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Abstract

The objective was to investigate whether qualitative as well as quantitative environmental factors can be:

1. Assessed in use
2. Integrated into formula financing
3. Blended into a form which is readily useable to architect and the client in the building design process.

It was concluded that only by revamping the building design process can the introduction of qualitative factors be assured. Architectural planning must be perceived as a continuing process rather than the production of a finite product. Therefore, the paper focuses on development of such a process.

Introduction

In 1965 the Government of Ontario created a system of Colleges of Applied Arts and Technology (C.A.A.T.) to provide an alternative to university education at the post-secondary level. The Colleges were intended "...for full-time and part-time students, in day and evening courses, and planned to meet the relevant needs of all adults within a community, at all socio-economic levels, of all kinds of interests and aptitudes, and at all stages of educational achievement" (1) The Colleges were allowed considerable latitude for individual college development but the enabling legislation did direct that "...some features will be common to all programs; they will be occupation oriented, for the most part; they will be designed to meet the needs of the local community - and they will be 'commuter' colleges." (2)

Barely sixteen months after the initial statement in the legislature by the Minister of Education, nineteen (later increased to twenty) Colleges opened for classes in September, 1967. The form of development of the Colleges has been strikingly similar. All Colleges have a new primary campus location and vestibular campuses dotted throughout the region that they serve. The vestibular campuses range in types from major new purpose built buildings to converted factories, 'shop fronts' and even two trap-lines. Eighteen of the primary campuses were designed for the new institutions, the other two were newly constructed Ontario Vocational Institutes which were incorporated into the college system. The form of construction on the primary campuses represents the development of a new building prototype - an enclosed campus complex.

To date in excess of \$200 million in capital funds have been authorized for construction and equipment purchases. It was necessary to devise governmental procedures for allocating funds which would assist the orderly development of the necessary facilities without hampering either the rate of growth or imposing preconceived limitations on the type of shelter appropriate to these new institutions. The relationship between Department of Education officials and college administrators was characterized by mutual trust and respect. The five years of construction reviewed in this study were undertaken in what could be called a pioneering period. In October, 1971, a governmental reorganization created a new Department of College and Universities.

C.A.A.T. Planning Procedures

The original means devised for reviewing college requests for capital funds was a series of five forms, the first of which (C.A.A.T.I.) prescribed the development of a Master Plan.

Document (3) Typical sections of this report were:

1. Educational Philosophy
2. Educational Programs
3. Educational Specifications
4. Community Analysis
5. Site Feasibility Studies
6. Enrolment Projections for Ten Years
7. A physical Master Plan for the Primary Campus

The documents produced are typical of college and university master plans in North America in the late 1960's. The deficiency in the planning methodology was that it veered from "motherhood" statements about education, such as, "Man cannot live by bread alone, and all students irrespective of the specific training they are receiving need to enrich themselves culturally, if they are to become whole persons and truly mature citizens," (H2-22) to specific requirements given a priori, for example, "language lab positions should be increased from the present fifteen to at least thirty-five. Reading skill lab positions should similarly be increased to thirty-five," (4) Planners, clients and governmental agencies accepted these documents because they looked impressive. This attitude was not unusual for the time. Richard Saul Wurman recorded his feelings "Until then I had always fooled myself. If something looked good, it was good... If a map or planning report looked good, it was good, and I had not asked myself two very simple questions: did I understand what I was seeing and could I tell somebody about it." (5)

Government asked for a master plan in the form of a finite document rather than a continuous process. The approach was accepted by the Colleges and their professional advisors. With hind sight, the attempt to produce a definitive statement about the initial ten years of the development of a college which was a new type of educational institution without precedence in Ontario seems almost naive. What would public reaction be to these Colleges? How might changing governmental policies, technological events, or student attitudes effect the development of a particular college campus? The C.A.A.T.I. required an assessment that was new to educational planning in Ontario and given the limitations of the static approach, it is surprising how much of the reports are still valid in an area of educational philosophy and program structure.

At the operational level of student enrolment, organizational structure and operating finances the Master Plan documents rapidly became outdated. The capital finance section of the C.A.A.T.I form was never used by the Department of Education for authorizing funds. Despite this there was little reassessment of the physical planning proposals. The Connect/Campus Computer Simulation Model was introduced to try to make planning more responsive to changing conditions. The model attempts to project space needs according to twenty-one categories of use. Despite three years of work on the model, for various reasons it is not yet utilized for physical planning by either of the colleges studied.

The original intention of this research project was to evaluate the Colleges on the

basis of the Master Plan proposals. A review of the available information showed that this approach was not feasible because they contained no logical development from objectives to activity criteria to performance standards. It was not even possible to evaluate actual versus planned growth on a per square foot and per student basis because neither the Master Plans or the simulation model recognized that physical space has a geographical attribute. Hence a number of critical projections lumped together several distinct campus locations.

Planning by Issues/Programming by Goals

In keeping with the viewpoint that planning is a process rather than a finite act, it is suggested that governmental planning methodology should also be subject to continual reassessment. As has been noted, during the last five years government has encouraged the Colleges to try first a finite Master Plan and then a computer simulation model. What is proposed is that a goal oriented approach to physical planning be initiated and that the goals form part of the basis for capital formula financing. Goals would also form the criteria against which the performance of the built form could be evaluated. In turn the performance evaluation should lead to an improved planning base for subsequent building projects.

This approach would complement the computer simulation model by using the quantitative data and providing the qualitative input lacking in computer analysis and blending these inputs into a readily usable form. It would reduce the paper work involved in submitting requests for capital expenditures because the working and approval format would be identical. The procedure outlined would allow the College to retain individual forms of administration and operation procedures in the area of physical planning but it would also encourage the development of expertise in these matters.

It is suggested that the initial stage in the building approval procedure call for the submission of a Tactical Working Document which

1. Outlines the methods to be used by the College to generate a plan.
Knowledge of the process should enable a co-ordinated participation by all the various people, groups, agencies and specialities involved.
2. Examines every problem which comes within the planning sphere in terms of issues. Issues cover administrative, financial, procedural and motivational concerns. Issues should be analysed in a standard manner and such analysis should be kept to one page. (More complex presentations have been shown to be the result of compound issues which should be segmented for analysis.) The analysis should take the form of
 - issue statement
 - source of available information
 - current Assumption/Policy/Situation
 - comments on current Assumption/Policy/Situation
 - recommendations re Further Analysis of Current Assumption/Policy/Situation (6)

3. Formulates a hierarchy of physically achievable goals. Issues relate directly to functional concerns, they clearly delineate the nature, extent and direction of the work to be done. They are the working brief to the architect and the basis of in-use evaluation. They could provide the means for introducing environmental concerns into formula financing. Goals are arranged in a hierarchical order so that if conflicts between goal attainments are unearthed during the design process it is clear which environmental consideration takes precedence. The College may change, add, delete, or revise the order of the goals during the subsequent design stage, but it should be clearly understood that these modifications constitute a revised brief to the architect and the College is responsible for any ensuing delays.

Program Goals and Building Design

One of the conceptual difficulties which arises in planning for both architects and their clients is understanding the difference between a building program and a building form. Far too many architects engaged in planning and programming too quickly extrapolate the input data into three dimensional shapes. Similarly, many clients want to see what the building will look like rather than diagrams of growth strategy, movement, organization and relationships. This is the core weakness in the original C.A.A.T.1 documents. One direct means of overcoming premature conceptualization is not to employ the same professionals for programming and design, but the benefit of continuity is also apparent because by preparing the program the architect will have developed an understanding of the client's problems and characteristics which no document can fully communicate. The review of programming goals by the Department of College and University Affairs prior to the approval of funds for design fees should encourage the rationalization of the programming process and prevent the program from becoming a justification of design forms.

Programming goals establish the performance criteria for the building. They should be concerned with the kind of things which will happen or should be allowed to happen in the building as the result of the planning issues. The hierarchy of goals should enable the architect to make an appropriate physical response based on the knowledge of the activities that will take place.

The establishment of program goals will enable the client to evaluate the design phase on a rational basis. All too frequently the consideration of major building projects by the client focuses on relatively insignificant details revolving around personal preferences and ignores the basic goals of the scheme.

Goal statements should avoid presetting the form of the design solution. This will afford the architect more latitude in prescribing environmental solutions for novel problems and the opportunity to reconsider historical solutions (such as the traditional classroom or lecture theatre) in light of present conditions and technology.

Goal statements should not be a catalogue of specific requirements. This type of

catalogue programming tends to repeat past solutions without evaluating this present validity. Since these types of electrical outlet, lab bench etc. listings are usually compiled by or with particular reference to an individual faculty member they presuppose a particular teaching format. The survey conducted showed that the most costly building and equipment reappraisals occurred in spaces purposely designed in detail for specific faculty members who by the time of completion were no longer involved in activities in those spaces.

An example of the differences between issues, goals and specific requirements is illustrated by the following hypothetical case.

Issue: What is the College's policy regarding community use of physical facilities? The resolution of this issue would entail policy decisions about the College's community vote, the basis of admission of public - groups or individuals, to community developed programs or to college developed programs, scheduling, fee acquirements if any. Financial considerations might include payment of the facilities entirely through funds for college construction, possibility of grants from local authorities, agencies or groups, private subscription, or special mortgage arrangements.

Goals

1. The gymnasium should be available for use by organized community groups on weekends and holidays when the College is not in operation.
2. The gym should be conveniently located for informal use by students during their unscheduled hours of the day.
3. The gym will provide scheduled classroom space for students in the recreation department and therefore should directly relate to the other classrooms and faculty offices in that department.

It is evident that these three goals relate directly to the location characteristics of the gym and might, given the limitations of a specific site result in conflict. The hierarchy of goals established by the College would tell the architect which is the clients primary locational consideration.

Specific requirement

The gym floor should be hardwood with an epoxy finish.

Relationship of Goals to Formula Financing

Since April 1, 1969, capital monies have been allocated to Ontario universities based on a devise known as Capital Formula Financing. "The formula is based upon involvement projections - Recognizing that certain types of students require more

space than others, the enrolment projections are weighted by course of study and year level. A unit of space is then applied to each weighted unit of enrolment. Thus a total cumulative space need is determined for any particular year. From this Total Cumulative Space Need is subtracted the Existing Space in order to calculate the Additional Space Required. A unit cost is applied to the Additional Space Required and a cumulative dollar entitlement is calculated for any one year." (7)

To date, the Colleges of Applied Arts and Technology have not been financed under this system but since the reorganization of government combined the responsibilities for universities and colleges into a single department speculation has existed about the extension of the formula theory.

Direct application of the university formula to the Colleges ignores their unique form of development and their mandate for community involvement and relevancy. The formula was devised at a time of increasing student enrolments. If enrolments become static or decrease the formula theory in effect cuts the institution off from capital expenditure funds even though the space available may not be compatible with current institutional aims and policies. Cyclical renewal funds equal to 1% of the allocation inventory plus 1% of the cumulative cash flow since April 1, 1969, are provided for annually. (8)

The present cost per unit of space (for universities) is a fixed allowance of \$55. per net assignable square foot of the building project. For many of the vestibular campuses this is an overly generous figure. Some of this space is leased to maximise flexibility by easily eliminating it from the College inventory when needs change. Clearly the cost allowance is inappropriate to remodelling and equipment needs.

The only truly manipulable factor in the formula is the enrolment weightings. There are five weights for university students ranging from 1.0 for Arts & Science undergraduates to 4.0 for Ph.D's in science. Refinements are presently being considered. Even though there are allowances for part-time students the College's heavy involvement in evening courses, special sessions, study groups etc. would be difficult to accommodate to this concept.

Enrolment projections are evaluated annually by a high level committee both from the total provincial standpoint and from the individual institutions' standpoint.

What I am suggesting is that the institutions environmental goals be assessed by a select committee and that the goals from the primary manipulable factor in the formula. This would allow for the provision of facilities not directly related to expanding enrolments and projects not involving total new construction. Also considerations of cost overtime could be taken into account.

The initial weighting of goals can be established through reference to historical data. User Evaluation Studies could lead to refinements and sophistication in goal weighting.

Goal/Evaluation Studies

A study of the in-use operation of two college primary campuses was undertaken. The aim was to scale data which would be useful both for the client in establishing the building program and the architect in the design of the next phase.

One of the major limitations to the establishment of a feedback cycle between evaluation and design decisions is that the type of information presently being generated by environmental researchers is not the type of information used in the architectural design decision process. As Perrin has so well recorded, the architects education does not predispose him towards the systematic refinement of design solutions nor does it provide him with an understanding of how to interpret sociological, psychological or even statistical data. (9) However, there are a number of architects searching for data which they can use, but they become confused and disillusioned by much of the material they read or hear at conferences (10).

Much environmental research seems to be arrived at establishing norms or a range of norms that the author presumes will have a wide application. This presupposes that the environmental response sequence must be space man and, indeed, a non-variable man response which denies a cultural dynamism. The search for these finite norm ranges may be intellectually interesting but the relevance of this type of research to architectural design seems dubious. For a building to have validity over time the response sequence needs to be man space. Thus instead of designing for historical norms the architect needs to build spaces in which the user can create the environmental response appropriate to changing cultural, etc. circumstances.

There needs to be a recognition that there is a grain of data beyond the scope of architectural consideration. This is true of both psychological data and physical information. An architect is not concerned with the molecular composition of steel but the strength of two particular steel sections. Those supplying the architect with input need an understanding of the appropriate data grain useful for design. For example, faced with Barkers goal, program, deviation countering and vetoing circuits, the architect is perplexed. As an educational planner Barkers conclusions about school size related to the behavior of inhabitants of undermanned and optically manned behavior settings has utility.

Goals are composed of sets of considerations. Psychological factors are only one set type. Economical (both capital and operating), structural, political and aesthetic aspects of goals must be balanced along with the psychological. Sets other than psychological may be more significant to both client and architect.

Examples of Goal Evaluation and Utilization from Pilot StudyData Collection

Psychological data series were assembled by six paid researchers who were familiar with market research techniques and had some previous experience in environment analysis surveys. The researchers were instructed to answer questions about what

they were doing directly and honestly. They were to be friendly towards students and staff, but avoid involvement in college activities.

Classrooms were assessed through observations made by the team. The form covered teacher and student activity, equipment usage and classroom atmosphere as they related to movement, perceived noise level, physical arrangement of furniture, clustering of students and proximity of faculty to students. Four-hundred-and-fifty classroom observations were made at College A and seven-hundred-and-twenty at College B. (The difference in the number of observations is primarily due to the open plan concept of College A.)

Individual reactions to the environment were ascertained by questionnaires supplemented by a small number of in-depth interviews. Questionnaires were distributed to students in classes to obtain a balanced distribution through divisions. In order to disassociate the research work from the College administration questionnaires were returned at various drop boxes 355 questionnaires were returned at College A and 310 at College B. This procedure resulted in an imbalance of return by division with those students in labs being three times as likely as those in lectures or seminars to return the questionnaires. Some items on the questionnaire provided checks on the equipment usage data collected in observations. Library usage and informal behaviour in the communal spaces - lounges, eating areas and circulation spaces where students lingered (surrogate lounges) were recorded photographically and graphically by coding on floor plans. In keeping with the hypothesis of the study, that have grain behaviour data is not of primary significance in architectural design decisions. Undisguised photography proved satisfactory. The research team found that when the subjects had assumed lounging positions, activity from the point-of-view of this study was not affected. Subjects in motion (and therefore not of interest) did modify their behaviour - There was a tendency to move out of the way of the camera. Photographs were taken every twenty minutes during one day from 8:00 a.m. to 5:00 p.m. from each of twenty-three viewing stations at College A and nineteen at College B. Viewing stations were established from previous observations of areas which attracted groups of stationary students graphic coding supplemented photographic areas by picking up behaviour between stations and provided a cross check on the photographic material. Instructed interviews amplified data files. Twenty-eight activity maps were compiled of all public circulation and lounge spaces in each college and six-hundred and forty-four photographs of College A and five-hundred and thirty-two of College B. The photography also proved to be a source of fine grain data about small group interaction.

Economic data series were assembled from records, budgets and interviews with college staff. Mechanical and structural data series were obtained from interviews with college personnel, architects and consultants and review of working drawings.

Summary Examples of Goal Evaluation

1. Issue: The College should be involved in the community.
 Goal: Pedestrians strolling through the park will be attracted into the College.
 Evaluation Procedure: During a one-week period all visitors to the College were asked reasons for visit.
 Evaluation Finding: Every outside visitor had a specific reason for coming to the College and the journey involved a special journey.
 Goal/Evaluation Correlation: None
 Correlation Analysis: Poorly formulated goal which ignored readily available psychological input data about pedestrian behaviour.

2. Issue: Students are non-academically oriented.
 Goal: English teaching will be dialogue oriented.
 A recreation room atmosphere is wanted to encourage rap sessions.
 Evaluation Procedure: Classroom observation data.
 Evaluation Finding: Students were in more than one cluster 58% of the time. This compared with 34% at the other College with more "conventional English classes". The scale of activity showed little difference between campuses and this evaluation base is being reassessed. The activity pattern of faculty showed a marked difference with faculty talking to students at the control college in 66% of the observations, while at the goal test college faculty were doing something other than talking to students 78% (of which 31% of the time they were observed listening to students).

3. Issue: In response to provincial budgetary restraints on educational spending a program of self-directed learning utilizing learning objectives conveyed through audio-visual media will be staged.
 Goal: The business division will teach typing and shorthand using a system which utilized slides and cassettes.
 Evaluation Procedure: Questionnaires, classroom observations.
 Evaluation: 43% of the typing classes used were using the A.V.T. system at the time of observation. 73% of secretarial students reported that they had used the A.V.T. system. Of those reporting use 67% found it very useful, 8% found it of some use.
 Correlation: Economic data required.
 Correlation Analysis: Economy was the essential factor. Economic analysis is being prepared by Business Division. Method of evaluation inadequate to assess goal correlation.

4. Issue: Because of the difficulty of defining the role of colleges in post-secondary education over an extended period of time and the changing nature of post-secondary education as a whole, college space should be flexible.
 Goal: Classroom and laboratory space should be designed for changing class sizes, class types and teaching techniques.
 Evaluation Procedure: It was decided that when activity patterns and space provision were grossly mismatched, renovation resulted. Renovation costs could provide the assessment parameter. The costs of renovations were assessed on a per square foot, per student and percent of construction cost basis. Because the

initial provision of flexible space tends to involve more initial investment than fixed feature space the latter was used to establish a correlation scale.

Evaluation: College A financed all renovation work for five years from their operating budget. They had purchased two portable classrooms which might be interpreted as reducing renovation costs. It was decided that these were disposable assets and should not be classified with renovation costs. College B had requested funds for renovations (amounts are confidential at this time).

Goal Correlation: A reverse scale of ten was established giving College A a score of 0. A score of 1 would indicate remodelling costs per year were 1% of construction costs, etc. Very significant differences were noted between the two scores.

Goal Analysis: The remodelling costs incurred by College B were the result of a poor definition of the parameters of flexibility. The parameters did not include mechanical and plumbing installations.

Formula Financing Significance: Costs overtime are one type of factor which could receive a formula goal weighting and produce a considerable net saving for the tax payer.

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