This document incorporates the findings of a project initiated to find solutions to the problems of planning, designing, constructing, and utilizing facilities to house career education on the part of educational administrators. Traditional solutions, continually increasing costs, and the need for greater emphasis on the learning environment provided the impetus for focusing attention on the options for local determination with minimum emphasis on regulating procedures. Project findings reveal that the design of new flexible facilities for career education requires space management—matching students' learning needs (curriculum) with the things of learning (space, tools, aids), placing them within a time frame (schedule), and doing this all within an allotted budget. Suggestions and building designs are offered for flexible facilities into which an almost infinite variety of settings can be placed that include delivery of the services necessary for facility operation without destroying the universal quality of the space.

(Author/MLF)
SPACES FOR CAREER PREPARATION

PLANNING FOR CHANGE

by Peter Tarapata

MICHIGAN CAREER EDUCATION FACILITIES PROJECT
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ACKNOWLEDGMENTS

In January of 1972, The Continuing Education Service, Michigan State University, initiated a research project to become known as the Michigan Career Education Facilities Project. Funding for the Project was made available by the Vocational Education and Career Development Service, Department of Education, State of Michigan.

The relative newness of the Career Education Movement and the recognized need for planning, designing, constructing and utilizing facilities to house Career Education on the part of the educational administrators, facility planners and designers was evident. Traditional solutions, continually increasing costs and the need for greater emphasis on the learning environment prompted the State Educational Agency to give maximum attention to the options for local determination with minimum emphasis on regulating procedures. Hopefully, they will find this series of documents viable tools in their efforts.

The Committee on Architecture for Education, American Institute of Architects, reviewed the Project in its early stage and designated Les Tincknell of Wigen, Tincknell and Associates, Inc., Saginaw, Michigan, as its representative and liaison to the project.

C. Theodore Larson, Professor Emeritus, School of Architecture and Design, University of Michigan, was designated as an architect-educator advisor to the project.

A first step resulted in the designation of an Advisory Committee to assist in the development and evaluation of the project. Members included:

William Chase, Program Officer
U.S. Office of Education
National Center for Educational Technology
Washington, D.C.

Richard Featherstone, Professor
Administration and Higher Education
College of Education
Michigan State University
East Lansing, Michigan

Dwayne Gardner, Executive Director
Council of Educational Facility Planners, International
Columbus, Ohio

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Educational Facilities Laboratories, Inc.
Chicago, Illinois

Milton Miller, Director
Educational Facilities Planning
Grand Rapids Board of Education
Grand Rapids, Michigan

Donald Leu, Dean
School of Education
San Jose State College
San Jose, California

The second step involved the appointment of an architectural-planning team whose primary responsibility was to study the recognized needs and propose options for solving local career
facility problems. The team included:

William E. Blurock  
William Blurock and Partners  
Corona Del Mar, California

C. William Brubaker  
Perkins & Will Architects, Inc.  
Chicago, Illinois

Stan Leggett  
Stanton Leggett and Associates, Inc.  
Chicago, Illinois

Linn Smith  
Linn Smith, Demiene, Adams, Inc.  
Birmingham, Michigan

Peter Tarapata  
Tarapata-MacMahon-Paulsen Corporation  
Bloomfield Hills, Michigan

The third and final step in the Project involved the final editing, publication and dissemination of the project findings. This is one of a series of five publications to be released to educators, planners and architects. The series include:

Document 1  Objectives and Options by William E. Blurock
Document 2  The Process of Planning by Stanton Leggett
Document 3  Facility Options by C. William Brubaker
Document 4  Planning for Change by Peter Tarapata
Document 5  Construction Options by Linn Smith

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Project Co-Directors:

Floyd G. Parker, Director  
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Robert Paullin  
Occupational Specialist  
Division of Vocational Education  
Department of Education  
State of Michigan
Earlier discussion in this series dealt with the option of utilizing existing facilities in the community for career preparation. This section devotes itself to dealing with the question of what to do if such facilities are unavailable or inadequate and it becomes necessary to build new facilities.

1. Programming for Change

A truism of modern school planning is that whatever is initially programmed to fit into a school facility is likely to be changed, not once, but many times over.

Witness the changes that evolution in teaching methods, subject emphasis and technology have wrought in our schools since World War II. Circumstances outside the school—the social patterns and life styles, the great new knowledge, have accelerated change we teach and how we teach. Facilities have to be adjusted constantly to meet new educational challenges.

The problem facing the facilities planner is how to control the demand for change and how to rationally accommodate it.

2. The Concept of Space Management

If change has become such an ever-increasing reality in the operation of a school facility, why not accept it as a constant and organize ourselves to live with it.

Change, as it affects physical facilities, can be controlled through a process known as space management. It is the art and/or science of people, time and money to most effectively use the available space. In a school, it is the process of matching students’ learning needs (curriculum), the things of learning (space, tools, aids), people within a time frame (schedule) and doing it within an allotted budget.

More specifically, the process can be closely related to the individual student’s needs. As each student course of study is programmed, space would be allotted and scheduled for him (in which to work or with a group). His space-time slot would be an accountable item, fitted into the space management master schedule. Should special or unique facilities be needed, they could be anticipated and set aside. At a certain time, a specific space would be made available for a specific activity for a given period of time. As the task is done, the space would be recycled or reconstituted for another activity.

The concept of space management is not a new one. Plant managers in industry have for years required it.
circumstances outside the school—the altering of social patterns and life styles, the great growth of new knowledge, have accelerated change in what we teach and how we teach. Facilities have had to be adjusted constantly to meet new educational challenges.

The problem facing the facilities planner today is to understand how to control the demand for change and how to rationally accommodate it.

2. The Concept of Space Management

If change has become such an ever-increasing reality in the operation of a school facility, then why not accept it as a constant and organize ourselves to live with it.

Change, as it affects physical facilities, can be controlled through a process known as space management. It is the art and/or science of managing people, time and money to most effectively use available space. In a school, it is the process of matching students' learning needs (curriculum) with the things of learning (space, tools, aids), placing them within a time frame (schedule) and doing this all within an allotted budget.

More specifically, the process can be closely attuned to the individual student's needs. As each student's course of study is programmed, space would be allotted and scheduled for him (in which to work alone or with a group). His space-time slot would become an accountable item, fitted into the space manager's master schedule. Should special or unique facilities be needed, they could be anticipated and set up as required. At a certain time, a specific space would be made available for a specific activity for a given length of time. As the task is done, the space would be recycled or reconstituted for another activity.

The concept of space management is not a new one. Plant managers in industry have for years rearranged
facilities to accommodate new processes or to improve efficiency.

Management of space can be extended to all space within a school complex, both old and new. All space would be inventoried for its suitability as learning space. This could include on and off-campus space. With this information on hand, the space manager would then be in an excellent position to imaginatively and effectively utilize his space resources.

Space management as applied to schools is a new field and will require the development and training of personnel who will be cognizant of the techniques of space manipulation. They will need to know the space requirements of the various tasks to be accommodated, have a knowledge of the manipulable elements at their disposal and an appreciation of the costs involved in such changes.

Gaming and simulation through the use of physical scale models is an excellent method for studying and evaluating the effect of changes. Models are highly tangible tools which allow planners to project themselves into proposed space situations. With models, they can experiment and test new strategies for optimum use of facilities.

Developing new space to accommodate dynamic space management implies a structure which goes beyond what was once called flexible planning, as epitomized in the movable partition. What is implied is, indeed, a truly unencumbered "universal" space, one into which an almost infinite variety of settings can be placed. Implied also, is the need to devise a means for delivery of the services necessary to the operation of the facility without destroying the universal quality of the space. Exploring how this can be accomplished is the subject of the following chapter.

HOW TO DEVELOP SPACE TO BE MAN

The easiest space to manipulate, of course, is completely unencumbered space. This idea, however, quickly becomes inhibited as soon as we encapsulate the space to serve the need of human habitation of providing shelter, services.

This, we soon realize, is but a minor re-recognition that most of our needs for space are within the horizontal plane and that vertically, we are using relatively modest heights.

If we try to visualize a tractable "universal" space, within which we can freely set up and shift micro-environments, we quickly come upon a problem: Space

Encapsulated Space

The "Loft"

Unencumbered Space
HOW TO DEVELOP SPACE TO BE MANAGED

The easiest space to manipulate, of course, is the totally unencumbered space. This idea, however, quickly becomes inhibited as soon as we try to encapsulate the space to serve the necessities of human habitation of providing *shelter, comfort and services*.

This, we soon realize, is but a minor restriction as we recognize that most of our needs for space are in the horizontal plane and that vertically, we can get by with relatively modest heights.

If we try to visualize a tractable "universal" space, one within which we can freely set up and stage our micro-environments, we quickly come upon one of the

\[
\text{Space}
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Uninhibited Space

Encapsulated Space

Unencumbered Space

The "Loo"
simplest forms of enclosed space, and that is the loft. Lofts can be as small as a single room or as large as an astrodome. For our purposes, we will think of them as omni-directional in the horizontal plane and limited vertically by functional and economic exigencies.

Horizontally, assuming we have a large enough site, the spread of space is limited only by the fire safety laws which specify the allowable travel distance from the deepest point within the interior to the nearest exit. Vertically, we can stack these lofts as many times as we wish until, again, we reach the limits allowed for fire safety.

Technically, enclosing such space is very simple if we work within a relatively short spanned, repeatable module. However, if we seek very large spaces, we will need to resort to more structural techniques such as space frame structures, lamella arches or other sophisticated devices. A relatively recent newcomer to enclosing scenes is the air-supported structure. This is economical and relatively simple plastic fabric tent anchored to the earth at its perimeter and pressurized by air. Another, similar enclosure is the air-supported plastic fabric tent hung from an external aluminum tubing. Both of these devices are at early stages of their evolution and hold promise for the near future.

Once we have enclosed the space, we must attend to the creature comforts of those who will be sheltering. These must be supplied to the enclosed space without destroying the “universal” qualities of that space. Lighting, ventilation, heating and cooling must be distributed horizontally to all points in the space. These are necessities that come as a set and must be integrated with the structure. (The approach is the subject of a separate section in this document.) If the lofts are stacked, vertical distribution systems must be introduced and this must be done in a way that does not disturb the “universal space.”

We should be aware in planning loft space that natural ventilation is available only in the areas immediately adjacent to the perimeter of the structure. Areas within the center must have mechanical ventilation. Even with this ventilation, core areas tend to become uncomfortable during the summer months. The least that can be done is to provide cooling at the core. A partial answer. Sealing of the core area and conditioning the air negates the idea of a “universal space.” Therefore, a condition of the loft that it be a fully air-conditioned space.
ed space, and that is the loft. A single room or as large as purposes, we will think of them the horizontal plane and limited and economic exigencies. If we have a large enough site, limited only by the fire safety allowable travel distance from the interior to the nearest stack these lofts as many again, we reach the limits such space is very simple if we short spanned, repeatable

module. However, if we seek very large, column-free spaces, we will need to resort to more complex structural techniques such as space frames, cable structures, lamella arches or other sophisticated devices. A relatively recent newcomer on the space enclosing scene is the air-supported structure. It is an economical and relatively simple plastic cover, anchored to the earth at its perimeter and supported by air pressure. Another, similar enclosure is the plastic fabric tent hung from an external frame of aluminum tubing. Both of these devices are in the early stages of their evolution and hold great promise for the near future.

Once we have enclosed the space, we need to attend to the creature comforts of those whom we are sheltering. These must be supplied to the structure without destroying the "universal" quality of the space. Lighting, ventilation, heating and cooling must be distributed horizontally to all points of the loft. These are necessities that come as a set of systems to be integrated with the structure. (The systems approach is the subject of a separate section of this document.) If the lofts are stacked, vertical linkage of the horizontal distribution systems must be introduced and this must be done in a manner which least disturbs the "universal space."

We should be aware in planning loft spaces that natural ventilation is available only in the areas immediately adjacent to the perimeter of the structure. Areas within the center must depend on mechanical ventilation. Even with this ventilation, the core areas tend to become uncomfortably warm during the summer months. The least that can be done is to provide cooling at the core. This is but a partial answer. Sealing of the core area to contain the conditioned air negates the idea of a "malleable" loft space. Therefore, a condition of the loft concept is that it be a fully air-conditioned space. The exceptions
would be such areas as auto shops and construction shops which are large, open rooms with oversized doors which can be opened to allow cooling breezes to blow across the interiors.

Next, we must consider the service functions of energy distribution, communications and waste disposal. These, too, are systems to be integrated with the structure. However, unlike the "comfort service," their universal distribution is not necessarily a foregone conclusion. It would be ideal if one could afford such a total system. This would mean that one could tap the service system at any point, instantly, to accommodate any potential need. Reason tells us that we do not need full capability from the service system at all points at all times. The system would be overdesigned.

A more judicious approach is to concentrate the service functions at focal points within the structure and distribute branch lines to points of demand as needed. These service foci would have the capacity to handle anticipated peak loads for each service area.

The size of each service area would be determined by how far the distribution branches can reach before becoming cumbersome to use and by the capacities of the branch lines.

Placement of these focal points becomes a planning function. They could be located at intervals along the periphery or at points within the interior of the structure.

Other hard elements of plan are stairs, toilets and elevators. These can be packaged together and located as free-standing elements outside the shell of the loft or treated as islands, placed at strategic points within the interior.

Note that the emphasis here has been to preserve the "universal" character of the interior space. All services are concentrated in the skin, i.e., the floor, ceiling or wall or in free-standing islands within the structure. All other...
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emphasis here has been to preserve the character of the interior space. All service ed in the skin, i.e., the floor, ceiling or wall or in free-standing islands spaced outside or within the structure. All other space is unencumbered.

It is conceivable that all anticipated learning functions could take place within a single loft space. The efficient uses of this space would depend on it housing a collection of learning functions with similar ceiling height requirements. Otherwise, if some portions of the program mix need higher ceilings, then the sections with low ceiling needs end up with excessive volumes. (One possibility is a singl e: on a sloping site—let the stepped floor provide the height differential.) A more efficient approach would be to provide two or more smaller lots of different heights. Space managers then have an option of
Tailoring functions and structure more effectively.

In addition to ceiling heights, there is the consideration of the light duty versus the heavy duty aspects of the facility. There is no need to provide the rugged construction and service one expects in an industrial setting in an office environment. Separate lofts would have separate characteristics.

Clean and dirty as well as quiet and noisy functions need separation. These can be dealt with by compartmentation of a single loft. However, separate lofts may offer even better separation.

Direct or indirect access to spaces within the loft are other criteria to consider. Certain learning functions require direct and easy access to them.

Large openings for material handling, entrances and for the removal of bulky projects are frequent program requirements. Small lofts offer more perimeter than large lofts, thus presenting more options to designers.

Lofts can be paired or clustered in multiple combinations. Frequently, it is possible to create outdoor spaces between for outdoor or indoor amenities which enhance and humanize the environment.
Mechanical Penthouse

Mechanical Penthouse

Mechanical Penthouse

Mechanical Penthouse

Mechanical Penthouse

Service Cores

Typical Two Story Service Core

Mechanical Penthouse

Heating, Ventilating, Air Conditioning, & Utilities Shaft

Stair

Toilet

Toilet

Toilet

require direct and easy access to the out-of-doors. Large openings for material handling, vehicle entrances and for the removal of bulky, completed projects are frequent program requirements. Several small lofts offer more perimeter than a single large loft, thus presenting more options for access openings.

Lofts can be paired or clustered in many combinations. Frequently, it is possible to utilize the spaces between for outdoor or indoor courts and other amenities which enhance and humanize the environment.
HOW TO MANIPULATE AND CONTROL SPACE AND TIME

Given this "universal" space, how do we shape it to achieve our educational and human objectives?

Space Allocation—Territorial and Time Definitions

Allocating space by number to be accommodated
- individual
- companions—two persons
- social group—three or more
- community—tens or twenties
- society—hundreds

Allocating space by the "elbow room" needed to accomplish the learning tasks.

Allocation of space by character of the task:
- noisy, clean—dirty, light duty—heavy

Allocation of space by services available

Allocating the same space in different ways (conventional scheduling of space as where a variety of classes use the space on a fractional time basis).

Allocation of a single space for a single course (scheduling on the basis of student blocks of time until project is finished).

Multi-use space (with its good and bad connotations—set up and take down...
LATE AND CONTROL

What is "space," how do we shape it to achieve and human objectives?

Territorial and Time Definitions

- Number to be accommodated
- Number of persons
- Number of persons or two or twenties
- Need for "elbow room" needed to accomplish tasks.

- Allocation of space by character of the task; quiet—noisy, clean—dirty, light duty—heavy duty.
- Allocation of space by services available to execute the task.
- Allocating the same space in different time frames (conventional scheduling of space and equipment where a variety of classes use the same room set ups on a fractional time basis).
- Allocation of a single space for a single project (scheduling on the basis of students taking only one or two courses and working continuously in large blocks of time until project is finished).
- Multi-use space (with its good and bad connotations—set up and take down at beginning and
WHAT ARE THE MEANS OF SPACE MANIPULATION

Within our universal space, we can now assume any number of spatial roles. We can create clusters of small rooms, large rooms or no rooms at all. The means for shaping spaces are a series of devices already available in the marketplace.

Compartmentation can be accomplished through the use of sound-deadening, demountable walls and sliding panels. Spaces can also be separated from one another with overhead, roll-up, slatted open mesh gates. In certain cases, we expected that an installation will remain an extended period of time, conventional materials such as light masonry block construction may be considered as temporary partitioning. Such materials, used in several alterations, can often be cheap, expensive, sophisticated system recycled number of time. (There will be a temporary inconvenience.) Lightweight, the necessary impact and abrasion required in shop environments.

The use of demountable partition systems that the loft structure be developed on a basis to receive the wall panels. (The generally been accepted as being the option for incremental room sizing.)

Recently, there has been the development of laying our work stations within large offices called "office landscape." It is organizing a series of work alcoves in the device of low partition panels (5' x 5'). These panels are self-supporting, have vertical edges, and can be shaped into combinations of spaces. Elements of as desks, cabinetry and shelving are clip-on devices to the panels. These combinations are laid out to follow through the offices. The office landscape, particularly effective approach to shared stations within a large, open space area, be highly adaptable to the educational. Its most appropriate application seems carpeted, light duty, academic, business, etc., areas.
another with overhead, roll-up, slatted walls or roll-up open mesh gates. In certain cases, where it is expected that an installation will remain in place for an extended period of time, conventional, throw away materials such as light masonry block or drywall construction may be considered as temporary partitioning. Such materials, used in the course of several alterations, can often be cheaper than an expensive, sophisticated system recycled an equal number of time. (There will be a temporary mess created as these changes are made; however, the process is quick and the mess will only be a temporary inconvenience.) Lightweight masonry has the necessary impact and abrasion resistant qualities needed in shop environments.

The use of demountable partition systems implies that the loft structure be developed on a modular basis to receive the wall panels. (The 5' x 5' grid has generally been accepted as being the most suitable option for incremental room sizing.)

Recently, there has been the development of a method of laying our work stations within large commercial offices called “office landscape.” It is a way of organizing a series of work alcoves into clusters by the device of low partition panels (5' to 7' in height). These panels are self-supporting, hinged at the vertical edges, and can be shaped into free-form combinations of spaces. Elements of furniture such as desks, cabinetry and shelving are attached by clip-on devices to the panels. These flexible combinations are laid out to follow the work flow through the offices. The office landscape concept is a particularly effective approach to shaping work stations within a large, open space and promises to be highly adaptable to the educational environment. Its most appropriate application seems to be in the carpeted, light duty, academic, business, medical, etc., areas.
Variations of the above-mentioned short, self-supporting panel systems can be developed for use in the medium duty areas to visually screen areas and supply wall surfaces for chalkboard, tackboard and shelving.

**Floor surfaces** in the loft space are a concern for the carpet.

Carpeting can be laid over the concrete areas where easily mopped surfaces are desired. Resilient tile, the old standby, still remains a possibility, especially in the areas where it might inhibit the inherent flexibility of certain tasks. Learning can be a concern for the carpet.

Specialized flooring (computer room) is a flexible means of handling spaces underfloor cable spaces. It should be selected carefully, for it is an expensive system to install.

Construction sheds may not need floor surfaces in all except in peripheral areas. Dirt is a measure of flexibility in teaching on a wooden floor surface. It is highly appropriate for masonry, mixing, pouring and testing.
above-mentioned short, panel systems can be developed for high-duty areas to visually screen areas surfaces for chalkboard, tackboard

Floor surfaces in the loft space are basically concrete. Carpentry can be laid over the concrete, where appropriate. Note the comment, “where appropriate.” Care must be taken not to impose carpentry into areas where it might inhibit the inherently messy execution of certain tasks. Learning can be constricted by concern for the carpet.

Resilient tile, the old standby, still is appropriate for areas where easily mopped surfaces are desired.

Specialized flooring (computer room flooring) is a very flexible means of handling spaces needing large underfloor cable spaces. It should be used judiciously for it is an expensive system to install.

Construction sheds may not need concrete floors at all except in peripheral areas. Dirt floors offer a measure of flexibility in teaching not found in another floor surface. It is highly appropriate for laying masonry, mixing, pouring and testing concrete, digging and laying trenches, backfilling, etc.

Ceilings may, in many cases, be allowed to show exposed structure. Acoustical treatment can be acquired through the use of cement bonded fibrous roof decking. Exposed ceiling structure in art laboratories, galleries, classrooms and elsewhere, offer natural places for clamp-on lighting to highlight special displays, accent light spaces and create “mood” lighting.

In many areas, of course, it will be appropriate to provide finished, acoustical ceilings, depending upon the character and quality of environment desired.

Lighting would be treated as a basic overall system, supplying the need for good, overall seeing capability. Supplemental lighting which can be of the clamp-on, plug-in variety mentioned earlier, can be readily introduced at any point in the loft to shape visual environment, much like stage lighting. It is a potent device which is too little used. It offers a
means to break up the visually bland and tiresome effect of overall uniform lighting.

Communication would consist of a basic, overall announcing system, supplemented by a ceiling, plug-in, pole-mounted, relocatable power and communications source which can be placed almost anywhere in the room. This device is now on the market. It furnishes a telephone, a PA speaker, as well as power plugs.

THINGS MANAGEMENT

Career preparation emphasizes the “do” side of education as against the “read about it” side—it is a hands-on operation.

Educative artifacts, tools, exciters, are an integral part of career preparation and must be managed along with the spaces in which learning takes place.

It is the process whereby things are collected, the process started, set in motion, maintained, finally completed, dismantled and cleared away for the next event.

What does one do with the things currently not on line and being used? Where and how are these things to be stored? Traditionally, things are put away out of site until called forth for use again. This promotes the hazard of being “out of sight and out of mind.” Things stored have a habit of waiting to be used until such time as they become “dodo's” and end up being abandoned. This is a static and expensive thing to have happen.

The solution is storage which advertises the potential of the things being stored, thus inviting their use. What is needed is a light, portable, service system which can be easily moved to dispensing points. Granted, a certain measure of “dumb” storage is necessary to act as a kind of attic. However, attics have a habit of being repositories of useless things.