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**The Environmental Factor
in the Teaching of
Architectural Technology**

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Climatic and environmental conditions, in general, differ from place to place. This differentiation, insofar as it is reflected in the characteristics of the interaction between buildings and the parameters shaping the above conditions, has to be taken into consideration in the process of building design and construction, in any part of the globe.

Ignorance of this fact, even though as long ago as the 1970's it was pinpointed as a problem with serious consequences in the energy and environmental behaviour of buildings, continues to exist, partly as an effect of globalisation in building construction (construction and insulation materials, products and techniques are created and used indiscriminately around the world). It is also perpetuated and, indeed, to some extent intensified by the incorporation of similarly indiscriminate approaches in the teaching of construction to currently active or future building engineers (e.g. use of materials and construction techniques unsuitable for, or even harmful to, the buildings in the place where the students practise, or will practise, their professions).

This paper examines the problem of the incautious ways in which the environmental factor is incorporated into building design and construction, particularly in regard to the teaching of Architectural Technology. It pinpoints some of the reasons why this problem continues to persist and, wherever applicable, suggests ways of addressing them.

Introduction

The teaching of Architectural Technology (A.T.) ought to take into account and present the factors that determine the environmental and energy behaviour of buildings. These factors shape design and construction choices and aim at utilising favourable environmental influences and cancelling out negative ones. In order to be effective in achieving this goal they have to be compatible with the environmental and particularly the climatic conditions of the place in which the relevant building is located. If a building designed to be built in a particular part of the globe were constructed in an area where different climatic conditions prevail, it would generally retain its functionality but would soon prove more vulnerable to environmental influences and problematic in terms of its role in securing comfortable conditions for its occupants. Apart from the climate of the wider surrounding area, an important factor in the formation of the web of interaction between a building and its environment is the microclimate of the area in which the building is situated, particularly those characteristics shaped by the parameters of temperature, humidity, sunlight and wind. An important role is also played by other factors, the most prominent of which are those which influence building construction methods in the local area, such as the availability of building materials, the relevant legislation, cost, traditions and so on. The fact that many of the factors mentioned above have a clear geographical connection and also change slowly over the course of time results in buildings of the same type displaying many common characteristics over a wide geographical area. A typical example of this is residential buildings. For example, the buildings in a London suburb resemble each other a great deal but differ considerably from the buildings in a small African town.

Findings like these were much more obvious several decades ago before a global tendency towards uniformity in the structure and appearance of buildings emerged. Although this particular tendency reflects a form of globalisation in the building construction sector (similar designs, similar materials, similar construction methods), it cannot easily be seen as representing progress in the art of construction.

This paper examines the importance of the above observations in A.T. courses. In particular, it studies the importance of the environmental factor and its incorporation in the teaching of these courses. It examines how this is achieved in practice and what the consequences might be if it were ignored. In addition, on the basis of the findings to which it is led, it suggests, wherever applicable, measures and practices that might improve the way in which the environmental factor is incorporated into these courses and make its incorporation more beneficial.

The environmental factor in the teaching of A.T.

The environmental factor is incorporated into the teaching of A.T. mainly through the following methods:

- a) The presentation and explanation of climatic and, more generally, environmental factors and the mechanisms via which these interact with particular buildings. Examples of such factors are temperature, sunlight, wind, humidity, noise, air quality etc.
- b) The presentation and explanation of the choices through which these interactions are dealt with, both at the design and construction level.
- c) The presentation of examples of completed architectural works in which these interactions are successfully dealt with.

According to current practice, the knowledge provided by these methods is assimilated through exercises and assignments. These assignments might focus exclusively on the management of specific environmental influences or they might concern other topics which, with the addition of relevant parameters, are enriched with the environmental dimension.

In the above methods for incorporating the environmental factor into the teaching of Architectural Technology there is scope for making mistakes. These mistakes concern the misunderstandings that might be produced in the minds of the learners regarding the context in which the material they are taught might be applied. To be specific, with respective reference to the methods mentioned above:

- a) In the presentation of environmental factors some might be included which do not concern or are of no particular relevance to the area in which the learners are practising, or will practise, their profession. Conversely, certain factors might be ignored that are of greater importance to the same areas. One example is seismicity. There are some parts of the globe where earthquakes are unknown and so have no bearing on the design and construction of buildings. In seismogenic areas, on the other hand, antiseismicity ought to be a basic parameter in building design and construction.

This group may also include factors which vary considerably from one area to another, in terms of the intensity and consequences of their effects. One example is solar radiation. In areas at high latitudes the sun is always welcome and architects focus their efforts on utilising the solar radiation that falls on the surfaces of buildings. In contrast, in areas at low latitudes (e.g. the tropics) the sun often causes discomfort and in these cases solar protection measures are taken.

- b) The solutions, which are proposed for managing specific environmental factors, may be inappropriate for the area they are recommended for. One example is natural cooling and the measures it includes to utilise the wind. The practices, in both design and construction terms, that favour natural cooling in the interiors of buildings are welcome in hot climates. The same practices, however, are inconceivable in cold climates.
- c) The examples of architectural works that are presented may, in environmental terms, be inappropriate for the area under consideration. One example is a building with light insulation and large openings presented in an A.T. lesson for an area in a cold climate (even if the issue in connection with which the particular example is presented is irrelevant to thermal protection, there is a danger that it might, even unconsciously, cause misunderstanding). In this respect, it would be advisable to stress that distinguished architectural works, and by extension those most often encountered in books and journals on architecture, have gained such a reputation because, amongst other things, they have successfully adapted to the character of the local environment.

Similar problems could also be caused by exercises and assignments designed to consolidate teaching that are inappropriate in environmental terms. In this respect, when setting a particular task simply failing to provide environmental data for the area on which the exercise or assignment is supposed to focus can cause the mistaken impression that it is not important. Apart from this, it is also wrong to provide environmental data that is inappropriate for the particular area of reference, e.g. temperature bands, humidity rates, wind intensities and directions, and direct solar radiation rates and directions. An extreme but typical example is an assignment that was given to students at a School of Architecture in Australia in which they were asked to make provision for solar protection on the south faces of the buildings. This assignment was evidently an unwisely chosen copy of a similar assignment at a School of Architecture in the northern hemisphere. And if this is an extreme example, it might be accepted that even small changes in the character of the insulation layers in a building (e.g. their thickness) resulting from erroneous data might involve extensive changes to the way in which it is constructed.

Such mistakes as those described above, which might lead to misunderstandings about the role of the environmental factor in building design and construction, do not occur only in the teaching of A.T. courses. They may clearly also occur in other architectural courses. Indeed, the problem with the other courses is that they unconsciously introduce messages of this kind into the minds of the learners. For example, if the buildings of famous architects that are quite rightly presented and promoted in architectural courses do not suit the conditions prevailing in the area where the learners will eventually practise their profession, it is possible, if this fact goes unremarked, that erroneous models might be produced.

The cases set out above, together with the negative examples of their practical consequences, provide a taste of the problems that might be caused by incorporating the environmental factor into the teaching of A.T. courses in an incautious or inadequate manner. The worst thing is that the consequences of such omissions and errors merely add to a whole set of negative factors already burdened by the symptoms of a globalising tendency in building construction. This tendency, which first began to appear in the early 1970's, is manifested in the application of similar approaches and practices in building design and construction, and even in the use of the same building materials and components, regardless of the conditions prevailing in the area where a particular building is being constructed. As a result, buildings that are constructed in different parts of the world and different climatic zones look almost the same. Such similarities, which represent different manifestations of the same globalising tendency in building construction, may also be observed in relevant items in books, journals, prospectuses and even specimens of ready-made building components in computer programs that are circulated and used indiscriminately all over the world. This tendency, apart from producing problematic buildings, has other, wider negative effects as well. For example, as happens with other commodities, it creates the impression that building materials and components from other countries with a long tradition and well-developed industry in that field are better. There is no guarantee that a window manufactured in Germany will be just as suitable in a Middle Eastern country, even if its specifications cover the conditions there.

Suggestions regarding ways of incorporating the environmental factor into the teaching of A.T.

The problems presented in the previous paragraph indicate the care with which environmental components ought to be treated in the teaching of A.T. courses.

Dealing with these problems by restricting the teaching matter to the narrowly perceived interests of the learners is not right either from a practical or a didactic point of view. Moreover, these interests are generally not known. Nowadays, with the wide exchanges of teachers and students that take place, it is highly likely that A.T. classes will contain individuals from different parts of the globe. Also, the high mobility of professionals (in this case architects) that also characterises our age does not permit us to predict where exactly each learner will eventually practise his profession. It is quite likely that many students attend A.T. courses at institutions situated in areas where the prevailing environmental conditions will differ from those in the place they eventually settle in. Similarly, students studying architecture in a particular location may well find themselves practising their profession in an area where different environmental conditions prevail.

Consequently, the problem of how to do a proper job of incorporating the environmental factor into the teaching of A.T. appears to be more complex. One way of dealing with it might be to make a balanced presentation of the relevant subject matter so that it covers the whole range of environmental influences on buildings while also highlighting those elements that are relevant to a particular area of reference. The latter could be the area in which the course is taking place. This is an area whose environmental conditions are familiar to both teachers and students alike and as such

provides a common basis of understanding. In addition, logically and statistically, it is more likely to fall within the area in which the learners will eventually practise their profession. Taking this idea further, another suggestion is that the teaching of A.T. courses should be of a more general nature in terms of its theoretical content while, as far as the practical side is concerned, it should be geared more towards applications that are suitable for the local area. For example, the completed architectural works that are presented and discussed in these courses should be chosen mainly from the local area and display characteristics that reflect interaction with its own particular environmental features. Also, the assignments that are given to consolidate the knowledge taught on the course should refer to the same local area: in other words, the environmental data that is supplied should relate to that particular area. In this particular case, a good practice would be to ask the students to gather the data they need to use in the exercise or assignment themselves.

The suggestions outlined above contain many gaps, of course. However, insofar as they might help the environmental factor to be incorporated into the teaching of A.T. courses in a better, more systematic way, they are worth investigating and developing further.

Conclusion

If A.T. includes the interaction between buildings and the environment as a topic in its course material, it ought to ensure that the environmental factor is properly incorporated into its teaching. Its incorporation is hampered by the fact that environmental data differs from one area to another. As a result, a student taught A.T. from the perspective of the environmental conditions prevailing in a particular place will have difficulty and problems in applying his knowledge to a place where different conditions prevail. (It is worth noting that this problem is much less evident in other components of architectural studies).

This paper contends that the first step in dealing with this problem is making both teachers and students aware of it. And this is its basic conclusion. However, it also proposes a rationalistic incorporation of the environmental factor into the teaching of A.T. courses, one that seeks to combine the need to give full coverage to issues relating to the interaction between buildings and their environments with an emphasis on matters more directly related to the particular area of reference. The incorporation of this factor, to the extent that it is achieved, will help A.T. courses to become friendlier and easier to understand. Also, more generally, it will help architectural design to make a fuller contribution to the protection of the environment and energy-saving.