Is Uniformity the Key to Flexibility?
A Post-Occupancy Evaluation of School Buildings

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ABSTRACT
Flexibility and efficiency are two fundamental concepts in the planning of school buildings. This paper is being set to investigate the theoretical and practical links between the two. It seeks to address a number of questions. What constitutes an efficient and flexible school building? What is the optimal range and size of teaching areas to maximise flexibility? In what way can teaching areas be optimised to enhance their efficiency in use? Attempting to address these questions, an in-depth review of the relevant literature will be undertaken to analyse and refine the size of different teaching areas. Later, some operational measures of uniformity of areas and flexibility will be refined and established. This will be applied on selected school buildings to assess their adequacy to accommodate change over time. The main outcome of this study is to provide an insight about the general rules of design for flexibility and efficiency. It also provides a framework for architects, surveyors and facilities managers to improve space efficiency in school buildings. This might enhance the process of space planning and management and improve the operational efficiency of other building types.

INTRODUCTION
It is apparent that the relationship between a building and an organisation is becoming more changeable, and thus necessitating more flexible design layouts to cope with different patterns of change of the functional, managerial, and communication requirements of an organisation. Nowadays the reliance on Information Technology (IT) and knowledge generation/retrieval techniques is becoming the most characteristic feature of many building types (Evans, 1993). This is especially true in school buildings where there is a recurring shift in planning and educational policies, curriculum, learning teaching and assessment methods (Maclure, 1984). Also there is a change in the perceptions and ways in which school buildings can be managed and optimised to provide for maximum efficiency and flexibility in use (Castald, 1982).

During the last twenty years several design notions were proposed, embodying the shift from identifying and designing for specific users’ requirements, towards more general and indeterminate users’ requirements (Maclure, 1984; Owen, 1990; Lovejoy, 1993). These notions are based on an assumption that the spatial organisation of building can be altered to suit any unique requirements of its users at any particular point in time. That is to say to maximise the potential for accommodating change in the organisation and activities housed in a building, without recourse to adaptation, or to maximise adaptation in some building elements to cater for change.

The first implies that a considerable degree of looseness of fit between activities and the building has to be maintained during use to cope with any demand for change. In other words, spaces should not fit closely the requirements of certain types of activities, but
they should be loosely fitted to the majority of activities performed in the whole institution. This may be facilitated by over-provision of spaces and similarity of areas of rooms, and by maximising the independence of building elements, that is permitting some parts of the buildings to be redesigned after initial construction (Llewelyn-Davies, 1973; Heat, 1976). However, this paper will only focus on measuring the impacts of similarity of area on a selected schools, endeavouring to test the hypothesis about its relevance to flexibility in use.

2 THE NOTION OF SIMILARITY OF AREAS

The notion of maximising similarity of area as the key prerequisite for optimising use has been strongly advocated in specific building types, such as hospitals and research building (Cowan, 1963; Weeks, 1969; 1986). By limiting the types of rooms in buildings into a few standard ranges and increasing similarity, it is highly likely that many activities could fit within this range.

The idea of similarity has characterised many traditional school designs; Most of which have embodied the formality of types of activities and size of learning groups resulting in greater repetition and similarity of teaching areas. This is contrary to most of the new school designs, particularly the 70s‘ and the 80s’ schools, which have advocated more variety in terms of type of activities and size of teaching areas. It is not clear yet whether there is any desirable size of space(s) which accommodate the majority of teaching activities as multi-use spaces.

These have been widely used in many traditional older school prototypes. It is usually less constrained where complex and fixed relations are avoided. The present school design experience shows major problems associated with larger areas. It is usually maintained that the design standards in the traditional classroom are mostly within a range of 1.5-2.0 sq m per pupil, which seems to be inadequate for the requirements of multi-use space, and which might suggest a higher area provision.

Examination of the range and categories of areas in school buildings will be beneficial in assessing their extent of similarity.

However, there is no commonly agreed on criterion for categorising teaching areas which has yet been established. Earlier attempts to quantify teaching areas have literally relied on the type of activities and their particular requirements as a basis for categorisation (DES, 1968, 1973). These are subjective and are not fully reliable, since they were based on the designs of some specific school buildings, i.e. newly built schools, rather than considering also the large stock of traditional school buildings built during the last few decades. The search for most up-to-date studies pointed to the 1980 survey of school buildings which was carried out by the DES & Welsh Office. In this survey, it was found that different teaching areas, of the surveyed schools, could be clustered into a few main distinctive types, based on the criteria of type of activities and their services requirements:

i) General teaching rooms up to 450 sq ft (41.8 m2)
ii) General and light-practical rooms (i.e. science, music, commerce, art and crafts) over 450 sq ft, but less than 600 sq ft (55.74 m2).
iii) Light-practical rooms over 600 sq ft but less than 750 sq ft (69.7 m2).
iv) Heavy-practical rooms (i.e. workshops, libraries and home-economics), all room size.
v) Large spaces (i.e. P.E. spaces, drama studios and halls).
It appears that teaching areas can be categorised into three distinctive ranges; less than 41.8 m², 41.8-69.7 m² and more than 69.70 m².

These are meaningful yardsticks to follow in school buildings. Practically, different school design layouts may vary in the pattern of distribution of their teaching areas around these ranges. Recent research on Craft, Design and Technology (CDT) accommodation revealed that a fourth category is required which exceeds the 750 sq ft 69.72 sq m but less than 1050 sq ft (96.6 m²) (DES, 1985).

Furthermore, past design experience (DES, 1973) shows that teaching areas in the new comprehensive schools i.e. less than 150 sq ft (13.8 sq m), are adequate for the new patterns of individualised learning, small work and seminar activities. It is possible to arrive at a more accurate interval scale for categorisation of teaching areas. It is highly probable that such a scale may cover a wider range of variations in teaching areas in both new and traditional schools and would be beneficial for the empirical study.

3 OPERATIONAL MEASURES OF SIMILARITY OF AREAS

Similarity of areas of rooms describes the extent of repetition of areas in the design layout which can be measured according to the general and specific characteristics of rooms. The general characteristics concern the distribution of areas in the design, their shape and proportion which can be indicated descriptively. The description aims to provide a preliminary assessment of different school designs by identifying the Mean, the Standard deviation (Sdev) and the Range of area. Both the length and the width of rooms will be recorded on an interval scale and their shapes can be obtained. The shape and proportion of rooms could be categorised according to four types; 1, 1-1.50, 1.51-2.00, and 2.01-4.00 respectively.

On the other hand, the specific characteristics could be measured in relation to similarity of all rooms contained in the layout. This could be indicated by adopting some statistical measures of dispersion expressed by a coefficient of variability (CoefVar) (Leedy, 1985:195-196). This incorporates both the Sdev (s) of areas and the Range ® of areas as a ratio to the Mean (x) of indicators one and two, expressed by the formula:

$$\text{CoefVar-A} = \frac{(s)}{(x)}$$

On the other hand, the specific characteristics could be measured in relation to similarity of all rooms contained in the layout. This could be indicated by adopting some statistical measures of dispersion expressed by a coefficient of variability (CoefVar) (Leedy, 1985:195-196). This incorporates both the Sdev (s) of areas and the Range ® of areas as a ratio to the Mean (x) of indicators one and two, expressed by the formula:

$$\text{CoefVar-B} = \frac{\delta}{(x)}$$

The higher the scores, the higher the degree of variety of areas and the lower is the extent of similarity of area. However, if the scores concerning the above indicator are the same, then some alternative indicators might be required by considering the main area types and the pattern of distribution. The criteria for categorisation has already been refined and hence an interval scale of five points can be adopted as the most appropriate yardstick for categorisation as follows:

Less than 13.8 sq m,
13.9-41.4 sq m,
41.5-69.7 sq m,
69.8-97.6 sq m and
More 97.6 sq m.
From the above and for any given layout, it becomes possible to identify the number and percentages of area per each type. The fewer the number of area types, the more similar the room will be and the higher is the extent of similarity. Also, the higher the teaching areas are clustered within one type, the higher the percentage score and the higher is the extent of similarity of area - indicator three.

When there is an equal number of rooms (X) in the design layouts, and different number of room types (Y), the extent of similarity can be computed as a ratio of rooms’ minimisation indicated in the formula:

\[
\text{Extent of minimisation of rooms types} = \frac{X}{Y}
\]

\[
X= \text{Number of rooms in the layout}
\]

\[
Y= \text{Number of room types}
\]

It is highly unlikely that the number of rooms contained in different layouts are is identical and hence, the ratio of minimisation should be modified proportionately to the number of rooms in each layout as follows:

\[
\text{Extent of minimisation of rooms} = 100 \left( \frac{X-Y}{XY-Y} \right)
\]

This ratio can be considered as indicator four of similarity of areas; the higher the score of extent of minimisation, the higher the extent of similarity of areas and vice versa. Similarity can also be measured within groups of rooms. By adopting the same statistical measures of dispersion around their mean, the extent of similarity of areas can be arrived at-indicators five and six.

4 THE NOTION OF FLEXIBILITY

Several definitions of flexibility have been proposed in the past, which differ according to the type of building and the emphasis that has been given in each study. This is particularly true when certain attributes or parts of these building were investigated.

The controversy in describing flexibility in buildings could be envisaged through a diversity of terminologies, such as flexibility, adaptability, variability, expansion, versatility, convertibility and so on (Aylward, et al., 1974, 1979). Most of these definitions have described flexibility as the potential to accommodate change, indicating why flexibility is needed, and how it was advocated in design.

Fawcett (1978) considered flexibility to take into account the uncertainty and changeability of the relationship between activities and space. He defined flexibility as "the probability that a building will not become obsolete, and it is a subjective probability based on state of knowledge about the activities that might occur in the building.”

Oddie (1974:115) distinguished between three facets of flexibility in school buildings; the "modular coarseness" or "refinement" which responds to the diversity of accommodating activities, "adaptability", which refers to capacity for physical alteration to meet changing circumstances and "versatility" or "polyvalence." He defined versatility as "the quality of building as planned and fitted out which allows for variation in patterns of activities, without the need for physical adaptation." He added that the greater the versatility, the longer the adaptation can be postponed (Oddie, 1974:114-115).

From the above, it seems that flexibility is a multi-faceted concept and that there is a diversity of definitions which describe these facets, which are mostly concerned with the accommodation of change or adaptation or both. In some definitions flexibility was distinguished from adaptability, and both were considered to be extremes of one.
The investigation will be limited to only two types of teaching departments; Humanities/Languages departments and CDT/Science departments. Three main characteristics will be assessed:

i) The Type of Activities Performed.

Teaching activities can be categorised according to four main types; theoretical, light-practical, heavy-practical and movement and physical education (P.E.) activities. Although this is very useful in indicating change in the level of services of teaching spaces, it would be of lower validity in transforming any detailed information about the nature of activities. An alternative categorisation can be proposed depending on broad types of activities, such as general teaching, tutorial, discussion and seminar, experimenting, project work activities and so on. The above includes an implicit assumption about size of learning groups performed. Nonetheless, the choice of learning group size is an arbitrary measure, which can be varied to suit specific users' requirements. By measuring change in types and number of activities, the extent of change in the characteristics of activities could be obtained for each space, this could then be averaged for all teaching spaces.

ii) The Size and Learning Groups organisation

It is very important to identify whether any change in the size of the learning groups has occurred. Measuring the mismatch in the size of learning groups—comparing the actual size with those originally proposed by the timetable, might provide an insight about any inadequacy, or inappropriateness of the size of areas to their users.

iii) The Time Spent on Performing Activities

This indicator measures the amount of change in the average period of time spent on performing each activity, or sets of activities, and the average number of daily and weekly periods of time-tabled activities. Some complementary information regarding change in teaching methods, curriculum and teaching aids is needed in relation change in the level of services of teaching activities. It is anticipated that questionnaire will be adopted as the main data collection technique. Despite the usefulness of the questionnaire in some situations, detailed observation of an exploratory nature would be a much more adaptable method.

This enables a cross-checking of the layouts of the teaching departments to be investigated and observation of the users at work to take place, discussing with them the nature of their activities and change in their requirements. Such informal discussions with users may highlight several points about users' problems and areas of dissatisfaction.

4.2 Indicators of Adaptation

Measuring adaptation in buildings is very difficult to achieve, though it can be arrived at by indicating all expenditures spent on conversion and adaptation. This depends on the availability of records about cost for each particular part of the building. It would appear that even if these records are available, they have often included the total adaptation cost of school building as a whole, rather than the departments, and hence, fall short in measuring adaptation.

Alternative attempt has been made to identify relevant indicators of adaptation by:
1. Examination of the available records and drawings concerning school buildings and accounts of past situations, so a comparison could be made on a chronological sequence.

2. Detailed observations and description of school buildings, which aimed to quantify the type and the amount of adaptation undergone during a fixed period of time.

This will be supported by questionnaire to gather information about the status quo of these buildings in use, enabling many changes in building elements which have not been annotated on the plans to be checked.

Two main indicators can be proposed:

Firstly, adaptation in the area and size of teaching spaces indicating the pattern of change in the spatial organisation of teaching departments as a whole.

Secondly, internal adaptation in teaching space in relation to the technical/environmental services and facilities within the teaching spaces.

Adaptation in areas can be made by addition of adjacent teaching spaces, contraction, subdivision and addition of completely new teaching spaces. The overall extent of adaptation in any particular department could be measured in terms of the average percentage scores for each space. However, the data about adaptation could be manipulated to enable a hypothetical model of cost of adaptation to be developed.

5 THE EMPIRICAL STUDY

An in-depth analysis of ten teaching departments chosen from a selected school sample has been carried out. It proceeds with descriptive comparison between the architectural drawings already prepared and followed by measuring the extent of incorporation of similarity of area according to the average scores of all indicators.

5.1 The Design Approaches and the Design Characteristics

It is obvious that school design characteristics are highly influenced by the design concept embodying the predominant educational thoughts and teaching methods, at the time when they were designed.

During the last two decades many schools were designed to reflect the changes in the educational methods which were based on diversity and integration of educational contents and processes. On the contrary most of the pre-war and post-war traditional schools were designed to be highly determinant, or tailor-made to predetermined users' requirements, where no consideration of future demand for change was made.

Nonetheless, preliminary examination of these schools indicate a considerable growth so that several changes have occurred during the last twenty years. Ten teaching departments belonging to both new and traditional schools were examined as follows:

(A) Dept. of CDT (Culverhay Comp. Sch.) CulverhayCDT
(B) Dept. of CDT (Hardenhuish Comp. sch.) : HardinCDT
(C) Dept. of CDT and Science (Syson Upper sch.) : SysonCDT/SC
(D) Dept. of CDT and Science (Henry Fanshawe sch.) : HenryCDT/SC
(E) Dept. of CDT (Oldfield Girls Comp. sch.) : OldfieldCDT
(F) Dept. of Humanities/Languages (Culverhay Comp. Sch.): CulverhayHUMAN
6 SIMILARITY OF AREAS OF ROOMS
The extent of similarity of areas of rooms can be measured according to the general and specific characteristics of similarity of areas as follows:

6.1 Similarity of Areas- General Characteristics
The types of areas of rooms encompassed in both new and the traditional teaching departments, have been analysed descriptively as follows:

i) Dimensions and Proportions of Rooms:
Comparison of departments' layouts, according to the proportions of rooms, indicated minor variations where most of the teaching areas fall in the second category i.e. (1:1.5) ratio. The highest percentages of rooms within this category were identified in traditional departments F, A, G, J and B respectively, compared to lower percentages in the new departments C, H, I, D and E as illustrated in table (1). This might explain the variations in shape of rooms, indicated by a regular rectangular classroom for formal teaching, as opposed to those in the new departments, which were characterised by L-shape and square-shaped rooms to accommodate a variety of arrangements and informal teaching.

6.2 Similarity of Areas- Specific Characteristics of Areas

i) All rooms in the teaching department
Similarity of areas of rooms, can be measured by incorporating the scores of the Mean, Sd and the Range of all areas in each department, and later by applying the statistical measure of dispersion- indicators one and two. Comparison of department layouts according to their scores for the above indicators revealed wider variations, as shown in table 1. The lowest scores, indicating more similarity, were identified in traditional departments A and G compared to the highest scores, indicating less similarity, in departments I and J. Ranking of departments according to their scores of the above indicators was made according to a five point scale of categorisation which extends from very high, to very low (3). Some variations in their extent of similarity of rooms were identified as shown in figure 1. Despite these variations, scores of departments regarding the above indicators are not conclusive, due to a wide variation in the range of areas contained in each layout, resulting in a wider scope of interpretation.

From the comparison, it was found that most teaching areas in traditional layouts fall within only three types of areas, compared to five types identified in most of the new design layouts. Highest percentages of rooms clustered within one area type, i.e. 41.5-69.6 sq. m., were identified in departments G, H and A at 68.18%, 66.67% and 57% respectively, compared to 47.06% in department F, where most areas fall within a range of 13.9-41.5 sq. m.

All the above departments fall within the traditional group, but the only exception was found in department B, where a low percentage of 35.0% was identified.
On the contrary, most of the teaching areas in the new departments were distributed almost equally on all area types, which might interpret the higher variety of size of areas. Amongst these types, a highest percentage of 38.7% was identified in department D which is far less than the percentages in the traditional departments. Ranking order of teaching departments according to their scores for this indicator is shown in figure 1.

Regarding indicator four, it was found that scores for departments are highly consistent with those of the previous indicators. Highest scores were identified in departments G, B, F, A and H compared to the lowest percentages’ scores in departments E, I and D, as shown in table 2 and figure 1.

ii) Grouping of rooms in the teaching departments

From the comparison, slight differences in the ranking scores of departments with respect to the above indicators were identified as shown in table 2. This could be attributed, mainly, to the variation in the adopted measuring procedures and the insignificant variations in areas within each type of areas. In spite of that, ranking of teaching departments still corresponds to the previous four indicators.

It was shown that departments A, F, G, H have revealed relatively the same ranking order for all the six indicators of similarity. This is compared to departments E and B, which revealed major differences in their ranking order. Meanwhile, the remaining departments C, J and F indicate slight variations in their ranking order for all the indicators examined as shown in figure 1.

7 DISCUSSION

When similarity of areas was examined in terms of the highest percentage of rooms-indicator three, it was found that most of the teaching areas in the traditional departments were clustered within a range of 41.5-69.0 sq m, as revealed in departments (G), (A), (H) and (F), at a percentage range of 68%-47% except for department (B) which revealed a slightly lower percentage at 35% as shown in table (1). Similarly, higher scores regarding room minimization-indicator four, were identified in the same traditional departments within a range of 27%-30%, compared to the lower scores at a range of 16%-21%, in the new departments as shown in table 2.

It can be said that greater variety of areas was distinguished in most of the new departments, which were distributed on a broad range of area types as shown in departments (D), (E), (C) and (J).

Significant variations in the scores of departments were identified, when similarity was measured within groups of areas. Though slightly lower scores were revealed in the traditional departments (A), (F), (B), (H) and (G), their ranking order does not fully correspond to their ranking regarding all areas in the departments.

Nonetheless, as grouping of areas is highly determined by the criteria of categorisation which is not fully objective, these measures can be considered as supportive, rather than crucial in determining the relationship, compared to those which emerged when similarity was measured with respect to all areas.

The empirical study demonstrates that traditional layouts are more uniform and incorporate more similarity as opposed to the new design layouts. Higher variations in the extent of similarity were revealed regarding the third and fourth indicators, in specific, compared to less variation with respect to the detailed indicators of similarity i.e. groups of rooms.
Considerable variations in the extent of organisational change were identified between teaching departments. Higher average scores were identified at 75.6% in department (A) compared to 22.5% in department (C). Ranking of departments according to the extent of organisational change is shown in figure. From the above, it becomes possible to arrive at an overall assessment of the extent of flexibility, by considering the scores of departments concerning the three specific indicators of flexibility.

9 FINDINGS

It was postulated that flexibility can be measured in terms of amount of change, in relation to the amount and extent of adaptation that has been made. If these departments are similar in the amount of change and adaptation, then they are similar in their flexibility. If they are similar in the amount of change only, then only those with the least adaptation are the most flexible. Whereas, if these are similar in the extent of adaptation only, then those with the largest amount of change are the most flexible. Otherwise, when the departments varied in both change and adaptation, then their flexibility will be assessed by considering the amount of difference between them in change, in relation to adaptation. Four main scenarios for assessment can be refined as follows:

i) Lower extent of adaptation with higher extent of change

In this case, the teaching department can be considered very flexible, where a higher extent of change can be accommodated with less adaptation. However, buildings undergoing a higher amount of change could also demand a higher amount of adaptation, which can not be carried out owing to the financial constraints. One should distinguish whether there is no need for such adaptation, or whether such adaptation is not financially possible. Some subjective measures might be needed by incorporating users' responses as conclusive evidence to indicate flexibility.

ii) Higher extent of adaptation with lower extent of change

In this case, a greater amount of adaptation has been made to cater for a relatively small amount of organisational change, and hence the department will be considered highly inflexible.

iii) Higher extent of adaptation with higher extent of change:

When there is a much higher demand for change activity requirements this might result in a considerable change in the level of services. The departments can be considered highly flexible, if users perceive change and adaptation to be easily achieved, and vice versa if higher material and labour cost is required. Attempting to assess flexibility, it seems that cost of adaptation is the most crucial and determinate aspect, and thus, if a higher amount change is made related to higher amount of adaptation with lower cost, then teaching departments can be assessed as more flexible compared to others.

iv) Lower extent of adaptation with lower extent of change:

This case may postulate less demand for change in the organisation and activities housed in the building. It could be attributed, either to a lower demand for change, or to lack of resources necessary to achieve change or adaptation. In both cases,
the department may be considered to be in an equilibrium state, and hence, there is no way to interpret the extent of flexibility unless, other diagnostic measures of performance, such as functional efficiency, maintenance and operational cost, are deployed. Also, some other subjective measures, such as user's perception of change, can be adopted for the purpose of assessment.

On the basis of the above, it becomes clear that assessing flexibility in use is highly subject to possible variations in the interpretation of the results arrived at from the analysis and measurements, indicating the complexity of investigating this phenomenon. Such complexity always exists in such research seeking an answer about which building is more flexible than another.

The comparison will consider the extent of change as the basis for making judgement, and hence, if departments are relatively similar in the amount of change i.e. within the same ranking level of change, those with the least adaptation will be judged as the most flexible. The finding of the overall assessment of flexibility is illustrated in table (3), except in department C which has indicated the least amount of change and adaptation amongst all the ten departments, it is very difficult indeed to make any judgement about its flexibility. It seems that this department is in an equilibrium state, where neither any significant demand for change, nor for adaptation was identified. Two distinctive differences can be envisaged; firstly, that this department is part of a large compact plan, and secondly, that the teaching areas contained therein, are larger than those in the other departments. This may give some clues about its flexibility and suitability to cater for the changing requirements of organisation and activities housed in it, at least, for the present time.

10 CONCLUSIONS
This paper has established some sort of criteria for categorising teaching areas according to their similarity. It managed to isolate and develop some operational definitions and measures of similarity. It demonstrates the validity of the main research hypotheses that the extent of incorporation of certain design variables is more conducive to flexibility, in relation to both ways of accommodation of change. In other words, the greater the extent of similarity of areas the higher the extent of flexibility in use, supporting the past claims which pointed to maximising similarity rather than variety of areas, as the main prerequisite for promoting flexibility. It becomes clear that the past ideas on designing for similarity are, to a higher extent, valid in relation to flexibility. The study has found the size of areas to be positively related to flexibility; as the range of 42-69 m2 could be seen to fit most of the teaching activities. This, supports the past claims about multi-use space, that there is a relationship between size and adaptive capacity.

This principle contradicts the validity of adopting anthropometric data based on minimal functional requirements of activities, as a basis for establishing spatial standards, as in the "close-fit" design proposals.

The study, however, demonstrates that these generally stated variables in the literature could actually be quantified and measured in such a way that an objective assessment and sensitive comparison can be made between different school designs, i.e. both in the new and traditional schools.

Practically, these measures are important for architects, surveyors and facilities managers to assess different design proposals towards maximising space flexibility and increasing
efficiency. These provide a higher degree of reliability in indicating the differences between alternative school layouts, rather than relying on a subjective assessment based on intuition and personal observation and judgements.

This might back up and justify what the architect and the facilities manager inherent analysis which comes about through training and appears as intuitive to be more quantifiable. In other words, these measures are very beneficial in creating a framework for professionals in the field to ensure that their conjectures about the potential for flexibility might be enhanced during the completion and post-occupancy stage. Thus, scores of the proposed layouts, with respect to similarity of areas, might suggest further recyclical modifications about the probability of flexibility in the resultant school buildings. Nonetheless, these measures should not be taken for granted, since the incorporation of this variable is not the sole aspect influencing flexibility and greater attention should be given to other design variables which were put forward. In assisting professionals in taking maximum advantage of this framework, a further possibility for testing the relationship between other design variables and flexibility could be facilitated with a higher degree of objectivity.

11 FOOTNOTES

1. The core argument supporting variety of areas is that even if an optimum fit of activities to space is made at present, it is highly likely that a misfit between activities and space may appear due to the demand for new activities, or due to change in their spatial requirements which could be catered for by greater variety.

2. Cowan (1963) thought that there is an interesting optimum distribution of room sizes in hospitals, loosely fitted to accommodate different types of activities. He pointed to the importance of standardising rooms, within a certain range, which are of compromised size (100-250 sq ft), arguing that such a distribution may enhance freedom of location of activities within changing patterns of relationships, and hence increasing in use flexibility.

3. The ranking order was developed depending on the statistical description of these scores in terms of the mean and the highest and the lowest scores. From the ranking of teaching departments,

12 REFERENCES:


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<table>
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<th>Teaching Departments</th>
<th>No. of Rooms</th>
<th>% of Ratio of Rooms</th>
<th>Mean Areas (%</th>
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<th>Max Area m²</th>
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<th>Indicator Two</th>
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<td>58%</td>
<td>41.2</td>
<td>7</td>
<td>136</td>
<td>0.85</td>
<td>3.13</td>
</tr>
</tbody>
</table>
Table 2: Similarity of Areas of Rooms (indicators three, four, five and six)

<table>
<thead>
<tr>
<th>Teaching Departments</th>
<th>No. of Room X</th>
<th>No of Area Types Y</th>
<th>Indicator Three Highest % of Rooms</th>
<th>Indicator Four Minimisation of room types</th>
<th>Indicator Five</th>
<th>Indicator Six</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-Culverhay CDT</td>
<td>14</td>
<td>3</td>
<td>57%</td>
<td>28%</td>
<td>0.11</td>
<td>0.12</td>
</tr>
<tr>
<td>B-Hardinhuish CDT</td>
<td>20</td>
<td>5</td>
<td>35%</td>
<td>30%</td>
<td>0.13</td>
<td>0.27</td>
</tr>
<tr>
<td>C-Syston CDT/SC</td>
<td>21</td>
<td>5</td>
<td>33%</td>
<td>21%</td>
<td>0.15</td>
<td>0.34</td>
</tr>
<tr>
<td>D-Henry CDT/SC</td>
<td>31</td>
<td>5</td>
<td>39%</td>
<td>17%</td>
<td>0.19</td>
<td>0.47</td>
</tr>
<tr>
<td>E-Oldfield CDT</td>
<td>25</td>
<td>5</td>
<td>36%</td>
<td>16%</td>
<td>0.17</td>
<td>0.29</td>
</tr>
<tr>
<td>F-Culverhay HUM</td>
<td>17</td>
<td>3</td>
<td>47%</td>
<td>29%</td>
<td>0.12</td>
<td>0.26</td>
</tr>
<tr>
<td>G-Sheldon HUM</td>
<td>22</td>
<td>3</td>
<td>68%</td>
<td>30%</td>
<td>0.15</td>
<td>0.32</td>
</tr>
<tr>
<td>H-Kingdown TEAC</td>
<td>12</td>
<td>3</td>
<td>67%</td>
<td>27%</td>
<td>0.17</td>
<td>0.28</td>
</tr>
<tr>
<td>I-France ENG/ART</td>
<td>21</td>
<td>5</td>
<td>33%</td>
<td>16%</td>
<td>0.26</td>
<td>0.60</td>
</tr>
<tr>
<td>J-Kingdown SIXTH</td>
<td>12</td>
<td>4</td>
<td>33%</td>
<td>18%</td>
<td>0.16</td>
<td>0.35</td>
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</tbody>
</table>
Table 3: Overall Assessment of Flexibility of Ten Teaching Departments

<table>
<thead>
<tr>
<th>Teaching Departments</th>
<th>Spatial Adaptation</th>
<th>Internal Adaptation</th>
<th>Organisational Change</th>
<th>Overall Flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-Culverhay CDT</td>
<td>Very Low</td>
<td>Medium</td>
<td>Very High</td>
<td>Very High</td>
</tr>
<tr>
<td>B-Hardinhaish CDT</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>C-Syston CDT/SC</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
<td>Very Low</td>
</tr>
<tr>
<td>D-Henry CDT/SC</td>
<td>Very High</td>
<td>Medium</td>
<td>Very Low</td>
<td>Low</td>
</tr>
<tr>
<td>E-Oldfield CDT</td>
<td>High</td>
<td>Very High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>F-Culverhay HUM</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>G-Sheldon HUM</td>
<td>Very Low</td>
<td>Medium</td>
<td>Very High</td>
<td>Very High</td>
</tr>
<tr>
<td>H-Kingdown TEAC</td>
<td>Very Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>I-France ENG/ART</td>
<td>Very High</td>
<td>Very High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>J-Kingdown SIXTH</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>