between the responses of English-Canadians and French-Canadians. Children in French-Speaking schools are more inclined to be satisfied with their CR area, than those in English-speaking schools.

	English	French
Ave. area sq.ft.	750	700
Ave. no. of ST /CR	28.5	27.5
Ave. area/ST sq.ft.	26.5	25.5
ST's,% satisfied	38	50

TABLE 5 Language: Spatial Env. - (Students)

It has been observed already that smaller CR's evoked more satisfaction than larger ones, but this was significant as larger CR's were more densely congested. From this table we see that, although, housing on the average one student less per CR than the English schools, the French CR's provide less area per student, but result in higher satisfaction. It can be hypothesized that French students would feel at ease in smaller areas than would be required by the English students. This could have some bearing with the fact that the French usually live in bigger families and more congested dwellings.

Examining the teachers' responses, we again find that the French are more satisfied with their CR area than their English counterparts.

Teachers, % rating "Adeq."	English	French
CR area	38	64
No. of students/CR	60	66
Storage area	38	47

TABLE 6 Language: Spatial Env. - (Teachers)

One explanation for this difference in the teachers' evaluation of the spatial environment of their CR's would be the fact that at the time of the study activist methods were implemented more in English rather than French schools, and would hence necessitate larger space which was lacking. However, when comparing the activist schools in both groups we find 58% of teachers in French schools approving the CR area, against 34% in English schools.

One should bear in mind that both the students' attitudes, and the teachers' opinions about the adequacy of their CR's vis-à-vis their TM, the PH and the MH of their students, are more positive in French rather than in English schools.

b) The Age of the School Building

Between 1950 and 1968 the educational evolution in Montreal has caused many changes in the planning of school buildings. The conventional corridor type has given way to cluster-type and later to open-plan types, and square CR's or teaching areas have replaced the long-rectangular rooms. Building and finishing materials have remained essentially the same, except that carpets are used nowadays in the open-plan schools. At the same time the total surface of windows have been reduced to a minimum, and is not eliminated altogether only for psychological reasons. These factors are to be borne in mind when the effects of the age of building are considered. This study, however, does not analyse the responses in relation to all those variables.

It was found that newer schools evoke higher student satisfaction than old schools. Teachers' opinions, however, do not seem to be influenced by the novelty of the buildings; sometimes their satisfaction is even higher in the older buildings.

	ave. area sq.ft.	ave. no.of ST/CR	ave. area/ ST of area	ST % satisf	Teachers % rating "adeq."		
					A	B	C
1951-56	755	29	26	37	43	64	39
1957-62	750	26	29	39	75	80	66
1963-68	700	28.5	24.5	49	50	59	39

A: area B:No.of students C:storage
TABLE 7 Age of Building:the Spatial Env.

Many observations can be founded on the foregoing table:

First, CR areas have been considerably reduced during the past 18 years, the largest reduction being effected in the most recent schools,built after 1966. This reduction may reflect the decrease of the birth rate in Montreal in recent years. The average enrollment per CR seems to be uniform in all categories of schools, and is very close to the norm set by the Department of Education, which is 27. This uniform enrollment gives the older schools an advantage over the new ones, providing larger per capita area.

This fact, however, affects only the teachers' opinions as they give more positive responses in the 5 schools (built between 1957-62)where the CR enrollment is the lowest.

Second,the attraction of novelty is very strong for the students, even though new schools have less area per student in the CR's.

The same remarks are true in the case of the students' attitudes and the teachers' opinions about the adequacy of the CR's.

If results in old and new schools based upon language differences are compared, the following is observed:

Older English schools rouse in the students much less satisfaction with the CR area than newer English schools.

Older English schools cause less satisfaction than older French schools.

In some cases older French schools evoke more satisfaction than new French schools.

Finally, new French schools almost always cause higher satisfaction with area than new English schools.

Moreover, student attitudes are more positive in the newer than in the older schools.

Part Two - The Thermal Environment

1. The Environmental Factors

The average dry bulb temperature, as recorded during the visits in the 32 CR's, was 73°F (between 67°F-80°F). The average humidity

was found to be 54.5% (30-65%). The effective temperature resulting would be 69°F (64 - 74°F).

About two thirds of all students were satisfied with the thermal atmosphere of their CRs. The rest were equally divided in asking warmer and cooler temperatures.

No consistent relationship was found between the recorded temperatures and the students' satisfaction with the thermal atmosphere.

However, other very interesting relationships were noticed between the thermal satisfaction and the spatial characteristics of the CRs, as well as between the thermal and the spatial satisfactions.

Therm.Atm. students	ave. area sq.ft.	ave. No.of ST/CR	ave. area/ ST of area	% satisf
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8 CR's w/ max. satisfaction(85%)	700	24.25	28.50	55.00
8 CR's w/ min. satisfaction(47%)	760	30.50	25.25	42.50

TABLE 8 Thermal Env.: Spatial Env.-(Students)

It is obvious that, as in the case of satisfaction with the CR area, students' contentment with the thermal atmosphere is inversely proportional with the CR area and the number of children therein, and directly proportional with the area per capita. It is also directly related with the satisfaction with the area.

The converse of these relationships are found to be true too. For example, when comparing the largest and the smallest CR's we have found that satisfaction with the temperature is higher in the latter than in the former, and so on.

The teachers were given a set of two questions, one concerning the adequacy of the temperature and the other, that of the ventilation in the CR. A little less than two thirds of them, on the average found both factors adequate. It was perceived that "adequate" responses to one of the questions almost inevitably was accompanied with "adequate" responses for the other.

While the teachers' opinions about the adequacy of the CR area do not seem to affect their opinions about the thermal atmosphere, the latter seem to be influenced, however, by the ratings of the number of students per CR.

Also, satisfaction with the CR windows concurs with the satisfaction with the ventilation.

Ventilation Teachers	% rating "adequate"		
	Temp.	No. of ST's	Windows
8 schools w/ max. satisf.(88.5%)	81	71	80
7 schools w/ min. satisf.(26.5)	38	62.5	68.5

TABLE 9 Thermal Env.: Spatial Env. (Teachers)

2. The Attitudes

Students' satisfaction with thermal environment had little bearing on their attitudes. Indeed, there is a certain parallel between the two, but it is too insignificant.

In the teachers' case however, it is different. When they are most satisfied with the temperature, their ratings of the adequacy of the CR vis-à-vis their TM, the PH and the MH of the students run very high, and they decrease when their satisfaction with the temperature decreases. Ventilation, on the other hand, seems to affect the above opinions about the adequacy of the CR with respect to PH.

Thermal Atm. Teachers	% rating "adequate"	
	TM	PH
8 schools w/ max. satisfaction(88.25%)	68	72.5
6 schools w/ min. satisfaction (33%)	53	57

TABLE 10 Attitudes: Thermal Env.-(Teachers)

3. Cultural and Other Factors

Students' responses do not show any significant variations when compared on the basis of either language or the age of the school building.

Teachers, however, show very interesting differences. English teachers are more satisfied, than French teachers, with both the thermal atmosphere and the ventilation. Now, though the CR's in French schools were warmer than in English schools, it was the French who required still warmer temperature.

The age of the building seems to affect teachers' opinions about the thermal atmosphere very slightly and this in favour of older buildings.

Part Three - The Luminous Environment

1. The Environmental Factors

Gross inequalities were found to exist in the intensity of lighting from one CR to another.

Ft-Cndles on		sunny	hazy	cloudy	general
		days	days	days	ave.
Desks	max.	275	255	160	275
	ave.	100	166	97	109
	min.	40	65	50	40
Chalk- Boards	max.	230	130	100	230
	ave.	70	92	45	62.5
	min.	15	30	20	15

TABLE 11 Luminous Environment

We observe that there is a big difference between the maximums on sunny and cloudy days, but the minimums are almost equal (even a little higher on cloudy days). Sunny days gave lower readings than hazy days, which may be explained by the fact that the shades or the curtains were nearly always drawn to keep out the sun. More important, however, are the big ranges found between the maximums and the minimums in the same categories.

However, other factors such as the altitude and the type of luminaires, the amount of window surfaces and their being shaded or not, the CR orientation, etc., may be the cause of the large differences in light intensities. For example, fluorescent fixtures with acrylic cover produced an ave. of 133 ft-cndles on desks and 80 on boards, while louvered ones gave 91.5 and 48 respectively. The light produced by incandescent luminaires was considerably less.

One thing is certain: children have been able to adapt themselves to work in luminous environments of greatly varying characteristics.

Students	% requiring the light		
	more	as it is	less
On the desks	27	49	8
On the boards	20	44	14
In the CR	20	61	9

TABLE 12 Luminous Env.-(students)

This leads us to the next point: are these percentages proportional to the light readings taken in the CR's? Yes indeed! Generally higher satisfactions with the existing conditions are found in CR's with higher light intensities.

However, it is also observed that in 10 CR's with the highest demand for more light in the desks the average reading is 104.5 ft-cndles, while in 8 CR's with the highest demand for less light the reading is 118. This, once more, indicated that there are no optimum limits to lighting conditions, or more correctly, these limits are very far apart, with a very big range of "comfort".

Students' satisfactions with both the luminous environment and the spatial environment show mutual influences. Thus, the higher the

satisfaction with the lights, the higher that of the area and vice versa.

Students	Area % satisfied
9 CR's w/ max. satisfaction w/ lights on desks (72%)	55
8 CR's w/ min. satisfaction w/ lights on desks (27.25%)	43
8 CR's w/ max. satisfaction w/ lights on boards (67.5%)	54
8 CR's w/ min. satisfaction w/ light on boards (24%)	37
9 CR's with max. satisfaction with lights in CR (77.5%)	56.5
8 CR's with min. satisfaction with lights in CR (42.75%)	33

TABLE 13 Luminous Env.: Spatial Env.-(students)

It has also been found that satisfaction with the CR area is higher in CR's with high light intensities than in CR's with low light intensities.

"Lighting" was considered "adequate" by almost all teachers (89%).

A certain direct relationship was found between satisfaction with the lighting and with the windows in the CR.

79% of the teachers rated the CR colours adequate.

2. Attitudes

The most positive responses to the question "do you like being in the CR" have occurred in those CR's with stronger light and with higher satisfaction with that light.

Students	ft-cndles on		% satisf.w/ light		
	desks	brds	on desks	on brds	in CR
9 CR's w/ max. "like" resp's (87%)	117	78	52.5	47	66.25
9 CR's w/ min. "like" resp's (40.75%)	88	50.5	43	40	55

TABLE 14 Attitudes : Lum. Env.-(Students)

Since the vast majority of the teachers are satisfied with the lights in the CR's, their satisfaction does not show any effect on their opinions about the adequacy of the CR's. On the other hand a slight direct influence of the satisfaction with the CR colours is noted to exist.

3. Cultural and Other Factors

Surprisingly enough English students are more satisfied with the lights in the CR's than French students, and this, despite the existence of much higher luminous intensities in French than in English CR's.

Another paradox is that the French are more satisfied with the CR area than the English, but it was previously mentioned that, generally, satisfactions with area and with lighting were interrelated.

Students	ft-cndles on		% satisfied w/ light		
	desks	brds	on desks	on brds	in CR
English	76	34	63	60	71
French	141.5	88.5	55	54	64

TABLE 15 Language: Lum. Env.-(Students)

Colour preferences too have been differentiated according to language. The colour the English like most is light blue, while that of the French is white. The colour disliked most by the two groups is dark red.

Teachers show no differentiation due to ethnicity in their appreciation of the luminous environment.

As to the influence of the age of the school building, a slight difference is recorded in favour of the newer buildings both in the case of students and the teachers.

Part Four - The Aural Environment

1. The Environmental Factors

No qualitative measurements of sound transmission were taken: the only observation that was recorded was about the kind of noises produced inside and outside the CR's. Generally these noises did not disturb the classes, specially the activist groups since children's own voices and movements would cover all other noises.

The students' satisfactions with the aural environment are given below:

% of students replying	what the teachers say	what the others say	TV	Misc
	very well	71	34	29
fairly well	22	43	17	19
not well	4	11	14	11

TABLE 16 Aural Env.-(Students)

We notice that "what the teachers say" is claimed to be the best heard as compared to "what the others say", etc.. This, however, would not mean that the CR's were not suited for hearing the other factors as in Table 16 . The teachers' voices are the most common source of sounds that are listened to, and in most cases children sit such as to concentrate on the teacher's station. It would be natural that in such arrangements one could not hear his fellow classmates as well as his teachers. TV and music on the other hand, may be lacking in many schools, and that can be very good explanation for the low ratings given to these two sound sources.

Some very interesting relationships were found between responses to hearing and responses to other environmental factors. Satisfactions were found to go parallel with respect to "hearing", "area" and "lights"

Students:	Area, % satisf	Lights in the CR, % satisf.
Do you hear what the teachers say		
8 CR's with max. "very well" resp's (90%)	51	75.5
8 CR's with min. "very well" resp's (43.75%)	36.5	48.5

TABLE 17 Aural Env. Lum. Env.: Spatial Env. (Students)

Conversely, in those CR's where children are most satisfied with the area or the lights, they also show higher satisfaction with the acoustics than in the CR's with least satisfactions with the other factors.

Teachers are generally more satisfied with acoustics (80%) and noise reduction (65%) of their CR's. As expected, when they rate highly one, they do the same to the other factor too.

The responses to "acoustics" and to "noise reduction" are influenced by and themselves influenced the responses to "area" and to "no. of students".

Teachers Area	Acoustics % "adequate"	Noise reduction % "adequate"
8 schools w/ max. "adeq" resp's (84.5%)	93	81
8 schools w/ min. "adeq" resp's (19%)	68	47.5

TABLE 18 Aural Env.: Spatial Env. (Teachers)

"Thermal atmosphere" shows a certain direct relationship with "acoustics", while ventilation is inversely proportional to "noise reduction", when teachers satisfactions of all these factors are concerned.

A slight direct relationship is observed between the satisfaction with acoustics or noise reduction and with that of lighting in the CR by the teachers.

2. The Attitudes

Very significantly, as their satisfaction with the acoustics of the CR's increases, students exhibit more positive attitudes, and vice versa.

Students Being in the CR	Hear Teachers % "very well"
9 CR's w/ max. "like" responses (87%)	78.5
9 CR's w/ min. "like" responses (40.75%)	57

TABLE 19 Attitudes: Aural Env.-(Students)

Similarly, when teachers are highly satisfied with the acoustics and noise reduction of their CR's, they also rate the adequacy of their CR's very highly for their TM, the PH and MH of their students.

Teachers	% 'adequate'		
	TA	PH	MH
11 schools w/ max. "adeq." responses to "acoustics" (100%)	71	75	81
8 schools w/ min. "adeq." responses to "acoustics" (44.75%)	52	68.5	69
8 schools w/ max. "adeq." responses to "noise reduction" (95%)	69.5	69.5	81
8 schools w/ min. "adeq." responses to "noise reduction" (31%)	45.5	57	62

TABLE 20 Attitudes: Aural Env.-(Teachers)

3. Cultural and Other Factors

No differences resulting from ethnic-language variations have been found between students' or teachers' responses to the aural environment.

While students are more satisfied in older schools than the new ones, teachers do not show any such variations due to the age of the building with respect to the aural environment.

S u m m a t i o n

1. Environmental Factors

Man's judgement of his physical environment is the result of not only the actual conditions of that environment, but also of his experiences and his background.

Students' satisfaction with the CR area is found to be in inverse proportion with the no. of students in the CR, and in direct proportion with the per capita area. Their appreciation of the luminous environment is similarly directly related to the amount of light in the CR. The shape of the CR too affects the responses to the spatial environment.

Moreover, students' satisfactions with the spatial environment are related to their contentment with the thermal, luminous and aural environments. The responses they give to the "thermal environment" are also in inverse proportion with the no. of students, and in direct proportion with the per capita area. Also, aural and luminous environments evoke parallel satisfactions from the students.

Students are most satisfied with the aural then the thermal environments, less with the luminous and least with the spatial environment .

Teachers' satisfactions with the area, the no. of students and the storage area of the CR's run parallel. Similarly do satisfactions with the thermal atmosphere and ventilation, also those with acoustics and noise reduction.

As in the case of the students, direct relationships have been found between responses to the spatial, thermal, luminous and aural environments. Teachers are most satisfied with the luminous then the aural environments, and least with the spatial environment.

Teachers and students alike feel that lack of space is the biggest inconvenience. Both groups seem to be satisfied with a very wide range of luminous intensities. Generally in the same schools teachers and students have, more or less, same proportion of satisfaction as compared with other schools.

Finally, students are more critical towards their physical environment than their teachers.

2. The Attitudes

A much bigger number of students have replied positively to the question "do you like being in your CR?" than to "if asked to remain longer in school, would you be glad, not mind, or be sad?".

Both attitudes are more positive when students are highly satisfied with various environmental factors, than when they are less so. The strongest effect is that of the aural environment , the weakest that of the thermal.

Teachers are most critical when they judge the adequacy of the CR for their teaching method, less critical vis-à-vis the physical health of the students and least critical for their mental health.

The judgements concerning these three factors are directly interrelated .

The responses to the environmental factors affect and are affected by the opinions about the adequacy of the CR for the three above mentioned purposes. The most influential is the spatial environment, the least the luminous one

3. Cultural and Other Factors

a) Language

There are differences between the English and the French in the appreciation of the CR area . The French students are more satisfied than the English, so are the French teachers, despite their having smaller classrooms.

English teachers find the thermal environment of their CR's more adequate than do the French teachers .

Although they have generally lower light intensities in their CR's the English students are more satisfied with the lights, than the French.

There are also different colour preferences between English and French students. The former like light blue the most while the latter like white .

Both French students and teachers have more positive attitudes than their English counterparts.

b) Opening Year

Students' responses are more positive in the new schools than in the old schools towards the spatial and the luminous environments, and less positive towards the aural environment. The thermal environment makes no difference . Also the student attitudes are more positive in the newer schools.

The age of the school building does not seem to exert such clear influence on the teachers' responses.

C o n c l u s i o n s

The first fact which this thesis puts forward is that environmental factors do not affect us in separate or independent ways, but rather in a combined manner. Our reactions to one factor, say area are indeed unconscious reactions to all the other factors too, like sound light etc..

Moreover, our satisfaction with any factor depends upon our own experiences more than upon that factor itself. Any given area is large or small because we are used to consider it so and our perception of it is coloured by our habits and idiosyncrasies.

Attitudes and environmental satisfaction not only go parallel but directly affect each other so that one has difficulty to tell which one is more decisive.

Other social-cultural factors also exert certain influences on our appreciation of the physical environment. The ethnic origin is one such factor and the differences found between English and French respondents might be attributed to the inherent proxemic variations due to their origin. Another factor affecting responses to the physical environment is the age of the building which creates that environment.

It is desirable that teachers become aware of the 'good' or 'bad' effects the school environment can have on their and students' performance, in order to be able to criticize the physical surroundings and fully describe its characteristics required for their educational purposes.

Finally, this study is just an initial attempt to find a method of measuring user satisfactions in correlation with the existing conditions of the school physical environment. For a thorough evaluation of the latter, however, coordinated studies should be undertaken on a much wider basis and they should include, alongside the architect, specialists in the physiological, psychological, social, educational and other sciences.
