COMPUTERS IN ARCHITECTURAL EDUCATION

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Throughout Europe there is a rapidly growing volume of initiatives towards integrating computer aids within all aspects of education. In architectural education, the support offered by these initiatives presents a double-edged sword. On the one hand it is gratifying to see the work of almost two decades of CAAD research bearing fruit and the concepts gaining recognition by the profession. On the other hand the resulting pressures on the few individuals with the necessary knowledge to implement the teaching will stretch many to breaking point. Where resources are so limited it is crucial to clarify the needs and objectives and, thereby, more effectively direct resources. These needs will change over time and, in the world of computers, the means are also changing rapidly as hardware and software improves. This paper therefore outlines a scenario which I believe is relevant at this point in time but the background is constantly changing and I offer no apologies for any shift in emphasis since my last presentation of this topic in 1983 [1].

Much of the confusion which surrounds CAAD education stems from the dichotomy between the perceived needs of the profession, for whom **CAD** means **C**omputer **A**ided **D**rawing, and the researchers whose preoccupation is with the use of the computer as a (design) - problem-solver. The expectations of both are equally valid yet equally inhibiting. Bridging the gap is the unavoidable role of the teachers within schools of architecture. If a balanced view is established among today's undergraduates then tomorrow's designers will make full and appropriate use of the technology.

THREE COMPONENTS

At this time I suggest that the different aspects of computer use should be acknowledged in the expectation that eventually these differences will become less relevant. The role of a computer facility within schools of architecture has therefore 3 principle components.

The computer as a **GENERAL FACILITY** - word processing, draughting, database management etc.

The computer as a **DESIGN AID** - towards producing better design solutions.

and

The RESEARCH component

Each of these can be further decomposed into a total of five activity areas as shown in **Fig. 1**. The following chapters are an amplification of the activities and their teaching implications.

1 The Computer as a GENERAL FACILITY

This is the aspect of computer use which most closely parallels the perceptions of architects in practice - whose most urgent need is to see the computer as a tool towards improved office productivity and efficiency.

Word-processing - This facility is now available in such user-friendly / teach-yourself packages that its use will inevitably expand and become as ubiquitous in schools as drawing boards. Their easy-to-use characteristics obviate any need to have these included within the formal teaching curriculum.

Database Management software - This almost falls within the same category as word-processing in as much as familiarity with DBMs will soon be a skill acquired before entering graduate education.

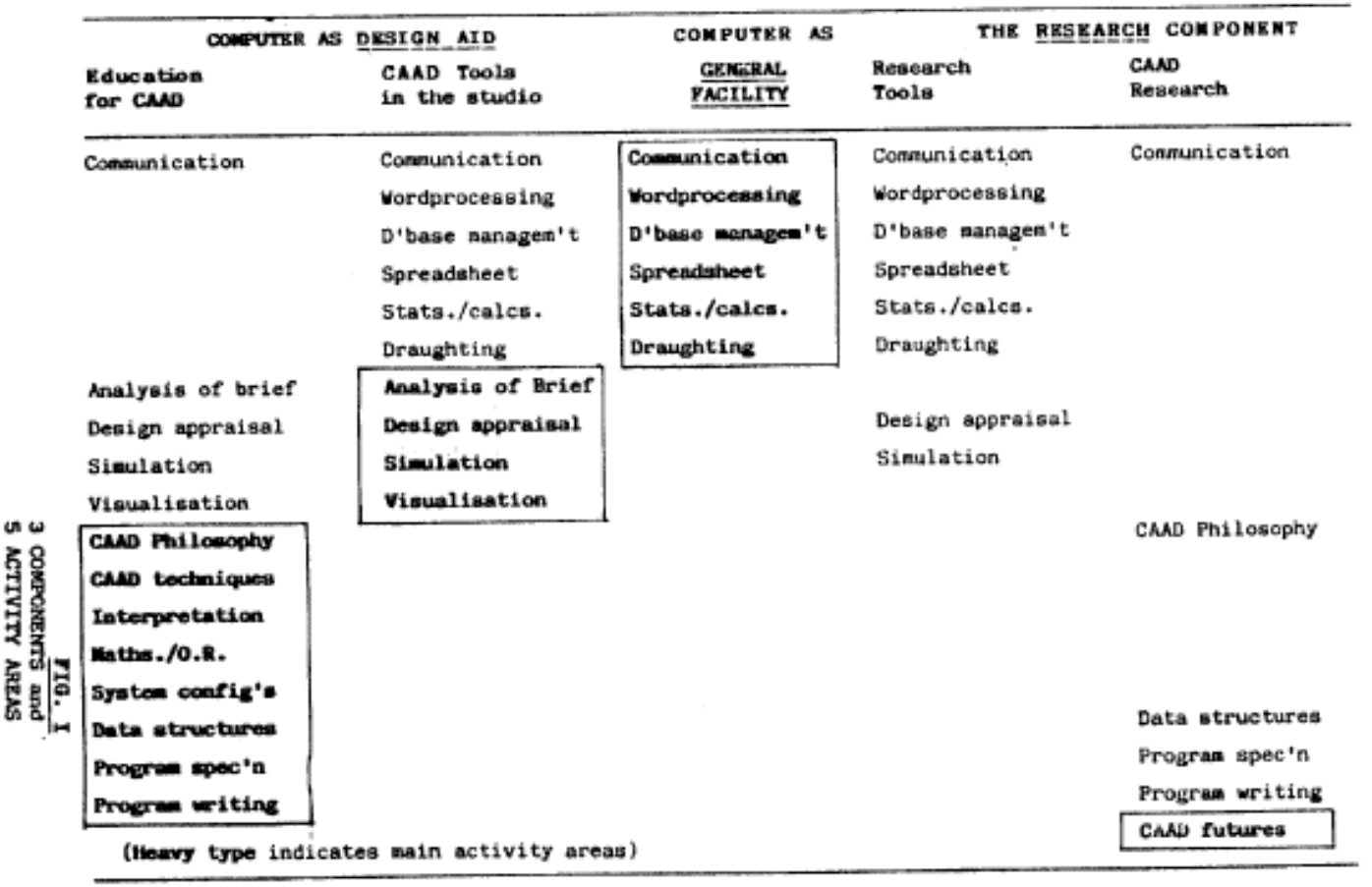

FIG. 1 3 COMPONENTS and 5 ACTIVITY AREAS

How ever, effective use of such systems for Information Retrieval requires skilled direction, preferably taught by an information specialist (e.g. the school librarian ?).

Spreadsheets - Teaching input is only required to demonstrate the potential for the manipulation and re-presentation of data. There are national differences in the extent to which architectural students must learn the skills of the (quantity) surveyor but, in most countries, some element of familiarity with this subject is required and it is within this discipline that the use of spreadsheet software is best exploited.

Draughting systems - The growing numbers of draughting systems, their continuing reductions in cost and their availability to suit most hardware configurations (mainframe to microcomputer) is, at the same time, good news and bad news. The release of low-cost packages for the smaller-memory microcomputers implies that most schools should now be able to offer this facility to students. There are however two limitations. Firstly it is the output from the system (the drawing) which determines its effectiveness as a drawing-board substitute and the quality of this is largely dependent on the investment in good plotter hardware - which continues to be expensive. Secondly, the diversity of the available systems renders it impossible for any school to demonstrate a representative sample of what students may meet with on completion of their studies. Educationally, their inclusion in the teaching element in schools must continue to be of limited value until there is sufficient acceptance of standards / input conventions to make the (necessarily large) investment in teaching time worthwhile. As a tool for ad hoc use their provision is highly desirable but will be limited by financial constraints.

2 The Computer as a DESIGN AID

There are two activities associated with this component (Fig I) the first of which bears close resemblance to the previous chapter

where the computer was considered as a general facility.

CAAD Tools In the Design Studio.

Design studio activity is traditionally centred on the drawing - board and the 'beaux-arts' preoccupation with drawing presentation technique continues to obscure the assessment of efficient design. Even so, increasing concern that buildings should be energy-efficient has highlighted the need for evaluative tools within the design process and it is fortuitous that the computer now offers, for the naive designer, a painless, fast and accurate tool for the appraisal of hip design hypotheses. Exposure to the use of the computer for energy calculations provides fertile ground for exploration of other appraisal techniques e.g. space-planning efficiency, cost benefit analysis, visual impact, morphological structure etc., and an increased integration of computer aids in the studio becomes not only highly desirable but should grow in response to student/staff demand.

The ability of schools to meet the demand for CAAD in the studio is at present inhibited less by the availability of equipment and more by the non-availability of staff resources. Re-training and the cultivation of CAAD awareness among studio teaching staff is now an imperative for those schools who wish to survive the onslaught of the new technology. Too many schools are dependent upon the knowledge resident in one or two specialist teachers and it is for this reason that the full integration of CAAD techniques within the studio is still difficult to find.

Education for CAAD

This activity represents the most important role for schools in the development and implementation of computer aide. The objective of educating today's students for their role in tomorrow's architectural practice unavoidably leads to a divergence between CAAD as taught in schools and CAAD as seen by (today's) offices.

Firstly, the subtle shift in design philosophy in which the role of the computer is portrayed (Maver identified this as long ago as 1970) [2] and which must be nurtured by debate, reading and

illustrative examples. Much of the roots of this philosophy stem from the writings of the design methodologists and are best presented against this background.

Secondly, the techniques of how to use available software must be taught if these are to be effective within the design studio. This not only involves teaching the processes of inputting / editing data and program running but, of vital importance and too often overlooked, the intelligent interpretation of results must also be taught.

It may be argued-that there is no need to educate all students beyond the scope of the above two activities and yet, if CAAD tools are to be developed which accurately reflect the needs of design professionals, then additional skills must be acquired by at least a proportion of students. In order therefore that we produce the **'program specifiers'** I referred to in 1983 [1], then the parallel disciplines of mathematics, operational-research data structuring techniques and computer programming must be available as an option within schools of architecture.

Returning to the more immediate needs of the profession at large, students graduating now should enter practice with the background necessary to make sound choices in the selection of hardware and software for the office. Because this knowledge-base changes rapidly from year to year and because it Involves some current awareness of costs then this topic is more appropriate to final year students and will benefit from input by part-time teachers whose involvement and experience with the tools in practice is likely to be more pertinent.

3 The RESEARCH Component

The use of computers as an aid to research within the architectural sciences may be expected to develop naturally in line with the availability of resources. Research into and about CAAD is a separate issue and the two will be taken separately here.

Research Tools

These largely parallel the issues raised under item 1 (Computers as a General Facility) although the need for powerful processing facilities for statistical analysis and good quality text handling facilities (hardware and software) should be anticipated. Of significant difference (compared to item 1) is that the use of computer-based simulation techniques for research into building performance (e.g. dynamic energy modelling, complex structural analysis etc.) will be inhibited in schools without access to the more advanced software packages and large memory processors.

CAAD Research

The research necessary for the development of CAAD tools requires input of a specialist nature and the evidence to-date implies that this input has come largely from mathematicians, engineers and computer scientists. It is essential that this pattern be broken by the inclusion of more architecture-trained research workers who are more likely to identify the real research needs and to tackle these in a way more sympathetic to the design - forum.

To promote this research activity we are again aware of a need which has less to do with computing facilities but more dependent on the recruitment of adequately prepared research workers. It is particularly in order to meet this demand that I have previously (Chapter 2 'Education for CAAD') specified the need for a proportion of architecture undergraduates to have an education in the related science disciplines and including a knowledge of computer-science and programming. Until schools acknowledge this responsibility it is unlikely that CAAD software -based design techniques will reach maturity in the eyes of the profession.

[1] LAING, L W W. "CAAD for undergraduate students of architecture, Teach what, and when. and to whom - and why", Proc. PARC83, Online (Pinner), (1983) pp.347-355

[2] MAVER, T W, "A theory of architectural design in which the role of the computer is identified", Building Science, vol.4, (1970) pp.199-207