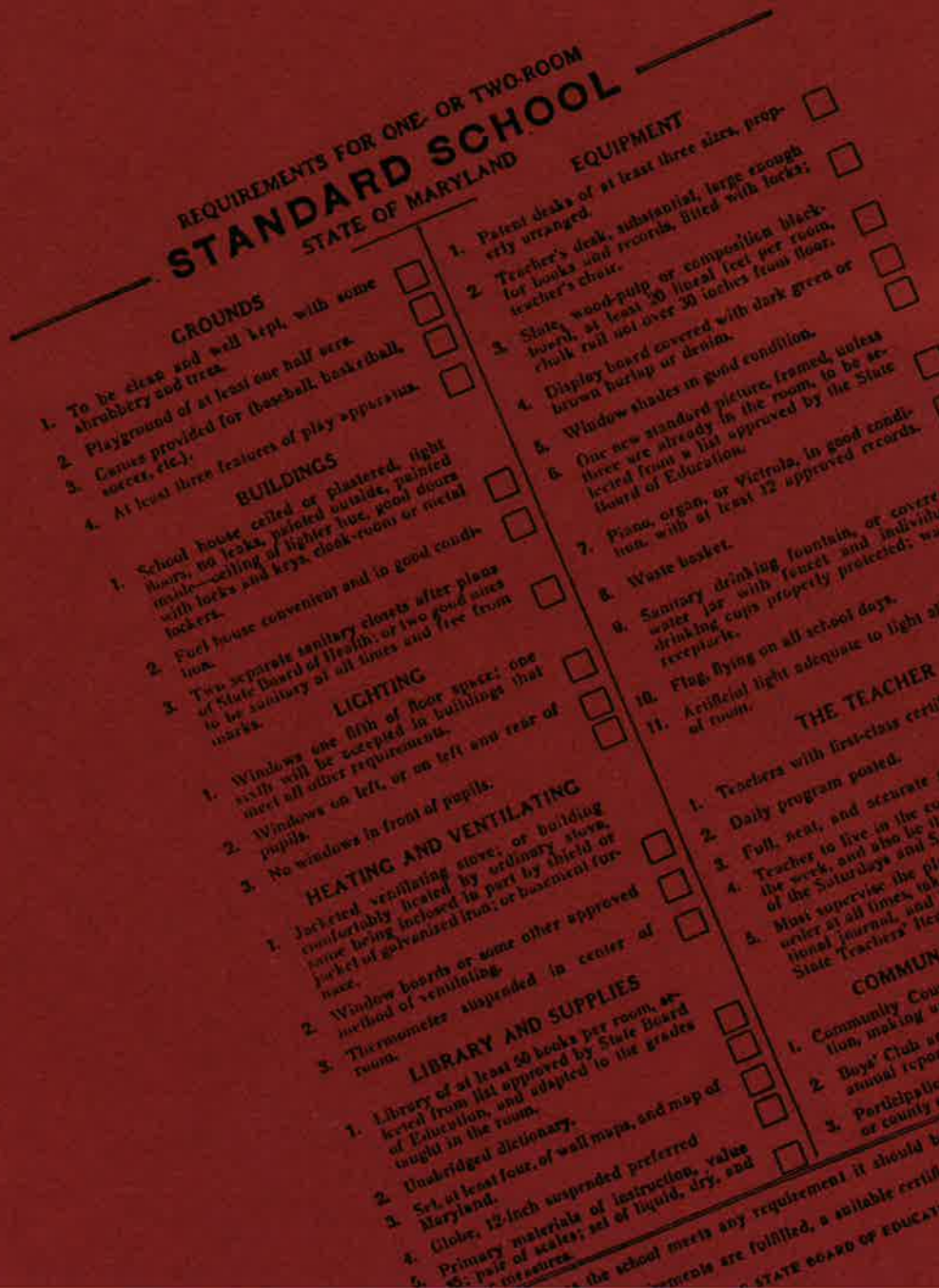
FACILITY GUIDELINES FOR GENERAL CLASSROOM DESIGN

Maryland State Department of Education
2005


REQUIREMENTS FOR ONE- OR TWO-ROOM
STANDARD SCHOOL
STATE OF MARYLAND

GROUNDS

1. To be clean and well kept, with some shrubbery and trees.
2. Playground of at least one half acre.
3. Games provided for (baseball, basketball, soccer, etc.).
4. At least three features of play apparatus.

BUILDINGS

1. School house ceiled or plastered, tight floors, no leaks, painted outside, painted inside—ceiling of lighter hue, good doors with locks and keys, cloak-room or metal lockers.
2. Fuel house convenient and in good condition.
3. Two separate sanitary closets after plans of State Board of Health, or two good ones to be sanitary at all times and free from odors.

LIGHTING

1. Windows one fifth of floor space; one sixth will be accepted in buildings that meet all other requirements.
2. Windows on left, or on left and rear of pupils.
3. No windows in front of pupils.

HEATING AND VENTILATING

1. Jacketed ventilating stove, or building comfortably heated by ordinary stove, stove being inclosed in part by shield of jacket of galvanized iron or basement fur-nace.
2. Window boards or some other approved method of ventilating.
3. Thermometer suspended in center of room.

LIBRARY AND SUPPLIES

1. Library of at least 50 books per room, selected from list approved by State Board of Education, and adapted to the grades taught in the room.
2. Unabridged dictionary.
3. Set, at least four, of wall maps, and map of Maryland.
4. Globe, 12-inch suspended preferred
5. Primary materials of instruction, value $5; pair of scales; set of liquid, dry, and linear measures.

EQUIPMENT

1. Patent desks of at least three sizes, properly arranged.
2. Teacher's desk, substantial, large enough for books and records, fitted with locks; teacher's chair.
3. Slate, wood-pulp or composition blackboard, at least 30 lineal feet per room, chalk rail not over 30 inches from floor.
4. Display board covered with dark green or brown burlap or denim.
5. Window shades in good condition.
6. One new standard picture, framed, unless three are already in the room, to be selected from a list approved by the State Board of Education.
7. Piano, organ, or Victrola, in good condition, with at least 12 approved records.
8. Waste basket.
9. Sanitary drinking fountain, or covered water jar with faucet and individual drinking cups properly protected; waste receptacle.
10. Flag, flying on all school days.
11. Artificial light adequate to light all parts of room.

THE TEACHER

1. Teachers with first-class certificates.
2. Daily program posted.
3. Full, neat, and accurate school register.
4. Teacher to live in the community during the week, and also be there at least some of the Saturdays and Sundays.
5. Must supervise the playground, maintain order at all times, take at least one educational journal, and be a member of the State Teachers' Reading Circle.

COMMUNITY ACTIVITIES

1. Community Council or similar organization, making annual report.
2. Boys' Club and Girls' Club, each making annual report.
3. Participation of school in county field day or county school fair.

If the school meets any requirement it should be checked in the space following the requirements are fulfilled, a suitable certificate will be awarded by the State Board

STATE BOARD OF EDUCATION, MARCH 29, 1918

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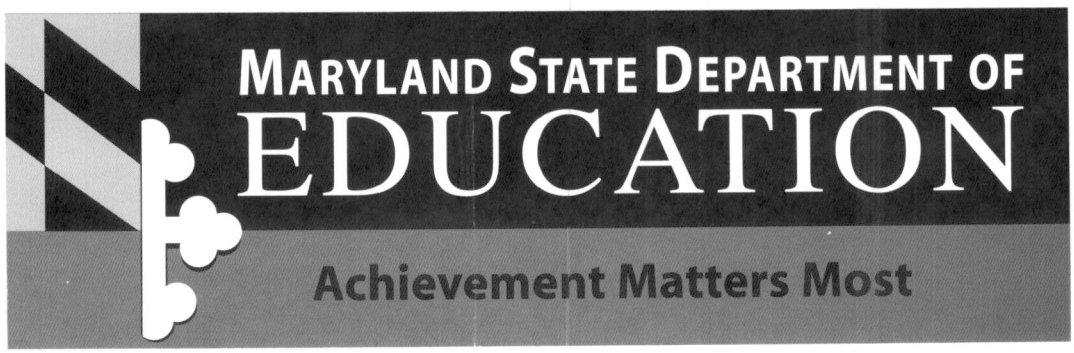

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Additional copies of this publication are available from the MSDE School Facilities Branch.
Call (410) 767-0098 for information and pricing.

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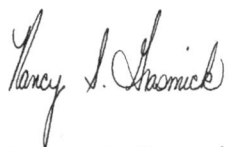
Foreword

Facility planning and the design of general classrooms are of paramount importance in meeting the goal of providing environments that support the education of all children. This guide is designed to help citizens, facility planners, educational administrators, educators, and architects make informed choices about the types of learning environments they will provide. The criteria in this guide were developed from field research with the users of school buildings, - administrators, educators and students, academic research, and study.

This document, *Facility Guidelines for General Classroom Design*, addresses the design of numerous elements needed to create a successful learning environment. Many of these items will most likely evolve as time goes on. Technological changes will occur. State standards and general educational practices may change. The principles of this guideline are forward thinking and intentionally open-ended in order to evolve with educational practices. Questions regarding the number of children per classroom, maximum number of children per teacher and state rated capacities of school buildings have not been addressed. Class size is a very important issue to address at the local level. It is my sincere expectation that this guide will make a significant contribution to the facility planning process and in turn, provide exceptional classrooms for future facilities.

I am pleased to provide these design guidelines to assist in planning the general classroom.



Nancy S. Grasmick
State Superintendent of Schools

Note: These planning guidelines do not in any way supercede state or local codes or regulations, nor do they replace federal or state legislation regarding building design and construction, access, safety or other pertinent issues.

Introduction

The single most important component of the school building is the general classroom. Of all the spaces in a school building, the general classroom is where children spend most of their time in school. The Maryland State Department of Education has long held that the physical environment of the school building affects learning. The Maryland Middle Learning Years Task Force produced a document in 1999 that states "middle grade students need learning environments that are designed specifically for them. Learning environment design should be linked directly to the processes of learning, transfer and competent performance." Prior to the passage of the Federal law - No Child Left Behind, the State of Maryland had established a Visionary Panel for Better Schools. This panel published its report "Achievement Matters Most" in January, 2002. This document proposes a Strategic Plan for raising the achievement of all students in Maryland. Two of the five goals presented in the document take into account the facilities in which children learn. One of the goals, Goal #2, relates to Instruction and Assessment – "How well we teach the content will make all the difference in the world." In order to teach "well" certain tools need to be on hand for the educators: an environment conducive to learning, human comforts met adequately, appropriate lighting, adequate learning tools such as access to books and/or computers. Goal #4 relates to Safety – "We will recognize an inextricable link between a child's physical, emotional and mental health and his or her academic success." This goal focuses attention on the design of the learning environment and its impact on the occupants of the school building, our students. Learning should occur in a facility which allows the student and staff to be healthy, safe and happy.

This guideline for the design of the general classroom is an effort to support not only the Maryland Initiatives and Federal Law but to support all the children of our State in their endeavor to learn.

> "The process of envisioning and designing environments that support competence, independence, exploration and inclusion is far more complex than following a list of suggested guidelines. The product can only be as good as the process that creates it and the expertise of the design participants." (Stoecklin, 1999)

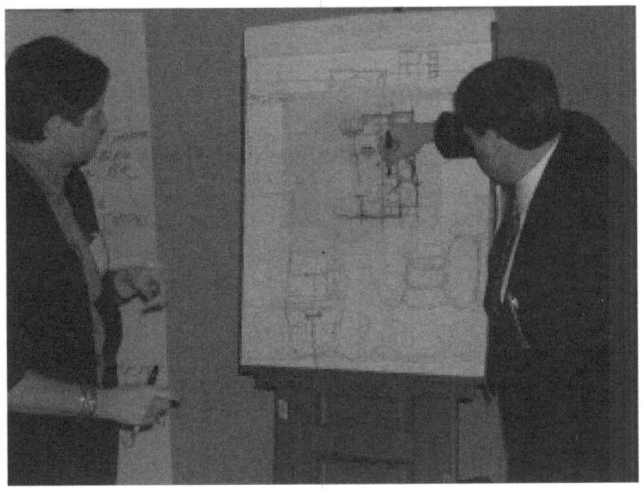
The State of Maryland Department of Education and the Public School Construction Program have devised a good community based process by which our schools are designed. These classroom facility guidelines are meant to augment, inspire, and enhance the expertise of the educational design professional. Current educational methods are discussed in this document in order to understand the impact of architectural elements on spaces designed for learning. The goal of this document is to illuminate the combined effects education and well designed environments can have on learners. Several questions to be explored in this document are:

- Have the concepts of learning and strategies for teaching changed?
- What is needed in today's classroom? What should be provided in current classrooms?
- Can physical characteristics enhance learning?
- How can the design of classrooms accommodate flexibility and allow for change?

CHAPTER I

Current Educational Theories

This guideline is an effort to combine the research being done in architecture, science, and education in order to offer a comprehensive view into the design of classrooms. A renewed awareness of ecological and sustainable principles as applied to architecture has occurred. More and more studies are being completed which focus on the impact that the physical environment has on learning and on teaching. Scientific research has expanded our knowledge of the brain and the process of learning. This research has spawned studies of brain targeted learning. Educational research also concentrates on several other topics: project-based learning, multiple intelligences, learning styles theory, the collaborative classroom theory and constructivist theory of teaching. The design of the classroom, by integrating knowledge of these theories, can enhance and support the application of teaching strategies. Data collected through field surveys performed by staff members of the Maryland State Department of Education during the spring of 2002 helped to confirm and clarify the needs of students, teachers and administration. The findings from this data, research and a classroom design workshop were combined to create this document.



CEFPI Conference Participants

The classroom design workshop was held in the spring of 2003, sponsored by the Council of Educational Facility Planners, International (CEFPI) Northeast Region and the Maryland State Department of Education. Those attending the workshop came from the northeast region of the United States and Canada. Among the participants were school facility planners, teachers, principals, educational administrators and architects. The workshop consisted of 4 presentations in the morning regarding different theories of education. The afternoon was devoted to participants working in groups designing instructional spaces for elementary school children and their teachers.

The speakers at the workshop gave valuable information and insight into the most recent thinking in education. Some of the subjects covered were brain research and learning, the importance of school design for special needs populations, constructivist learning and the impact of standards based education on the classroom. These are just a few of the issues that educators are grappling with in today's world.

By the end of the day, the workshop attendees agreed that classrooms of the twenty-first century should be designed differently than many we see today. The task given to the groups was to design two learning environments: one for a group of children with a small percentage of special needs children and one for a group of children with a large special needs population. For purposes of this document, special needs students are defined as students requiring special education services, children requiring English language tutoring or English Language Learners (ELL) and/or students receiving free and reduced price meals (FARM). This group of students generally requires either an aide, more individualized assistance from the teacher and/or additional tutoring time. Space should be planned in the classroom to provide these services. Most participants, educators, architects and designers alike agreed that the environment to support special needs populations is also very applicable and justifiable for the general student population. Additional space for tutoring, one on one interaction with the teacher or hands-on learning projects would benefit any student. **One common observation was that classrooms needed to be larger than are typically built by today's standards in order to accommodate the needs of both students requiring special services and general education students.**

Have the concepts of learning and strategies for teaching changed?

All sketches demonstrated a partiality for project rooms or spaces that could either be shared with another class or could be self-contained, designed for hands-on learning and long term projects. These rooms had vision panels to the classroom for adult supervision. The project rooms were designed to be flexible to meet the needs of the students and teachers at any time. With this arrangement, one-on-one instruction could be accommodated as well as whole class settings in the main classroom area. Desks, if shown, were often paired or in groups of 4; sinks were included in 90% of the schemes, two-thirds of the schemes provided toilet rooms accessible from the classroom, 50% included personal cubbies or lockers *inside* the classroom; all rooms had windows; all rooms were provided with storage – either built in casework or storage closets. Most sketches assumed the use of laptop computers versus built-in computer stations in the classroom. Some went so far as to design cabinets for night time recharging of the lap top computers.

Appendix A includes the floor plans generated by the groups during the workshop. The sketches were taken from hand sketches to CADD drawings. Modifications to the sketches to address items such as codes, accessible door clearances, etc., were added later due to the time constraints of the workshop itself.

• Brain Targeted Learning

Educational professionals continue to refine the art of teaching by exploring research topics such as brain-based learning. Or better yet – Brain *targeted* learning.

As Mariele Hardiman, Ed.D., principal of Roland Park Elementary/Middle School, Baltimore City Public Schools, Maryland and doctoral graduate from Johns Hopkins University, pointed out at the CEFPI conference (April 2003), "All learning is "brain-based" but not all teaching is brain *targeted*." Effective teaching is a "brain targeted teaching model". The classroom climate and environment play a big part in brain receptivity to learning. The term "climate" includes not only the physical comfort (variables of air temperature, relative humidity and air movement) in the room but also the emotional climate in the classroom. In addition to climate, the physical learning environment, (such as the amount of space, the quality of light, and the physical layout of the room) has an important impact on learning.

Brain targeted teaching uses the information brain researchers have uncovered in the past several years regarding how the brain processes and stores information. (Sousa, 1998). The research has unlocked information on how to teach not only students with special needs but also how to better teach every student.

This brain targeted teaching model, called **Dimensions of Learning**, consists of five main principles or dimensions: Dimension 1-Positive Attitudes, Dimension 2-Acquiring & Integrating Knowledge, Dimention 3-Extending& Refining Knowledge, Dimension 4-Using Knowledge Meaningfully, and Dimension 5-Habits of Mind (Marzano, 1992). **These principles are defined in Chart 1.1 in the left two columns. Architectural components are added in the right two columns as some examples of how to support a model of this type.**

A regional CEFPI conference workshop held in Minneapolis MN in 1998 explored similar findings. The workshop goals were to explore recent findings in brain research, discuss how these findings may impact educational curriculum and explore the implications of these findings on school design. Jeffrey A. Lackney, Ph.D., A.I.A., describing twelve design principles based on the outcomes of this workshop, prepared the summary below.

Brain-Based Principles

for Educational Design and items which school environments should provide:

- *Rich-stimulating environments – color, texture, "teaching architecture", student displays (appropriate for the type and variety of activities performed)*
- *Places for group learning- breakout spaces, alcoves, table groupings to facilitate social learning and stimulate the social brain; turning breakout spaces into living rooms for conversation*
- *Linking indoor and outdoor places*
- *Corridors and public places contain symbols of the school community's larger purpose–provides coherency and meaning that increases motivation; going beyond slogans*
- *Safe places (representing culture and values of community)*

- *Variety of places*
- *Changing displays - interacting with the environment stimulates brain development*
- *Provide resources for a variety of disciplines in close proximity (multiple functions and cross-fertilization of ideas is a primary goal)*
- *Flexibility*
- *Active/passive places*
- *Personalized space for students and teachers*
- *Utilize the community at large as the arena for learning*

Lackney notes that this list is not meant to be comprehensive. "It is only a starting point for discussion. Also note that many of these principles reinforce one another and should be used in as many combinations as possible. Schools incorporating a variety of these principles will, by definition, have the flexibility to accommodate a wide array of learning styles." (Lackney, 1998)

Dimensions of Learning

Principle	Goal	Architectural Contribution	Architectural Components
Dimension One: Positive Attitudes	A student's attitudes and perceptions serve as filters that enhance or inhibit learning	Impacts a student's attitude and physical comfort	• Sunlight, windows, a view to the outdoors, openness, acoustically separate, comfortable temperature & relative humidity*
Dimension Two: Acquiring & Integrating Knowledge	Learning new information must occur within the context of what the learner already knows and must be adequately assimilated so that information can be used easily in new situations	Provides visual and physical access to instructional tools	• Open shelving, readily accessible to the children and for the display of manipulatives, books, related to the topics being studied • Televisions and videos • Bulletin boards for display of current activities and study units • Visual and physical access to the outdoors
Dimension Three: Extending & Refining Knowledge	Examining already known information in a deeper, more analytical way by comparing, classifying, inducing, deducing, analyzing errors, constructing, abstracting, & analyzing perspectives.	Provides physical space, acoustics furnishings and equipment to allow for active learning, spirited discussions and other components of brain-targeted learning	• Project space or project rooms to allow active learning and exploration to take place • A multi-purpose space to apply knowledge by investigating, doing experiments, solving problems and inventing; finishes should be durable • Demonstration and study stations like an aquarium, terrarium or miniature greenhouse provides on-going learning • Provide a space for small group discussion/ debate; a place to get others input • Provide a place to present conclusions and theories to classmates, departments, visiting mentors, etc • Provide access to real world & community
Dimension Four: Using Knowledge Meaningfully	Learning takes place most effectively when we need information to accomplish a goal and when it is used to perform meaningful tasks. problems		
Dimension Five: Habits of Mind	Monitoring one's own thinking, goal setting, seeking accuracy, maintaining one's own standard of evaluation through self-regulation and applying one's unique learning style to future learning situations; thinking critically and creatively while pushing oneself to attain know-ledge and work at the edge of one's own competence	Provides the space furnishings and acoustics to support quiet contemplative activities	• A quiet area or room to contemplate, evaluate and set goals; a quiet reading zone; a loft or "cave" atmosphere for privacy and a get-away • Safe environment-supports risk taking and exploration • Space to store and display long-term projects • Provide small seminar spaces for one on one exchanges; verbal "confirmation" of one's own theories through discussion with teachers, classmates, etc • Electrical outlet for lamp to create atmosphere

Chart 1.1

*For clarity, "thermal comfort" is defined as a range of temperature and relative humidity as listed in ASHRAE Standard 55. Providing temperatures between 71degrees Fahrenheit and 74 degrees Fahrenheit with a relative humidity of 40-60% in the summer and 30-50% in the winter. Children can generally be comfortable at temperatures up to 5degrees F lower due to their higher metabolic rate.

• Project-Based Learning

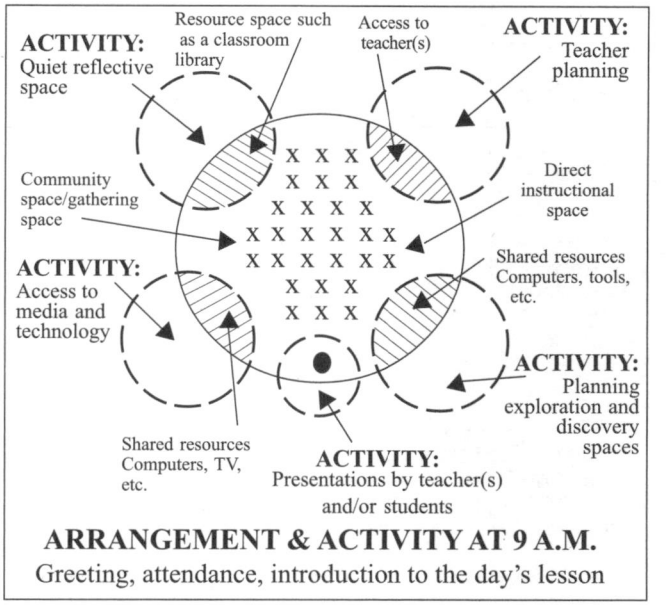
Project-based learning is another research finding impacting the field of education. A project-based learning method is a comprehensive approach to teaching which emphasizes the interdisciplinary nature of learning. Project-based learning stresses "a whole body approach to learning by incorporating relevancy, experience and application to cognitive learning." (Wolff, 2002) Projects provide the student with a wide variety of skill exposure – mathematics, language arts, geography, fine arts, science and/ or technology. Traditional teaching methods focus on verbal/linguistic strategies and mathematical/ logical strategies. This can be frustrating for students who best learn using other intelligences such as kinesthetic, visual, musical, naturalist, interpersonal or intrapersonal, which are discussed later in the chapter. Project based learning does not replace cognitive learning. It enhances it. Project-based learning techniques increase the possibility to address all types of intelligences for all types of students.

Providing an environment that supports the basic tenets of project-based learning ensures the most is gained. A recent study (Strange and Banning 2001) suggested that to support this type of learning the following elements needed to be provided:

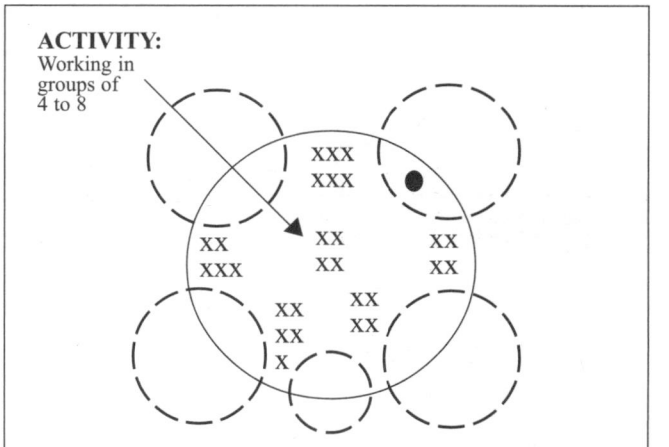
- *gathering spaces*
- *planning spaces*
- *resource spaces such as libraries*
- *media like television, cable*
- *access to technology*
- *exploration and discovery spaces*
- *production spaces*
- *practice spaces*
- *presentation spaces*
- *community spaces*
- *direct instructional spaces*
- *quiet, reflective spaces*
- *access to faculty*

The goal for designers would be to provide flexible spaces that could meet one or more needs. Careful planning & design would provide convenient relationships for overlapping activities.

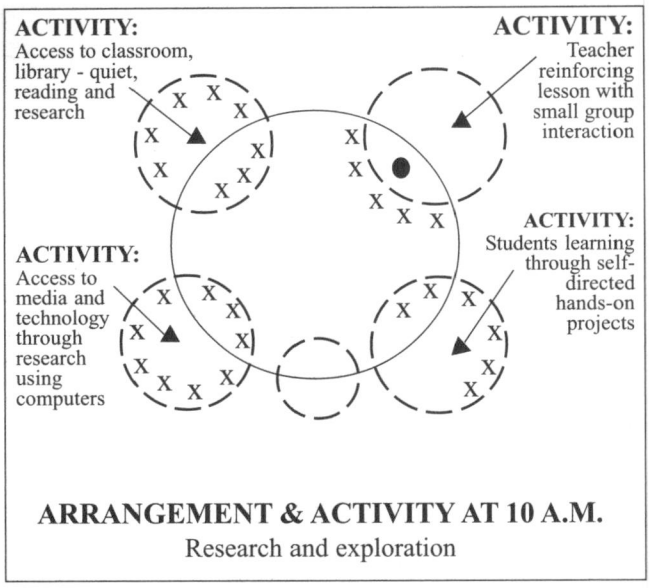
The presentation of these items in list form is not meant to suggest that a single specialized space is needed to accomplish each of the above. Spaces which are flexible and adaptable can allow one or more activities to occur within. The following diagrams exemplify this layering of activities within a single space. The time periods and activities are included only for representational purposes of the diagrams. These diagrams can be applied to activities in all age ranges pre-kindergarten through 12.



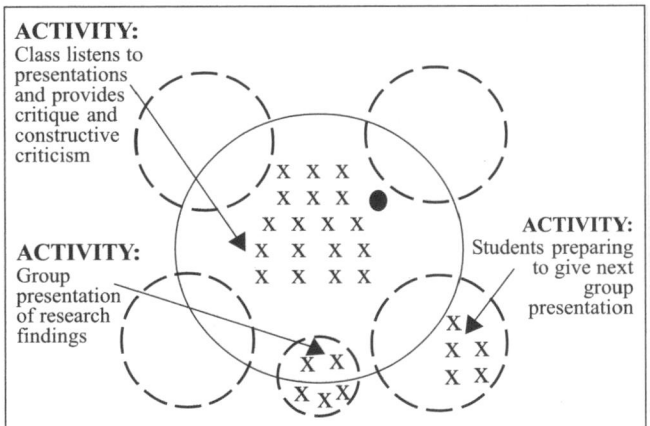
ARRANGEMENT & ACTIVITY AT 9 A.M.
Greeting, attendance, introduction to the day's lesson



ARRANGEMENT & ACTIVITY AT 9:30 A.M.
Collaborative work session



ARRANGEMENT & ACTIVITY AT 10 A.M.
Research and exploration



ARRANGEMENT & ACTIVITY AT 11 A.M.
Group presentation of findings from research and exploration

In a doctoral research study by Susan Wolff the following 32 design features were highlighted as desirable "Design Features for Collaborative, Project-based Learning". The following list of design features provides a great resource when designing classrooms and project rooms. Further details of several design features are given in Chart 1.2.

Project Based Learning
Design Features

Structural Aspects
- *Flexible Spaces*
- *Spaces with visible infrastructure, exposed mechanical, structural systems, etc*
- *Adaptable Spaces*
- *Layered Spaces-spaces which can accommodate a multitude of activities and various groups of children*
- *Spaces with durable building materials and finishes*
- *Spaces with core or fixed elements*

Group Size
- *Variable sized space*
- *Individual workspace*
- *Faculty team spaces*

Furnishings
- *Spaces with versatile furnishings*
- *Display spaces*
- *Space with variable lighting*

Functional Spaces
- *Focus lab spaces*
- *Classroom spaces*
- *Presentation spaces*
- *Practice spaces*
- *Process galleries, studios & display spaces*
- *Project space*
- *Home base*
- *Informal learning space*
- *Collaboration incubator*

Psychological/Physiological Support
- *Spaces that provide a sense of belonging*
- *Spaces with access to food and beverage*
- *"Get away" spaces*
- *Ownership and pride*
- *Space and furnishings for technology*
- *Zoned spaces*
- *Cave-like semi-enclosed spaces*
- *Natural light*
- *Spaces for transportation support*

Adjacencies
- *Access to community*
- *Adjacent and nested spaces*
- *Visibility*
- *Connection among people and spaces*
- *Resource, supply, and storage spaces*

In an effort to apply illustrative examples of how to provide an environment, which would support and enhance project-based learning – selected items from the above list are paired with architectural and environmental elements below.

Collaborative Project-Based Learning Model

Feature	Description	Architectural Contribution	Architectural Component
Structural Aspects	**Spaces with Visible Infrastructure** • Elements of the building which may normally be hidden are now fully exposed	• Encourages inquiry and enhances observation skills and curiosity • The building itself can become a learning tool • More economical use of finish materials equals a more sustainable building design	Primary and Secondary Education: • Exposed structure: Beams and Columns, Roof Trusses • Exposed mechanical systems: Ductwork and Plumbing • Gauges and dials which list items like temperature, relative humidity, etc
Group Size	**Variable Sized Space** • Areas that are easily changed moment to moment, day to day	• Supports several learning activities within the same space • Provides space for multiple purposes and different sized groups • Encourages and supports integration of curriculum and programsthrough sharing of space and equipment	Primary and Secondary Education: • Rooms which are visually and physically open within - no permanent obstructions within the space • Define areas by floor material or pattern • Define areas by ceiling material, pattern or height • Easily moved furniture • Portable shelves to create room dividers for varying sizes of groups • Storage and display
	Individual Workspace • A space for an individual to personalize and in which to work and study	• Provides sense of ownership and helps to teach responsibility for one's own learning and one's own environment	Primary Education: • Provide supervisable nooks and cubbies within classroom, spaces students can personalize • Consider cubbies which become more than just a coat closet but a personal area, semi-enclosed space for contemplation and quiet time Secondary Education: • Provide supervisable individual workstations within the classroom
Furnishings	**Spaces with versatile furnishings.** • Movable furniture • Track lighting • Variously sized and shaped work surfaces • Comfortable seating • Equipment - computer, printers, scanners, projectors, etc. for age-appropriate presentations	• Provides flexibility to allow users to shape the learning environment	Primary and Secondary Education: • Provide tables and chairs as well as desks and chairs • Provide nooks and niches within the room to accommodate special furniture - couches, easy chairs, rockers, bean bags • Ergonomically sensitive furniture; supports students of different sizes - allows students to change positions (up, down, back, forth)

Chart 1.2

Collaborative Project-Based Learning Model (con't)

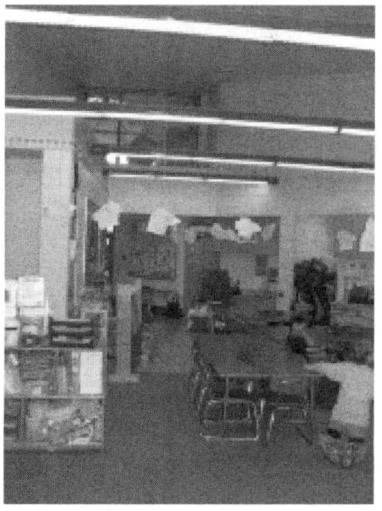
Feature	Description	Architectural Contribution	Architectural Component
Functional Space	**Presentation spaces** • Places for individuals or teams to demonstrate and perform	• Gives the opportunity to practice, share acquired skills and knowledge with learners, staff, etc. and receive feedback	Primary Education: • Provide a reading circle area • Provide an accessible "stage" • Provide an elevated accessible loft space • Sound amplification • Provide special lighting • Provide display boards Secondary Education: • Provide a reading circle area with sofas and cushions • Provide a small accessible platform/display zone defined dimensionally with raised floor and/or floor/ceiling material and special lighting • Sound amplification • Provide display boards
	Project Spaces • Provide space to produce information, services or products **Collaboration Incubator** • Idea generation space, team meeting space, access to technology and other resources	• Provides a variety of work surfaces, cabinets for supplies, storage area for projects in the development stage, access to tools and technology • Encourages critical thinking, problem solving and teamwork • Supports creativity, idea generation, teamwork and prototyping of concepts	Primary and Secondary: • Provide an area or room with durable easily cleaned finish materials for messy projects • Sink for clean up • Provide an area for "works in progress" • Display-in classroom (but also throughout building-rotating "changing displays") • Provides versatility and supports a variety of group sizes • Spaces should be sound-deadened from the main teaching/ lecture zone of the room • Sink and counter area • Older kids work with, share ideas, mentor young kids
Psychological /Physiological Support	**"Get away" Spaces** • Small study areas • Soft reading spaces • Outdoor seating to take a break from formal learning activities • Physical activity-motor skills	• Provides areas to support the need for rest, relaxation and reflection	Primary Education: • Cave-like structures, semi-enclosed, observable spaces • Loft-like accessible structures - to gain another perspective from a slightly elevated platform • Secure courtyards outside classroom Secondary Education: • Lounges • Niches in classroom and corridors • Secure courtyards • Walking gardens - open fields

Chart 1.2

Collaborative Project-Based Learning Model (con't)

Feature	Description	Architectural Contribution	Architectural Component
Adjacencies	**Resource, supply, and storage spaces.** • Closets and space within or adjacent to the learning activities space to provide ready access to resources, store supplies for classroom projects, tools, learning products and materials	• Provides easy access to needed supplies, tools and storage for learning projects	Primary and Secondary Education: • Provide teacher personal storage (lockable) • Provide teacher professional storage (lockable) • Provide classroom supply storage (lockable) • Provide book storage (resource or extra textbooks) • Provide project storage • Provide student, individual storage for projects and personal effects

Chart 1.2



Hollywood ES
Varied Furnishings

Furnishings are one of the most important items to influence how well a space supports project-based learning. Tables, desks and chairs should be able to be moved easily and quickly to accommodate any number of arrangements of students. As space is usually limited, consider the use of stackable or multi-function chairs and tables which fold up in order to provide the maximum amount of space for use by the students. Desks which are of the same height or are easily adjustable and have a level writing surface are best for true versatility. They can be used in any combination to provide as small or as large a surface as needed for the task. The traditional student arm chair with its attached sloped writing surface works against this principle. Portable bookshelves and cabinetry on wheels can also lend versatility. But comparisons should be made based on program needs between costs, expected life and durability of portable items versus built-in items. Lofts, raised floor areas, built-in bookcases, and cabinets are permanent and can reduce flexibility within the room. Life span, durability, and meeting program needs may support the choice for some items to be built-in to the classroom.

Storage is another item, which can influence how well a space supports project-based learning. Provide an adequate amount of storage for teacher tools and for student projects, in-progress. Also important is to provide appropriately located and designed utilities such as electrical outlets, water, adequate ventilation, and access to technology.

• Multiple Intelligences and Learning Styles

In 1983 Dr. Howard Gardner of the Harvard Graduate School of Education published "Frames of Mind," a study introducing the theory of multiple intelligences. Initially seven intelligences were identified. In 1999 Dr. Gardner published "Intelligence Reframed" and added two more "intelligence" categories with others still being currently developed. Chart 1.3 lists the intelligences and architectural components which supports that particular style of learning.

The term "intelligence" refers to a way of processing information. All learners take in and process information in different ways, defined as "intelligences." All people possess all nine intelligences in varying strengths. One or two of these intelligences become the dominant way of learning for an individual. A domain is a subject or topic one wishes to master. Dr. Gardner writes "Any domain

can be mastered through a lot of different intelligences." Some students reason logically, some use intuition. Some students tend to analyze while others visualize. Similarly, teachers like learners, have their own style of teaching. Teachers should strive to create a balance of methods in instruction. In order to do this the environment must be versatile enough to support teaching methods addressing multiple intelligences.

Not all learners *learn* the same way. **A classroom, which is designed to be a lecture hall, is the ultimate environment for students with dominant verbal/linguistic intelligence. It is not the most conducive learning environment for students with a strong bodily/ kinesthetic intelligence, or musical/rhythmic intelligence.** Therefore the environment of the classroom should be designed to be versatile and support all activities for all learners. This theory reinforces the need to provide classrooms which can be easily changed from a lecture format with rows of desks all facing the same direction, to a writing assignment for small groups of four to work collectively, to an art exercise with enough room for each student to paint or draw or to a quiet time emphasizing reading and reflection.

Dr. Sue Teele of the University of California, Riverside has determined that, generally, different multiple intelligences are more dominant than others at different age groups. Associating age with grade, we find that the following intelligences are dominant. The most dominant is listed first, then the next and so on.

- *Kindergarten: spatial, bodily-kinesthetic, linguistic, intrapersonal*
- *First grade: spatial, logical-mathematical, bodily-kinesthetic, linguistic*
- *Second grade: spatial, bodily-kinesthetic, logical-mathematical, linguistic*
- *Third grade: spatial, bodily -kinesthetic, interpersonal,linguistic/logical -mathematical (tie)*
- *Fourth grade: spatial, bodily-kinesthetic, interpersonal, musical*
- *Fifth grade: spatial, bodily-kinesthetic, interpersonal,musical*
- *Sixth grade: bodily-kinesthetic, spatial, interpersonal, music*
- *Middle school: interpersonal, spatial, bodily kinesthetic, musical*
- *High school: interpersonal, bodily-kinesthetic, spatial, musical*

Although this list associates dominant intelligences at each grade level, it must be understood that all intelligences are at work in some way. A three year variance among children of the same age group is normal. Classrooms should be designed to enable students to experience growth and development in all seven intelligences through multiple and different resources and materials.

Project rooms or spaces in the classroom for projects and hands-on learning provide a good environment for bodily/kinesthetic, visual/spatial, logical/ mathematical and interpersonal intelligence learners. The lecture/teacher-oriented space in the classroom provides a good environment for verbal/linguistic intelligence. Quiet corners, nooks and lofts are good environments for students with a dominant intrapersonal intelligence.

Learning styles are closely related to the concept of multiple intelligences – learning styles focus on the different approaches to learning. One publication sponsored by National Clearinghouse for Bilingual Education (NCBE - now known as National Clearinghouse for English Language Acquisition or NCELA) defined learning styles as "the result of a complex interaction of age, educational experience and cultural background." The types of learning styles have different definitions depending on the research source. Some researchers list visual learners, auditory learners, or tactile/kinesthetic learners. The publication mentioned previously describes research done by Bernice McCarthy (1980) who developed four types of learning styles based on how people perceive and process information. McCarthy's learning styles are innovative learners, analytic learners, common sense learners and dynamic learners.

Dominant Intelligences by Grade Level

	Pre-K/K		Primary			Intermediate		Middle			High			
	PK	K	1	2	3	4	5	6	7	8	9	10	11	12
Intrapersonal														
Spatial														
Bodily-Kinesthetic														
Linguistic														
Logical-Mathematical														
Musical														
Interpersonal														

Most dominant (and common) intelligence at the given age range

2nd and 3rd most dominant (and common) intelligence at the given age range

4th most dominant (and common) intelligence at the given age range

Least dominant intelligence(s)

Multiple Intelligence & Learning Styles Model

Style and Description	Architectural Contribution	Architectural Component
Visual/Spatial: Ability to perceive the visual; tend to think in pictures, create mental images to retain information, enjoy looking at maps, charts, pictures, and videos	• Introduce shape, forms and color into the room • Provide an interesting visual environment	• Highlight architectural elements through the use of color, form and textures • Provide appealing entries and environments
Verbal/Linguistic: Ability to use words and language Tend to think in words, have highly developed auditory skills, like to listen, speak, write, story-tell, teach, can easily remember information	• Provide ready access to books • Provide an acoustically adequate environment	• Use acoustical materials on ceiling and wall surfaces • Provide bookshelves
Logical/Mathematical: Ability to use reason, logic and numerical patterns making connections between pieces of information, asks lots of questions, and likes to experiment	• Introduce patterns, rhythms with architectural elements	• Provide patterns in floors and ceilings • Create rhythms within elements of the room like window patterns, light fixtures layout; cabinetry
Bodily/Kinesthetic: Ability to control body movements and handle objects skillfully; have a good sense of balance, eye-hand coordination, process information by interacting with the environment around them, express themselves through movement	• Encourage interaction through the environment	• Create spacious airy rooms • Provide varying textures and colors
Musical/Rhythmic: Ability to produce and appreciate music; think in sounds, rhythms and patterns; many are extremely sensitive to environmental sounds	• Provide an acoustically adequate environment	• Provide patterns in floors and ceilings • Use acoustical material on ceiling and wall surfaces
Interpersonal: Ability to relate to and understand others; try to see things from other people's point of view in order to understand how they think and feel; have an uncanny ability to sense feelings, intentions, motivations; are great organizers	• Provide a gathering zone	• Provide large enough space for all students to gather as a group
Intrapersonal: Ability to self-reflect and be aware of one's inner state of being; try to understand their inner feelings, dreams, relationships with others and strengths and weaknesses	• Provide a secure private zone	• Create an alcove within the room which can be supervised but provides the student with a sense of privacy and a quiet contemplative space

Chart 1.3

Multiple Intelligence & Learning Styles Model (con't)

Style and Description	Architectural Contribution	Architectural Component
Naturalistic: Ability to recognize and categorize plants, animals and other objects in nature; like to differentiate by subtle differences or meanings; categorize	• Provide a view to the outdoors • Provide a way to open the classroom to the outdoors	• Large windows • Deep window sills for plants, window seats, etc
Existential: Ability to tackle deep questions regarding human existence; try to understand the world and mankind in relation to the "big picture" of existence; like to ask "Why are we here?" and "What is our role in the world?"	• Provide a place for contemplation	• Quiet space • Electrical outlet for lamp to create atmosphere • Soft lighting

Chart 1.3

The main goal of exploring these educational theories is to understand the process of learning in order to better educate children. These theories and teaching techniques provide an awareness for teachers so they may expose all students in the classroom to the given curriculum utilizing different styles. Coincidently, many of these teaching techniques have been successful in the education of students with special needs, such as students with disabilities. Federal and State rules and regulations, and improved medical conditions have increased the number of students attending public schools with unique needs and disabilities. Since the adoption of Public Law 94-142 followed by The Education for All Handicapped Children Act of 1975 (later amended in 1990 and 1997 and renamed IDEA, Individuals with Disabilities Education Act), an increasing number of students are being placed in public schools in the least restrictive environment (LRE). The LRE means that students with disabilities, to the maximum extent appropriate, are educated with students who are not disabled and in the school they would attend if not disabled. This often means that a student is fully included in the general education classroom. When Section 504 of the Rehabilitation Act of 1973 became effective, it guaranteed students with disabilities the right to equal education opportunities, regardless of whether these students required special education services (Abend, 2001). This act requires every K-12 school district to identify every qualified person with a disability in its jurisdiction and to provide him/her with a free appropriate public education regardless of the nature or severity of the disability. It prohibits any discrimination on the basis of disability. A student with a disability means a student, age three through the school year in which a student turns 21 years old, who has been evaluated according to the federal regulations and the Code of Maryland Regulations (COMAR) is found to have a disability (as indicated in COMAR) and because of the disability needs special education and related services. If this occurs, an IEP (Individual Educational Program), a written document, identifies the special education and related service supports needed for each student with a disability. **The learning styles methodology of teaching has been noted as most productive in teaching students with learning disabilities, as well as students with no identified disabilities. This methodology of teaching has proven to enhance learning by all students and does not promote teaching one style to one child.** Special education and related services provide support in the LRE for students who have had an appropriate evaluation, and it has been determined that a disability exists, and that this disability adversely affects academic performance. The recognized disability categories under COMAR (and the federal Rules and Regulations) are: autism, deaf-blindness, emotional disturbance, hearing impairment, including deafness,

"If we want to raise achievement levels of students across the state, we need to pay particular attention to meeting the learning needs of special populations." Nancy Grasmick: (September 25, 2002)

mental retardation, multiple disability, orthopedic impairment, other health impariment, specific learning disability, speech or language impairment, traumatic brain injury, visual impairment including blindness and who, because of the impairment, needs special education and related services.

According to the U.S. Department of Education, Office of Special Education and Rehabilitative Services, Annual Report 2000-2001, approximately 13% of the student population in public schools ages 3 to 21 years old qualify for special education services. Other students having need of unique individualized educational support are ELL students and disadvantaged students who receive free and reduced priced meals. These children require more concentrated attention from the teacher or a para-professional. Along with the need for more attention, more space must be provided in the classroom to accommodate additional tutors and aides.

The physical elements which support the **learning styles model** in classroom design is similar to other educational theories:

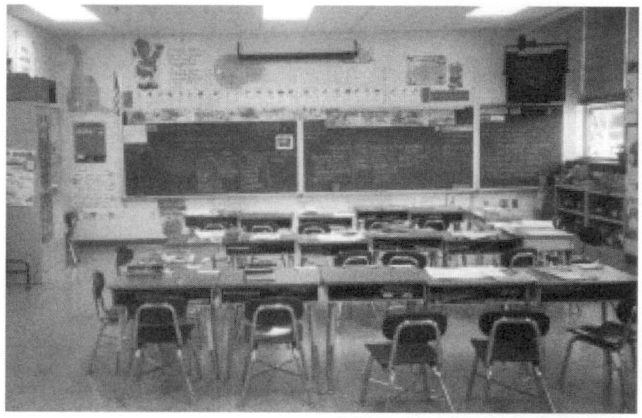
- ***provide versatility, in both spatial arrangement and in furniture***
- ***provide features such as sinks and project rooms or spaces***
- ***provide additional space for tutoring or self directed work***
- ***provide for appropriate storage and display space***

These theories do not stress lecture style teaching as the sole method of instruction nor do they dismiss it as an appropriate approach among others. It is recognized that learning happens in very different ways in very different settings and the general classroom should be designed to respond to the needs of both teacher and students.

• Collaborative Classroom Theory

A classroom designed with the collaborative classroom theory in mind "often has a multiplicity of projects or activity centers using everyday objects for representing numerical information in meaningful ways and for conducting experiments that solve real problems" (North Central Regional Educational Laboratory 1990). Both activity centers and the ability to experiment, directly impact the amount of space needed to provide a good learning environment and the physical arrangement of the room. Classroom designs which provide enough space to allow for versatility and flexibility support what teachers need to teach well.

The physical arrangement of the room, its furnishings and focus is one aspect that affects the environment of the classroom. The mood or the environment of the room is determined mostly by the arrangement of the student desks or tables and the arrangement and location of the teacher's desk. In a paper sponsored by North Central Regional Educational Laboratory (1990) called "What is the Collaborative Classroom" several suggestions were made on how to improve the environment. "Teachers (should) move desks so that all students can see each other, thus establishing a setting that promotes true discussion. Teacher(s) may also wish to move their desks from the front of the room to a less prominent space."



Mt. Savage Elementary/Middle
Z-shaped Seating Arrangement

• Constructivist Theory

How do children function in the learning environment?

What should children learn to function in the world environment as they grow to be adults?

These and other questions result from the consideration of education in light of a constructivist theory. Drs. Vonnie Ryland and James Ryland from Shippensburg University gave a presentation regarding this educational theory at the CEFPI conference (April, 2003). This complex theory defined

as constructivism has many facets and many approaches to its application. Some basic tenets of constructivist learning are:

- *to create real world environments for learning, thereby making the learning experience relevant*
- *to have the teacher serve in the role of "coach," "guide," "facilitator," and "tutor"*
- *to acknowledge the complexity of the world through multiple representations of the same concept which fosters the acknowledgement of multiple outcomes and perspectives*
- *to encourage inquiry as a shared experience and recognize the social nature of human beings*
- *to foster the concept of "meaning" as derived from personal values, beliefs and experiences*
- *to empower students to ask and answer questions on their own; active learning as well as deep understanding through contemplation are stressed*

This teaching methodology emphasizes what the students will do, instead of what the teachers will do. The following chart shows activities that would commonly occur in a classroom exemplifying the constructivist methodology. In order to accommodate these activities the classroom designer should consider:

- *Sufficient space – for products, projects, performances and processes*
- *Groupings of Students - Whole class, large group, small group and individual*
- *Active and quiet learning areas*
- *Cooperative and individual learning areas*
- *Technology and communication (voice, video, data)*
- *Lighting*
- *Acoustics*
- *Storage – for both physical items and digital items*
- *Access to water*

Constructivist Classroom Model

Activity	Architectural Contribution	Architectural Component
Literary	• Encourages concentration and quiet activity through environmental cues such as soft lighting, quiet color schemes, soft floor and furnishings	• Provide reading alcoves • Create nooks with bookshelves • Design light fixture with dimmers
Numeric	• Encourages exploration of numbers and sequences through repetitive architectural elements • Provides easy access to storage, bookshelves, manipulatives	• Integrate rhythms and patterns through architectural elements, such as bulkheads, window patterns, lighting • Provide bookshelves or places for bookshelves and cabinets for easy access by students
Projects/ Developing Portfolios	• Provides space to work on large flat surfaces • Provides a separate room or area	• Include a project room or area with a sink • Provide space for large tables with plenty of circulation space
Research	• Provides space, furnishings and utilities to support research - both electrical and literary	• Provide area for computers with sufficient electrical and data outlets • Provide bookshelves for class library • Provide adequate light, both natural and artificial illumination
Exhibits	• Provides adequate vertical surfaces for display	• Provide bulletin boards • Provide display counters and display cases • Provide markerboards/chalkboards • Consider installing electronic display devices

Chart 1.5

Constructivist Classroom Model (con't)

Activity	Architectural Contribution	Architectural Component
Use of Electronic/ Digital Products	• Provides space, furnishings and utilities to support electronic and digital use	• Provide adequate space for computer systems such as computers, printers, speakers • Provide adequate electrical outlets for support • Provide adequate space for paper storage, disc storage, cameras, document cameras, projectors
Performance/ OralPresent-ation/Demon-strations	• Provides a focal point in the room both visually and acoustically	• Provide a slightly raised or specially treated area such as wood flooring and different ceiling treatment • Provide adequate acoustical treatment • Provide adequate lighting
Athletics	• Provides access to the out of doors	• Consider a door to the exterior • Provide large open area within the classroom
Questioning/ Interviewing	• Provides acoustically private space within the classroom	• Create space for portable cabinetry/bookshelves which can create small private yet supervised nooks within the room • Provide a nook in the room
Performing Self Assessments	• Provides a place conducive to contemplation	• Provide a quiet "get-away" area

Chart 1.5

• Summary

Recent advances in research emphasize a broadening of the concepts of learning and teaching. These methods of teaching greatly impact the design of schools and classrooms. The general classroom, therefore, should be designed based on an awareness of current learning theories to create an environment to support all students, their learning styles and their intelligences. It is extremely important to keep educational theories in mind when planning and designing all spaces for students to grow and learn.

Approaching the total design of educational facilities in this fashion reinforces the full integration of the visual arts, music, dance, theatre arts and physical education with the core subjects of English, Language Arts, Mathematics, Science and Social Studies. The design of the general classroom and the school as a whole should recognize the spatial needs and interaction of a full curriculum such as this. Relationships of general classrooms to other program areas may diverge from the traditional layout of a school building.

I remember...

...10% of what I read,

...20% of what I hear,

...30% of what I see,

...50% of what I see and hear,

...70% of what I discuss with others,

...90% of what I experience by doing.

Text based on the principles of Edgar Dale and the Visual Depiction of Information Retention, Known as the "Cone of Experience", 1946.

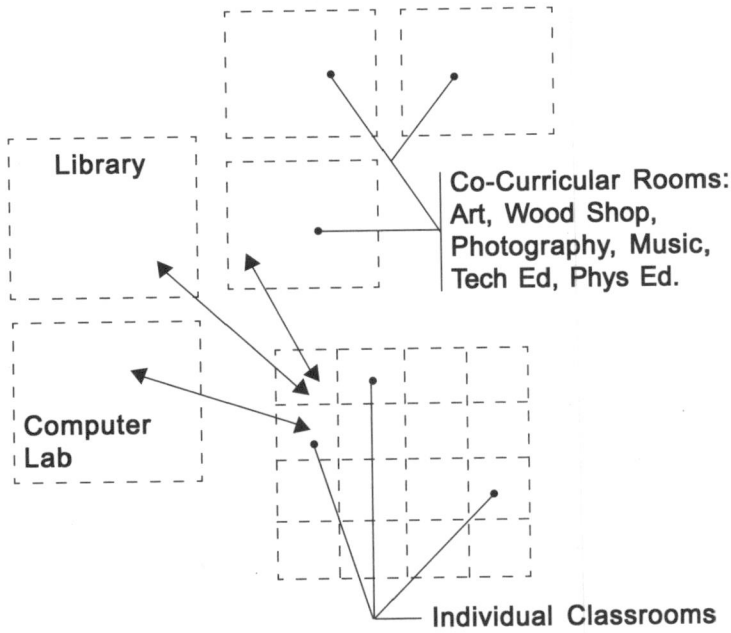


DIAGRAM OF TRADITIONAL SCHOOL MODEL

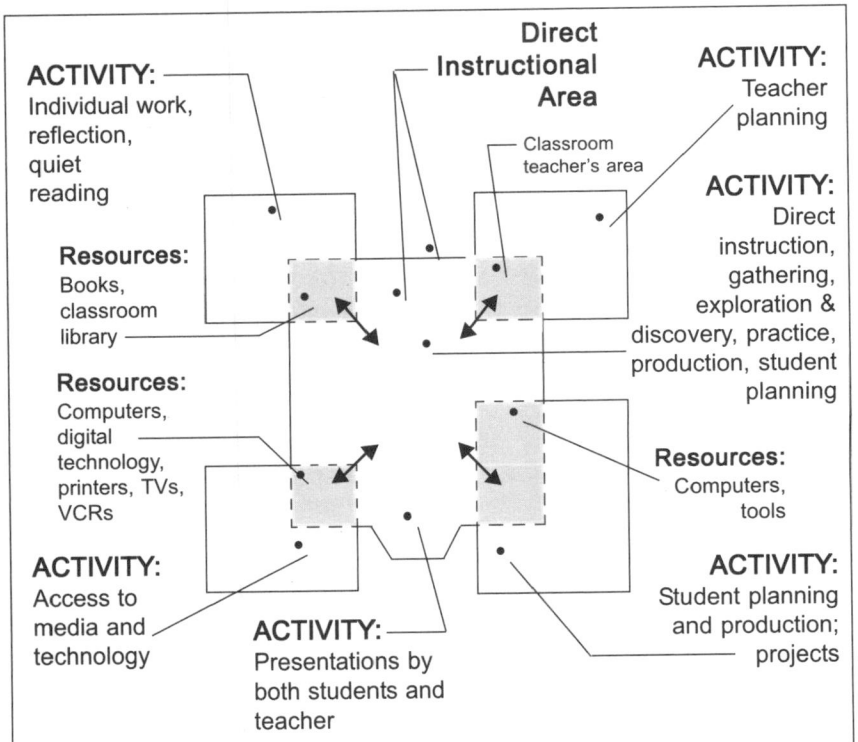


DIAGRAM OF PROJECT-BASED CLASSROOM MODEL
Portraying shared resources between individual activity areas & direct instructional area

CHAPTER 2

The Classroom - Pre-K through 12

• Educational Components

Commonalities occur in every general classroom regardless of the age range and maturity of the children it serves. Some variations occur because of the size of the children and the focus of the scheduled activities. Chapters Four through Eight will concentrate on the components and the particulars of each age range classroom. **This chapter discusses common elements that should be addressed in general classrooms for all age ranges,** whether for a pre-kindergartener classroom, a 6th grade classroom or a classroom in a senior high school. The following educational components will be discussed: classroom entries, student space including whole class instruction, small group instruction and individual exploration, and learning centers; classroom and teacher storage, student beloingings; teacher workspace both in the classroom and outside the classroom; the natural environment, project rooms, and student commons. Electrical, mechanical and architectural items such as lighting, acoustics, heating, ventilating and air conditioning, technology, walls, doors, windows, furniture, storage and sustainable products are discussed in Chapter 3.

The design of the classroom should take into consideration the needs of the students, the needs of the teachers, the accommodation of technology, the planned activities, human comfort, lighting levels, acoustics and durable functional finishes on wall, floor and ceiling surfaces. Historically, the spatial quality of a well-designed classroom was of rectilinear proportions of approximately 1:1.25 to 1:1.5, in order to address the need for natural light and ventilation, pre- air conditioning. These proportions allow good visual and auditory contact between teachers and students, and are still applicable today for spaces *within* a classroom. In response to the needs of today's educators, more square arrangements of rooms with nooks, alcoves and adjacent support spaces allow for multiple groupings of children within one space. The goal is to provide spaces which provide flexibility.

Classroom Entries

Entries into the classrooms can be a good place to set the tone for the classroom experience. It is the first formal greeting place for the student. Which acts like a foyer of a home. "Come In", "Greetings", "Make Yourself Comfortable". For younger students it is a place to change out of coats and /or boots, store personal belongings such as lunches and book bags, and get a sense of what is expected. This area is usually referred to as the cubbie area. It can serve more than just as a storage place. By diminishing the height of the ceiling in this area and providing architectural cues such as decorated archways and doorways, it can signal the entry into a different space other than the noisy corridor beyond.

Samuel W. Tucker Elementary
Entry Feature

What is needed in today's classroom? What should be provided in current classrooms?

Lighting levels in this area could be dimmed slightly (or placed on a dimmer) to provide a visual cue to calmer activities.

Older students should also be given a "welcome" to the classroom. Often bulletin boards are set very near the doorway to post notices for the day, work assignments, etc. Individual mailboxes, enough for each student, can be placed near the door for students to pick up reviewed homework, or get notices to take home. Each section could be labeled with the student's name and could be as simple as cardboard slots big enough to reach in and get several letter-sized pages or as elaborate as a built-in wooden mailbox arrangement, each compartment being approximately 2 ½" high x 9" wide x 12" deep.

Teaching Walls

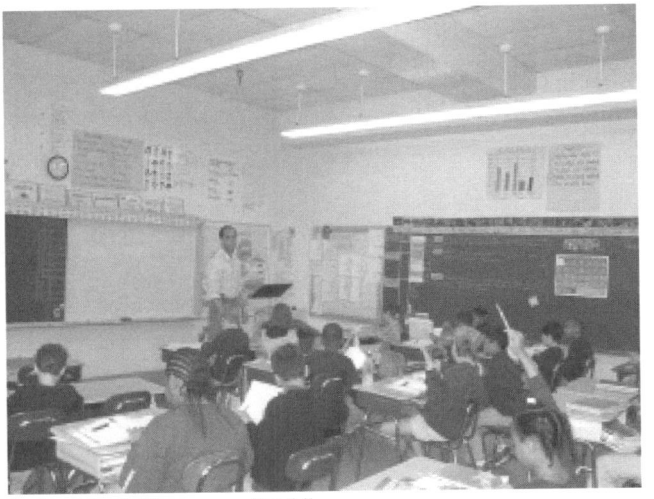
Teaching walls, primarily filled with a markerboard or chalkboard and tackboards, should be spacious, brightly lit for good viewing, and provided with plenty of electrical outlets (minimum of 3 duplexes in a 20' length or as code requires). Vertical space above sitting eye level can be used for teacher display, student work, wall hung storage or visual stimulation for the curricular activities of the class. A projection screen or equivalent should be provided in conjunction with the main teaching wall. It is preferred to provide a minimum of two adjacent walls as teaching walls instead of two opposite walls.

Student Space

What type of atmosphere should be created to make a "good" classroom, a good learning environment?

Flexibility and versatility are items high on most educators' lists. The classroom should provide an environment for the transfer of knowledge, the exploration of knowledge and the testing of hypotheses. These three types of activities relate to spatial needs: whole class space, small group spaces and individual exploration or learning centers. Each of these activities requires a different atmosphere, and different amenities and furniture configurations to accommodate the varying numbers of students in the group. In order to design a space which fosters all of the tasks assigned to the "classroom," the influential word must be "flexibility". Flexibility should not be mistaken merely for open space; having no form or assigned use. A flexible classroom allows the inhabitants a wide variety of choices in furniture, floor covering, lighting, acoustical quality, storage and display to accommodate the frequently changing needs of learning activities. A flexible classroom should accommodate slide presentations as well as verbal presentations by several students. A flexible classroom should provide room for the entire class to gather but also have room for four to six different groups of students doing different tasks. A flexible classroom should be technologically up to date, allowing for changing technologies, and accommodating computers, projectors and items such as computer oriented white boards and "smart boards." Some of these amenities can be shared and move from classroom to classroom or group to group, in response to fiscal limitations.

Whole Class Instruction



Roland Park Elementary/Middle
Whole Class Instruction and Adjacent Teaching Walls

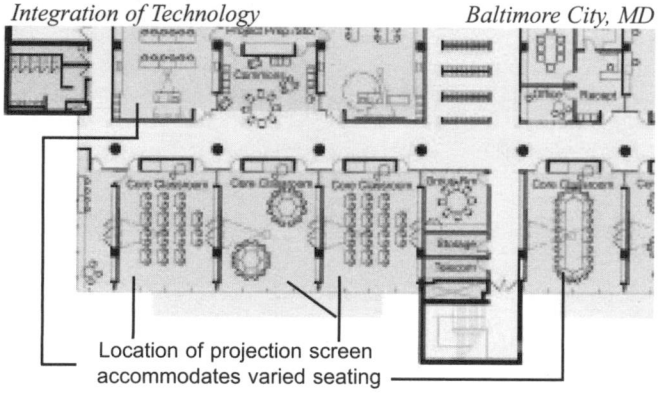
The transfer of knowledge can happen in a large group setting where all participants in the class gather. This activity is referred to as "large group instruction" or "whole class instruction." One activity for a whole class instruction could be a 20-minute lecture by the teacher. Traditionally, in this setting, for all age levels, the teacher is the focus of the group. Hence, a classroom needs a space to accommodate the group of children who make up the class. This area should accommodate all children sitting at desks, tables or sitting on the floor. See Chapters 4 through 8 for space requirements for whole class instruction for each grade level.

Other critical needs in this space are acoustic. Materials should be utilized which allow the voice of the teacher to travel to all students, within a range of 20 to 30 feet. Acoustic ceilings with a Noise Reduction

Classification (NRC) of .70 or better are recommended. The placement of hard surfaces should be carefully considered as these surfaces promote reverberation, which makes it hard to hear what is being said. The newly adopted ANSI S.12.60-2002, *Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools* standard should be consulted.

Another critical factor in large group instruction is visual contact between the teacher and the students. Although some may believe outdated, the overhead projector allows the teacher to write instructions, perform mathematical equations or show diagrams while still maintaining eye contact with the class. The use of newer technology to project large images for the entire class to see, such as LCD projectors and computer oriented display screens are another consideration. If the LCD projectors are mounted permanently in the ceiling, consider this location carefully in order to accommodate the most flexibility in the classroom.

Paul Laurence Dunbar High,Partial Plan
Integration of Technology *Baltimore City, MD*



Requirements for whole class instruction:

- *Provide a wide-open space for gathering all students in the class. Students in desks occupy a minimum of 12-15 square feet per student, including circulation space around each desk. Younger students, who may gather by sitting on a carpeted surface will occupy 9-12 square feet (including circulation space.) Desk areas for younger students would occupy approximately 12 square feet per student. Younger students need both desk area seating and floor seating.*

- *Provide vertical writing surfaces such as chalkboard(s), markerboard(s) or electronic board(s) for the teaching wall(s) focus. Consider multi-rail display board tracks for versatility and space-saving.*

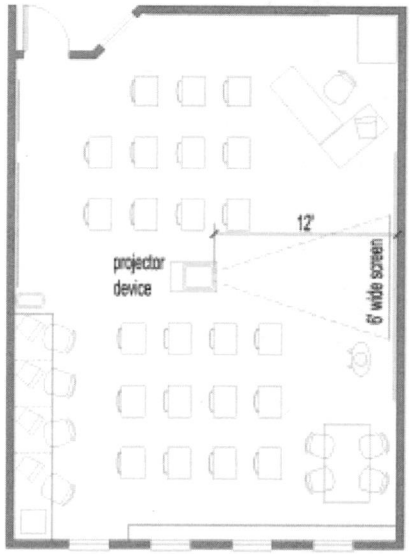
- *Provide tackable surface(s) close to the teaching wall(s).*

- *Provide either a pull down projection screen or a surface which can be used as a screen. Offset screen from main teaching boards, clock and emergency lighting so as not to provide obstruction..*

- *Consider location of ceiling mounted projectors (note: permanently mounted items can limit flexibility in the room).*

  - *Video, LCD, Data - Mount projectorsat a distance of 2 times the width of the screen. (example: a 6'-0" wide screen should be mounted 12'-0" away from the projector.) Note: For ceiling recessed projector screens and enclosures: Proportions utilized today at 3 units high by 4 units wide may not be adequate for future projection media. For example DVD and HDTV proportions are wider with a proportion of 3 x 5.3 (or 9 x 16). Carefully consider room size, speaker sizes and quality.*

  - *Lighting levels in a classroom should still be bright enough for student interaction during video presentations, 40-50 footcandles at the desktop, but no more than 3-5 footcandles of light should fall on the projection screen.*



classroom layout with projection device

- *Provide shading devices and lighting controls on all windows.*

- *Provide space in the room for teaching tools such as an overhead projector, which would require space approximately 1'-6" x 2'-6".*

  - *Consider appropriate proportions and viewing angles for presentations. For example: in order to provide suitably sized images, an overhead projector should be at least 9' away from the screen.*

- *Provide space and utilities for computer workstations and printers.*

- *Consider newer more versatile technology such as LCD projectors and computerized interactive whiteboards. LCD projectors can project onto any light colored surface and not lose clarity; overhead lighting in room can remain on and does not affect visibility. The interactive whiteboards (like powerpoint projectors) have higher lumen output, therefore the classroom lights are less of a factor in visibility.*

- *Consider location of television monitor/VCR/DVD:*

  - *Monitor should be easily viewed without taking up valuable classroom space.*

  - *Due to the sizes of televisions and comfortable viewing angles it is recommended to mount the television in a cabinet with storage below. Image perception & distortion occurs when viewing angle is too great, such as a circle perceived as an oval on a high mounted TV.*

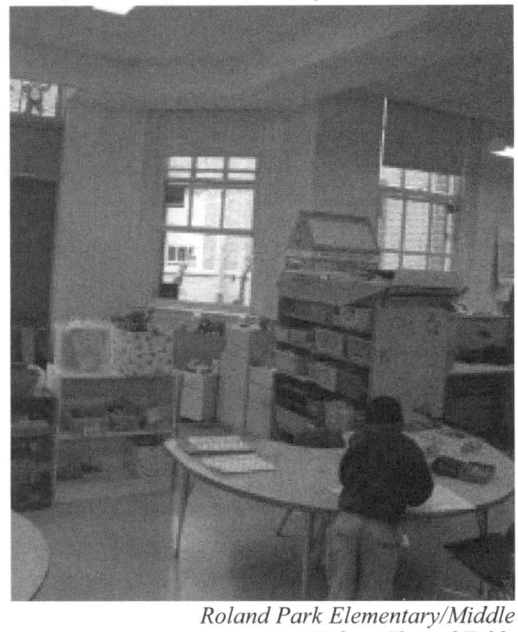
  - *Locate to avoid glare from exterior light sources.*

- *Consider the use of newer technologies like document cameras. Discuss and coordinate with technology consultants and school staff.*

Small Group Instruction

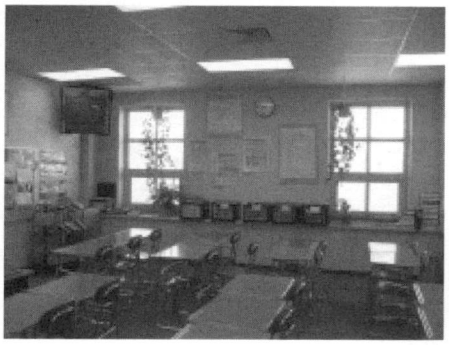
Another learning technique used throughout the school day is to explore knowledge and learn in pairs or small groups. Communication and language are key components to this type of learning exercise. Social interaction with others reinforces a learner's experience. **Depending on the furniture in the room, and the type of activities, the total combined space required for small group activities can be more than the area needed to accommodate the large group as a whole.** Common combinations used by teachers are pairs of desks (Think-pair-share activities), groups of three or four desks, or four students to a table. The area the groups occupy includes pertinent items for the task at hand such as bookshelves, counters, and circulation space. Circulation space around the groups is imperative for the teacher to have easy access to all groups and to ensure safety for both the students and the teacher. In theory, most traditional style furniture like the tablet armchair and the 18 x 24 desk with seat attached occupies less square footage when arranged in rows than when the same style is used for group arrnagements. Conversely non-traditional style furniture like 18x24 desks with free standing seats or the 24x48 table with two chairs occupies more square footage when arrranged in rows than when arranged in groups. Each furniture style is economically designed for what it was originally meant to do - be lined up in rows (static) or arranged in groups of all kinds (dynamic). Refer to Chart 3.6 in Chapter 3, Furniture, for more information.

In the earlier grades, the use of half circle tables (also known as kidney shaped tables or horseshoe tables) accommodates 5 to 9 children for direct instruction and guidance from the teacher. These tables typically occupy 65 – 70 square feet including the teacher's and student's chairs. These tables are often preferred for small group instruction for younger children because the teachers can provide close visual and auditory contact with each child. The students can act as a group, diminishing potential individual awkwardness, which can interfere with the learning process. The students can also help one another in proximity.

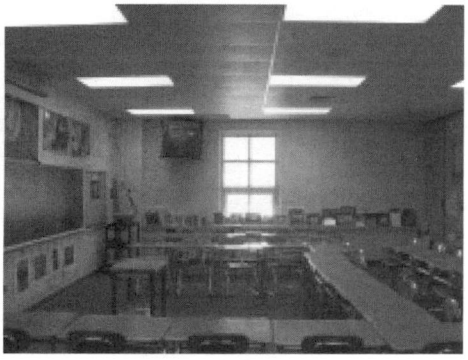


Roland Park Elementary/Middle
Kidney-Shaped Table

Older students may gather in pairs or groups of four to work on projects, reading assignments, etc. Desks or tables, which are easily moved into groups and provide a flat contiguous work surface, are best for this purpose.



Wilde Lake High
Groups of Two and Three



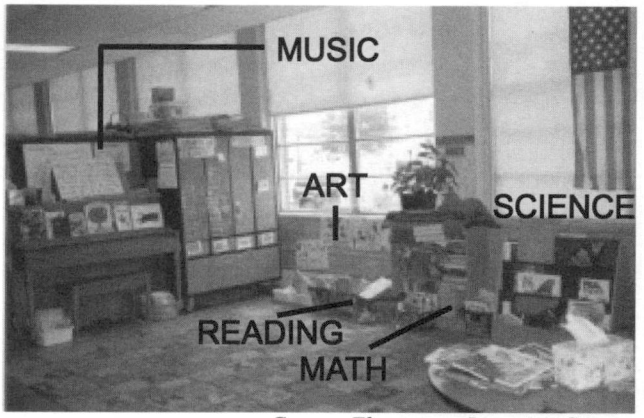
Wilde Lake High
"C" Shaped Arrangement

Requirements for small group instruction:

- *Provide gathering spaces for multiple groupings of 2 – 4 students and 6-8 students (review space requirements in each individual grade level chapter)*
- *Provide vertical writing surfaces such as chalkboard(s) or markerboard(s) for the teaching wall(s) focus; consider mobile display boards*
- *Provide tack surface(s) close to the teaching wall(s)*
- *Provide space for circulation,comfort and maneuverability*
- *Provide space and utilities for computer terminals and printers*

Individual Exploration and Learning Centers

Individual exploration and learning is not only for young children. Although the "main mode of learning for young children is doing" according to the National Center for Education Statistics' website on Learner Outcomes, (January 2003) and kinetics is the main method of constructing knowledge, this mode of learning applies to all students from pre-K through the high school grades. The design of each age level classroom should address this style of learning. Acoustics play an important role in considering the layout of multiple individual centers in one room.



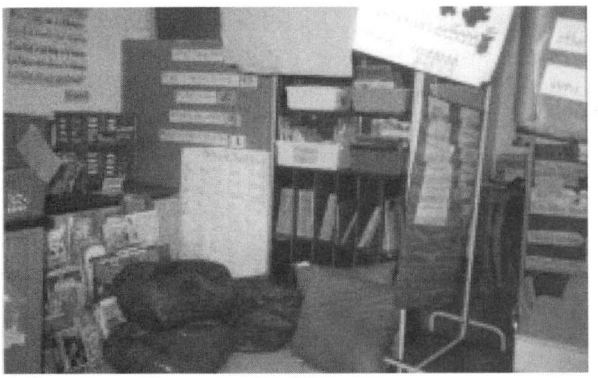
Garnett Elementary Learning Centers
Five Centers within 10' x 18'

Portable room dividers or shelving units can provide some noise reduction from one area to another. Fabric tack surfaces mounted low to the floor can help with younger children's learning centers for both acoustics and as a task surface. Individual exploration instruction can range from "learning centers" in the earlier grades to project rooms and computer stations in the later grades. Accommodating multiple work areas is discussed in Chapter 3 - Space and Shape of Classrooms. Learning centers relating to early education classroom design are discussed further in Chapter 4.

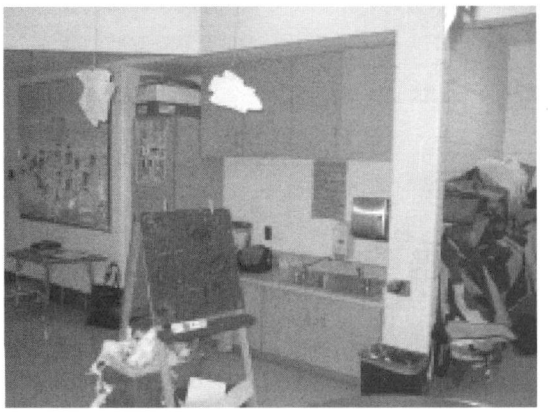
For older students, individual learning and exploration is just as important. For middle school students it allows the student to experiment, learn and explore without fear of failure or notice from peers. For intermediate and high school students, individual exploration fosters a more independent approach to education, allowing the student to gauge or direct his or her learning experience.

Requirements for individual exploration and learning centers:

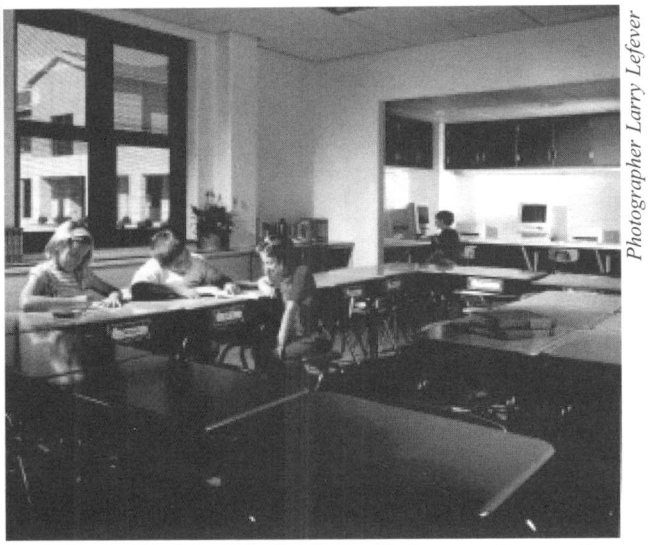
- *Provide space for individual student stations throughout the room; review the space requirements and needs in each chapter for the individual grade levels*
- *Provide adequate data outlets and electrical outlets*
- *Consider acoustic treatments to diminish the travel of sound from one individual area to another*



William Paca Elementary/Middle
Reading Center, Carpeted Floor with Bean Bag Chairs and Pillows



Hollywood Elementary
Art Learning Center with
Sink and Durable Floor Surface



Photographer Larry Lefever

Selinsgrove Intermediate
Whole Class Instruction Area with Self Directed Computer Learning Alcove

• Storage Components

Classroom Storage

Storage is a critical factor in the successful design of a classroom. There are many items which require storage: teaching tools, manipulatives, paper, cardboard, books, student belongings such as backpacks, bookbags, coats, hats and boots, project tools and supplies, items for show and tell, teacher reference material and teacher belongings. Storage should be versatile, both in size and location. Designers must be aware of not only the sizes of things to store but also the frequency of use of each item and current trends of popular items used by teachers and students.

Standard wall mounted cabinets and floor cabinets with counters are very versatile for most of the items needed in a classroom. Items such as large poster board (24" x 36") can be better accommodated in deeper than normal storage cabinets measuring 2'-3" to 2'-6" deep. These storage cabinets can be full height cabinets or cabinets below a counter. Generally, one over-sized 3'-0" wide 6-8 drawer cabinet with a counter is adequate classroom storage for the oversized items.

Glenelg High

As paper and posters become heavy in quantities drawers should be not more than 4"-6" deep. Provide overhead storage for adult and teacher oriented items, which are not meant to be within the students' reach. Bookshelf storage should be low with particular attention given to the size of textbooks. Some textbooks have widths over 11" and cabinets designed too shallow can prove to be awkward and useless for textbook storage. Conventional wall cabinets (typically measuring one foot deep on the outside) with doors are not always a good fit for textbook storage as the clear dimension inside the cabinet may prove to be inadequate. Bookshelves should accommodate not only textbooks and resource books but also a classroom library and manipulatives.

Typical Instructional Materials

Stored on Shelves

Item	Requirements/Measurements
Teaching Units (Pre-K thru 5)	Deep Boxes - 16" Deep 6" height x 12" wide (16" deep shelf a plus)
Portfolios	Sizes range from pizza box size to letter size.
Paint Brushes	Usually stored in cans 12" high
Bottles of Paint	Approximately 6" high

Stored in Drawers

Item	Requirements/Measurements
Posters	12"x14", 18"x24" - 24"x36"
Construction Paper	18"x24" and 9"x12"
Drawing Paper	12"x18"
Chart Paper	18"x24" and 24"x36"
Poster Board	18"x24"
Scissors	

Stored in Both Shelves or in Drawers

Item	Requirements/Measurements
Boxes of Crayons	
Markers, Yarn	
Glue bottles/Sticks	
Craft Materials	
Pipe Cleaners	
Popsicle Sticks	
Office Supplies	
Paper clips	
Sev. dozen pencils	
Standard size env.	4 1/8" X 9 1/2"
Manilla env.	8 1/2" X 6"
Note pads	
Sticky note pads	various sizes
Boxes of staples	
Extra staplers	
Boxes of file folders	2 1/2" H X10" W X12" L
Boxes of pocket folders	
Writing paper	8 1/2"X11" & 8 1/2"X14"
Extra pens, high lighters	
Tape, clear & masking	
Chalk	
Markers	
Extra composition books	
Extra spiral notebooks	

Classroom Items to Store on Shelves

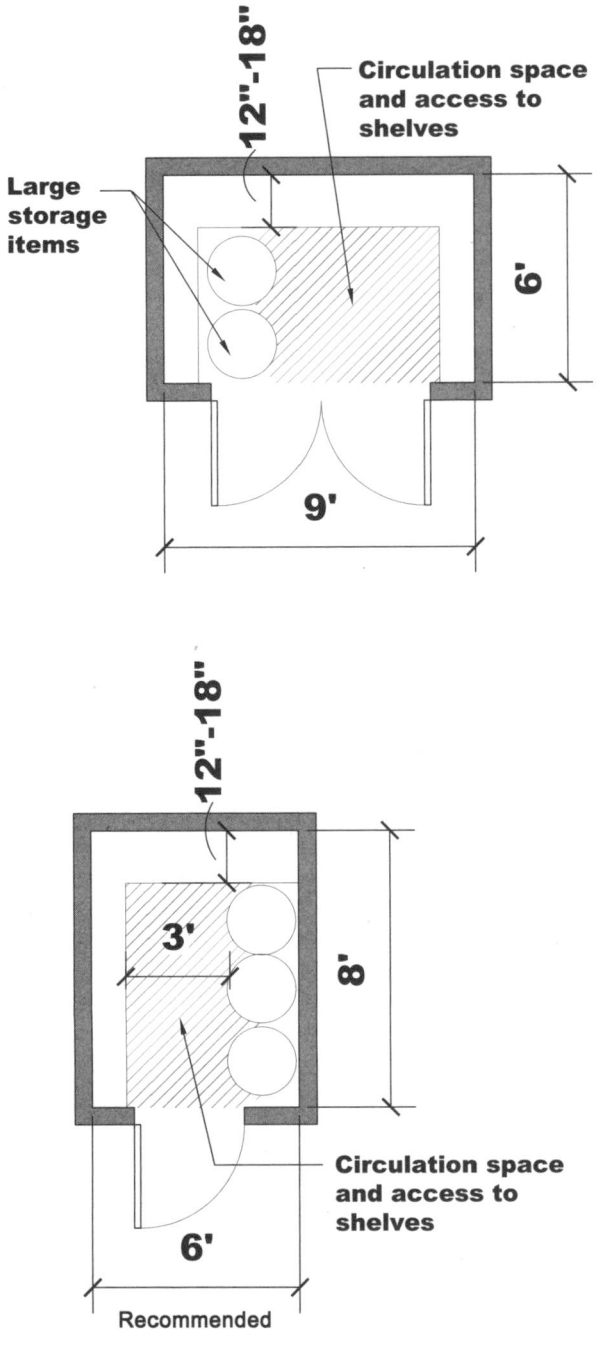
Item	Requirements/Measurements
Extra Books (oversized)	19 1/2" X 14"
Sentence Strips	18" - 24" Long
Bulletin Board Borders	2"-4" W X 36" L
Science Materials like hard lens	shoe box sized container
Microscopes	
Learning Unit Collections	plastic containers of various sizes
Audio/video tapes	shoe box size to storage bin size
Classroom libraries	stored in baskets or bins 13"X10"X6" or plastic magazine/book holders 11 3/4"X9 3/4"X4". The libraries' selections are rotated throughout the year. Storage must be provided for the "off season" books.

Miscellaneous Items to Store

Item
Extra Boxes of Tissues
Paper Towel Rolls
Bottles of Hand Soap
Cleaning Supplies, sponges, bucket
Zip lock type bags

Extra space is needed to store items which are being collected and saved for a specific project like two liter soda bottles, shoe boxes, etc.

Storage can gain versatility through the use of mobile units. Bookshelf units which are double-sided and on wheels can be used to create spaces within the classroom. The location and size of the space created with the mobile units can change as often as the students and the teacher see fit.



STORAGE CLOSETS

Student Project Storage

Storage for student projects can be accommodated by tall cabinets (3'-0" wide x 2'-0" deep x 7'-0" high) with tote bins. These units usually have a double door with tote trays on both sides from top to bottom. Two of these cabinets, can accommodate a classroom of approximately 20 - 25 students. In the younger grades, the lower areas can be for student use and the upper areas for teacher storage. The tote bins can be easily cleaned and are lightweight enough for even younger children to handle them. Trays can also have wire mesh enclosures to make it possible to see into the trays, themselves.

Teacher storage

Storage is a critical item for teachers. Schematic plans of classrooms typically show furniture for the children and only a 2'-6" x 5'-0" desk and chair for the teacher. File cabinets for the teacher are often not shown but play an important role in providing an adequate teaching environment. The most common file storage arrangement for teachers of all grade levels is a minimum of two (2) four-drawer file cabinets. The proper placement for these file cabinets in the room can become limited due to visibility concerns. The height of four-drawer file cabinets is typically over four feet.

Pre-manufactured teacher wardrobe cabinets can accommodate some of these needs. These cabinets are usually full height, can be specified to contain built-in two-drawer file cabinets, hook or closet rod for coats and can be lockable. Usually these cabinets are deeper than standard counters at a depth of 2'-6".

A walk-in storage closet in the classroom or one easily accessible from the classroom can also resolve some of these visibility issues. Storage closets accommodate a wider range of items and are thus more versatile. **Storage rooms which are narrow and deep, with the door on the narrow side, are more efficient spatially than square storage rooms.** A room width of 6'-0" allows for door clearances and shelves deeper than twelve inches along one wall. Deep narrow rooms should be designed to accommodate shelving on at least one side and the back wall of the room. Shelving on both sides of the door is preferred to make maximum use of required circulation space. Consider different depths of shelves - deeper shelves (14-18") for storing larger items like boxes, smaller shelves (6"-8") for small items like glue

bottles, and the standard 12" shelf for files and books. Also consider a place within the storage room for file cabinets. Storage rooms, such as these, could be shared by two classrooms, or shared and organized by team or department.

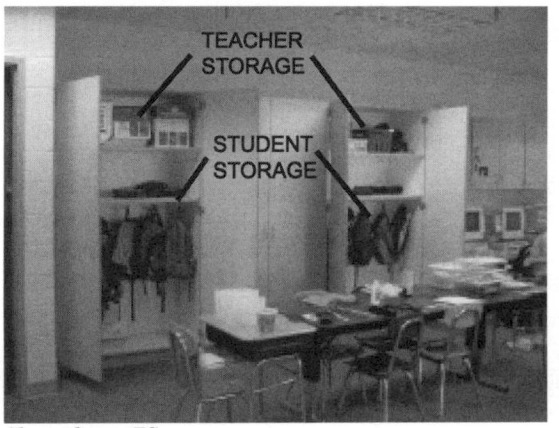
Student Belongings

Personal item storage for students can be tricky and the issues change depending on the age of the children. There are issues of security, safety and physical well-being that need to be considered. Often, administrative policies will help determine how much and where storage for students' personal items should be accommodated. During the planning phase for classrooms it is important to discuss the following criteria:

Security
- Administrators: ability to discourage hiding unwanted items such as guns, drugs, knives
- Students: ability to monitor the security of one's own belongings

Safety and Spatial Implications
- Administrator: consider lockers (open, optional) in full view, in every classroom, regardless of the age to offset bookbags in classroom aisles and bags on backs of chairs
- Student: overnight storage is still needed in upper grade levels for textbooks not taken home

Physical well-being
- Administrators: discuss the detrimental effects of carrying heavy items on backs, shoulders; safety hazards for teachers with bags in aisles



Shrewsberry ES
Storage Cabinets for 6-8 Students' Belongings with with Teacher Storage Above

- Students: pay attention to current trends of what students are using to carry books and supplies. Also, note the sizes of the students and their reach capabilities.

A recent search on the Internet for the most popular pack sizes are as follows:

Style	Width	Depth	Height
School Packs	12 1/2" - 14"	6 1/2" - 10 1/2"	16 3/4" - 20"
Wheeled Packs	12"-16"	7" - 10"	17" - 22"
Wheeled Packs with Optional Day Pack	16"	13"	18"

• Teacher Workspaces

In the design of classrooms and schools two alternatives are often considered for the teachers' workspace. One option is to provide the individual teacher with workspace in the classroom with a worksurface, file cabinets and space for personal storage. The second option is to provide a general teacher work space to be shared with other teachers separate from the classroom. This development of a separate office-based workspace is influenced by an attitude that regards the teaching profession on a par with other professions. It is also fostered by many alternative school schedules. This separate space allows the teacher to be accessible not only at the designated class time but also on a less formal basis. Students are encouraged to address the teachers more personally in an atmosphere devoid of peers. Shared office space can foster professional communities and collaboration among staff members (Lieberman, 1996). Cohesion across disciplinary boundaries can be fostered (Duke, 1998). Experienced staff share knowledge and wisdom with the new arrivals of the teaching staff. Retention of staff can be enhanced.

There are pros and cons to both options and the philosophy of the school and its student population should be considered in making the decision. Regardless of the location in the school the trend is toward more personalized instruction and the role of the teacher as facilitator of learning. Consider and provide the following items and space for the teacher's station:

- *wiring for intercom/telephone (two way communications)*
- *a computer and printer*
- *easily accessible controls for lighting and ventilation*
- *easily accessible to intercom communication either via traditional intercom or phone system*
- *adequate storage such as two to three file cabinets, a closet and wall cabinets*
- *located away from high use areas*
- *access to natural light – near windows, preferably*

For maximum flexibility in the shared teachers workspace consider providing modular workstation assemblies. The following spaces should be provided in close proximity to a teacher workroom: conference room or small group room, copiers, fax machine, acoustically separated telephone area, toilet areas, and storage for supplies and coats. In choosing file cabinets consider the flexibility gained with a dual set of two-drawer file cabinets (great for work surface or layout) versus one tall four-drawer file cabinet.

For the **Classroom-based workspace** provide:

- *50 - 80 square feet per teacher*
- *Coat closet or lockable cabinet for personal belongings*
- *Desk or work surface and chair*

For the **Office-based workspace** provide:

- *50 - 75 square feet per teacher*
- *Area for conference table for 6 (approximately 130 – 160 square feet)*
- *Shared coat closet for 4-6 teachers*
- *Minimum 5'-0" counter, as worksurface with knee space, computer, outlets and chair per teacher*
- *Equivalent of two (2) four-drawer file cabinets in overhead cabinets, mobile files, and/or standard files*
- *Bookshelf space big enough for 3 ring binders*
- *Task lighting*
- *Printer, intercom or phone*

Classroom-Based Workspace

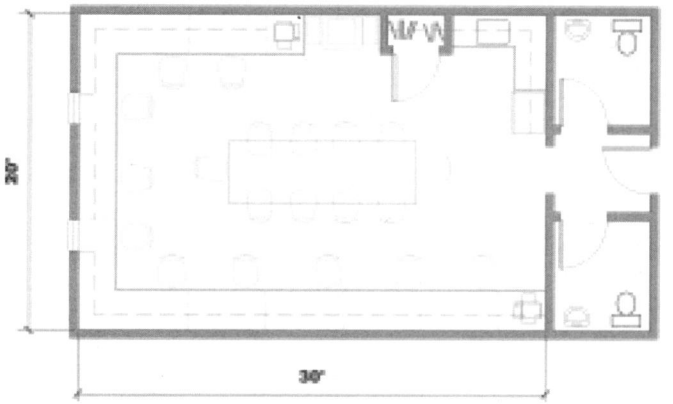
Pros	Cons
Students have continuous access to teacher and vice versa	Limited privacy for personal phone calls, conversations with students/parents is compromised; limits interdisciplinary/team interaction and informal interaction with colleagues
Ownership of room in terms of personalization and pride is	Increases quantity of classrooms needed to meet student capacity, thereby increasing size of school

Chart 2.1

Office-Based Workspace

Pros	Cons
Privacy and office creates a more professional environment	Limit room size to accommodate 6-12 teacher workstations; areas larger than that become unmanageable
Allows teachers to share strategies, experiences, ideas, and resources; mentors young teachers & improves teacher retention	Uses more space in the building overall, but a much smaller teacher's station is required in each classroom
Becomes an interdisciplinary center for science, social studies, language arts, mathematics or a department center	Equity and turf issues could arise
Provides a potential meeting space	
Can provide additional supervision if located in academic wings	Teachers have to carry / transport materials from office to multiple classroom locations
Allows classroom to be used by several teachers	Allows classroom to be used by several teachers

Chart 2.2



TEACHER SHARED WORKROOM

725 square feet = ten teacher stations with kitchenette, meeting table and toilet rooms

Features:

- *Sink*
- *Easily cleaned durable flooring such as vinyl flooring or linoleum*
- *Storage available either in the form of cabinets, (upper and lower), or storage closets*
- *Data outlets and electrical outlets*
- *Varied lighting to provide for non-glare task lighting and ambient lighting and general illumination*
- *Storage (for portable lap-top carts, supplies, large format portfolios, etc)*
- *Natural illumination*
- *Counter*
- *Copier/scanner for projects*
- *Visual transparency for passive supervision*

Additional Instructional Spaces

Project Rooms/Areas

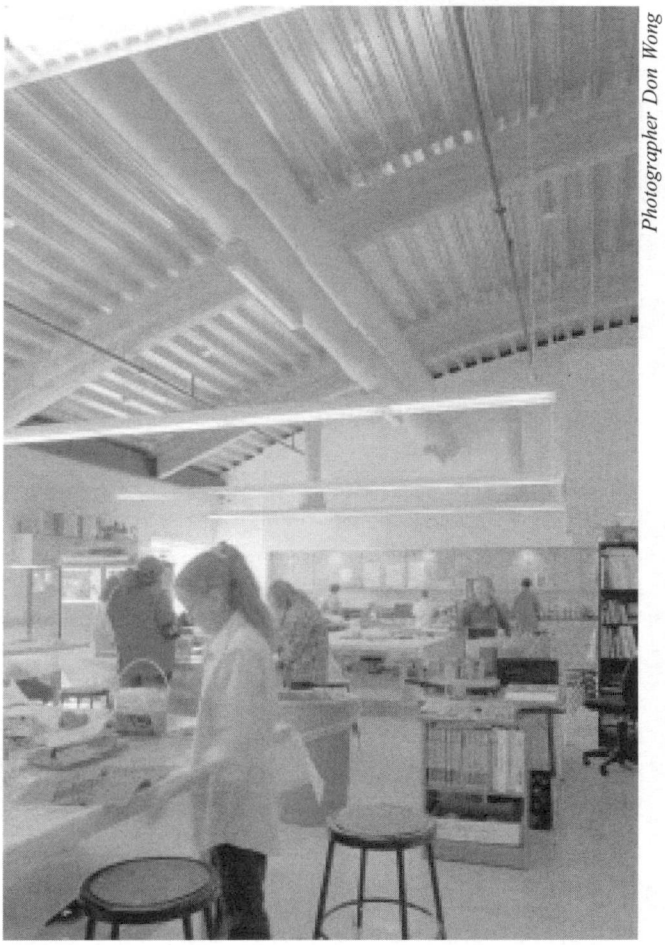
Project rooms or areas should be designed with as much versatility as possible; the range and types of activities that could occur in this space is limited only by the imagination of the students and teachers. Because of the amount of space needed to provide versatility, project rooms are generally rooms or areas shared among a number of classrooms or in an area designated by grade level, subject matter or another grouping method.

The use of this space could change from day to day, season to season, month to month. It might be a technology based "clean" project room one day or a "messy" project room where glue, paints, cutting tools, and items like balsam wood may be used another day. The ideal would be to design an environment which allows the occupants to determine the use.

The Versatile Project Room:

Activities

- *Small group instruction*
- *Individual exploration center*
- *Building/creating (manipulative) projects*
- *Computer projects*
- *Research*
- *Graphics, large format projects*



Photographer Don Wong

Crosswinds Arts and Science Middle Project Room

The Natural Environment

A discussion about classrooms would not be complete without the mention of the importance of the natural environment as a teaching tool. The natural environment is an often overlooked tool for curriculum subjects such as science, math, art and social studies as well as environmental education. This importance remains for students of all ages. A nationwide survey completed in 2000 by Survey Research Center of public school teachers reported that 61% of the teachers include environmental topics in their curricula. But this percentage drops off dramatically from the 83% of the K-3 teachers that incorporate environmental topics, to 58% for fifth through eighth grade teachers and only 44% of high school teachers. A stronger relationship to the outdoors could improve an integrated education approach.

The natural environment offers the opportunity to study biology, physical phenomena, and social, technological, cultural, historical, moral and aesthetic aspects of environmental issues. Many areas of the curriculum are also enhanced through the use of the natural environment as a teaching tool: for example, Art, through the exploration of color, texture and composition in drawing, painting and sculpture; Mathematics, through the exercise of calculating the number of plants needed for a garden bed or the cost required to plant an acre of corn; and Social Studies, through the discussion of natural forests and rivers and their impacts on early civilization. The use of the natural environment in the curriculum emphasizes critical thinking and problem-solving skills, which falls right in step with current educational goals.

"Environmental education engages students' minds and hands, often in real-world investigations that are inquiry-based, interdisciplinary, and supportive of standards-based curriculum." (ASCD Infobrief August, 2001) Classroom design should strive to keep an awareness of the natural environment, the ease with which it can be incorporated into the curriculum and the benefits gained by all students exposed to environmental education. A classroom design can incorporate many of the following:

- *doors to exterior courtyards or outside classroom areas*
- *daylight*
- *views to the out-of-doors*
- *consider size of children when designing sill heights of windows*
- *window sills deep enough to allow plants to be displayed and grown;*
- *fully glazed bays or projections which extend out beyond the face of the building to allow for windows on three sides; these projections provide an opportunity to bring nature into the classroom and provide an alcove for a reading nook and/or a greenhouse*
- *natural lighting in the classroom*

Student Commons

Student commons areas should be considered a design solution only when the school curriculum is designed for such areas and when the staff fully support its intended use. The types of curricula that can benefit from a student commons area focus on team teaching techniques and cross-fertilization of ideas from one subject area to another. If not properly planned for, the space could become a dumping ground for miscellaneous items or a wasted space in the building. Strong consideration and staff committment to utilize the space is key.

Although providing classrooms with shared commons areas may be more expensive to build because of the additional space required than the traditional double loaded corridor layout, there are benefits that should be considered. An area with such versatility can provide a more relaxed learning environment than the general classroom and be more flexible in its use. The benefits gained by providing these spaces called "student commons" are as follows:

- *The spaces can help "identify" a house or group of classrooms. It acts as a front porch to a group of classrooms, whether they are arranged departmentally or by grade level. It can also support the human need for belonging" and inspire "ownership." This becomes especially important at the high school level where loss of ownership by both teachers and students is felt most prevalently, due in part to the transient nature of classroom scheduling.*

- *The space can be used for group meetings by all the classrooms it serves. Again, group meetings reinforce the concept of community and ownership. Also, students become role models when coming in contact with other students, outside their own classroom.*

- *Commons can provide an additional space for large group instruction, especially for K-6 where an entire group sit on the floor in a gathering setting. It provides versatility in use.*

- *Several small group instructional areas can be accommodated.*

- *Commons can be break-out space for one on one consultations.*

- *The area can be utilized as a technical resource area with computers and modems.*

- *The area can be used for gathering space to view a video or movie.*

- *Commons can be a project-based area, which provides space for building items too big for a 24" desktop.*

- *Projects can be left out – "in progress."*

- *Commons can be designed to provide locker space easily accessible to classrooms.*

- *A demonstration & presentation space for a group of classrooms can be accommodated.*

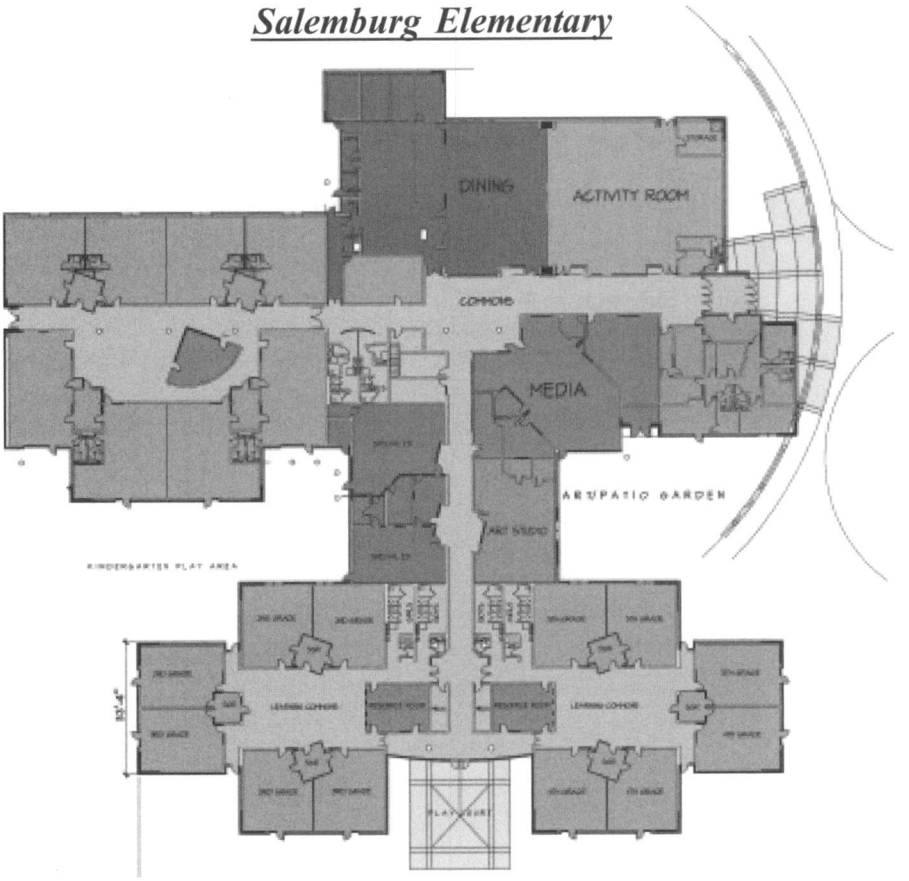
- *Changing display space – visible to the entire school population can be housed here.*

Features

- *Variable lighting controls*
- *Speaker and Intercom*
- *Good acoustics*
- *Projection system*
- *Display area for student work – bulletin boards, display cases*
- *Visual supervision from classrooms*
- *Toilets and drinking fountains near the commons*
- *Adequate electrical and data outlets to accommodate computers*
- *High ceilings*
- *Natural lighting/day lit*
- *Exposed structure to hang items from*
- *Comfortable with variety in seating,tables, interaction for more than one class*
- *Focus area for oral presentations*

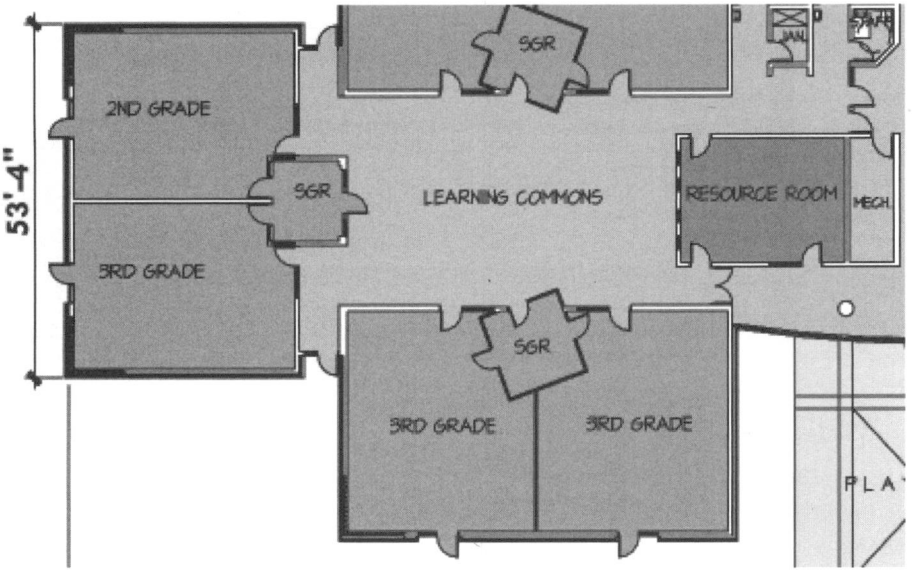
Note: Circulation through commons space must be carefully considered. Fire codes and egress requirements can sometimes be an issue if these spaces are designed as exit corridors.

Salemburg Elementary



Architect: Shuller Ferris Lindstrom & Associates
Classroom: 832 net square feet (average)
Group resource room (small): 104 net square feet
Location: Sampson County, North Carolina

Grades: K-5
No. of children/class: K -2 = 23 3 - 5 = 26
Group resource room (large): 166 net square feet



Lighting/Artificial Illumination

The light level, at desk height in the classroom should be between 50 to 100 fc (footcandles) per the Illuminating Engineers Society (IES) standard. This wide range of light level responds to the many different activities that the lighting design of a classroom environment should respond. Considerations should be given as to the mood to be created, the activities of the children, solar orientation of the room, the ceiling treatment, and room colors. Maximum control and flexibility are allowed the instructors when multiple switching or dimming is provided. One option for lighting control can be parallel to the "front" of the room to allow for lighting the entire room, lighting only the front, only the middle and/ or only the back part of the classroom as the need arises. (The "front" is defined as the wall that will act as the main teaching wall where most of the large group instruction focus will be, especially for the use of the projection screen). See Image 3.2. Another lighting control option is to switch fixtures parallel to the way the light comes into the room. Light fixtures near windows on bright days can be switched off; middle fixtures can be dimmed to respond to the amount of light needed on the worksurfaces. See Image 3.1.

Some options for general overall illumination with artificial lighting are:

- *1x4, 2x2 and 2x4 fluorescent lay-in or ceiling mounted light fixtures*
  - *Note: Parabolic louvers on light fixtures minimize glare and light on projection and computer screen. These types of fixtures can also lead to a perception of a dark ceiling and upper quadrant of the wall*
- *1x4 Pendant fixtures*
- *Pendant up/down lighting (for use with high ceilings)*
- *Pendant up lighting (for use with high ceilings)*
- *Recessed or Track lighting for accent*

Note:

- *Energy saving fixtures should be utilized wherever possible.*
- *Automated controls, which respond to the light level coming in the classroom are available.*

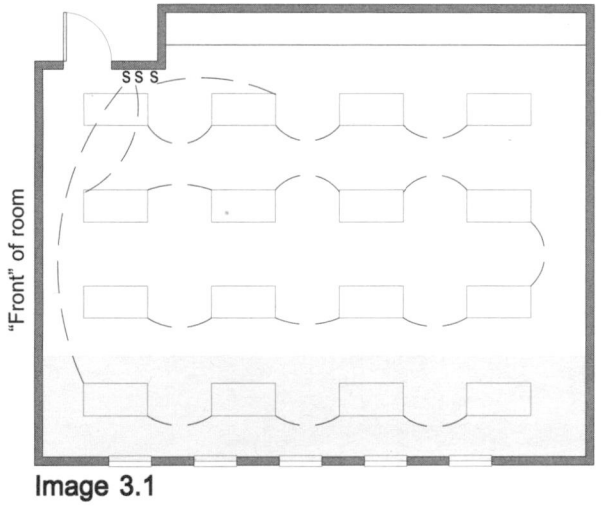


Image 3.1

Lighting Fixtures Switched Parallel to Window Wall

(On a sunny day the fixtures at the windows can be turned off.)

Dark zone for projecting images.

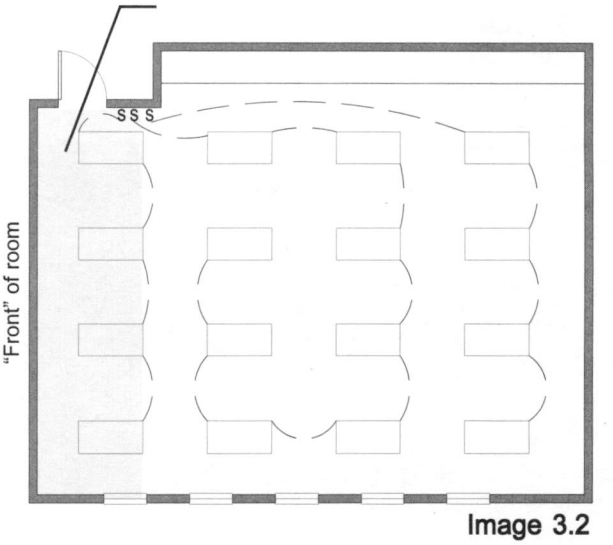


Image 3.2

Lighting Fixtures Switched Front to Back

(Allows light control at front & back of classroom separately.)

Can physical characteristics enhance learning?

Natural Illumination/Windows

A view to the out-of-doors is a nice contrast to what we experience indoors, both in light quality and focal distance. It provides a visual diversion, a needed rest for eyes. A minimum of one window with blinds or shades, should be provided for each classroom. The number of windows per classroom is something that is determined by many factors, among them the building orientation and aesthetics. The important issue is to provide an *appropriate* amount of natural light in the classroom space. Data taken in a brief survey of Maryland schools in the spring of 2002 asked teachers to rate different physical items in their existing classrooms as either "poor", "average" or "excellent." The teachers stated that an "excellent condition" existed in a classroom when the conglomerate size of the window area ranged from 68 - 72 square feet or more in a single classroom ranging in size from 762 gsf to 864 gsf. **This would represent approximately five 3'-0" x 5'-0" windows or approximately 8.5% of the floor area of the room. Of the 37 teachers interviewed, 81% stated that natural light was very important for an effective classroom setting.**

Consider providing some high windows for natural daylight, to minimize distractions and preserve wall space for chalk, marker and tack boards. High windows also improve light quality in the room by bouncing light off the light colored ceiling, thereby providing natural light further into the room. An ideal condition would be to provide light from two walls, whenever possible, to create a more diffuse light in the classroom and avoid glare. Other options for providing natural light in the classroom are through skylights, roof monitors, clerestory windows and light wells.

One or two operable windows in each classroom should be provided for conveinience. Some jurisdictions require emergency egress windows regardless of whether the building is fully sprinklered or the age of the occupants; verify with local code agencies.

Another item to note, especially for windows in the earlier grades is the window sill height. The weather is often a source of inspiration for teaching pre-k and kindergarten classes with children ranging in height from 3'-5" to 3'-9". Allowing everyone to see the outside from their desks and to view the weather without climbing onto things is most important. Sitting eye levels for these children ranges from 2'-6" to 2'-8".

The traditional solution of using clerestory windows in the wall between the classroom and the corridor can provide borrowed light from the classroom to provide natural light to the corridor or on the other hand, light from a day-lighted corridor can be directed to the classroom. Privacy is accomplished, both visually and acoustically, display space is still provided at student level, and light is exchanged between the classroom and the corridor. Interior windows, at eye level, between classrooms, project rooms and/or corridors are desirable for passive supervision and provide a greater visual connection between teams.

Providing natural light into all instructional spaces without glare is highly desired.

Acoustics

As a result of a parent petitioning the Architectural and Transportation Barriers Compliance Board (Access Board) on behalf of their hearing-impaired child, a standard for classroom acoustical design was completed and approved in 2002. Although the child in this case was hearing impaired, studies have shown that acoustics play a critical part in learning for children of all ages. Young children and English Language Learners (ELL) learners have difficulty distinguishing subtle nuances of the spoken word, affecting speech, spelling and vocabulary. Information taken from a web article "Learning Environments and Classroom Design" lists the following data:

- *"Children in noisy schools had higher blood pressure, were more distractible, and had more difficulty with complex puzzles and math problems than children in quieter schools (LA study 1986 – Cohen et al). Children do not adjust to the noise, in fact the longer they are exposed to the noise the more they became distracted."*

- *"Children raised in noisy environments also have trouble learning how to discriminate between irrelevant noise and the relevant task. They either tune out too much in the environment or cannot tune out enough."*

The new Acoustical Standard was developed by the Access Board with the assistance of the American National Standards Institute (ANSI). The document produced is ANSI/ASA S12.60, *Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools.* The standard provides acoustical performance criteria for learning spaces, and defines requirements and guidelines for noise isolation. The following are two of the pertinent requirements from this standard for typical classrooms:

Recommended Maximum Reverberation Time: 0.6 -0.7 seconds (Relative to room volume & proportions)

Maximum Background noise level in unoccupied space: 35 decibels

The main goal in providing a good acoustic environment for the classroom is to increase the signal to noise ratio (SNR). The "signal" is that which needs to be heard, including information generated by a teacher's voice, television, music, other children speaking, etc. The "noise" is any background sound which impedes hearing - HVAC equipment, light ballasts, extraneous noise from outside the classroom. These sounds are measured in decibels (dB). A typical speaking voice ranges from 50 dB to 60 dB. The Signal to Noise Ratio (SNR) at a student's ear should exceed a minimum of 15 dB with 20-25 dB as a design goal. For example, a room in which the speaker can be heard in the middle of the room at 50 dB with a background noise level of 35 dB and a reverberation time of .31-.63 seconds could meet the standard by default. (50-35 = 15 SNR with reverberation less than 0.6-0.7 seconds) There are other considerations to account for though, such as the fact that sound diminishes as it travels. In this case, students at the back of the room may not be able to hear intelligibly. These measures are all dependant on the volume of the room itself.

The Maryland State Department of Education recognizes the importance of meeting this standard. Background noise in a classroom comes not only from papers being shuffled and rustling feet but from such items as lighting ballasts, HVAC units, electrical appliances, computers and diffusers. Noise from adjacent rooms or corridors, traffic and children on the playground should also be considered when designing for an acoustically sensitive classroom. Reverberation is also a culprit in poor acoustic environments, as echoes tend to diminish the clarity of audible sound. **The goal is to diminish noise from sources we can and should control, which are not a necessary ingredient of the learning process.** "The ANSI standard exempts sounds generated by overhead projectors and other instructional equipment despite the sometimes significant contribution of these in- room sources to background sound" (Trane Engineers Newsletter, Volume 32, No. 1). Quiet ventilation systems, electronic fluorescent light ballasts, and generous sound absorbing material minimize the need for voice amplification.

Diminishing sound from classroom to classroom or from outside to classroom can be accomplished utilizing acoustic insulation in conjunction with double wythe masonry walls with air space between, double staggered stud walls, stud walls with resilient furring channels or sound-absorbing backer board, double paned windows, and providing door and window with seals. Acoustic sealant should be applied at the top and bottom of the wall construction and around any penetration in the wall surface. Outlet boxes should be offset from one another to eliminate the transfer of noise through the penetrations, themselves. Distance acts as a tremendous noise reducer. Noise from hallways can be diminished by building in noise barriers such as closets, toilets, and storage between the corridor and classroom proper.

The sound transmission class rating (STC) of a partition or floor ceiling assembly is a measure of its ability to reduce air-borne sound transmission; the higher the STC, the more it resists the transmission of sound. Floor/ceiling assemblies should be equal to or greater than the given partition rating. **ANSI Standard S12.60 recommends a minimum rating between classroom and corridor to be STC 45. Between public and common use toilet rooms and classrooms the enclosure rating should be STC 53.** Spaces, such as a gymnasium, cafeteria, music room or mechanical equipment room, which are likely to produce more noise than a classroom, should be provided with an enclosure of a rating of STC 60. According to Architectural Graphic Standards, Ninth Edition " the human ear can detect a 1-2 point difference as barely audible." Fluctuations of one to two points in STC rating, is acceptable so entry doors would be expected to have laboratory STC ratings of 30 or more (ANSI S12.60). Sound transmission class

should not be the only criterion used when designing walls, but it is a key measure in terms of diminishing the transfer of speech, which is especially significant for classroom design.

HVAC-related noise can be greatly diminished through the use of fully ducted systems. **According to ANSI S12.60 "unducted systems should not be employed since the sound they produce is inherently unable to conform to the background noise level criteria."**
Voice amplification systems can also be employed. These systems allow a teacher to use a low speaking voice and still be heard equally well throughout the classroom. Voice strains and fatigue are prime health concerns of anyone in the education field. This system helps to relieve the health issues. Efforts must still be made within the classroom to address reverberation.

The following chart lists some acoustic considerations. It is not meant to simplify acoustic design but to bring attention to creating good acoustic environments for learning.

Acoustic Considerations for Classroom Design

New Facilities and Existing Facilities	
• Select quieter equipment, both mechanically and electrically	• Seal around all penetrations through walls and ceiling to prevent noise leakage from other spaces
• Provide fully insulated ductwork and vibration isolators between mechanical equipment and ceiling /structure	• Consider drop seal door gaskets to prevent noise leakage from hallways and the exterior
• Consider the full complement of materials in the classroom, floor, ceiling, walls and furniture and evaluate where acoustic treatment would serve the best	• Where solutions for good acoustics within the classroom are less than desirable, consider providing a sound system

New Facilities	Existing Renovated Facilities
• Consider placement of HVAC components and utilities -Mechanical equipment on grade should be placed away from or buffered from classroom windows -Roof mounted and ceiling mounted equipment should be placed away from general classrooms, possibly over less noise sensitive spaces such as closets, toilets and storage rooms	• Relocate equipment outside of the classroom proper, provide ductwork for supply and return with sound insulation
• Provide walls between classrooms and corridors with high sound transmission class rating (STC) such as 45 STC	• Provide acoustic panels in especially noisy spaces, classroom entries or coat areas, to diminish the the transfer of sound beyond the noisy space and diminish reverberation time
• Locate noisier spaces (music, Phys. Ed, dining) away from classrooms	• Provide ceiling treatment with higher absorptive qualities than existing to diminish echo and reverberation time
• Extend walls to roof deck or floor above, acoustically seal both top and bottom of wall construction	
• Separate exterior windows in different rooms to prevent cross leakage from room to room	• Consider storm windows, or replace existing windows with thermal insulating units

Chart 3.1

Heating, Ventilating and Air Conditioning

The appropriate mechanical equipment choice for educational environments is defined by its ability to provide good energy performance, good air quality, be a good match for applicability to the circumstances and be a good monetary investment. **For educational environments such as the classroom the equipment should also be "acoustically conscious."** As stated previously, any effort to diminish background noise in a classroom is not only commendable, but a necessary step to provide adequate learning facilities. According to the new ANSI Acoustic Standard, ANSI/ASA S12.60 the maximum acceptable background level noise for an unoccupied classroom should not exceed 35dB. It should be assured that mechanical equipment meet this standard in order to support the activities of the classroom.

Ventilation is an important factor in indoor air quality. **The first course of action in the control of pollutants at their source is by selecting non-emitting or low emitting building materials, finishes, instructional materials, and housekeeping products.** Advanced technology has increasingly allowed buildings to be built with nearly airtight skins, which diminish the natural transfer of air from the outdoor environment to the interior. Occupants, construction materials, instructional materials and cleaning solutions can emit indoor pollutants into the air. Without proper ventilation these contaminants can build up to unsafe health standards. Appropriate recirculation of clean air through the room (or air-changes) is the remedy for contaminant build-up. The amount of fresh air circulated through the general classroom should be at a minimum of 15 cfm per person as prescribed in ASHRAE 62-2001. Applications such as science classrooms require more air changes - 20 cfm per person. Other standards to be followed are:

- *ASHRAE 62-2001 Ventilation for Acceptable Indoor Air Quality*
- *ASHRAE/IESNA Standard 90.1-1999 Energy Performance Standards*
- *ASHRAE Standard 55-1992 Thermal Environmental Conditions for Human Occupancy*
- *ASHRAE Standard 52.2-1999 Method of Testing General Ventilation Air Cleaning Devices*

Clean air is accomplished by providing appropriate filters both at the intake and supply sides of mechanical units. Filters are rated according to several performance characteristics: Dust spot efficiency is one criteria which addresses indoor air quality. Initial and final resistance are most important to the designers of the mechanical system and arrestance reflects the percent value of the weight collected by the filter. The MERV rating of a filter listed in ASHRAE 52.2-1999 goes beyond that criteria. Filters rating less than 25% efficient are not recommended. The standard of choice when evaluating a filter based upon improving indoor air quality is ASHRAE 52.2-1999. Implementing this standard allows the specifics to choose a filter based upon the particular contaminant they wish to remove from the air, whether that be pollen, bacteria, dust, smoke, auto emissions, mold spores, or paint spray. Which is expressed in a single number value called MERV.

Filters rated with less than 25% dust spot efficiency are not recommended. An average minimum dust spot efficiency of 25% - 30% is acceptable. MERV ratings vary depending on what particulate matter is being filtered out. For example, a MERV rating of 5-8 resists particles 3 to 10 microns such as mold, spores, hair spray, cement dust, snuff, and powered milk. This standard allows for more specific control of the indoor air quality sought after; filters are chosen based upon the size of the contaminant, upon its ability to remove respirable size contaminant and selection based upon a MERV rating.

In regards to heating and air conditioning most age levels have the same requirement: to be thermally comfortable. Air temperature ranges for thermal comfort year round should be between 72 degrees Fahrenheit and 76 degrees Fahrenheit. Relative humidity should be maintained between 30 and 60 %. It is recommended to provide individual classroom control of temperature within a 3-5 degree range.

The earlier grades require more consideration as pre-kindergarten students through first grade students spend a large amount of time working on the floor. **Make provisions to avoid drafts along the floor in the younger age group classrooms. Insulate or heat the floors to maintain a minimum of 72 degree Fahrenheit on carpeted floors.** Low temperature

radiant heat panels can be used in classrooms to get heat down to the floor. Baseboard radiation enclosures may be a safety issue, due to the high surface temperatures, close to the floor, if kids grab or roll into the enclosure (typically 4"-18" above the floor). Typical air devices throw air horizontally across the ceiling and not vertically to the floor since vertical airflow creates a drafty condition which effects thermal comfort. Even though properly-designed overhead heating is typically not a problem for adults and large kids, stratification does occur and lower temperatures will occur below the thermostat elevation at the floor level where smaller children are playing and/or sitting. This is primarily a concern in older buildings with slab on grade conditions where there is little insulation. Infrared-heat units heat the mass whether it is an overhead installation or in-the-floor type installation. Naturally in the floor is preferred in new construction and overhead in renovation projects.

Another supplemental heat source is electric heat mats in the slab to supplement the overhead heat. The concrete floor and other mass warms and prevents temperature differences from floor to ceiling. Other similar products are available in 2x2 and 2x4 ceiling panels as well as wall mounted cove style for above floor applications. The heating medium can be electric or hot water. Inexpensive prepackaged systems for installation within the slab provide flexible type tubing.

Evaluating Mechanical Systems

Inevitably HVAC systems affect the environment of the classroom and consequently the classroom design. Choosing a HVAC system that enhances the learning environment is ideal. A system should be chosen whose individual units have the most positive impact on the learning environment. Following is a chart which rates typical HVAC systems based upon several criteria specific to classroom design:

- *Quiet (evaluated according to the noise emitted by unit or the ability to add noise suppression to unit)*
- *Air distribution (ability for unit to distribute air evenly throughout the room)*
- *Floor space requirements (evaluated on whether the standard installation of the individual units utilizes floor space, whether in the classroom or within the building, on the corridor side, etc.)*
- *Control-ability (based on simple, reliable and inexpensive standard controls)*

Other criteria, which may be used to make decisions for an entire school building or school system, should also be considered:

- *First cost (initial cost of unit/system)*
- *Life expectancy (industry standard)*
- *Complexity of controls*

Some criteria, which also play a very important role in affecting the classrom environment, are detemined by the actual design of the system itself. Most of these type of criteria are dependent on other choices made within a system. For example, if energy efficiency rates "excellent", temperature control and relative humidity control may only be "moderate". Conversely, if energy efficiency rates "moderate" then temperature control and relative humidity control may be "excellent". These criteria may range from poor to excellent for the same type of systems in different applications. Due to the limited focus of this document these items are not evaluated here. Nevertheless, these elements should be addressed with the design engineers to choose and design the best system for the school.

- *Temperature control (evaluation of the ability of the system to maintain a constant comfort range for the occupants)*
- *Relative humidity control (evaluation of standard equipment using standard controls to provide humidity control)*
- *Energy efficiency (evaluation of energy use)*
- *Indoor air quality including ventilation and filtration (evaluation of the ability of the system to provide good indoor quality)*

The following chart rates only the criteria, which have a quantifiable impact on individual classroom design. Other criteria are equally important and must be considered at the local level.

Evaluation of HVAC Equipment in Terms of Supporting Learning Functions

Heating, Ventilating and Air Conditioning Systems								
Unit Criteria	Vertical Unit Ventilators	Standard Variable Air Volume	Fan-Powered Variable Air Volume (Series Type)	Fan-Coil Units **(See Note 1)**	Geothermal Water Source Heat Pumps **(See Note 1)**	Single Zone Air Handling Units **(See Note 2)**	Mulit-zone Air Handling Units **(See Note 2)**	Hydronic Heat Pumps **(See Notes 1 & 4)**
Quiet	Poor	Moderate to Excellent	Moderate	Moderate	Moderate to Excellent	Excellent	Excellent	Moderate to Excellent
Air Distribution	Poor	Fair	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Recommended unit installation is on floor (See Note 3)	Yes	No	No	Yes	Yes	No	No	No
Control-ability	Poor	Moderate	Excellent	Excellent	Excellent	Moderate	Moderate	Moderate
Outdoor Economizer Cycle	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Requires Dedicated Outdoor Air System	No	No	No	Yes	Yes	No	No	Yes
System Criteria								
Flexibility to handle loads, community use, 24 hour zones	Poor	Poor	Poor	Poor	Excellent	Poor	Moderate	Excellent
First Cost	Low	Moderate	High	Moderate	Moderate to High	High	High	Moderate
Life Expectancy	Moderate	Low	Poor	High	High	Low to Moderate (outdoor)	Low (outdoor)	Moderate
Complexity of Controls	Moderate to High	Moderate to High	Moderate to Highest	Moderate	Low	Moderate to High	Moderate to High	Moderate

NOTE 1 - Based on utilizing dedicated outdoor air system (DOAS) with heat recovery and dehumidification control used in conjunction with horizontal or vertical type terminal units with ducted supply and return air.
NOTE 2 - Based on chilled water cooling coils and hot water heating coils (i.e., not packaged).
NOTE 3 - The term "Units" refers to individual heating and cooling units for classrooms not power plant units like boilers.
NOTE 4 - Based on use of Modular Condensing Boilers with a supply setpoint of under 100 degrees F, and propeller fan cooling towers using less than 0.05 Hp per Ton of heat rejection.

Technology Integration

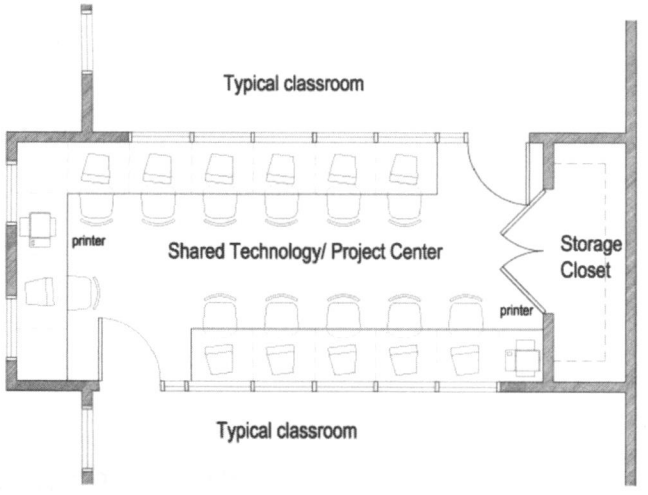
The integration of computer technology into the classroom setting begins as early as pre-K and Kindergarten classrooms. **The computer is a vital component of learning for today's student. Technology integration is highly important to a well functioning educational environment, and it is always progressing.** Designing classrooms that keep up with technological advancements is very challenging. It is best to keep flexibility and evolving technologies in mind. Minimum standards for hardwired systems are set forth in the MSDE *Maryland Public School Standards for Telecommunications Distribution Systems*, revised February 2002, assuming a hard-wired network in all rooms. These standards address specifications for quality assurance, telecommunications pathways and spaces, telecommunications wiring standards, video systems, and the building electrical system. MSDE strongly encourages school systems to keep up with advancing technology and to use it to the degree that it is most productive for the school system. Some of the advances in the past several years are: the use of computer-oriented display boards (often referred to as "smart boards") for instruction; lap–top computers assigned for students' year-long use; wireless technology, palm pilots or personal digital assistants (pda's); and ceiling mounted LCD projectors. The use of any of these technological advancements should be part of the design discussions. Thorough coordination should occur between student's viewing heights, desktop mounted objects like computers and the bottom of the projection screen. Sometimes screens are hung too low and it presents a difficulty to see, especially for younger children. Consideration should be given to technology during the schematic phase of the project. Classroom design and planning should take into consideration the following elements:

- *glare from windows on screens*
- *teacher visibility to all monitors*
- *peripheral light leakage and glare from doors being opened and closed*

- *spacing and distribution of data outlets around room*
- *proper electrical service*
- *storage of wireless carts*
- *providing electricity at wireless cart storage for recharging*
- *security issues with desktop and laptop computers*
- *the impacts on teacher's spaces whether using laptops or desktop computers*
- *careful coordination should occur through all phases of the project unitl construction completion*

Appropriate infrastructure should be built into the project to support all uses of technology and provide flexibility for future expansion and migration of emerging technologies to include use of wireless technology. Consider providing extra capacity in the electrical service to support future needs.

When asked about computer technology, some teachers felt that the best instructional environment would be a classroom wired with one computer for every student. Financially this may not be feasible. One option would be to provide fully visible mini labs of approximately 300-400 square feet, between two classrooms with 10 -12 computer stations. In this scenario two students could be working as a team at each computer or half the class could be doing one activity in the main instructional area and half the class could be working in the computer lab. Teachers have expressed frustration with just 4 or 5 computers in a classroom. "It is much easier to find an assignment for half the class than it is for just 4 or 5 students." This shared lab space could also double as a project room. Providing full supervision from the classroom into this space is extremely important. Carefully coordinate the height of the interior window sills with the height of the students and with teacher's standing and sitting eye level.



Points to consider with this arrangement:

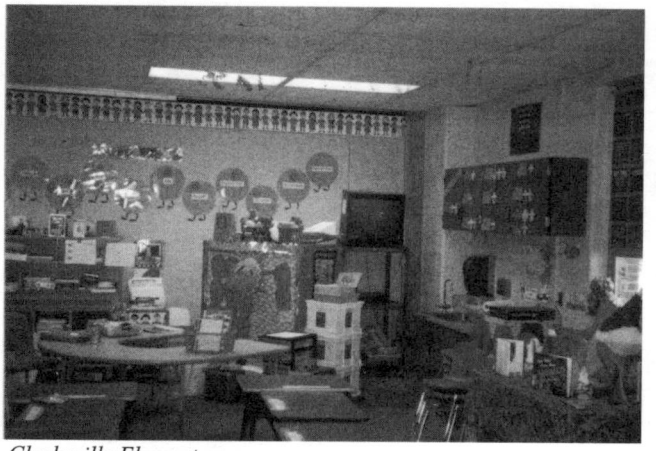
- *Some technological issues may evolve when downloading programs for all the stations to share*
- *Coordination time with the adjoining classroom teacher*
- *Maintenance and management of computer machines*

As a minimum for each instructional space, MSDE requires adequate space for three student computer workstations and associated data outlets, adjacent duplex outlets (one per data outlet), a printer, a teacher's computer and one multi-use networked device (such as another workstation, a printer or a scanner) within the classroom. Even if computer access is available elsewhere within the building, these stations within the classroom can always be used by the instructor, for individual student project work, small group research or as an incentive for good behavior. Provide a more flexible and progressive installation by distributing the data outlets around the room instead of clustering them all together. Provide for maximum usage with plenty of electrical and data outlets, which can respond to the increased need for technological access. Regardless, the design should respond to the needs.

Walls

There are four basic uses for walls:

- *To display student work or act as "display boards" for the teacher*
- *To provide soundproofing from other classrooms and from the outside*
- *To provide infrastructure support for plumbing, electrical wiring and outlets, data outlets and storage cabinets*
- *To eliminate visual distractions from adjoining groups*



Clarksville Elementary
Walls as Display

The display of student work is probably the most important function walls can perform. The ability to walk through a classroom and see the work being produced by the students provides a good insight into the curriculum being studied and their enthusiasm regarding the subject matter. Displays offer a sense of ownership to the students. This is *their* classroom. "See my work, here!"

For purposes here, the term "display boards" refer to tools used by the teacher to communicate with a large group of students. The boards act as a visual exhibit of the curriculum as presented by the teacher. These boards can take the form of chalkboards, markerboards, or tack boards. Providing as much display, tackable surface as possible is the best way to use walls above, alongside and below chalkboards or markerboards. Every unclaimed inch of a classroom wall is often used as display! Display boards, such as chalk or marker boards should be located on at least two walls of the classroom.

Teachers often prefer two contiguous walls as it shortens the distance between the two boards, allowing easy visual association between the two. It is recommended to coordinate the location of the boards with the projection screen. Try not to overlap the two as educators often like to use both, the display board and the projection screen simultaneously. Recently markerboards have begun to replace the long-standing mainstay, the chalkboard. Refer to the chart below for pros and cons associated with each type of display board. Versatility is gained by providing multi-track sliding markerboards or chalkboards. Consider a combination of markerboards and chalkboards for maximum flexibility.

Following are some items to consider when making the choice between markerboards and chalkboards.

Markerboards

Pros	Cons
Marker colors are more brilliant/ vibrant	Markers are more expensive than chalk
Some boards can also provide a low quality projection surface	Some markers & boards require specific cleaning solutions
Reflectance rating is typically 80% or higher	Not every "marker" is appropriate for use – avoid permanent markers
Can have a magnetic surface	Shorter life expectancy in comparison
	Some markers with volatile compounds contribute to poor air quality- have a strong "fumelike" smell

Chart 3.2

Chalkboards

Pros	Cons
Maintenance personnel and staff are familiar with the product, it's a "known" quantity	Contributes to poor air quality with chalk dust; may aggravate the allergies of staff and students
Can be used as a display surface and a writing surface	Chalk dust may harm computers and equipment
Long life expectancy in comparison	Can't be used as a projection screen
Can have a magnetic surface	

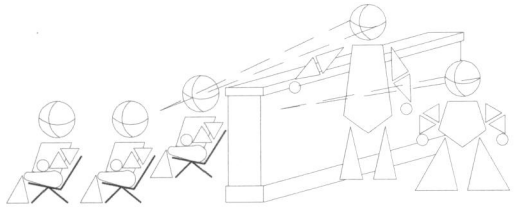
Chart 3.3

Walls should typically meet a sound transmission class (STC) of 42-60 to deaden the sound transmission between classrooms. As discussed earlier, acoustic separation and privacy are two dominant features of a well-designed classroom. The STC varies depending on the level of noise expected to travel from one place to another: example – the STC rating between corridors and classrooms should be no less than 45; the STC rating between general classrooms and sound producing spaces such as gymnasiums, cafeterias and music rooms should be no less than 60. Reference should be made to the ANSI Standard S12.60 for complete details on acoustic wall construction.

Obviously, walls serve the purpose of providing a place to put the utilities needed to support a classroom: electrical outlets, data outlets, plumbing fixtures. Walls also provide support for wall mounted items such as televisions and overhead storage cabinets. All of these should be carefully coordinated to produce an efficient work environment for both teacher and student.

Walls can provide a barrier to visual distractions, especially between classrooms. They can also create areas within a classroom, which are unable to be supervised. Designers should carefully analyze who the clientele are that use the space, their sizes in both sitting and standing positions and determine when partial height walls would be best suited to providing the necessary visual barrier.

Finally, consider flexibility in wall placement. Be conscious of where loadbearing walls are placed and where walls could be removed later, should the need to expand arise.



Wall is low enough for teacher to supervise students beyond but tall enough so children are not distracted by others in the room.

Low wall or partition within classroom

Doors

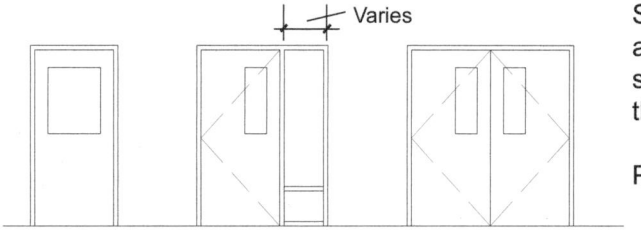
Providing panes of glass or lites in interior corridor doors has become common in many school designs. This addresses security concerns, maximizes supervision and provides full visual access to all places within a school building or classroom. An option can be to provide solid doors for durability with fully glazed sidelights. Regardless, all student occupied areas should be fully visible. To maintain the acoustic continuity of the corridor wall, acoustic door seals should be specified.

Doors to the exterior from the classroom are significant assets for the earlier grades (pre-k through third). However, the door to the exterior can also be an advantage for later grade school children. In an Association for Supervision and Curriculum Development information brief (www.ascd.org) dated August 2001 the following was stated: "...but providing a door for activities directly integrates the out-of-doors and would promote the possibility of experiencing the out-of-doors in an educational environment.

Environmental education engages students' minds and hands, often in real-world investigations that are inquiry-based, interdisciplinary, and supportive of a standards-based curriculum." A report developed by the North American Association for Environmental Education demonstrated that environmental education can help improve the overall quality of education.

Some unfavorable aspects of doors to the exterior are additional security concerns, energy conservation issues, maintenance costs and the initial construction cost of additional doors. These concerns and costs should be carefully weighed against the significant educational impact of providing easy access to the exterior from each classroom. Human nature often leans toward using tools that are easiest reached without a lot of trouble. Doors to the exterior provide ready access to the environment without the extra steps of gathering up a full classroom of children and taking them down to the end of the hall, to go outside.

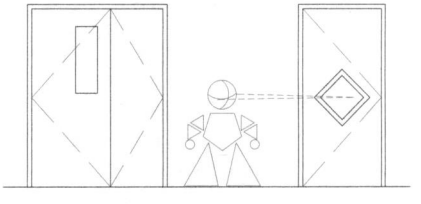
Consider double doors from the classroom to the corridor to alleviate traffic jams at the classroom entries, provide easier movement of equipment, accessibility, and a greater connection to corridor. These double doors can be an unequal pairing of any size door with a 3'-0" accessible door.



Single door with half lite vision panel

Single door with vision panel and sidelite

Double doors with vision panels



5' opening - uneven door leaves with vision panel

Decorative vision panel at child height

Classroom Entry Door Options

Ceilings

Consider varying the heights of the ceiling in the classroom. Ceiling heights should reflect the size and performance requirements of the space – the larger the space the higher the ceiling. A cozy entry can be accomplished with a lowered ceiling, which helps with sound control with any group of children. The height of a space often influences the loudness or the softness with which inhabitants speak. Soft ceilings such as lay-in acoustical panels contribute greatly to noise reduction. It is relatively easy to meet ANSI S-12.60 with acoustical ceilings rather than hard ceilings.

Lowering ceiling heights in classrooms in the area along the corridors can also serve the practical need for accommodating mechanical air duct space and other utilities. A minimum ceiling height of 9'-0" is recommended for rooms of 700–900 square feet. If indirect lighting (lighting bounced from another surface prior to meeting the eye) is a consideration, provide ceiling height between 10' – 12'. Direct/indirect light sources provide better light distribution and less glare. Consider higher ceilings in larger spaces and lower ceilings in portions of the space where more quiet activities may take place.

Sagging ceiling tiles are an eyesore. Products are available which, for a minimal cost above the cost of standard ceiling tiles, are designed to resist humidity, thereby reducing the tendency to sag.

Provide ceiling finish materials with:

- *A noise reduction Coefficient (NRC) between .55 to .75*
- *A minimum Sound Transmission Class (STC) of 40 combined with floor assembly to a range of STC 60*
- *Minimum light reflectance value of 0.80*
- *Use highlight reflectance products with 0.83 or greater*

Floor Finishes

In general, hard floor surfaces like vinyl or wood, have poor acoustic values but the products typically require less maintenance and can have a longer useful life. Soft, carpeted surfaces, especially for younger children are better because of the amount of time they spend in floor activities. Carpet requires a diligent maintenance plan. Each type of floor has its pros and cons. The design of the classroom should take into consideration all materials on all surfaces - ceilings,

walls, furniture and floors to create an environment which is durable, acoustically appropriate and easy to maintain. All floor types should be easily cleaned and maintained.

Carpet: Carpeting in classrooms can help reduce sound impact and provide warmth under foot when students sit or work on the floor. It is a critical floor finish for grades prekindergarten through first in at least some portion of the room. Primary and secondary school teachers often utilize area rugs. This is partly due to the probability of carpeting to harbor molds and bacteria. An intensive maintenance program is a must - including daily vacuuming with proper equipment and shampooing and/or hot water extraction several times a year. Institutional guidelines for carpet specifications should include meeting Carpet and Rug Institute's (CRI) IAQ certification including CRI IAQ testing program label for installation adhesive, ASTM E-648 Class II minimum flammability, ASTM E-662 <450 flooring mode, soil resistant treatment minimum average of 350 ppm flooring on pile fiber of 3 separate tests. Test method CRI TM_102. Yarn should be solution or yarn dyed, level loop, multilevel loop, textured loop or cut and loop. Antimicrobial treatments may be hazardous for some children.

Vinyl composition tile (VCT) or vinyl sheet goods: Wet-areas in classrooms as well as door entries, either from the outside or from the hall, are often prime places to install vinyl composition tile or vinyl sheet goods. It is a durable, moisture resistant, hard, floor surface. Coordinate furniture specifications with floor surfaces. Some student desks are designed for vinyl floor applications versus carpet and can mar the VCT finish. Solid colored tiles are prone to show marring and soiling much easier than patterned styles. Consider maintenance issues as some vinyl products can require almost as much maintenance as carpeting.

Linoleum: Another durable finish material is linoleum, a product invented in 1863 in England. Linoleum gets its name from the Latin word *linum*, which means flax and *oleum*, which means oil. It is manufactured of renewable natural raw materials such as linseed oil from flax, pine resin and wood powder with a backing made of jute. It is inherently hygienic halting the breeding of many micro-organisms, is extremely durable in commercial applications and allergen-free.Colors and patterns are through-body versus surface applied.

Terrazzo: A hard durable floor surface - durable enough to be used in high traffic areas such as corridors and lobbies. Terrazzo is made of marble chips, mixed in a matrix of Portland cement and hand trowelled to an even surface on site. Curing is approximately 6 days and the surface is machine rubbed while covered with water, using increasing finer grit pads. Cement grout is applied to fill in surface voids. A terrazzo sealer is applied and the floor is buffed. The installation requires skilled knowledge and is very labor intensive, hence more costly. Longevity and durability are significant traits of terrazzo flooring.

Terrazzo Tile: This hard surface floor finish product has successfully been used in classrooms. It is manufactured in factories and brought to the site for installation. It is available in varying sizes. Maintenance is often less frequent than for vinyl tile and carpet, but typically has a more expensive first cost.

Polymer Seamless Floor System: This product is highly effective in either new or renovation projects where moisture resistance is a prime objective. The system provides a seamless, water resistant surface ideal for wet areas such as bathrooms and kitchens. Options include different grit for slip resistance, self-leveling polymer floor coatings and troweled polymer floor systems.

Wood: Although not a common floor finish for institutionals applications, wood can bring an appeal and visual warmth to any environment. Limited use of wood flooring in classrooms can be utilized successfully. The initial cost of the product can be nearly twice as much VCT. Wood is a strong, durable floor finish and will sustain a long, beautiful life with proper care and maintenance. This product is recyclable and supports the concepts of a sustainable environment.

Ceramic Tile: Another environmentally friendly floor finish, ceramic tile is also used sparingly in classroom design. Kitchen areas and toilet rooms are the most common application. Ceramic tile, although one of the more costly floor finishes, is durable, scratch

resistant, fire resistant and has easy maintenance requirements. The dense glazed body of the tile resists moisture penetration and staining.

Color

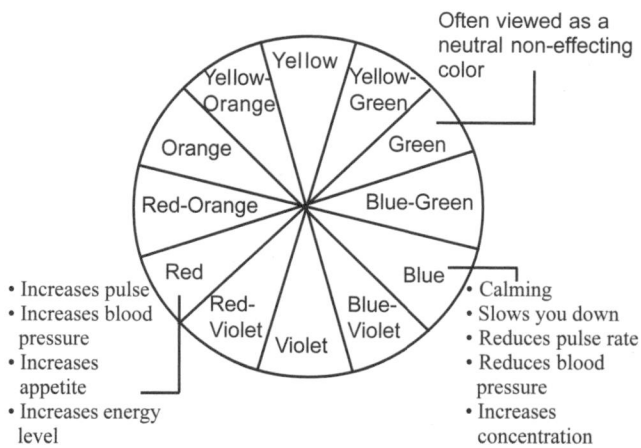
Color does matter. Most of us know that red means "stop" and green means "go". Color and the use of color can affect mood, behavior, learning, and vital signs. There are six ways that humans process color; as a biological response, as part of the "collective unconscious", through conscience symbolism, by cultural influences and mannerisms, through style and trends, and through personal relationships.

Color is a tool of communication that we use every day. As designers we should choose color carefully to express the intended message and effect. School environments can, by virtue of the color palette, be depressing, monotonous, boring, or they can be stimuluating, pleasing, and exciting.

Color schemes should work with the natural environment surrounding the school. Classrooms are not painted red or orange in hot climates like the southwest. Cool colors balance the warm hues of the native surroundings. Classrooms in the northeast should not be designed with dull, grey schemes. Again, color should respond to and balance the natural environment.

A bright color on a white background stimulates the pupil of the eye to open wider. Bright colors attract attention, especially elementary school children.
Warm colors and bright light: increases muscular tension, respiration rate, heart action, blood pressure and brain activity.

COLOR WHEEL



Cool colors and dim lighting: reduces muscular tension, respiration rate, heart rate, blood pressure and brain activity. Sleep is easily facilitatated.

Faber Birren, 1900-1988 an American art historian and author on color noted, "Color effects are always temporary." This statement does not diminish the importance of color to the visual environment. He advocates the fuctional use of color by introducing a "variety of colors in order to keep the human responses continually active and to avoid visual adaptation or emotional monotony."

Space and the Shape of Classrooms

Space, the type and amount provided, affects the needs of different classroom groupings. These groupings are described in Chapter 2. With the advent of collaborative learning activities in educational environments today, the traditional rectangular shape of classrooms may not be sufficient.

James A. Dyck's 1994 article advocating the virtues of the "Fat L-shaped" classroom introduces criteria for the modern classroom:

- It has to accommodate the formation and functioning of small learning groups while providing a sense of separation, because groups working together will experience distractions and nonproductive interaction.
- It has to be flexible enough to allow the continual reorganization of the whole class into various sizes and number of small learning groups. This means the space must be free as possible of permanent obstructions.
- It has to be manageable by a single teacher who has command of the entire space. This means the space must be compact and open (Dyck, 1994).

The Fat L-shaped classroom, with both legs nearly equal, provides up to 5 corner zones which create 5 unique activity settings. The role of two walls coming together to form a 90 degree angle creates a sense of place, to view others as well as perform the task-at-hand. "The corner is a permanent feature open to the setting as well as contained." (Lippman, 2004) Depending on the arrangement of the walls and furniture creating the corner different types of atmospheres can be created. When a group is bounded on one side by a wall the group becomes peripherally engaged; bounded by two walls the group becomes partially engaged and bounded on three sides creates a completely

engaged group. In turn, a whole class instruction may occur in one leg of the "L" with individual or small group instruction occurring in the other leg of the "L" without being a distraction to the other (Lippman, 2004). The L-shaped classroom offers a lot of flexibility to provide instructional space for all types of learners. The environment can be used to address diverse ways of learning.

Furniture

The selection of available furniture for a classroom is broad, ranging from desks, tables, chairs, easy chairs, book racks, portable book shelves and easels to soft furniture and pillows and rocking chairs. The choices seem limitless. These recommendations should be kept in mind:

- *Address ergonomic concerns*
- *Choose the most flexible furniture style*
- *Approximately 10% of the seats in a classroom should be left-handed or all should be universal*
- *Approximately 2% of the seats in a classroom should be oversized units or all adjustable*
- *Select furniture that is flexible and multi-functional*
- *Consider a variety of furniture types for each classroom*
- *Consider the amount of noise generated by a group of desks being moved- specify furniture which has a low noise impact surface in contact with floors (versus utilizing modified tennis balls on feet of desks and chairs)*
- *Tables with adjustable leg heights are convenient not only for providing accessible workstations but also are versatile for use with differing sizes of students*
- *For desks, the size of the writing surface is critical when notes are taken from books or a laptop computer needs to be accommodated alongside notebooks or books*
- *Level topped desks allow more flexibility for grouping desks to create a larger work surface*
- *Square edged desks (versus radius or round-edged) allow more flexibility for grouping desks to create a larger work surface.*

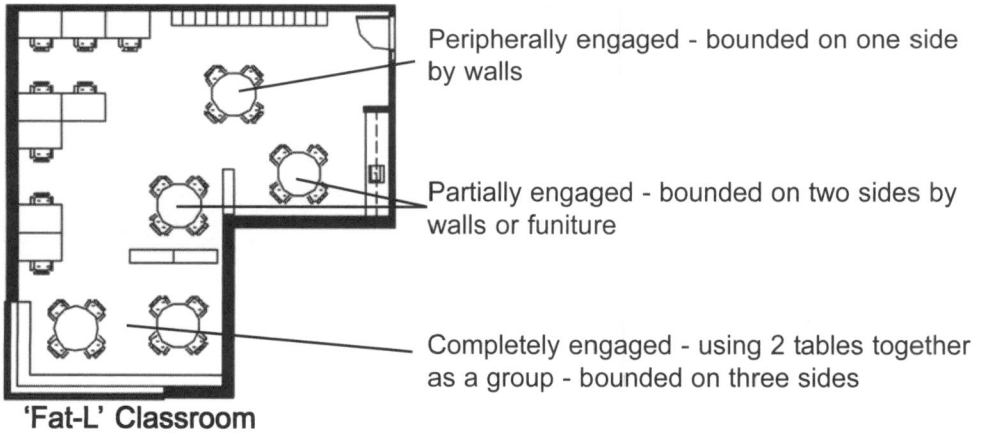
Questions to consider in desk type selection:

- Seat attached versus seat free?
  This is often based on program needs, student activities and the amount of flexibility needed.

- What type of versatility is needed in the room?
  Separate desks and chairs are more easily moved, stacked, cleaned around and under.

- Which type of chair/desk leg? What is the floor finish?
  Desks with sled slider legs are designed for installations on carpet and are not conducive to installations on vinyl tile. The sliders mar the vinyl surface. Desks with four legs are more appropriate with vinyl tile flooring.

- How are student books, papers and personal items stored?
  Under the chair, wire book baskets – visually open.
  In a compartment beneath the desktop. Open metal mesh allows visual inspection more readily.
  Solid side and bottom panels (traditional pocket).



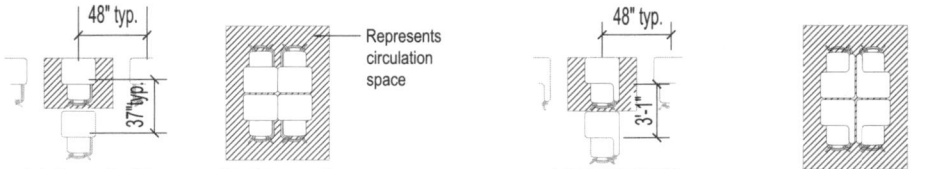
'Fat-L' Classroom

Furniture Comparison Chart Area Distribution for Row Arrangements and Group Arrangements

Furniture Style	Furniture Description	Area for a Single Seat	Area of one Seat in Row Arrangement	Area for 25 Seats in Row Arrangement	Area of one Seat in Group Arrangement	Area for 25 Seats in Group Arrangement
Style A*	Seat attached Traditional	12 SF	12 - 13 SF	300 – 325 SF	12 – 12.5 SF	300 – 313 SF
Style T*	Tablet Armchair Traditional	12 SF	12 - 13 SF	300 – 325 SF	13 – 14 SF	325 – 350 SF
Style S	Single Table, seat separate Non-traditional	15 SF	11.75 - 12 SF	319 – 331 SF	11.5 – 12 SF	288 – 300 SF
Style D	Double Table - For two, seats separate Non-traditional	12.5	12.5 – 13 SF	319 – 331 SF	12.75 – 13.25 SF	319 – 332 SF

*Group arrangements are limited with these styles because of the pre-determined left or right-handed orientation of the desks. Equal numbers of left and right handed desks are seldom available in one classroom, restricting group work.

Note: Traditional furniture occupies less space when arranged in rows (what it was designed for). In comparison, non-traditional furniture occupies more square footage overall when arranged in rows but less square footage when arranged in groups.



1 desk occupies 12 square feet with circulation on two sides

4 desks grouped together occupy 46 square feet or 12 sf each with circulation aisles on all sides of group

1 desk occupies 12 square feet with circulation on two sides

4 desks grouped together occupy 50 square feet or 13 sf each with 2'-0" circulation aisles on all sides of group

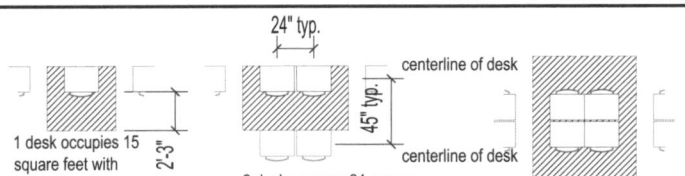
Style #A

18" x 24" desk with seat attached

Glider leg style, & four leg style, similar

Style #T

Tablet armchair



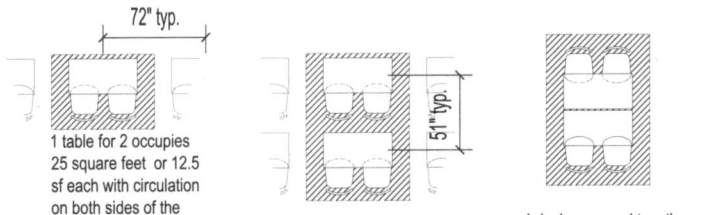
1 desk occupies 15 square feet with circulation on two sides and allowing 27" for chair & chair movement

2 desks occupy 24 square feet or 12 sf each with circulation on two sides and 27" for chair & chair movement

Group of desks: 4 desks occupy 45 square feet or 11.25 sf each with 2'-0" circulation around

Style #S

18 x24 desk with separate chair



1 table for 2 occupies 25 square feet or 12.5 sf each with circulation on both sides of the table

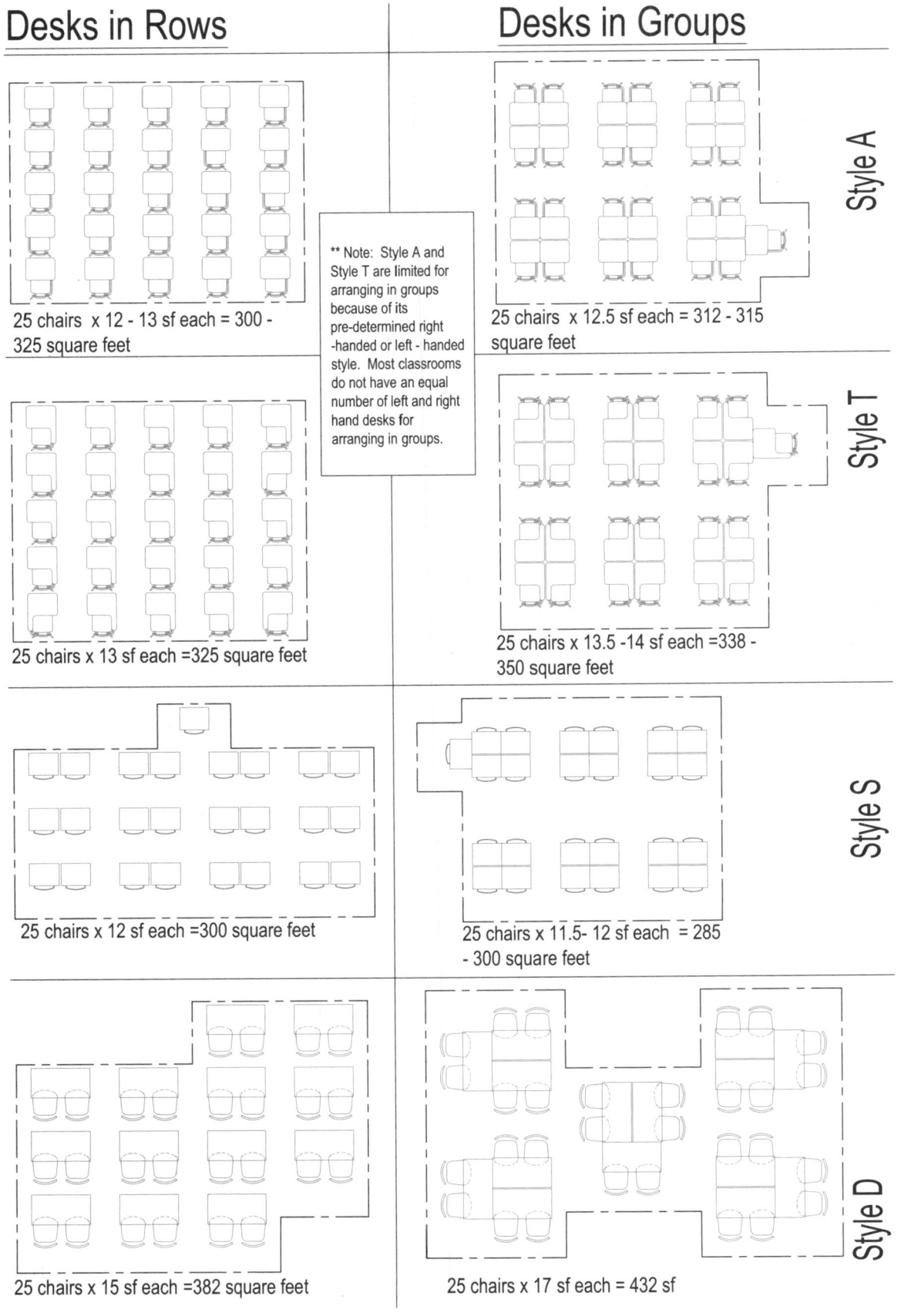
4 desks arranged in rows =50 square feet or 12.5 sf each seat with circulation aisles

4 desks grouped together occupy 52 square feet or 13sf each with 2'-0" circulation aisles

Style #D

24" x 48" Table with 2 chairs

Comparisons of Seating Arrangements and Desk Types



Worksheet for Calculating Space Needs for General Classrooms

(Use separate worksheets for each age level)

Step 1 - Choose furniture style. Consult diagrams and chart above for minimum square footage requirements. Please note: if furniture specifications are undecided, utilize the following range for design purposes of classrooms seating twenty-five: 300 square foot (sf) to 350 sf for furniture for 25. Adjustments are made for classroom occupancy greater than or less than 25, see #2.

A. Student Seating and Worksurface's

1. Area needed for furniture (based upon the type of furniture and arrangement) — 1. _____ SF to _____ SF

2. Adjustment for class sizes — 2. _____
   - if less than 25 students - SUBTRACT 10 sf/student
     (Example: 23 students = -20 sf)
   - if more than 25 students - ADD 15 sf/student
     (Example: 28 sf = +45 sf)

   OR _____

3. Apply factor for additional space needs relative to student size. Apply factor to total of #1 and #2 together. — 3. _____ SF to _____ SF

   Factors:
   - 0% = PreK and K and Primary
   - 5% = Intermediate
   - 10% = Middle and High

   (Example: For high school classroom of 25
   1. "300 to 350"
   2. "Zero"
   10% of 300 = 30; 10% of 350 = 35
   3. add "30 to 35"

SUBTOTAL A — **_____ SF to _____ SF**

Step 2 - Calculating area needs for each component within the classroom.

B. Teacher Workstation — _____ SF
- workstation within the classroom = 75 sf
- workstation outside the classroom = 50 sf

(workstation includes 5'-0" work surface, side table, 2 file cabinets, 2 full height storage cabinets and circulation space)

C. Computer Stations
- minimum quantity = 3 per classroom — 25 sf each x _____ = _____ SF

(includes space for printer, file storage, tech supplies)

D. Work Counter with Storage — _____ SF
- prekindergarten through intermediate
  12 LF x 2'-0" D = 24 sf
- middle through high
  6 LF x 2'-0" D = 12 sf

E. Storage (minimum) — _____ SF
- prekindergarten through middle = 40 sf
- high = 20 sf

F. **Bookshelving** _____ SF
- prekindergarten & kindergarten - 2 x 12 LF x 1'-0" = 25 sf
- primary - 2 x 10 LF x 1'-0" = 20 sf
- intermediate and middle - 2 x 16 LF x 1'-0" = 32 sf
- high - 2 x 8 LF x 1'-0" = 16 sf

(assuming 2 shelves high/linear foot)

G. **Presentation/Focal Point** 150 SF
(assumes full width of classroom approximately 25' x 6' deep)

SUBTOTAL B - G _____ SF

Step 3 - Calculate area needed for learning centers and special needs students.

H. **Individual Activity Centers/Learning Centers** _____ SF
- prekindergarten & kindergarten (minimum 200 sf for two stations)
- primary (minimum 150 sf for two stations)
- middle and intermediate (minimum 120 sf for two stations)
- high (minimum 100 sf for two stations)

I. **Specific Needs Populations** _____ SF
- if more than 10% of students require special education services - ADD 30 sf
- if more than 15% of students require english language tutoring - ADD 30 sf
- if more than 40% of students receive free and reduced meals - ADD 30 sf

SUBTOTAL H - I _____ SF

Step 4

SUBTOTAL A	_____ SF to _____ SF
SUBTOTAL B - G (add same figure to lowest **and** highest ranges)	_____ SF to _____ SF
SUBTOTAL H - J (add same figure to lowest **and** highest ranges)	_____ SF to _____ SF
TOTAL	**_____ SF to _____ SF**

Note: Instructional spatial requirements may be met through the use of shared project rooms and commons areas.

Sustainable Products and Techniques

The classroom is an ideal model to introduce the concepts of sustainable environments, utilizing green products and making "green" choices. The architecture itself can act as a teaching tool to reinforce environment-conscious stewardship. Some research studies have demonstrated that optimum daylighting for example can improve student test scores (Heschong Mahone Group, 1999). Green building practices offer an opportunity to create environmentally sound and resource-efficient buildings by using an integrated approach to design. Green buildings promote resource conservation, such as energy efficiency, use of renewable energy and water conservation features; consider environmental impacts and waste minimization; create a healthy and comfortable environment; reduce operation and maintenance costs; and address issues such as historical preservation, access to public transportation and other community infrastructure systems. (Dept. of Energy)

The following are products and techniques of ways to contribute to sustainable design.

Painting
Products

- *Specify low or no-VOCs (volatile organic compounds) paints*

Recent regulations have greatly reduced the use of oil-based paints, which contain high amounts of VOC's and is a culprit in maintaining good indoor air quality. Some alkyd-based and latex paints still have high levels of VOC. Specifications should state all paints applied on the project to have low VOC levels. Some paint companies manufacture products with no VOCs. If unavoidable, specify a VOC limit of 150 grams per liter of latex paint or no more than 250 grams per liter of oil-based paint.

Painting
Techniques

- *Provide a well-ventilated work area, using fans to ensure that fresh air is continually circulating through the workspace*
- *Provide as much time as possible after painting to allow the VOCs to dissipate prior to occupancy*

Partitions/Underlayments
Products

Specify the following:

- *Masonry cement minus the Portland*
- *Wood-fiber cement blocks*
- *Auto-claved aerated blocks*
- *FSC – Certified OSB, plywood sheathing*
- *FSC – Certified MDF*
- *Bark-based panel adhesive*
- *Laminated strand Lumber products*
- *Straw-based particleboard, formaldehyde-free*
- *Wheat straw particleboard-formaldehyde-free*
- *Formaldehyde free Interior Grade MDF*
- *Formaldehyde free face fiberglass batts*
- *Ozone friendly insulated doors*
- *Compressed straw wall panels*
- *Certified Engineered Wood Products*
- *Engineering Lumber studs*
- *Recycled plastic composite deck*
- *Recycled wood-plastic composite deck*
- *Vegetated roof system (green roofs)*
- *Ozone safe Roof insulation and underlayment*
- *Recycled content EPS insulation*
- *Cotton insulation*
- *Wet spray cellulose*
- *Ozone friendly open cell polyurethane*
- *Interior and exterior light shelves*

Finishes
Products

Specify the following:

- *Concrete: Consider leaving concrete floor slabs and walls or columns "bare." Concrete can be colored and/or textured to look like stone, tile, and slate. Several ways of acquiring color in the floor are adding colorants to the concrete at the plant, adding to the surface and mixing in to the top layer while still green, or color may be added at the end of the process through acid etching or painting. Sealers are still recommended on concrete floors to enhance cleaning. Longevity and durability are unsurpassed.*
- *Linoleum*
- *Compressed straw ceiling panels*
- *Wood fiber ceiling panels*
- *Natural Fiber Acoustic Ceiling Panels*
- *Polymer Carpet*
- *Terrazzo tiles*
- *Zero VOC or low VOC exterior paints*
- *Certified hardwood flooring*
- *Resilient textile flooring*
- *Recycled carpet backing*
- *Cork Flooring*
- *Bamboo Hardwood Flooring*
- *Sisal Wallcoverings*
- *Water based polyurethane finishes*

Windows and Doors
Products

- *Windows: Consider solar screens or awnings to reduce solar heat gain, especially in late spring, summer and early fall*
- *Windows: Specify low-e coatings to reduce heat gain and save on energy costs*
- *Windows: Provide small windows to East and West exposure to avoid solar gain or provide light shelves designed to reduce excessive light infiltration*

Engineered Building Products
Products

- *Engineered roof and floor trusses: Engineered products can be ordered to length specifically for the job-no sawing, no waste, no trash removal. Some products provide better performance for the cost, there is a reduction of natural resources used (more "scrap" material is put to good use instead of going into the land fills), less waste on the construction site*
- *Engineered studs: Short pieces of wood, finger-jointed to create a full-length wood stud-the advantage is to save the old growth forests because smaller dimension lumber is utilized*

Mechanical, Electrical and Plumbing
Products

Consider the following:

- *Geothermal and hydronic heat pumps*
- *Solar Water Heating*
- *Waterless urinals*
- *Carbon Dioxide sensors*
- *Passive Solar Heating*
- *Thermostatic By-Pass valve for Hydronic Baseboard Heat*
- *Pedal controls for lavatories*
- *Point of Use or Direct Contact water heaters*
- *Recovering heat from waste water*
- *Energy Efficient Lighting*
- *T-5 fluorescent lighting*
- *Electrical Hand Dryer*
- *Variable speed drives*
- *Heat recovery devices*
- *Thermal energy storage*
- *High efficiency motors*
- *High efficiency chillers*

- *High efficiency boilers (condensing type)*

Mechanical, Electrical and Plumbing Techniques

- *Design for daylighting – This technique not only brings more natural light into the building, but also can reduce energy costs and sizes of mechanical equipment*
- *Design for 2% of Daylight in at least 75% of the classrooms and all other areas with permanent occupancy*
- *Building envelope modeling*
- *Variable flow/variable speed pumping systems*
- *Variable flow/variable speed air distribution systems*
- *Demand controlled ventilation*
- *Displacement air ventilation systems*
- *Free cooling economizer control system*
- *Precooling at night control system*
- *Dedicated outdoor air systems*
- *Design integration with other disciplines*
- *Use of occupancy sensors*
- *Rain water harvesting*
- *Gray water systems*
- *Commissioning*
- *Control and monitoring through an energy management system*

Recycling

Items to consider for recycling in renovation projects:

- *Carpet*
- *Concrete*
- *Glass*
- *Metal – studs, steel framing members*
- *Access flooring*
- *Concrete Masonry Units (recycled for aggregate for road beds, etc.)*
- *Wood and Lumber*

Websites

For further information consult the following:

- US Green Building Council www.usgbc.org
- National Institute of Building Science (whole building design guide) www.wbdg.org
- Building Green (publishers of Environmental Building News) www.buildinggreen.com
- Green Schools Focus at Montgomery County Public Schools www.mcps.k12.md.us/departments/facilities/greenschoolsfocus/
- Collaborative for High Performance Schools, California www.chps.net
- Energy Smart Schools, Office of Energy and Efficiency and Renewable Energy, DOE www.energysmartschools.gov

Other references:

- MSDE Bulletin *Building Ecology and Partition Design, 1996*
- *MSDE Bulletin Building Ecology and School Design, 1995.*

CHAPTER 4

Pre-K and Kindergarten Classroom Design

Kindergarten classrooms, as well as Pre-Kindergarten classrooms, are where young children learn best when engaged in hands-on activities, independently, and in small and large group settings. Kindergarteners have acquired some sense of independence and curiosity and have a highly active imagination. The room itself should be designed to provide opportunities that foster growth and discovery. Consider repeating colors, forms and shapes to reinforce way-finding from the front door of the school to the Pre-K or K classroom. Repetitive cues and themes from the front door of the school to the classroom give a sense of security to young children.

Photographer Beth Singer

Detroit Country Day Pre-school

The Maryland Model for School Readiness (MMSR), prepared and revised in July 2001, is a framework that assists educators in providing quality early learning opportunities for children. MMSR identifies five domains for children's development: social and personal, language and literacy, cognition and general knowledge, approaches toward learning, and physical well-being and motor development. Experiences for young children should promote development in the five domains.

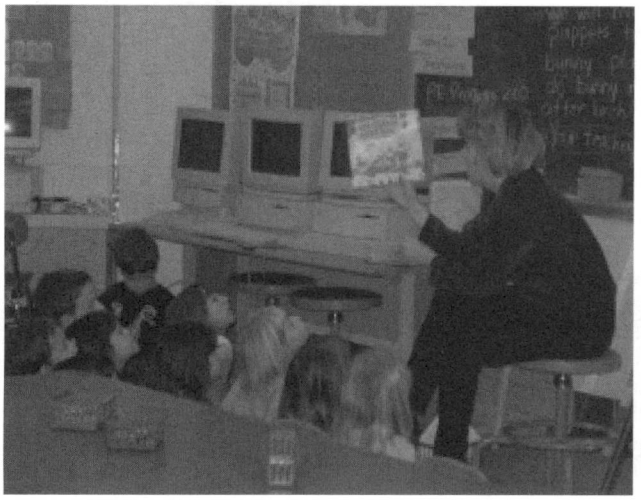
Pre-K and Kindergarten classrooms must be located on the grade level floor of the building and ideally near a parent drop-off zone. Easy access should be given to the school administration, media center, cafeteria and the health suite from these classrooms. Spatially the classroom should be generous. The design of the heating, ventilating and cooling (HVAC) system should take into account the amount of heat generated in the classroom given the number of children and their activities. Provide plenty of natural light. Windows should be provided with blinds or shades. At least one window should be designed as an egress window. Lighting should be able to be dimmed or multi-switched, as children of this age group could still take naps or do activities which require lower levels of lighting. Shelving is to be dispersed throughout the classroom. If shelving units, built-in or moveable, are provided to act as space dividers for the room, the units should not be any taller than 2'-6". Locking brakes on moveable units are a must.

Blackboards, markerboards, or bulletin boards should be mounted at a kindergarten child's height, typically placing the bottom of the board around 18-20" from the floor. Also consider accomodating the height of the teacher using these boards. For this purpose it is recommended to specify boards which are taller than 4'-0" or mount units vertically. Areas high on the walls are typically used for display or for the teacher's use. Standard units can be placed vertically to accommodate child and adult heights.

Provide a door to the outside or provide an enclosed courtyard right off the Pre-K and K classrooms. This allows unfettered supervised play and many opportunities for discussion of the weather, time of day, celestial objects, plants, and animals. It extends the classroom outside and provides a rich resource. Children have an instinctive affinity for nature.

Provide a minimum of one toilet room accessible from the classroom. As a supplement to the ADA Accessibility Guidelines there are referenced heights and clearances, which address building elements designed for children's use, primarily toilet fixtures. These guidelines have not yet been approved by the Department of Justice, however they are recommendations to be considered. Toilet seat heights can range anywhere from 11" to 17" (17" is the height of a standard adult toilet). During the

schematic design phase of a project a point of discussion with the teachers and supervisors of early learning should be the height of the toilets. The preference of the immediate staff should govern. Some individual jurisdictions have particular requirements on what is to be provided for young children. A conversation with the local permitting office regarding plumbing fixtures would avoid conflicts later in the construction of the project. Arguments can be made for installing kiddie-sized toilets to enhance the independence of the children; the opposing view is that the toilets the children use at home are not kiddie-sized, so why provide them at the school. Pay particular attention to separating play and food areas from toilet areas.



Hollywood Elementary

Other items to provide in a Pre-K or K classroom are:

- *A walk-in storage room with adjustable metal shelving for bulky items such as large toys, outdoor toys, hoola hoops, etc*
- *A water fountain*
- *A sink within the classroom with scald-proof faucets*
- *A space for the teacher*
- *Areas with secured area rugs or carpeting*
- *Covered electrical outlets*
- *Adequate task lighting*
- *Adequate heat/warmth at the floor level*
- *Hygienic flooring materials with welded seams*
- *Textures, colors and simple design features that create the sense of a stable, yet cozy environment*

One of the most important components of the Pre-Kindergarten and Kindergarten classrooms are the "Learning Centers, "; areas specifically designed to reinforce learning in each of the five domains. Pre – K and K classrooms need a lot of space to accommodate the learning centers as well as other small and large group activities. The whole class instructional area in the classroom generally has tables for four to six students. The learning centers are typically dispersed around this whole class instructional area.

Learning Centers

Learning centers provide children with opportunities for acquiring knowledge. The content most often imbedded in the learning centers are reading, writing, mathematics, science, computer science, social interaction, art, motor development and social studies. Learning centers can accommodate wide varieties of items such as books, manipulatives, work counters, miniature replicas of household items such as ovens and refrigerators, puzzles, blocks, easels and comfortable chairs or pillows. The space requirements for each learning center varies therefore the classroom should be designed with as much flexibility in mind. Typically, learning centers range in size from 7'-0" x 8'-0" for sand table areas to 9'-0 x 12'-0" for large motor areas with large toy blocks. It is important to design the classroom to accommodate a range of learning centers. Reading and writing should be embedded in all the learning centers to create a literate environment. Following are some of the typical learning centers found in kindergarten classrooms. However, each school system curriculum may vary slightly. Curriculum needs should be discussed with the instructional supervisor responsible for early childhood education.

Learning Centers

Topic	Concept	Architectural Requirements
Reading	Introduced through the use of books, small groups of students curl up in either soft chairs or with pillows. This domain can be represented in several areas.	Provide bookshelves that can double as physical and visual barriers. Provide storage for books and electronic media. Provide soft finishes like carpet. Utilize child height shelving to encourage exploration. Provide an acoustically quiet area.
Mathematics	Introduced through the use of blocks and items to count and other manipulatives.	Provide space for minimum 3'-0" length of storage cabinets and shelves for counting games and storybooks and a minimum of 4'-0" length for displayboard (magnetic preferred).
Science	Introduced through the use of objects such as a water table, sand table, kitchen areas, and aquariums.	Stationary water and sand tables are stored visibly in the classroom. Covered units can be used as a worktable when the lid is closed. Sizes range: 18"- 20" wide, 2'-0" to 5'-0" long and 18" - 25" tall. Aquariums range in size from 18" – 2'-0" wide and 2'-0" to 3-0" long and require an electrical outlet and sunlight for plant growth. An outdoor area near the classroom is an optimal science teaching area. Flooring should be easily cleaned. Proximity to a water source is desirable.
Art	Introduced through creative activities utilizing paint, crayons, chalk, clay, etc.	Provide an area for two – 2- sided easels, one or two tables (2'-6" x 4'-0") for children to work on; adequate storage for supplies, paintings, portfolios, both accessible by the students and high storage accessible only by the teacher, preferably lockable. Flooring should be easily cleaned. Proximity to a water source is desirable.
Technology	Introduced through the use of computers and calculators.	Provide counter space or tables to accommodate a minimum of 2 computers, optimally 4 computers and one printer. Ergonomically scaled furniture. Carpeting should be static free or area should have hard floor surface.
Motor Development	Introduced through items such as blocks and large toys for gross motor skill development; dramatic play hrough miniature household items: refrigerators, living room furniture.	These types of areas can occupy 30% or more of the total classroom area (approximately two areas of 12' x 15').

Bombeck Family Learning Center

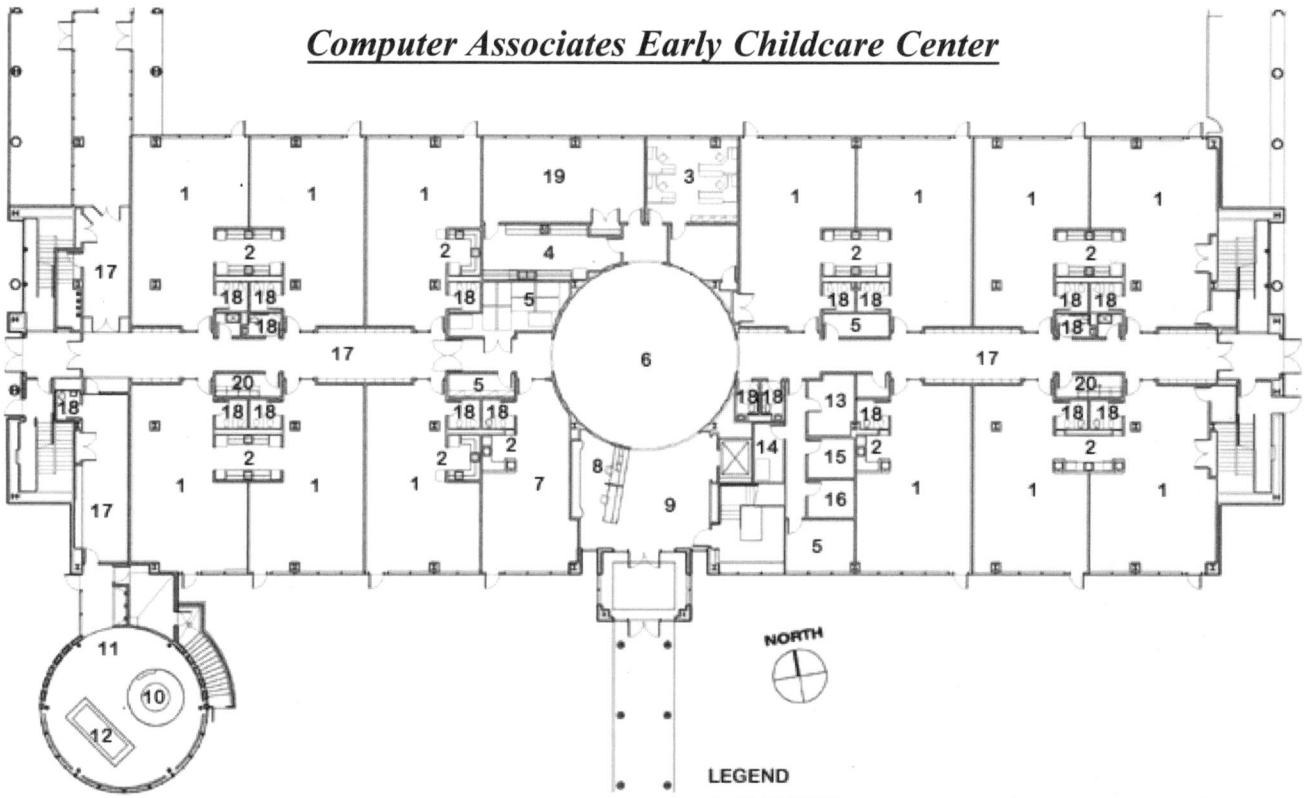
Architect: Steed Hammond Paul, Inc.
Classroom: 1,300 net square feet
Location: Dayton, Ohio

No. of children/class: See plans
All images provided by and with the expressed permission of Steed Hammond Paul, Inc. Cincinnati, Ohio

The best thing that can be given to Pre-k and kindergarten classes is SPACE. Teachers, when asked in the MSDE survey of Spring 2002, responded that they prefer the ability to rearrange the room as needed. The focus of the learning centers are often changed throughout the school year and a flexible classroom space better supports this need. Spatial needs for each individual learning center change as well. Portable bookshelves and storage units for manipulatives and books can act as space dividers.

One area that is often provided in Pre-k and K classrooms but seems unconventional for a school atmosphere is a kitchen area. One of the priorities in early education environments is to create a home-like atmosphere. What better represents home than a kitchen area? This versatile area can be used to present science and math problems dealing with concepts of hot and cold, changes that occur in matter, counting and measurement. As a snack area, the kitchen area can be used to hone social and cultural skills. In designing the kitchen area consider this area as used by the entire class together. Small kitchen alcoves, which inhibit the number of students able to "see", should be discouraged. Heat-producing devices such as ovens or surface burners are discouraged but light food preparation for a snack or lunch can reinforce group interaction.

Computer Associates Early Childcare Center



FLOOR PLAN

Architect: Spector Group
Classroom: 1,287 net square feet
Location: Islandia, New York

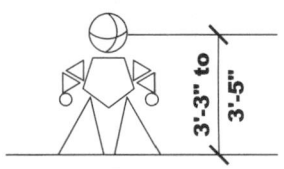
Grades: Pre-K
No. of children/class: Varies depending on age of children - ranges from 18 to 24

Recommended Minimums for Pre K and Kindergarten Classrooms

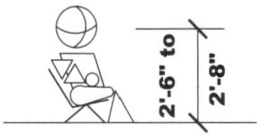
Refer to worksheet on page 46 and 47 for calculating individual rooms

Component	Characteristics	Comments
Square Feet/Student (includes storage rooms, excludes toilets and kitchenette)	50-55 Square Feet	1,000 sf = minimum room size for class size of 20 Pre-K students; 1,100 sf = minimum room size for 22 Kindergarten students
Chalkboard/Markerboard*	12-16 Linear Feet Bottom at 18" - 20" AFF	Magnetized and mounted at child height, provide flag holders and map rails
Tackboard (approximately 4'-0" high)	12-16 Linear Feet Bottom at 18-20" AFF	
Tack Strips	12-16 Linear Feet	Ranging in height from 2" to 1'-0" tall
Television		
Projection Screen		
Book Shelving (assuming book shelf is 2 shelves high; each LF of bookshelf = 2 LF of shelving)	24 Linear Feet Depth should range from 12"-16" deep	Multiple widths and adjustable heights preferred
Walk-in Storage	40-50 Square Feet (add to classrm)	
Storage Cabinets for supplies	40 Square Feet	Includes full height, upper and lower cabinets
Storage Cabinets for teacher belongings (lockable)	12-15 Square Feet	Full height cabinets or comparable to accommodate coats, tall items, etc.
Kitchenette: Counter w/sink Upper & Lower Cabinetry Microwave & Refrigerator	12 Linear Feet of Counter (add space needs to the classrm)	With sink, at least some part of counter "child-sized" (25" AFF) and part of counter "adult-sized" (36" AFF)
Sink	Child Height w/Bubbler (drinking fountain)	Tempered water for faucet recommended
Light Fixtures	With dimmers or provide separate switching of lights	
Plumbing	Accessible Toilet & Sink	Provide floor drain in toilet room

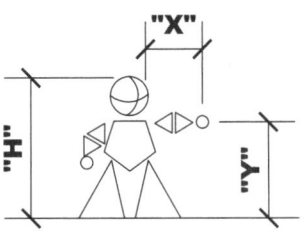
* These two can be used together or separately depending on individual school system preference.



Eye-Height, Standing



Eye-Height, Sitting



Height & Reach

X = 1'-6" to 1'-8"
Y = 2'-6" to 2'-9"
H = 3'-5" to 3'-9"

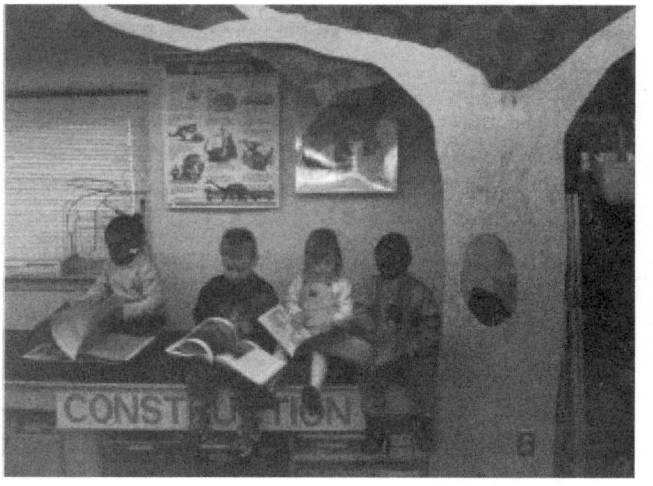
Personal Student Areas

Personal student areas or "cubbies" are small semi-enclosed cabinets for storing coats, shoes, books, personal possessions and possibly lunch. Providing cubbies for the storage of each child's personal belongings is essential. The shape and size vary greatly from school to school and designer to designer. Small children often need to sit to put on their shoes; providing a small step in front of the cubbie is helpful.

Roland Park Elementary / Middle
Cubbies

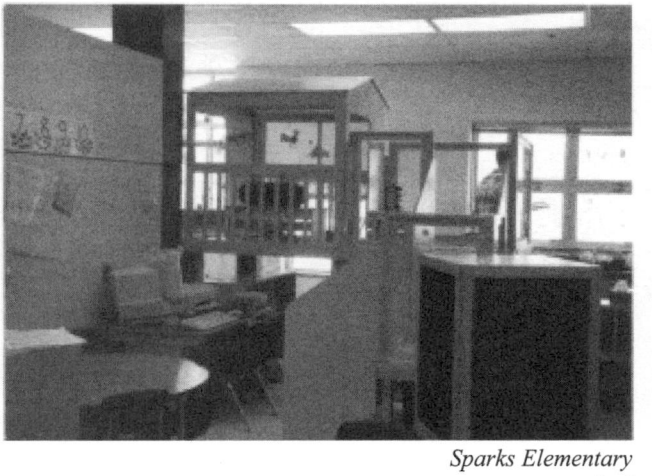
The cubbies themselves are often used as space dividers and the teacher or assistant will need to be able to supervise all spaces within the classroom area. Cubbies should be designed to be no more than 3'-6" high. This is a great place to provide something creative, giving each child an identity or figure with which to relate. Avoid coat hooks that point or extend out of the cubbie. Wall mounted cubbies also allow the space above the students cubbies to be utilized for extra storage space for teaching instruments.

A space saving technique is to provide shared cubbies to accommodate the belongings of two or more children. Cubbies for two children should be at least 14" – 18" wide. Larger, deeper cabinets, similar to teacher's cabinets can accommodate a small group of 4-6 children. See example of this in Chapter 2 under Student Belongings. The upper sections can be utilized by the teacher and cabinet doors can serve as extra display space.



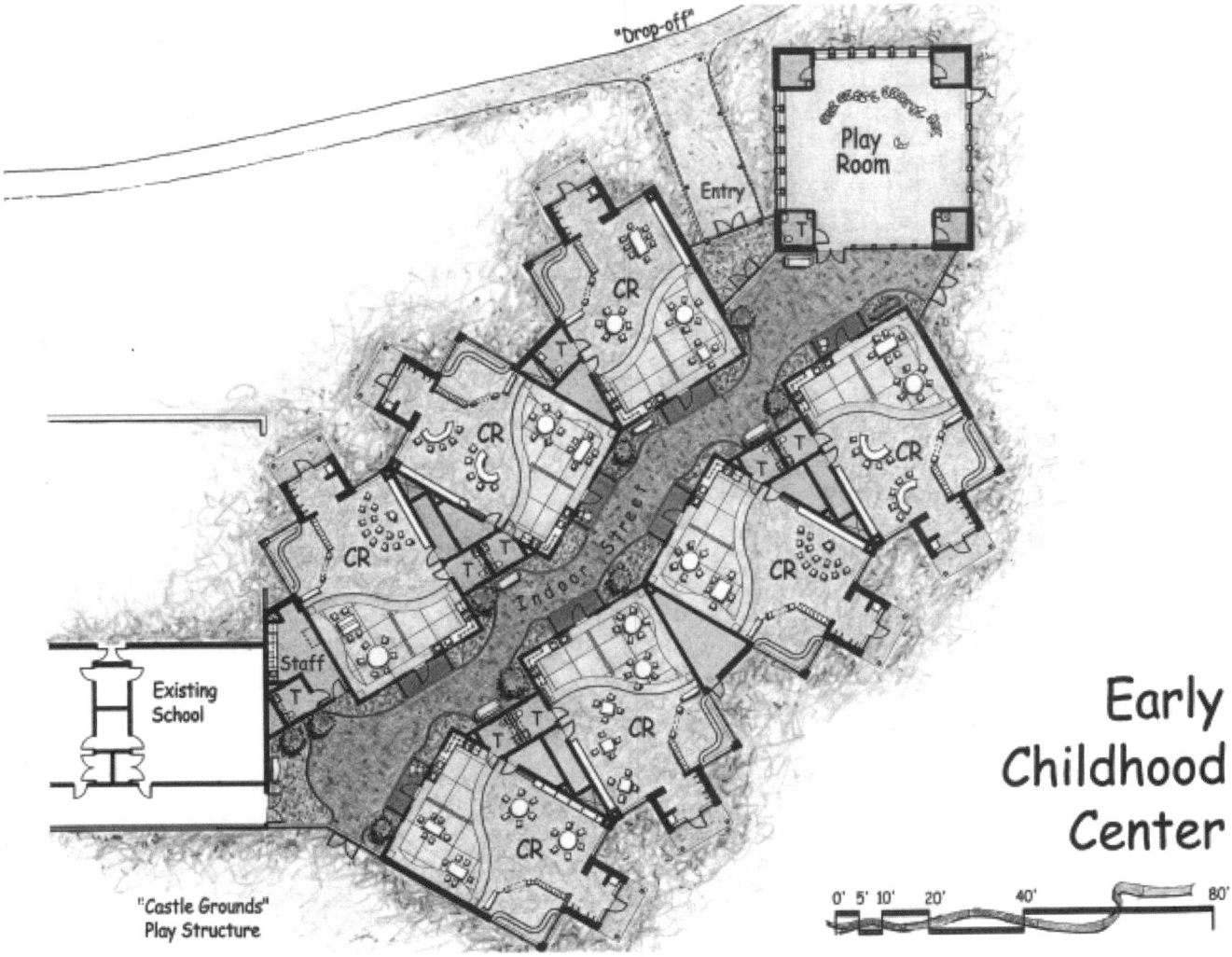
Judy Hoyer Center - Garnett Elementary
Creative Reading Environment

Provide supervisable cozy, soft spaces for reading. Consider lofts and mini amphitheaters for gaining a different perspective on the world. Gathering spaces which reinforce the "group" concept are good for team building exercises and socialization.



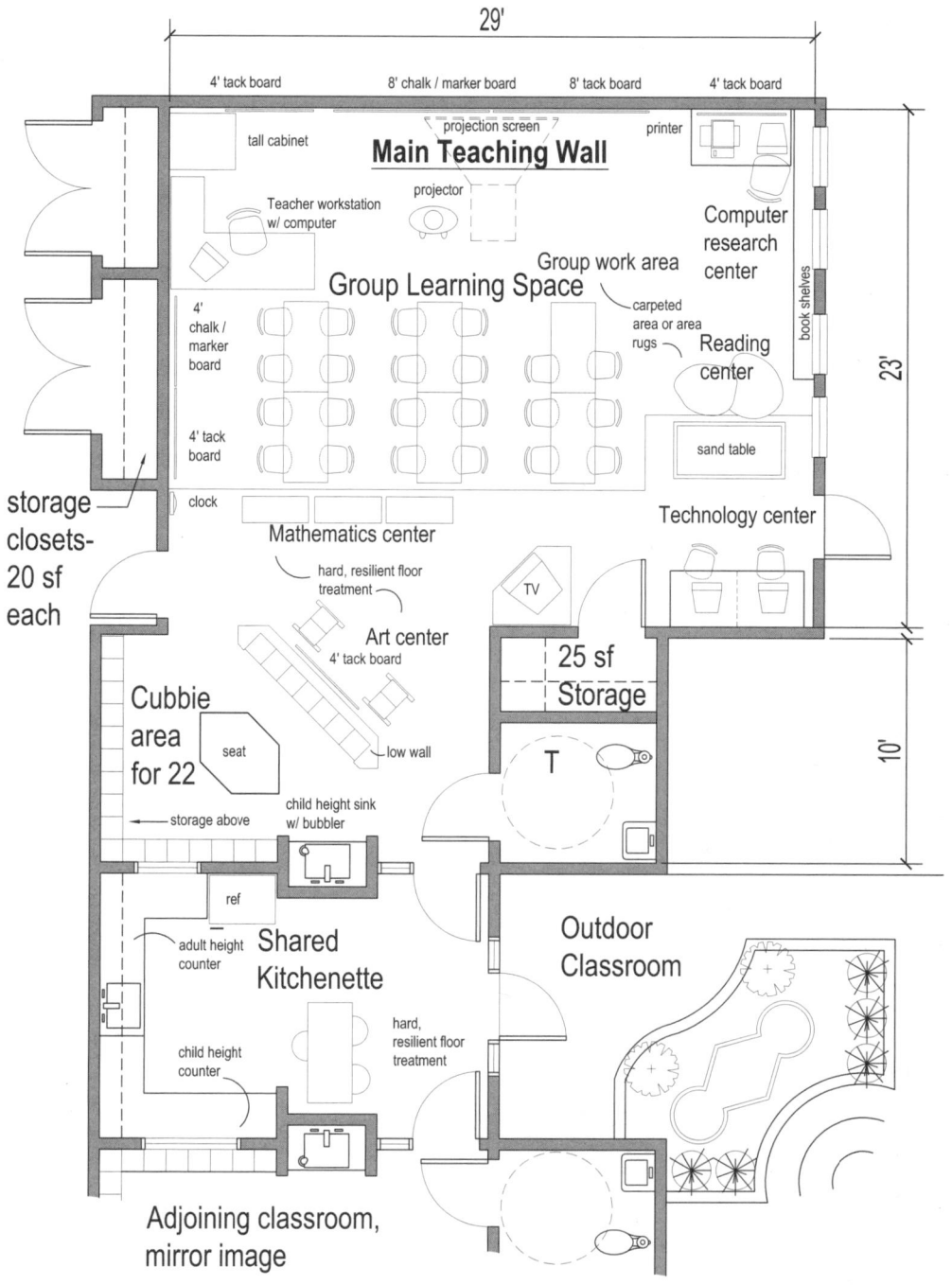
Sparks Elementary
Loft

Detroit Country Day Pre-School Plan



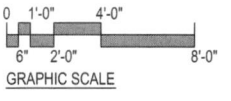
Architect: TMP Associates Inc.
Classroom: 1,200 net square feet
Location: Bloomfield Hills, Michigan

No. of children/class: 16

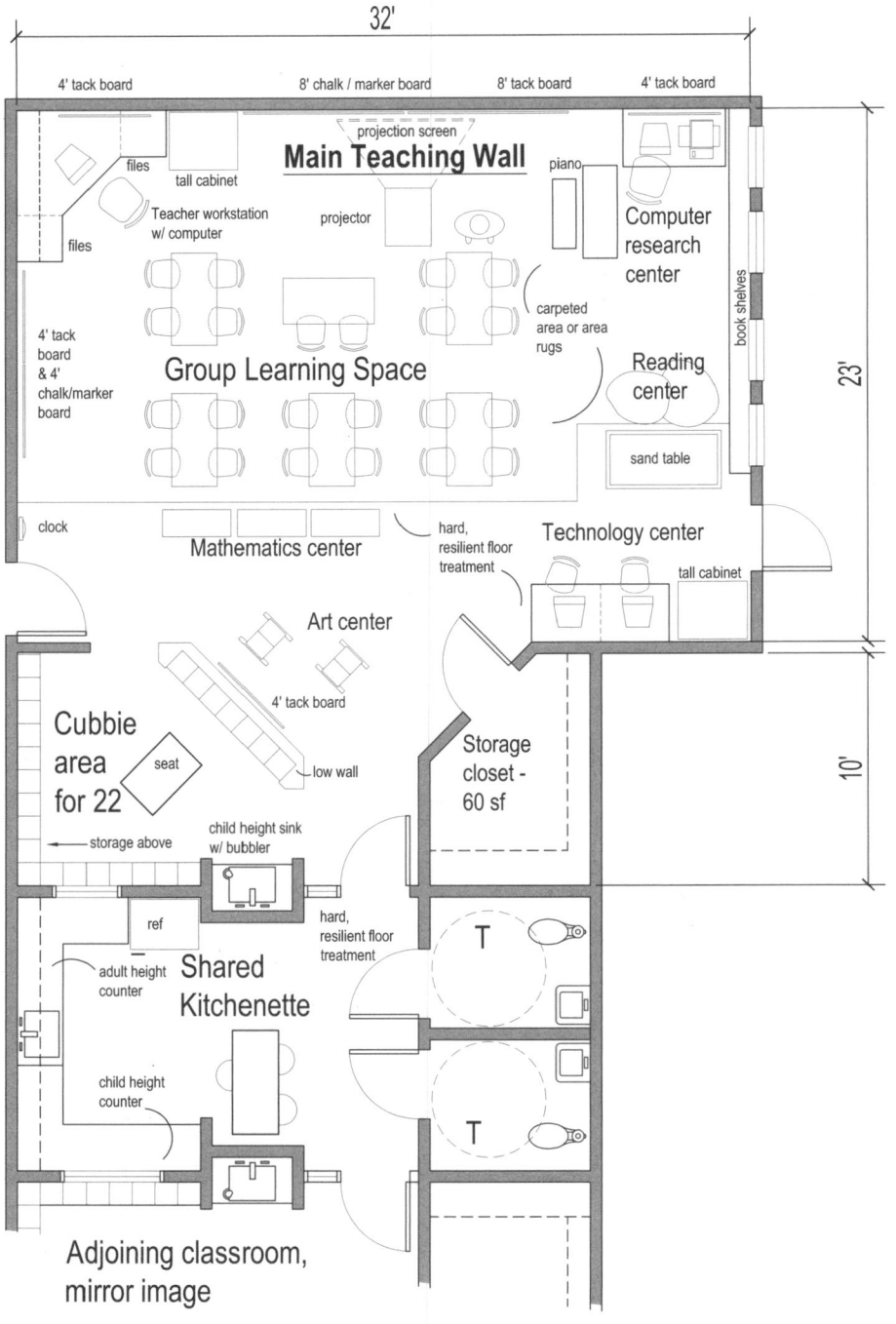


Pre-K and K Grades

1050 square foot classroom w/ 5 centers including cubbies, storage & half of 205 sf kitchenette

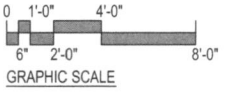


Sample Classroom Layout



Pre-K and K Grades

1150 square foot classroom w/ 5 centers including cubbies, storage & half of 300 sf kitchenette/toilet area



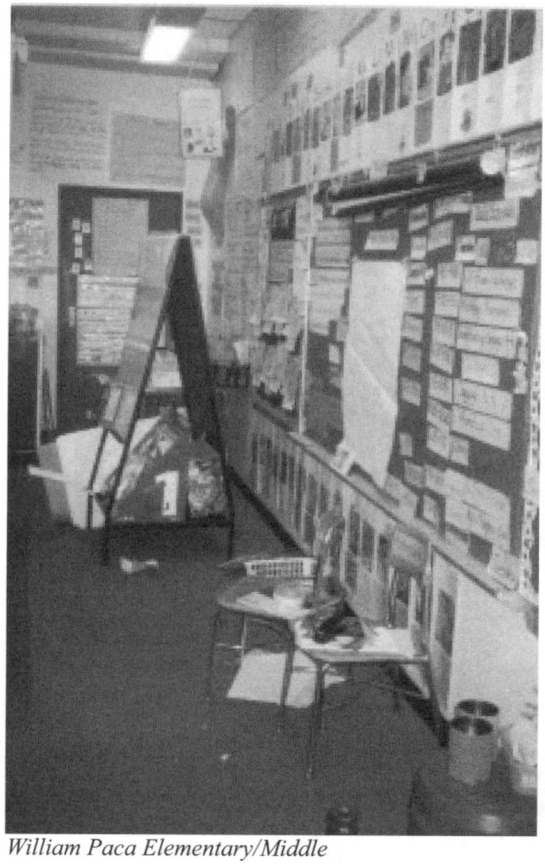
Sample Classroom Layout

CHAPTER 5

Elementary Classroom Design - Primary

• First Grade

The first grade level is a continuation of the development in subject areas utilizing learning centers just as in kindergarten. The same subjects areas - reading, writing, listening, speaking, literature, science, social studies and mathematics - remain the focus of the academic program, although on a more sophisticated level. The children are beginning to develop mental concentration habits that allow them to work on projects for longer lengths of time. The classroom environment should provide for a variety of learning styles and teaching approaches. Some of the learning experiences planned for first graders are writing exercises, learning of mathematical concepts (usually utilizing manipulatives), silent and oral reading in groups or individually, science experiments and environmental programs, social studies activities which may involve presentations and projects, computer activities, expressive and creative activities – either independently or in a group. See sample classroom layouts accommodating various centers and activities.



William Paca Elementary/Middle

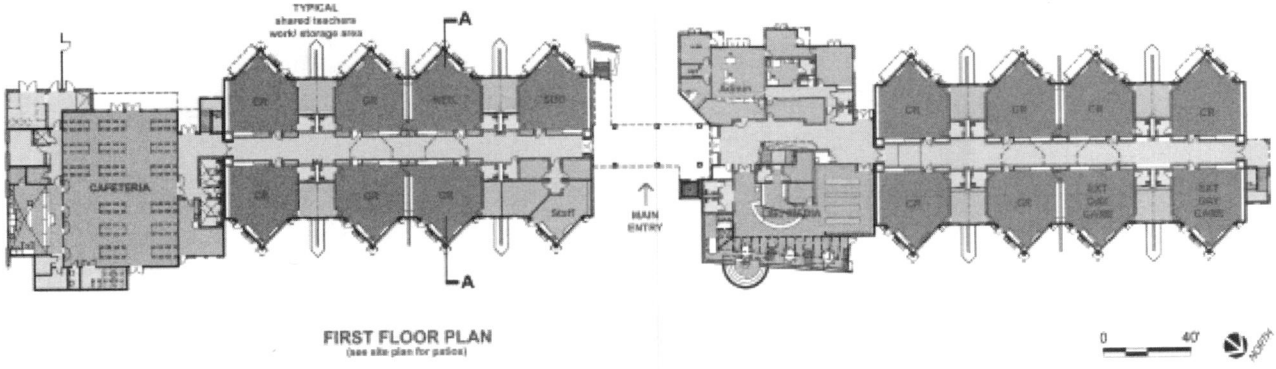
Student Belongings

A place for personal belongings is very important for this age student. Typically there is an area set aside to hang coats, place boots, books and store lunch. In the 1920's the "coat room" or "cloak room" was an area that was secluded from the classroom both visually and physically by a full height wall that had openings on either side of the room. Students were meant to enter through one opening and leave out the other opening, and then filter into the classroom to their assigned seat.

Areas such as these, which are secluded, are highly undesirable in today's classroom design, but the concept exemplified by the "coat room," of providing unobtrusive places for personal belongings is highly desirable. One modification, to respond to today's security needs would be a partial height wall instead of a full height wall. This could be designed to serve the same purpose; to visually conceal the students belongings but also be low enough to allow for supervision by adults. The use of individual "cubbies" for the primary grades is very common. The cubbie gives students a place that is their own. The use of a cubbie to store one's lunch, hat, boots, coats, personal belongings or projects offers a sense of familiarity in the classroom. Cubbies can also be built into the wall, allowing for storage overhead for the teacher. Cubbies can be designed as room dividers and should be no more than 3'-6" tall to allow for adult supervision. Metal lockers with doors have also been successfully utilized.

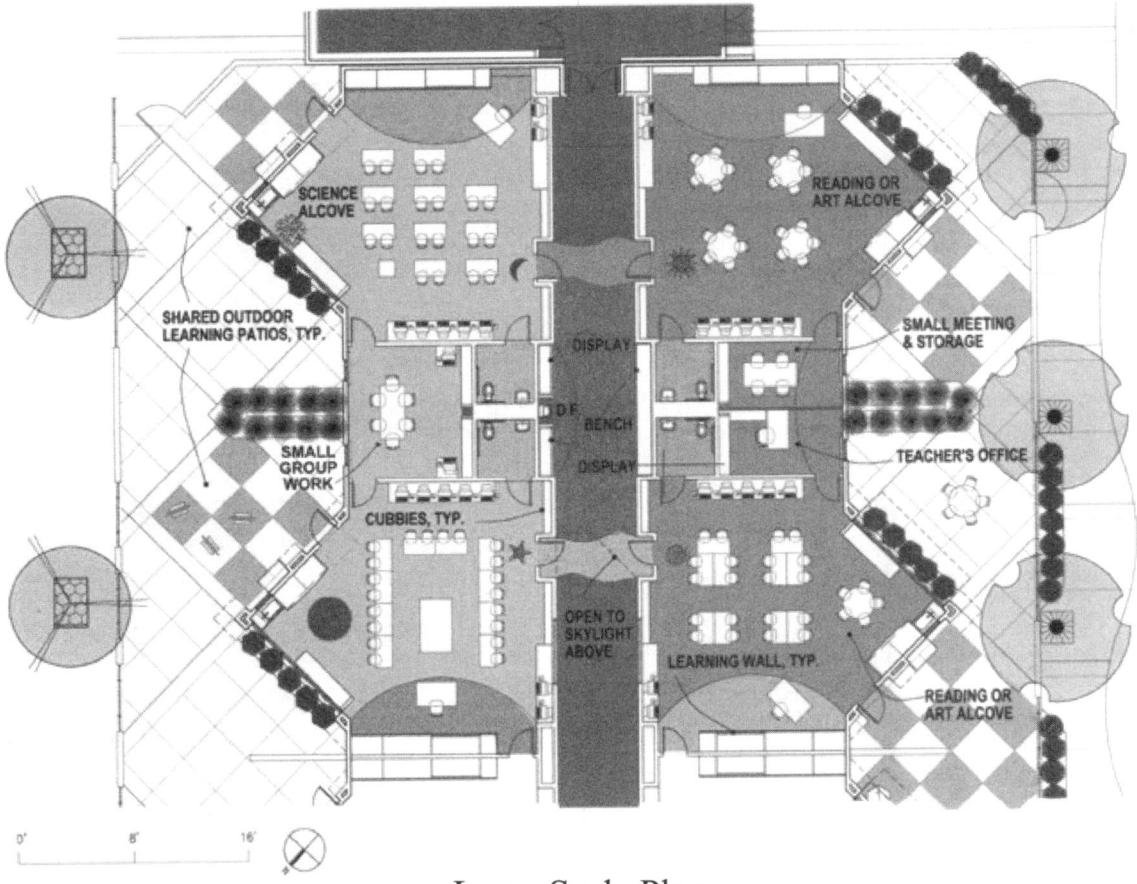
How can the design of classrooms accommodate flexibility and allow for change?

Cesar E. Chavez Education Center



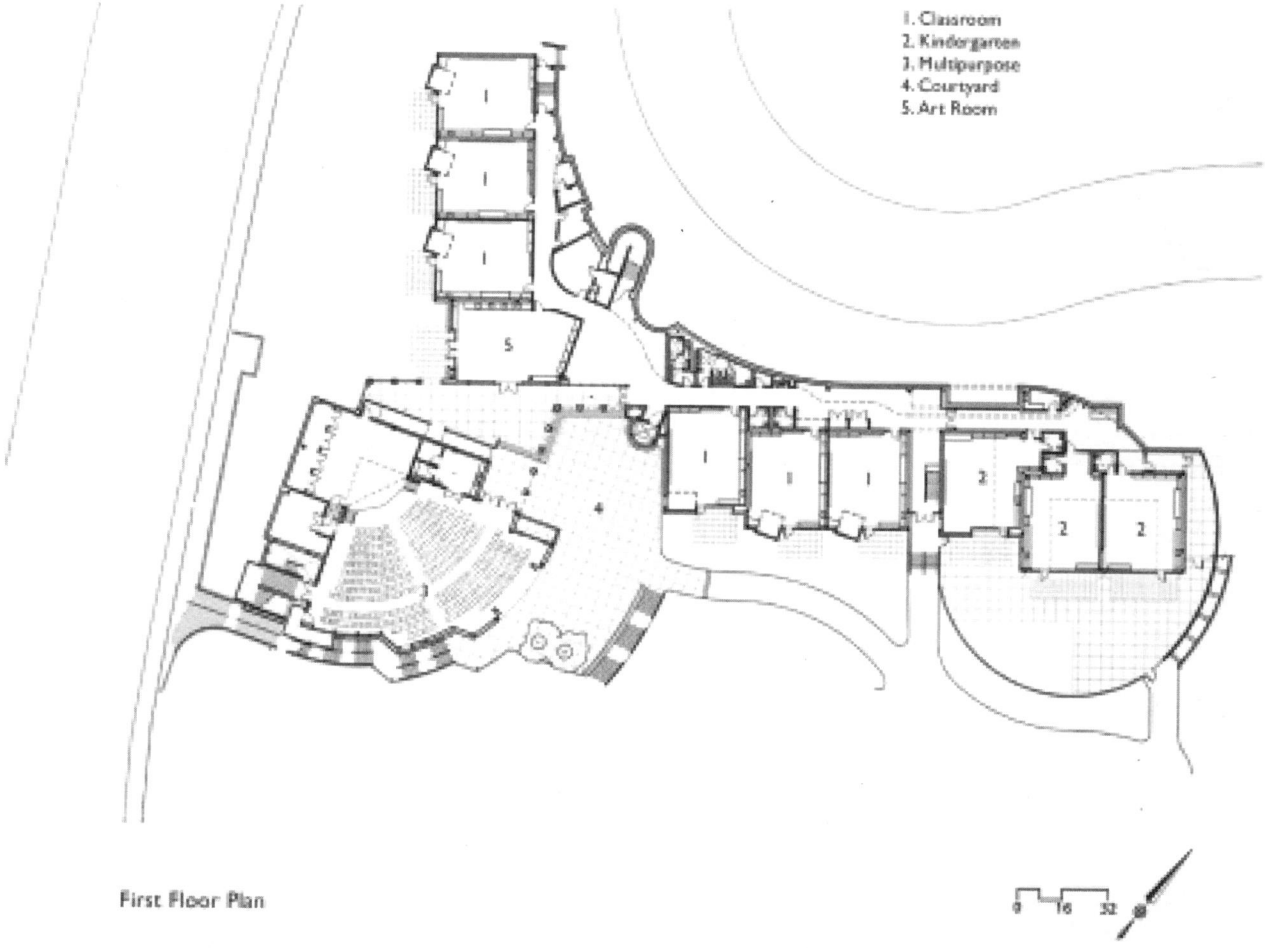
Architect: VBN Architects
Classroom: 844 net square feet
Toilet Room: 51 net square feet
Location: Oakland, California

Grades: Pre-K through 5
No. of children/class: 20 (K-3)
Small Group Work: 231 net square feet



Large Scale Plan

Cragmont Elementary School



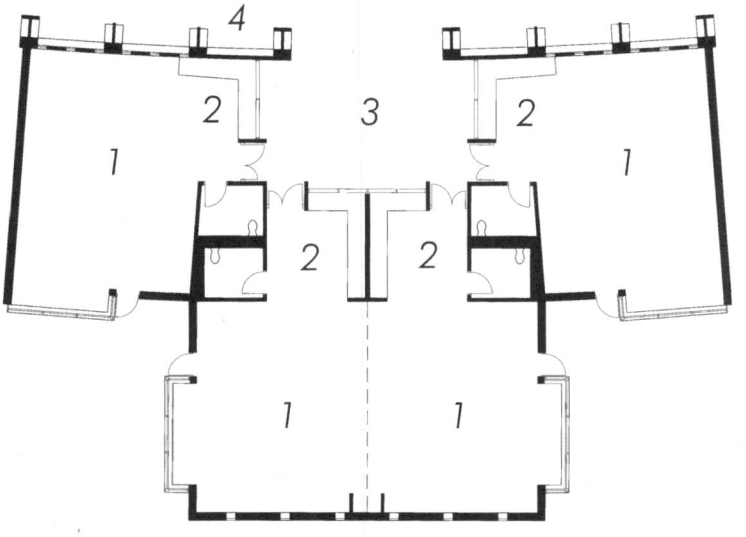
Architect: ELS Architecture
Classroom: 850 net square feet (1-5)
K classroom: 910 net square feet (K) including private toilet and shared teacher workroom
Location: Berkeley, California

Grades: K through 5
No. of children/class: 20
Small group area: 90 net square feet

Fearn Elementary School

1 classroom cluster
2 special education
3 kindergarten
4 professional development
5 administration
6 multi-purpose gym
7 music
8 art
9 mechanical
10 mechanical yard

Architect: Perkins & Will Architects
Classroom: 950 net square feet
Location: North Aurora, Illinois
Grades: K-5
No. children/class: 24-26
Study resource: 540 net square feet



1 classroom
2 project area
3 study resource area
4 student benches and cubbies

Large Scale Plan

• Second and Third Grade Classrooms

For flexibility, second and third grade classrooms are designed approximately the same size. There is much to be said for flexibility not only within the rooms but also within the building. Provide classrooms with amenities that allow the rooms to be used by Kindergarten through third grade. Older students do not require a bathroom accessible from the classroom but it can be a time-saver. Although it is not essential, some educators feel that providing bathrooms within the classrooms allows for less disruptions in the classroom during class time. Providing sinks with water fountains (bubblers) in the classroom is still very important for projects, clean-up and comfort. Learning centers are beneficial at second and third grades. Provide adequate space in the classrooms to allow flexibility for the teacher to arrange not only individual desks for all of the students but provide for learning centers as well.

Student belongings

At this age level, storage of personal belongings often changes from a cubbie to a locker. Simple, tall units are used, often with doors. Due to the "look" of disarray inherent in 25 children's belongings occupying an area of 100 square feet area within a classroom, teachers often frown on this arrangement. The spill-over into the instructional area is inevitable. Providing lockers in the corridors is a more efficient use of space, although creating an individualized space ina public corridor is very hard to do. Efforts should be made to allow students to personalize an area. Important factors to consider and address are the dimensions of currently used backpacks, coats and other personal belongings. Lockers that are 12" to 18" wide are more appropriate for the rolling backpacks that are currently being used. If arranged in an alcove the space occupied would be approximately 105 sf (see sketch). Sharing lockers can be considered for this age range, provided the lockers are large enough. Issues may arise in sharing lockers, such as whose belongings are whose, and the transfer of head lice. Individual lockers are the best safeguard.

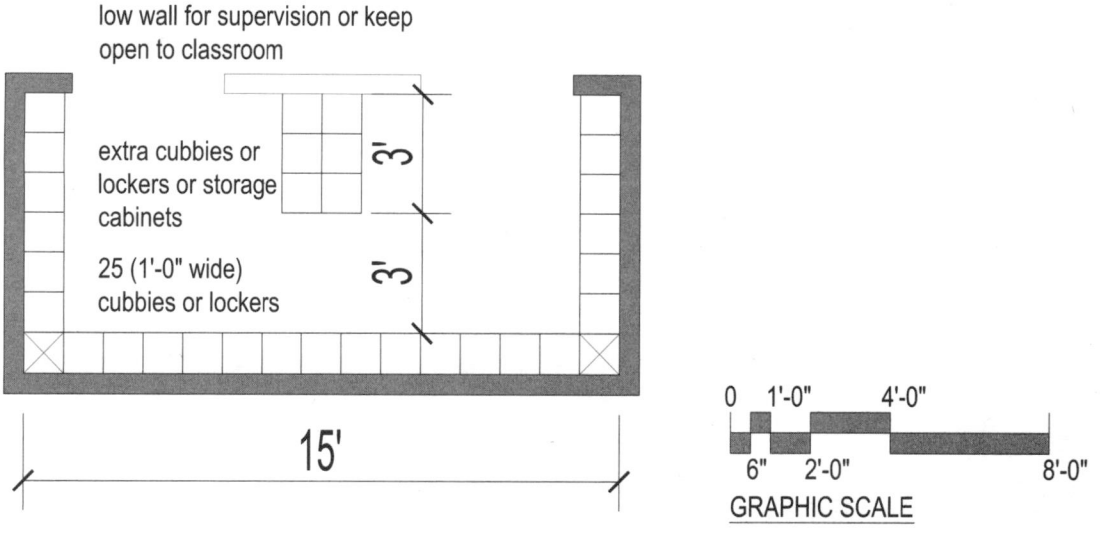


DIAGRAM OF CUBBIE/LOCKER ALCOVE
105 SF for Cubbies or Lockers

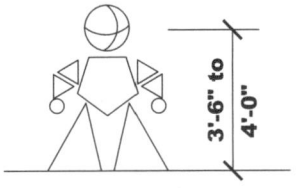
Recommended Minimums for Primary Classrooms First through Third

Refer to worksheet on page 46 and 47 for calculating individual rooms

Component	Characteristics	Comments
Square Feet/Student	34-36 Square Feet	850 sf = minimum room size for class size of 25 students
Chalkboard/Markerboard*	16 Linear Feet Bottom at 24"-30" AFF	Magnetized and mounted for child height, provide flag holders and map rails
Tackboard (approximately 4'-0" high)	8-12 Linear Feet Bottom at 24"-30" AFF	
Tack Strips (ranging from 2" to 1'-0" tall)	16-24 Linear Feet	
Television		
Projection Screen		
Book Shelving (assuming book shelf is 2 shelves high; each LF of bookshelf = 2 LF of shelving)	24 Linear Feet	Multiple widths and adjustable heights preferred
Walk-in Storage and/or Storage Cabinets for supplies	40-50 Square Feet	Full height, upper and lower cabinets and walk-in combined
Storage Cabinets for teacher belongings (lockable)	10-12 Square Feet	Full height cabinets or comparable to accommodate coats, tall items, etc.
Counter	12 Linear Feet Counter height=30" AFF	With sink, some portion of counter at child height
Sink	Child Height w/Bubbler	Tempered water for faucet recommended
Light Fixtures	With dimmers or provide a separate switching of lights	
Accessible Toilet		Recommended for first grade, optional for other grades; Provide floor drain

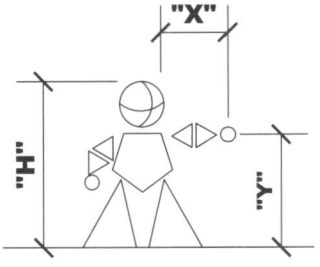
*These two can be used together or separately depending on individual school system preference.

X = 1'-9" to 2'-3"
Y = 3'-0" to 3'-9"
H = 3'-9" to 4'-5"



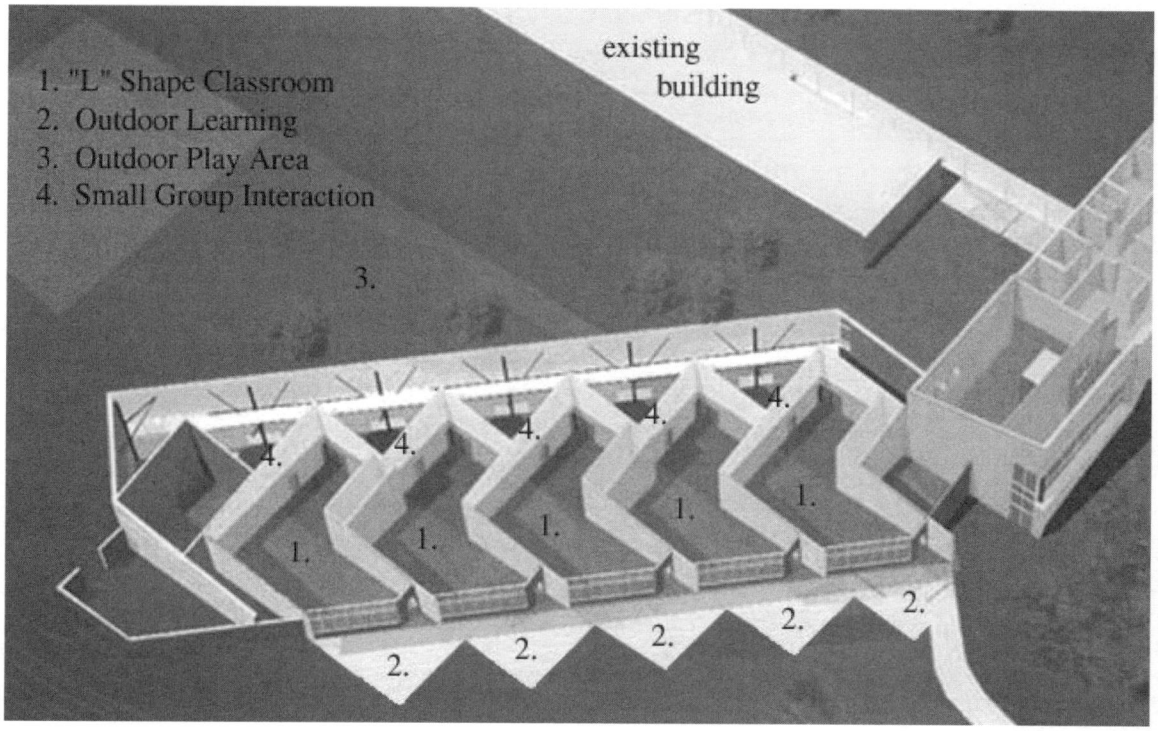
Eye-Height, Standing

Eye-Height, Sitting



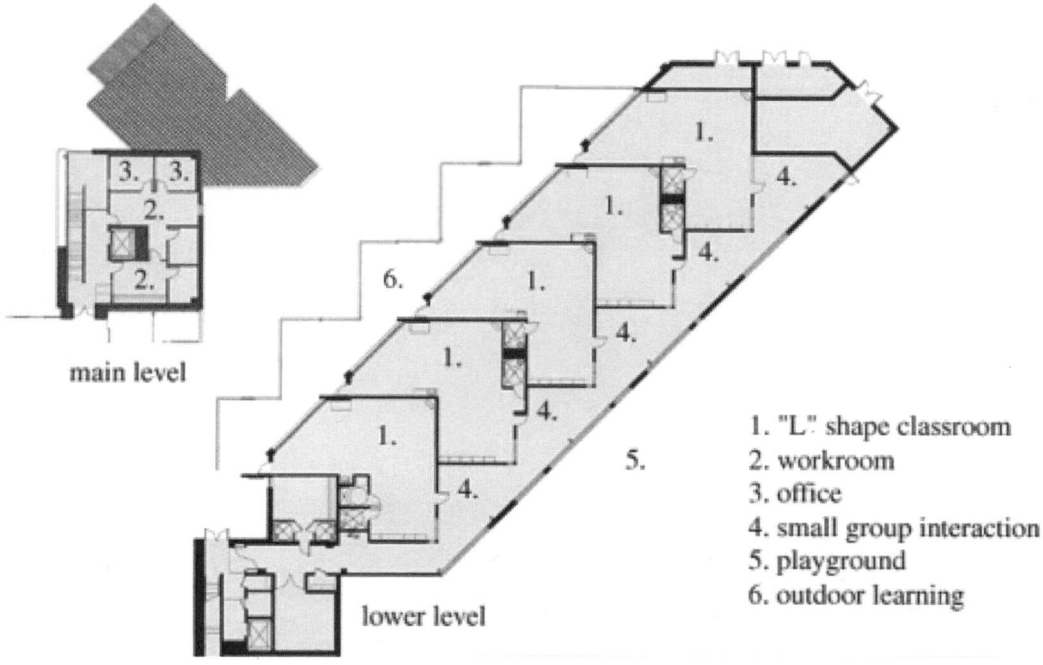
Height & Reach

Millis Road Elementary School



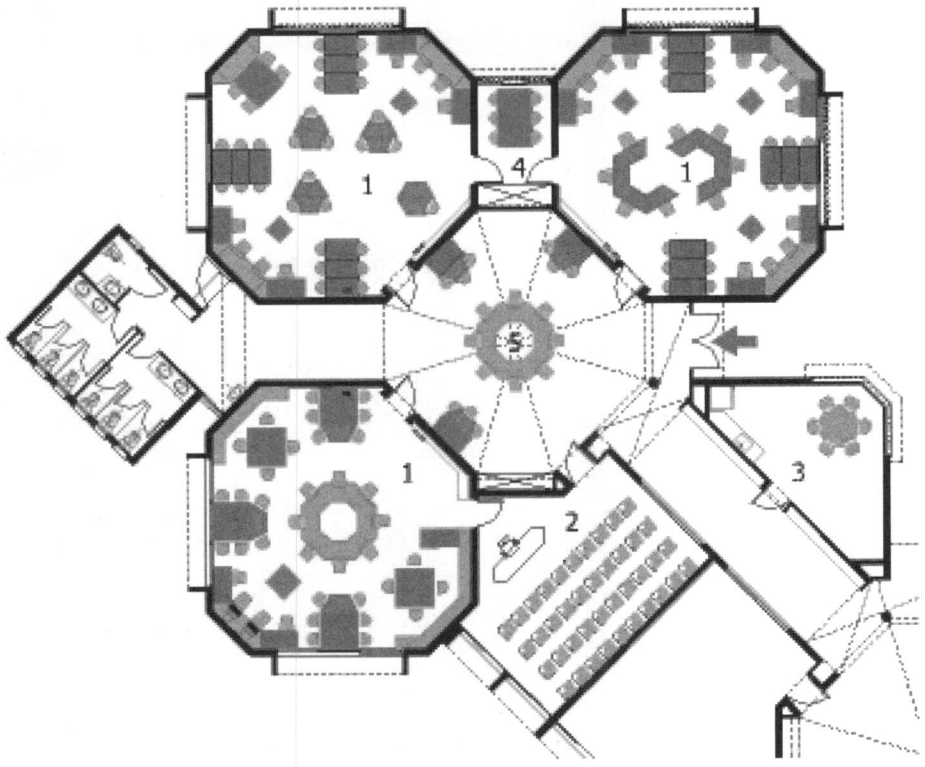
Architect: Adams Group Consultant & Henry Sanoff
Classroom: 1,115 net square feet plus 57 square feet toilet
Location: Jamestown, North Carolina

Grades: K-5
No. of children/class: 18 with 2 teachers
Small group area: 200 net square feet



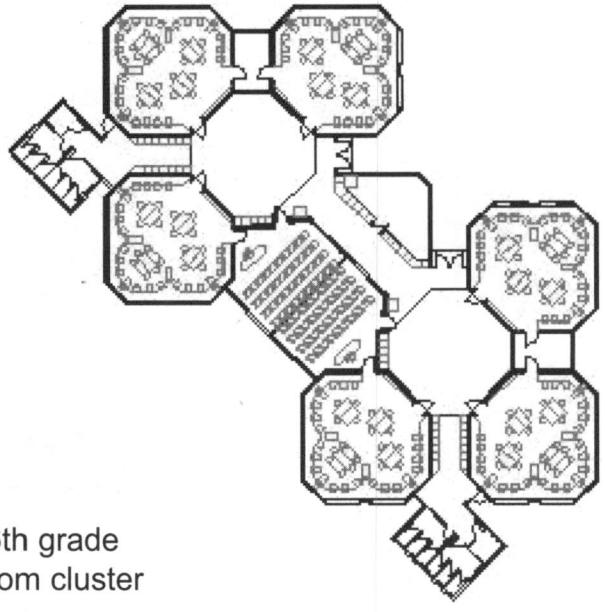
Lev Hasharon Elementary School

legend
1 class room
2 lecture room
3 teachers room
4 project room
5 multipurpose space



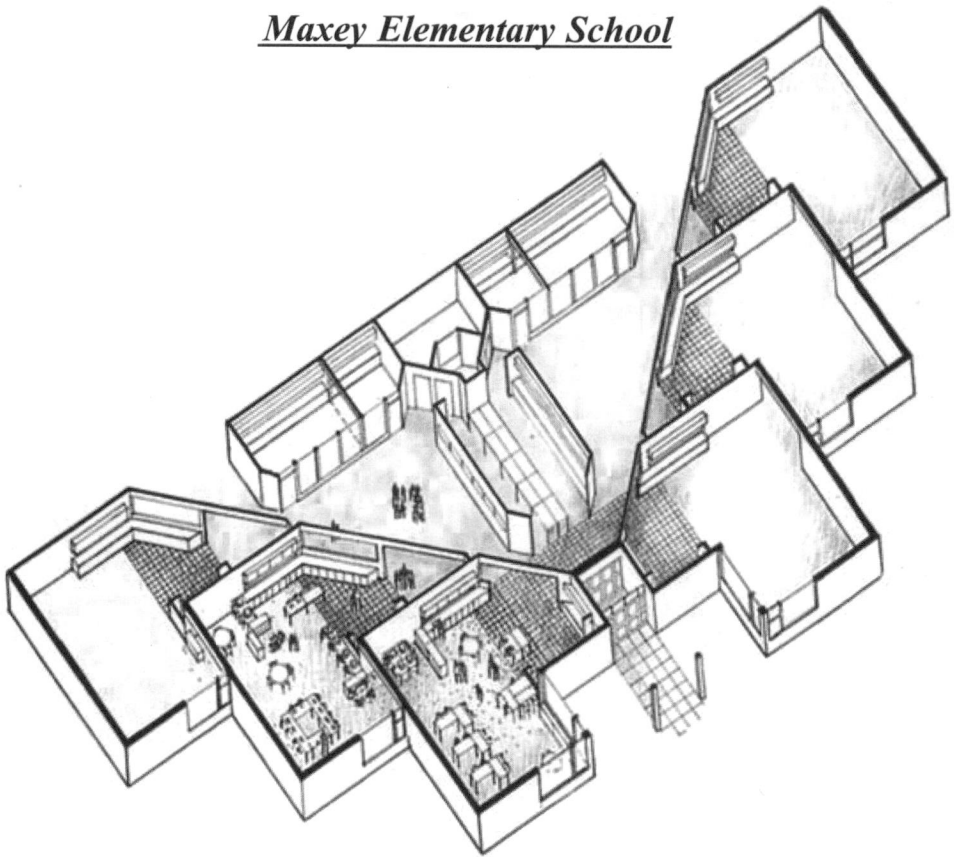
Architect: Powsner Simon
Powsner Gideon
Classroom: 646 net square feet
Location: Tel-Mond, Israel

Grades: 1-6
No. of children/class: 38
Multi-purpose space: 650 net square feet
Project room: 88 net square feet

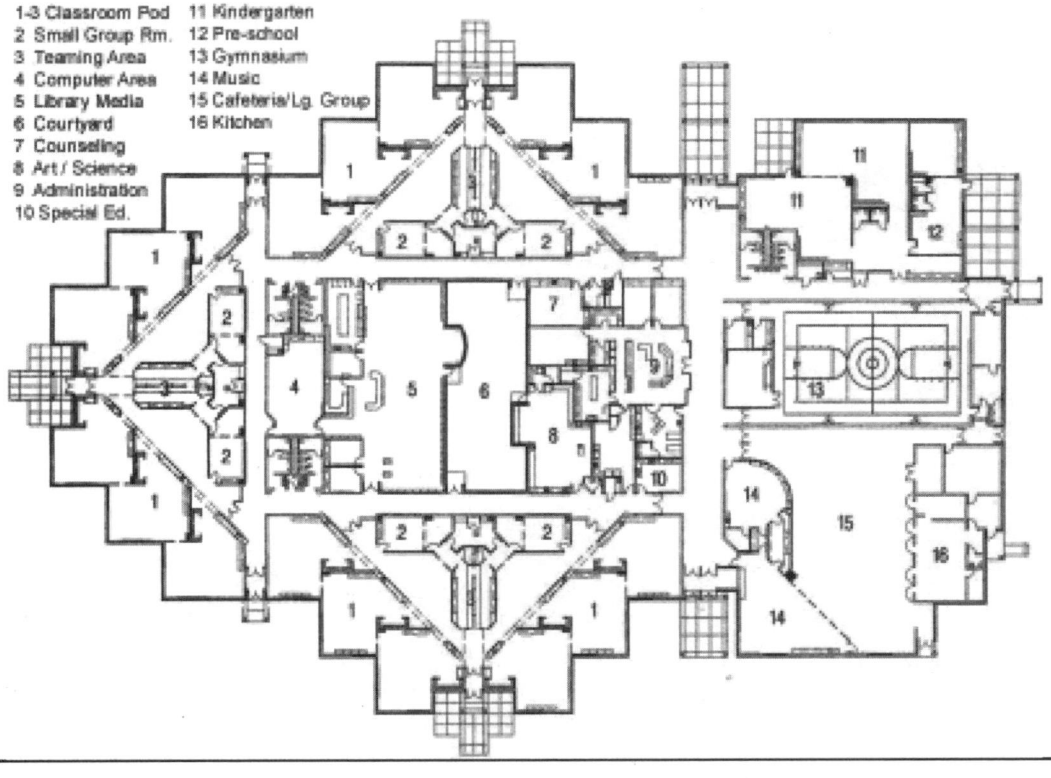


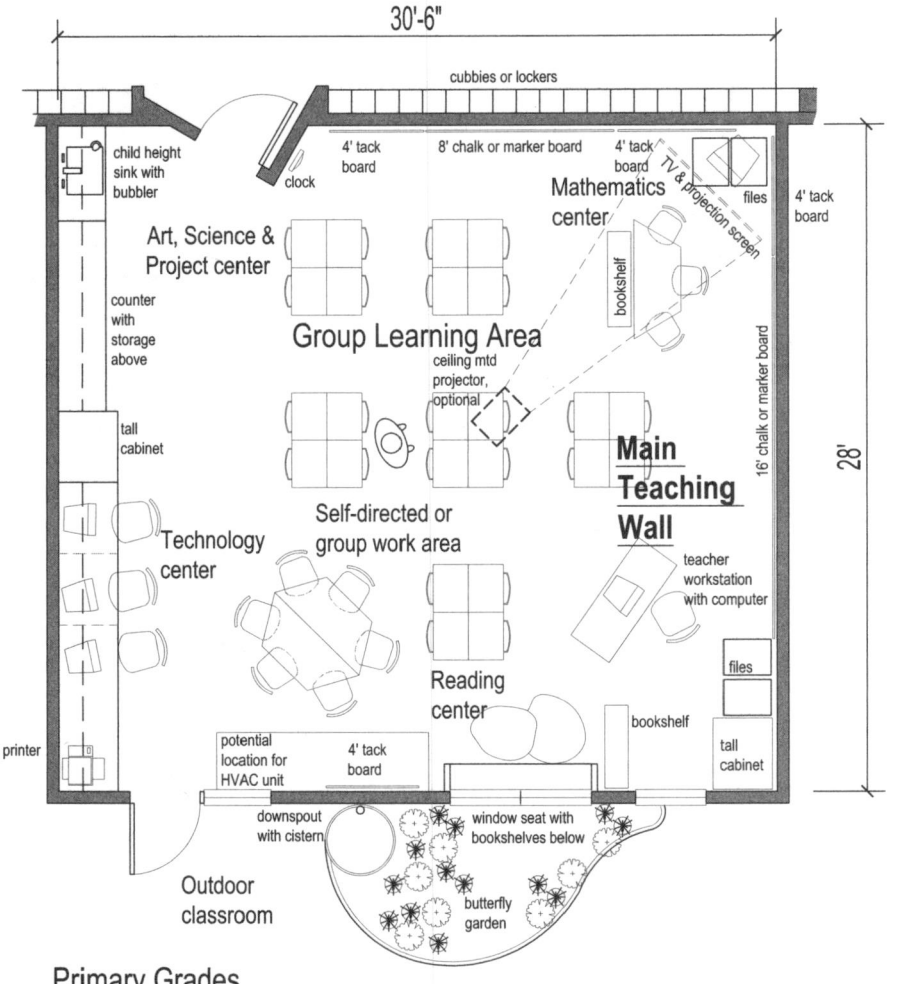
5th to 6th grade
classroom cluster

Maxey Elementary School



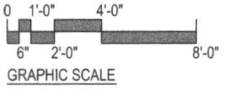
Architect: Architectural Partnership PC **Grades:** K-5
Classroom: 880 net square feet **No. of children/class:** 24-25
Location: Lincoln, Nebraska



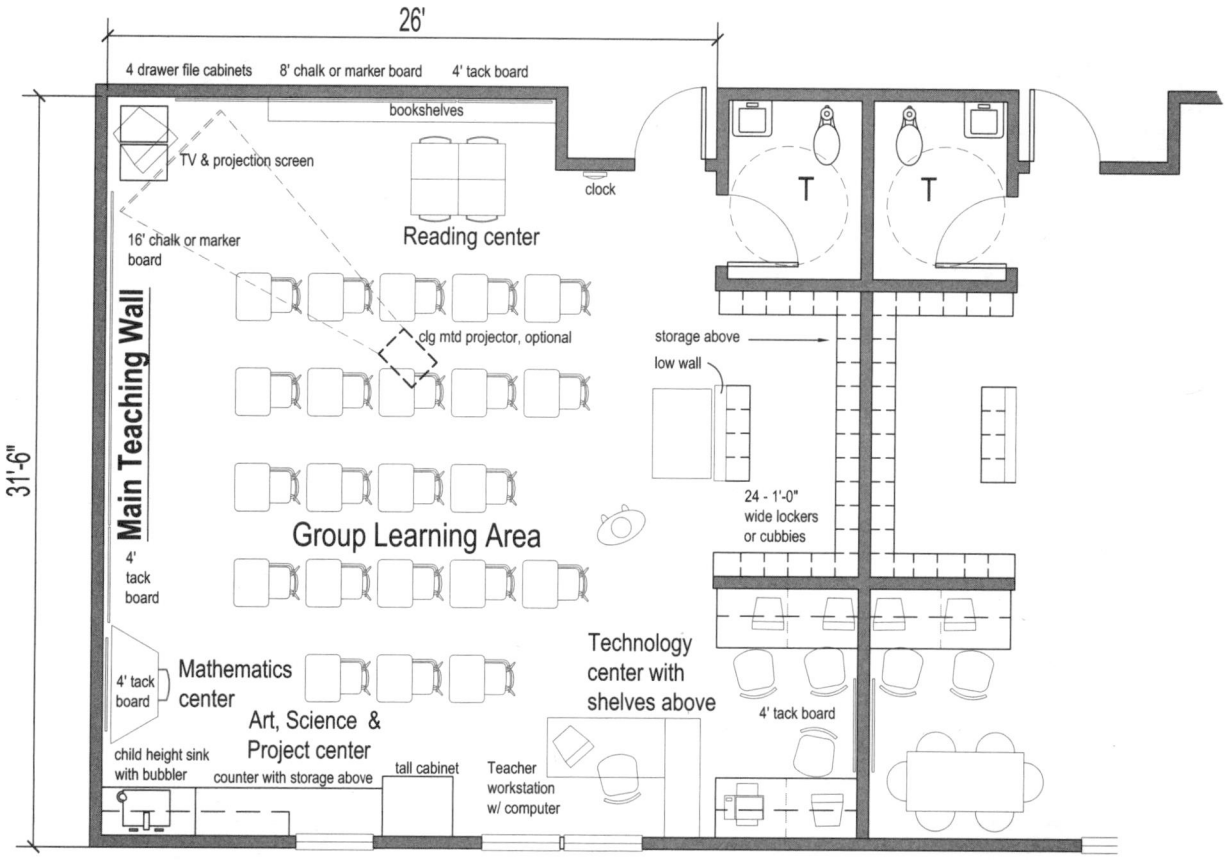


Primary Grades

850 square foot classroom with 4 centers
Cubbies/Lockers are provided outside of classroom



Sample Classroom Layout



Primary Grades
925 square foot classroom w/ 4 centers
Cubbies/Lockers provided within classroom square footage

Sample Classroom Layout

CHAPTER 6

Elementary Classroom Design - Intermediate

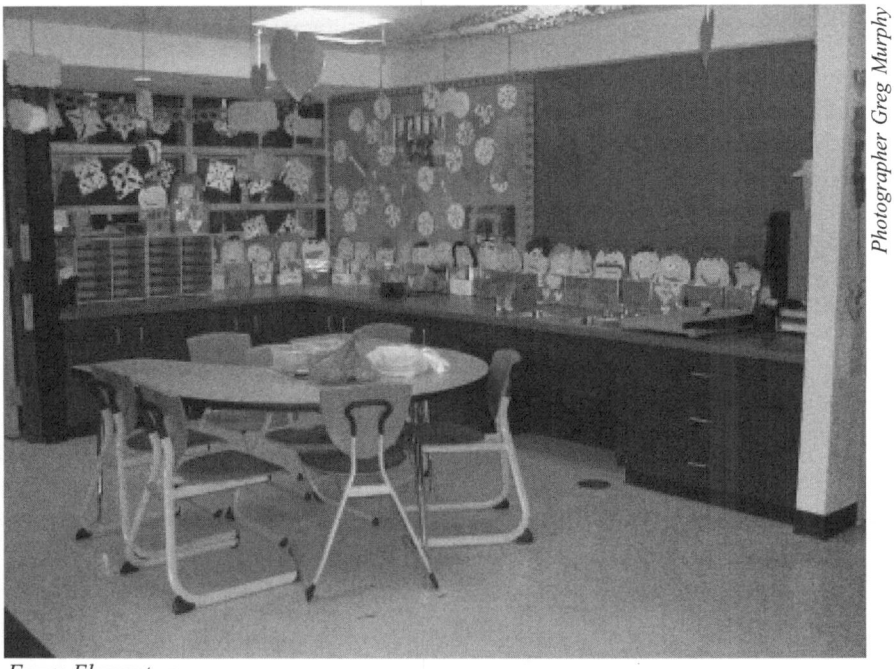
- **Grades: Fourth and Fifth**

The common struggle with the design of classrooms for intermediate grades is to establish whether these students are older primary school students or whether they are younger secondary students. The needs of primary students, both educationally and spatially, are different from secondary students. The challenge in education at this age group is to reach children who are nearing adolescence and are developing a more logical thought process without losing class members who may not yet have developed to that point. Curricular subjects are beginning to be introduced in a more comprehensive way – focusing on the interrelationships among subjects. Hands-on projects are a wonderful match for these energetic and highly creative minds. It is essential to provide sinks in or near the classroom to promote the use of other modalities beyond traditional writing and reading. Built-in bookshelves are indispensable as children of this age are very active, energetic and curious. The inclusion or display of interesting items at their eye level enhances the learning experience.

Student belongings

For student belongings at this grade level the transition is made from storage in the classroom to the more public location of lockers usually placed in the corridor. The space in the classroom once occupied by places to store student belongings can now be used for small group instruction, work centers or reading nooks.

Recognize the wide range of sizes and shapes of children in this age group and provide a wide variety of furniture to accommodate this range.



Photographer Greg Murphy

Fearn Elementary
Project Area

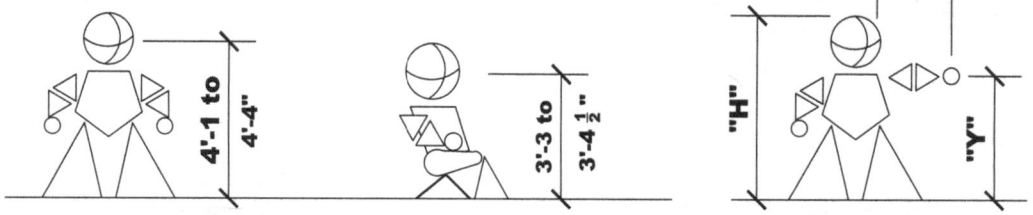
Recommended Minimums for Intermediate Grade Classrooms

Refer to worksheet on page 46 and 47 for calculating individual rooms

Component	Characteristics	Comments
Square Feet/Student	32-34 Square Feet	800 sf = minimum room size for class size of 25 students
Chalkboard/Markerboard*	24 Linear Feet Bottom at 30" AFF	Provide flag holders and map rails
Tackboard (approximately 4'-0" high)	8-12 Linear Feet	
Tack Strips (ranging from 2" to 1'-0" tall)	18-24 Linear Feet	
Television		
Projection Screen		
Book Shelving (assuming book shelf is 2 shelves high; each LF of bookshelf = 2 LF of shelving)	30 Linear Feet	Multiple widths and adjustable heights preferred
Walk-in Storage and/or Storage Cabinets for supplies	25-40 Square Feet	Full height, upper and lower cabinets and walk-in combined
Storage Cabinets for teacher belongings (lockable)	10-12 Square Feet	Full height cabinets or comparable to accommodate coats, tall items, etc. (provide in classroom or in teacher workspace)
Counter	10 Linear Feet Child sized Counter at 30" AFF	With sink (recommended that some portion of counter be child sized)
Sink		Tempered water for faucet recommended.A shared sink within close proximity to several classrooms is essential; One sink per classroom is ideal
Light Fixtures	With dimmers or provide a separate switching of lights	

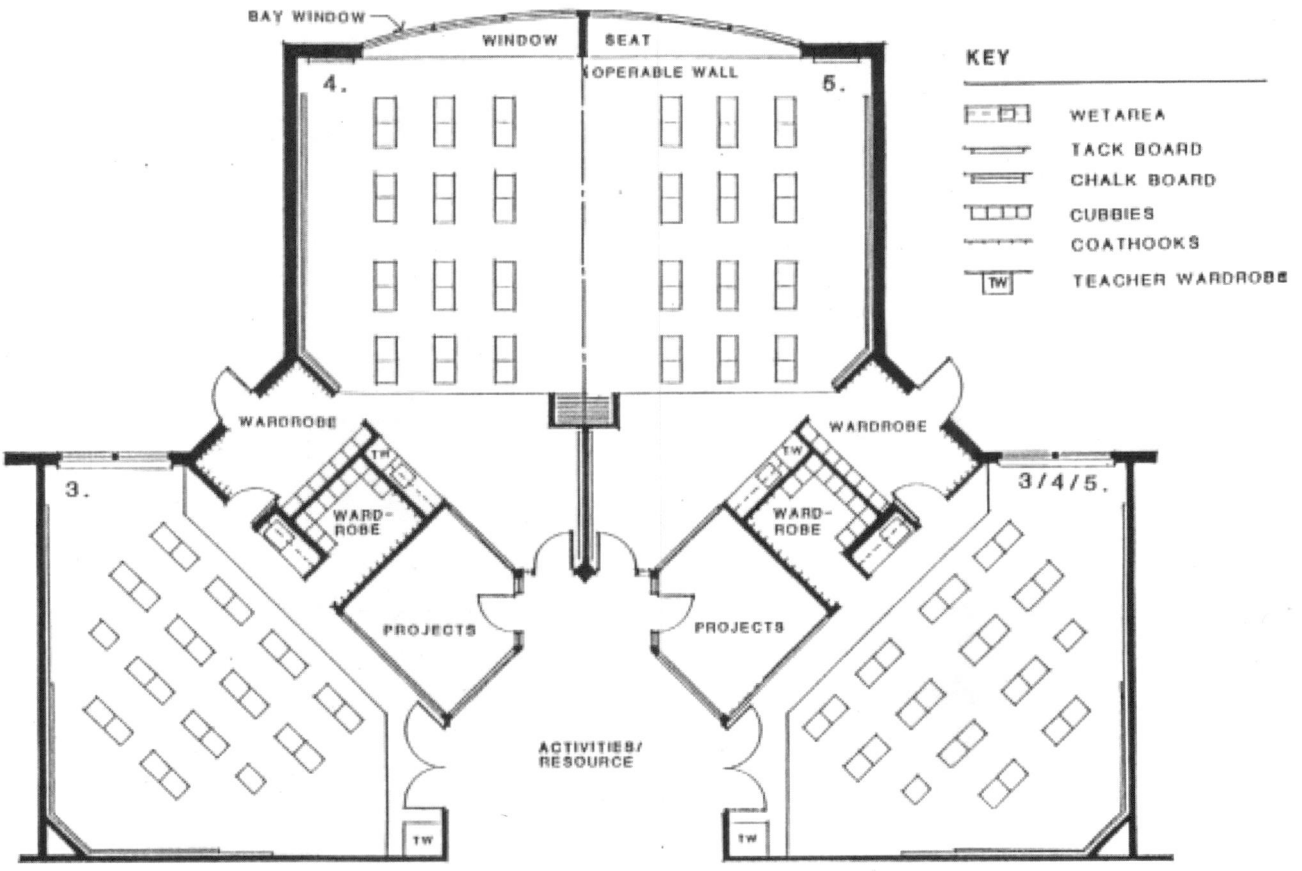
* These two can be used together or separately depending on individual school system preference.

X = 2'-3" to 2'-5"
Y = 3'-10" to 4'-0"
H = 4'-7" to 4'-10"

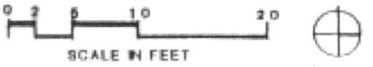


Eye-Height, Standing **Eye-Height, Sitting** **Height & Reach**

Hollywood Elementary School



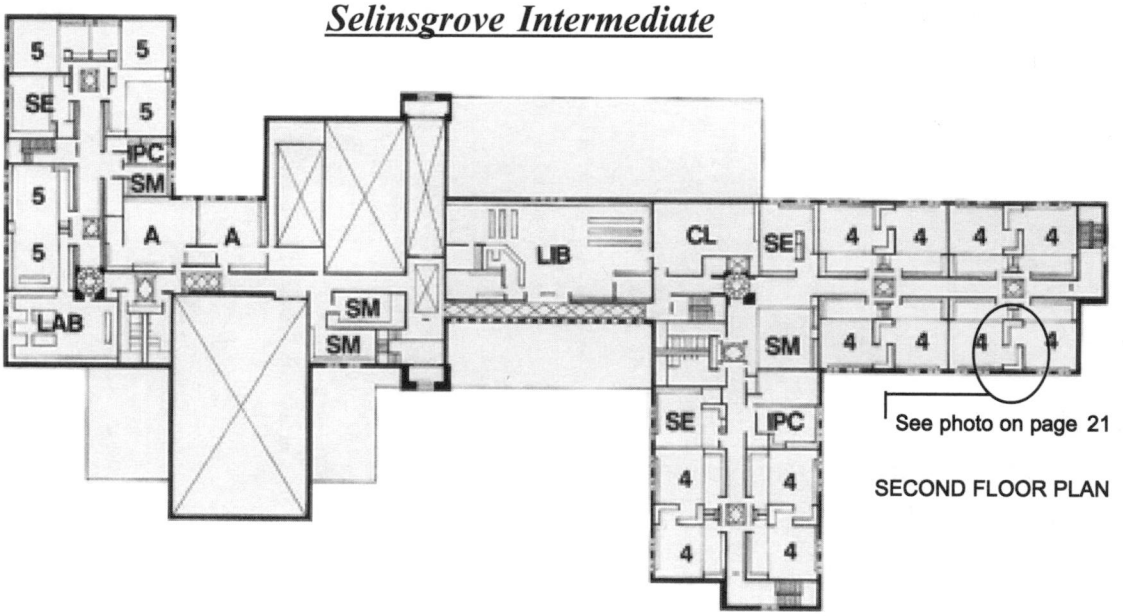
TYPICAL INTERMEDIATE CLUSTER



Architect: Grimm & Parker Architects
Classroom: 833 net square feet
Projects now: 136 net square feet

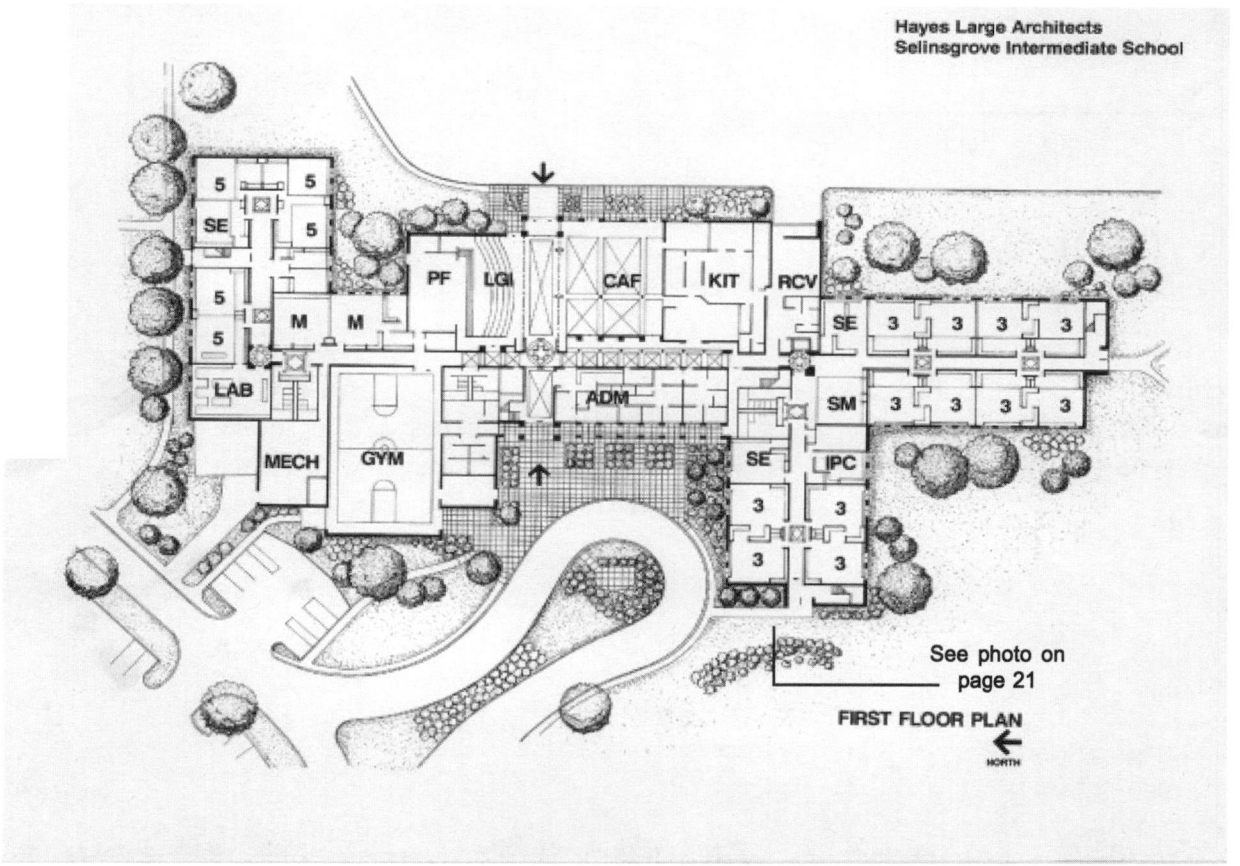
Grades: K-5
Activities/Resources: 378 net square feet
No. of children/class: 26 with 1 teacher
Wardrobe area: 90 net square feet

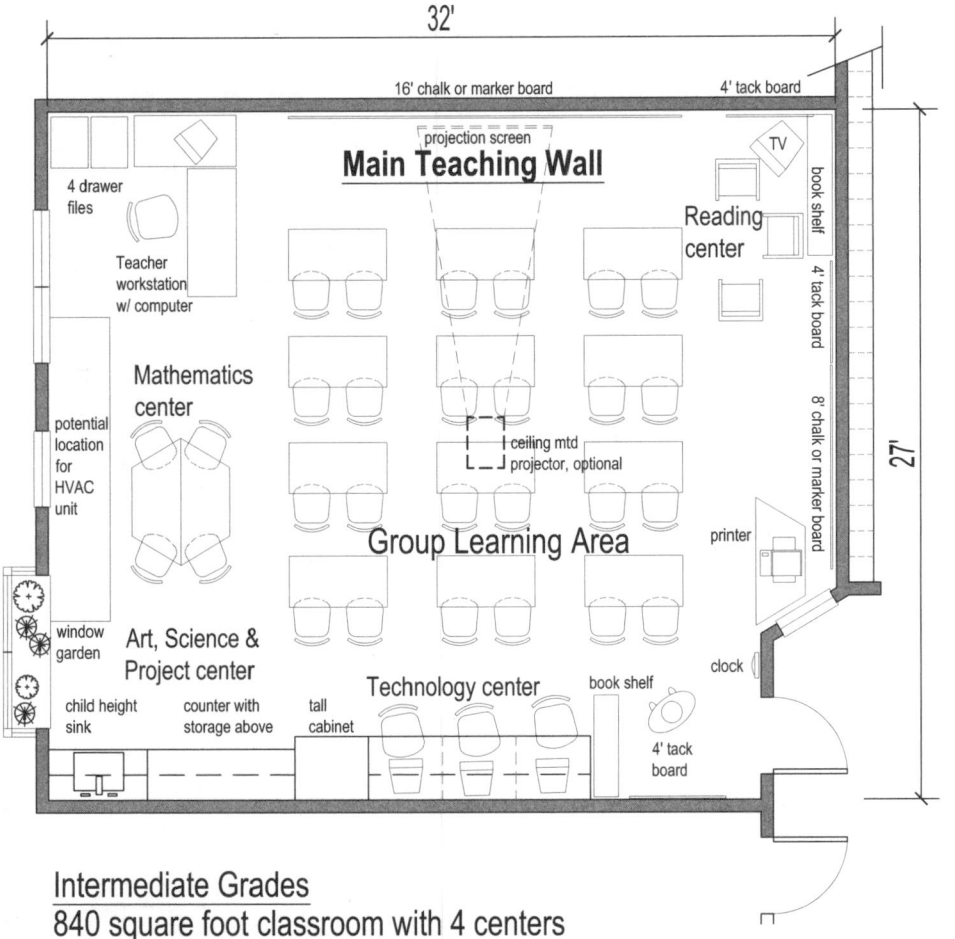
Selinsgrove Intermediate



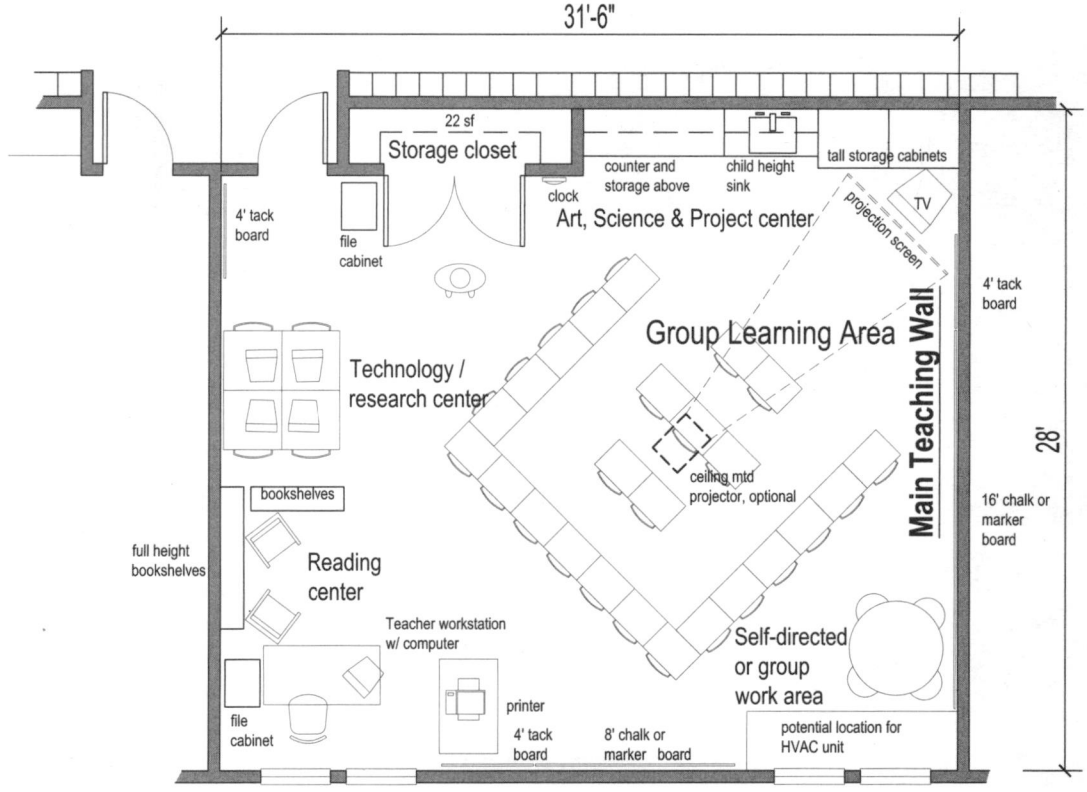
Architect: Hayes Large Architects
Classroom: 762 net square feet (3rd & 4th grade)
Work/Computer Area: 93 net square feet
Classroom: 784 net square feet (5th grade)
Location: Selinsgrove, Pennsylvania

Grades: 3-5
No. of children/class: 22



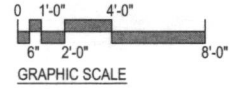


Sample Classroom Layout



Intermediate Grades

865 square foot classroom w/ 3 centers and storage closet
lockers provided outside of classroom



Sample Classroom Layout

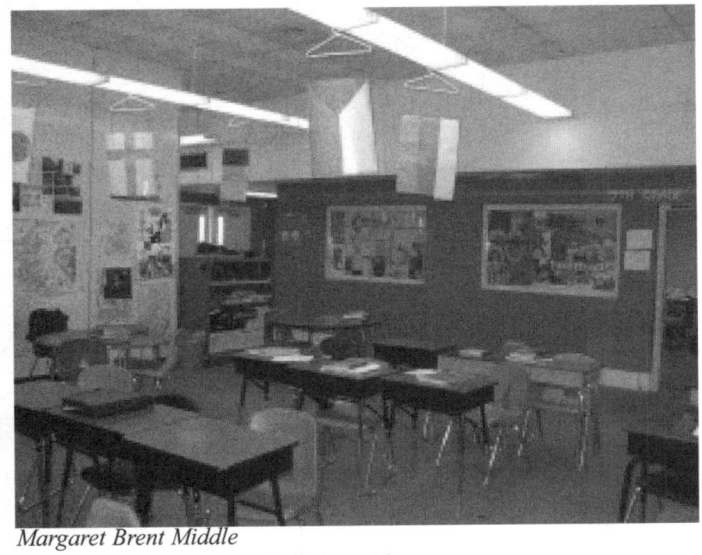
CHAPTER 7

Middle School Classroom Design

• Grades Sixth, Seventh and Eighth

The Maryland Middle Learning Years Task Force in 1998-1999 produced curricular recommendations for middle school students. There were three areas of concentration addressed: Upgrading Instruction, Revamping Teacher Education Programs and Restructuring School Environments. Each area is preceded by a compilation of research-based information that has significant implications for the way students learn, teachers teach, and schools organize (Executive Summary July 27-28, 1999).

Research verifies that the brain grows, expands and exhibits physiological changes as a result of enriched learning experiences and environments encountered. Learning environments need to be designed to respond to the specific needs and challenges of this age group: "capitalizing on the early adolescent's innate curiosity, desire for social interaction, physiological need for active learning and increasing concern for the world around him/her. These environments would also recognize the social vulnerabilities, increasing need for independence and varying intellectual and emotional maturity rates characterized by early adolescence." (Executive Summary - Maryland Middle Learning Years)



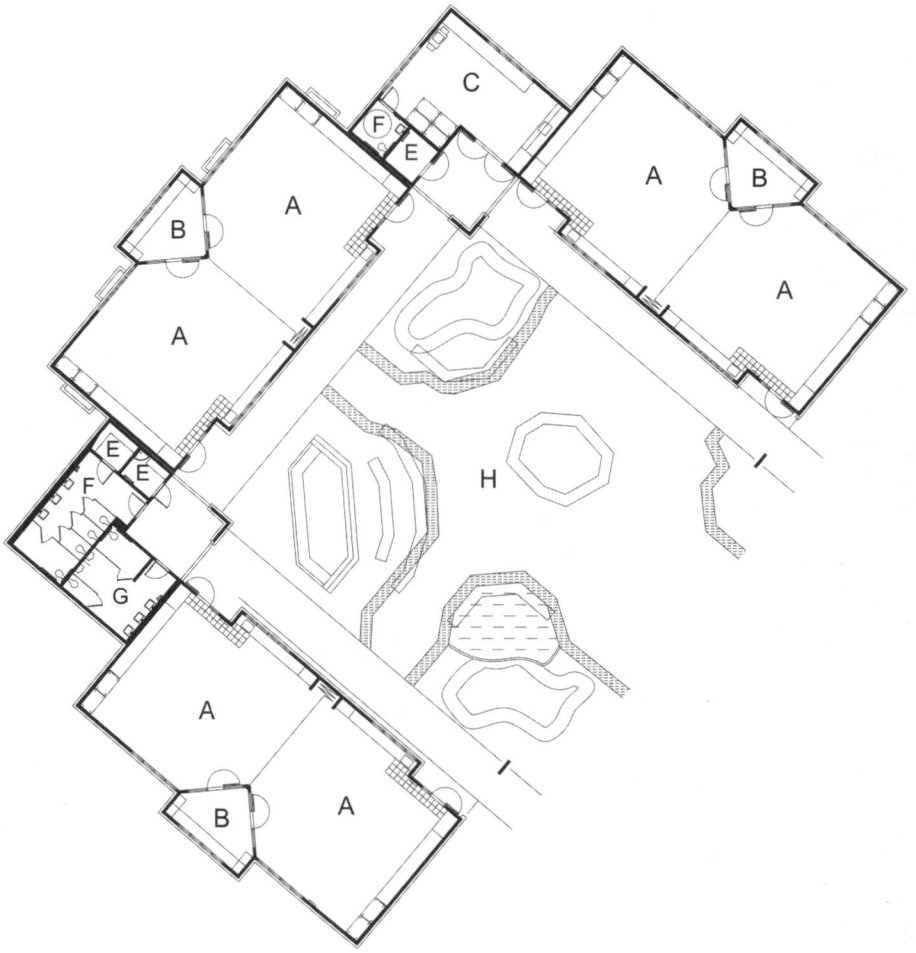
Margaret Brent Middle Classroom with Teacher Work Area Adjacent

One of the tenets of the curriculum for the middle school years is that of interdisciplinary work. **"Interdisciplinary work helps them to bring personal and social concerns into their learning, to develop unity and coherence in their academic studies and to make meaning of their learning experiences."** The classrooms must accommodate exploratory activities with areas for long-term projects and storage for student projects. This project area would ideally be part of the classroom. The provision for sinks in or near the classrooms also supports the aspect of "projects". In a MSDE survey taken in the spring of 2002, 28% of the middle school teachers surveyed reported that having a sink in the classroom was either important or very important for the effectiveness of the classroom. Time and convenience of cleaning up after or during the production of projects was highly effective with a sink provided within the classroom.

Team teaching and interdepartmental teaching teams are often introduced at the middle school age level. Rooms can be clustered by grade, providing easy access to teachers of English, Math, Science, and Social Studies. This allows the team of teachers to reinforce certain concepts by reiterating common activities across all disciplines. For example, the study of Greek mythology can be reinforced in Math class by discussing the proportions used in building Greek temples. The unique geographical characteristics of Greece can be reinforced by building a model of the terrain. Students at this age level have the ability to think critically, and cross-discipline ideas can be fostered. The instructional delivery should be investigative, interactive, and project-based. Interpersonal and social skills should be cultivated at this age level. Academic intervention is critical at this phase of growth. Spaces should be provided for one on one tutoring, small group instruction, and alternaitve co-curricular subjects such as Music, Art, Sports, Computer Enrichment, and book discussion groups.

Another important item is providing sufficient storage shelving for all content areas. This can be provided through a shared walk-in closet for a "house" cluster, a grade level or a content area.

Silverado Middle School



Silverado Middle School

DETAILED PLAN

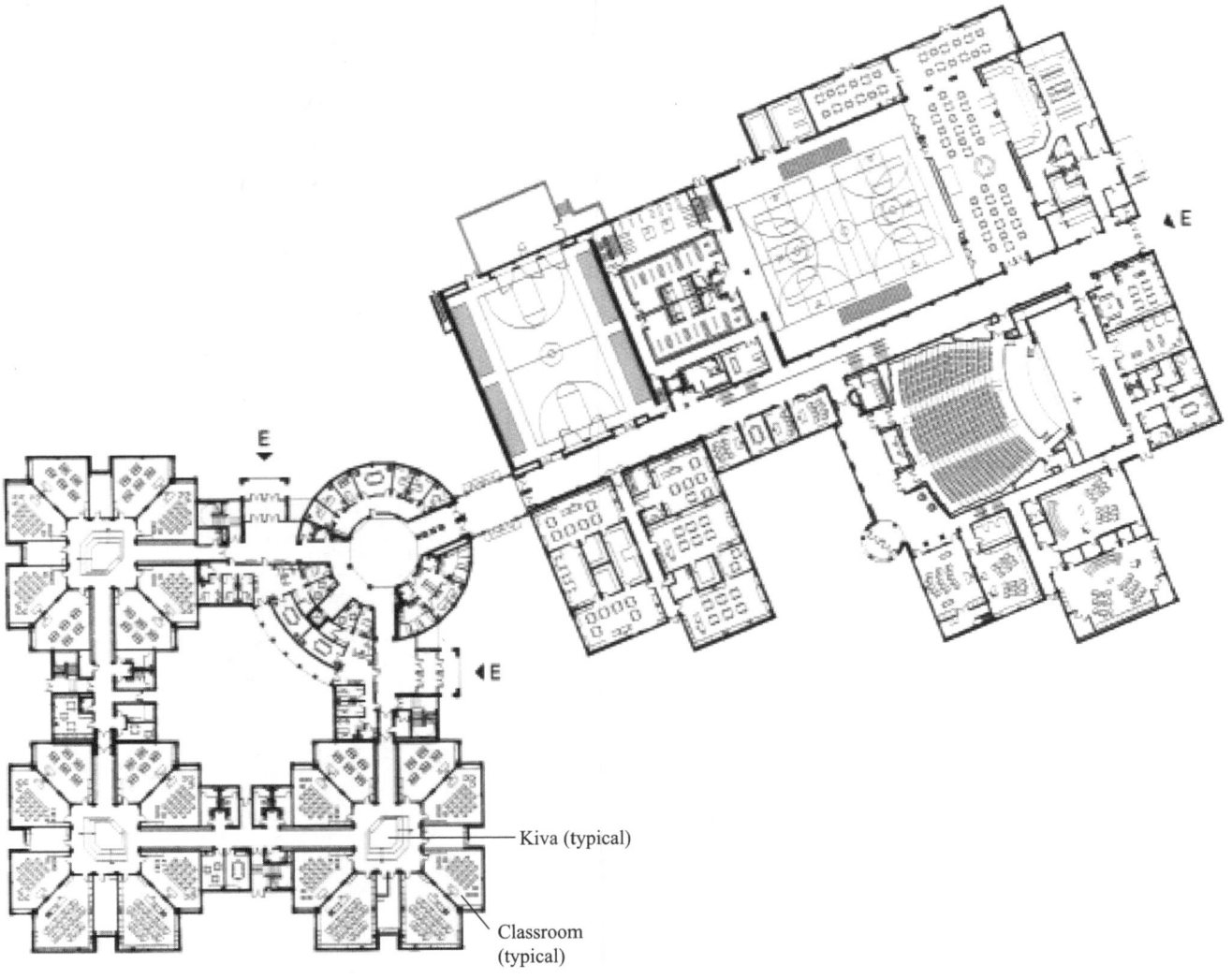
3 6 12 N

A. Classroom
B. Group Room
C. Staff Lounge
D. Staff Restroom
E. Utilities
F. Girls' Restroom
G. Boys' Restroom
H. Courtyard

Architect: Perkins & Will
Classroom: 943 net square feet
Group Room: 147 net square feet
Location: Roseville, California

Grades: 6-8
No. of children/class: 24

Ipswich Middle/High School



Architect:	Flansburgh Design Inc.	**Grades:**	6-12
Classroom:	780 net square feet	**No. of children/class:**	24
Location:	Ipswich, Massachusets	**Kiva:**	650 net square feet

"Early adolescents learn best in active, process-learning environments which include both subject – specific skills and global implications." (Executive Summary - Maryland Middle Learning Years)

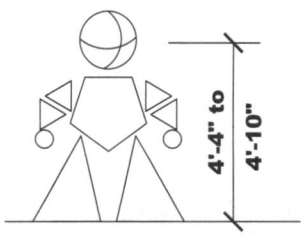
Recommended Minimums for Middle School Classrooms

Refer to worksheet on page 46 and 47 for calculating individual rooms

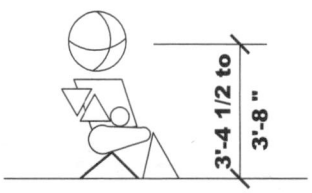
Component	Characteristics	Comments
Square Feet/Student	32-34 Square Feet	800 sf = minimum room size for class size of 25 students
Chalkboard/Markerboard*	24 Linear Feet	Provide flag holders and map rails
Tackboard (approximately 4'-0" high)	8-12 Linear Feet	
Tack Strips (ranging from 2" to 1'-0" tall)	12-16 Linear Feet	
Television		
Projection Screen		
Book Shelving (assuming book shelf is 2 shellves high; each LF of bookshelf = 2 LF of shelving)	32 Linear Feet	Multiple widths and adjustable heights preferred
Walk-in Storage	25-45 Square Feet/ Classroom	Storage Room can be shared by several classrooms in a gradel level or team in close proximity to classroom
Storage Cabinets for supplies	40 Square Feet	Full height, upper and lower cabinets and walk-in combined
Storage Cabinets for teacher Belongings (lockable)	10-12 Square Feet	Full height cabinets or comparable to accommodate coats, tall items, etc.
Counter	8 Linear Feet	
Sink		Tempered water for faucet recommended. A shared sink within close proximity to several classrooms is essential; one sink per classroom is ideal
Light Fixtures	With dimmers or provide a separate switching of lights	

* These two can be used together or separately depending on individual school system preference.

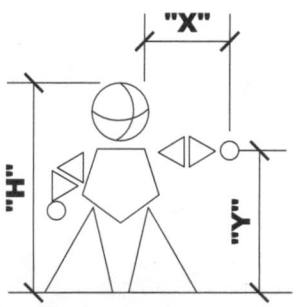
X = 2'-4" to 2'-6"
Y = 3'-10" to 4'-4"
H = 4'-10" to 5'-3"



Eye-Height, Standing

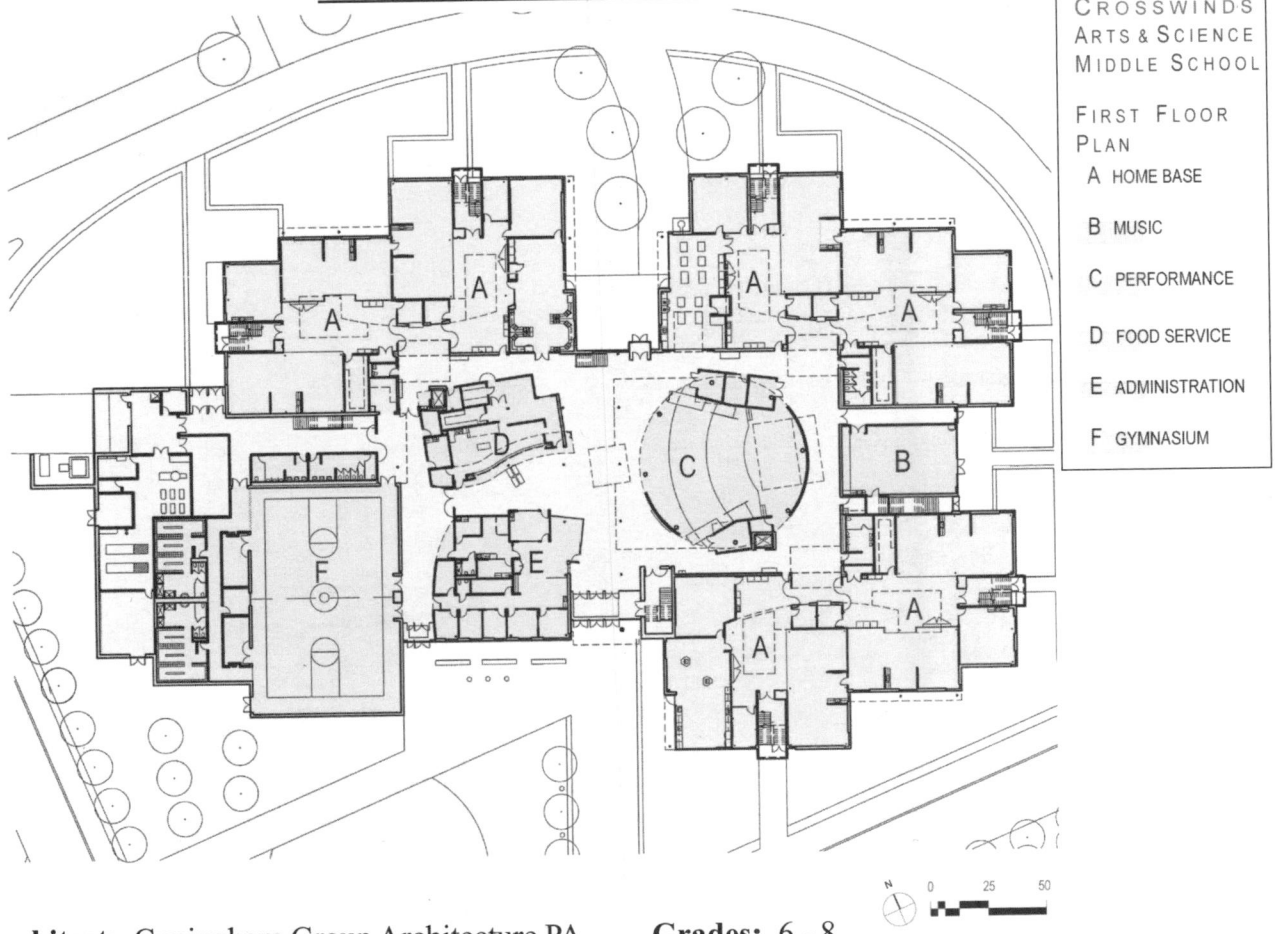


Eye-Height, Sitting



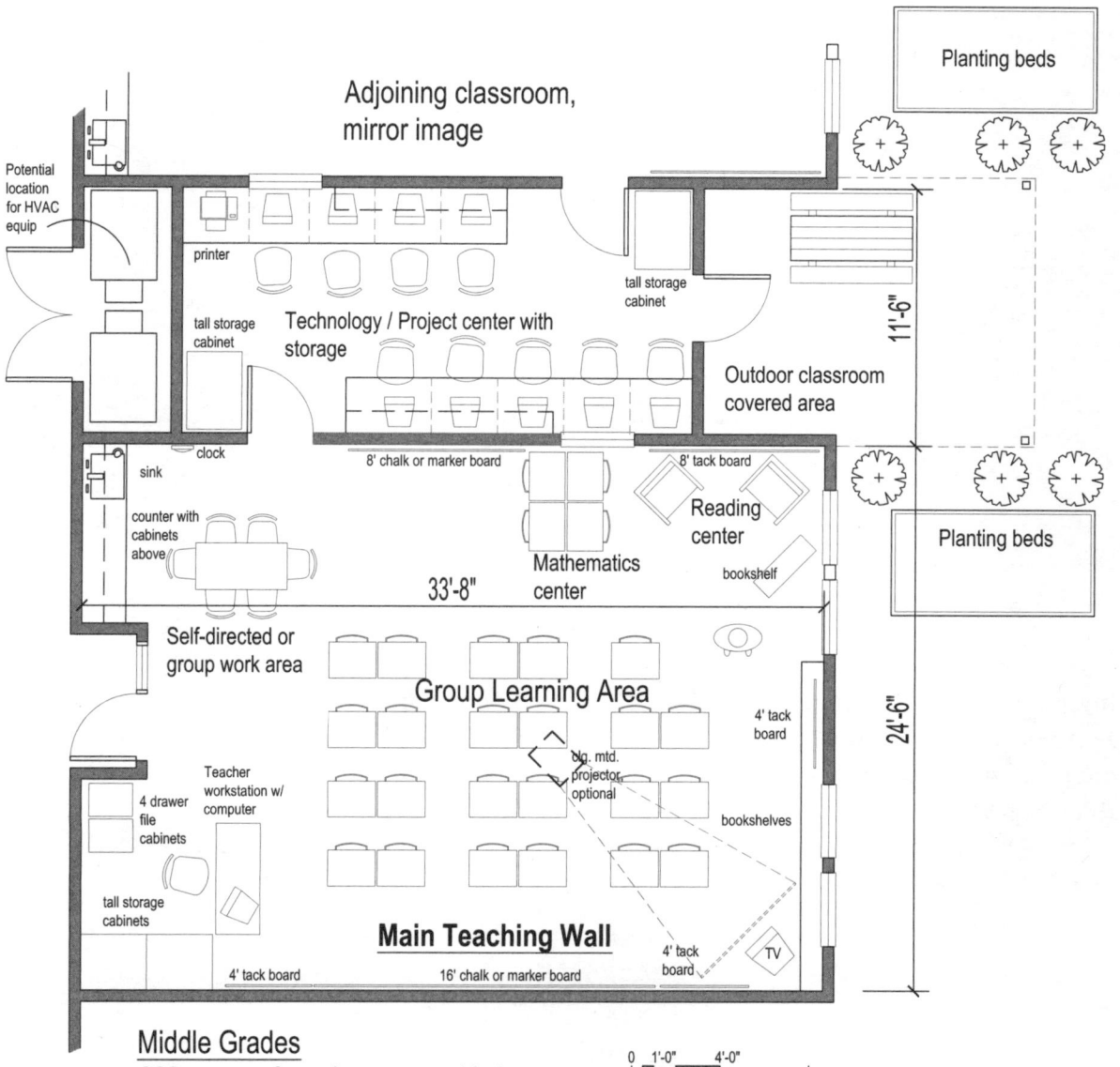
Height & Reach

Crosswinds Arts and Science Middle



Architect: Cuningham Group Architecture PA
Student team: 450 net square feet
Resource area: 350 net square feet
Small group: 120 net square feet
Location: Woodbury, Minnesota

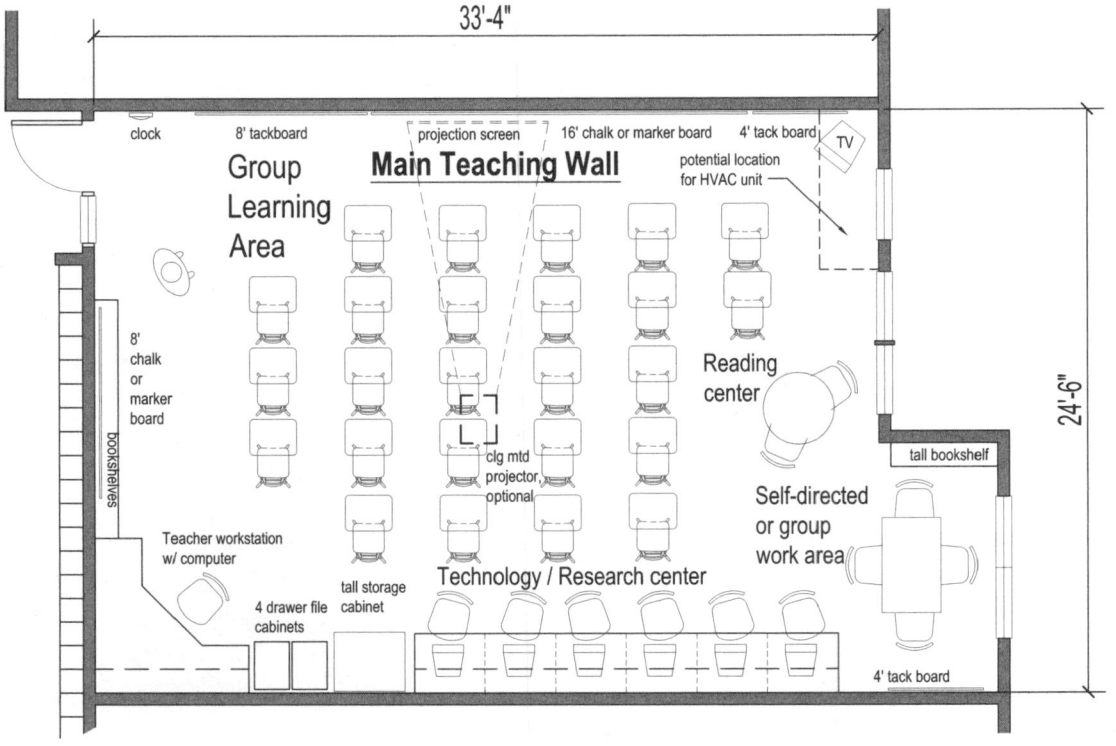
Grades: 6 - 8
No. of children/class: 16/group
100/home base or learning community
Gathering/performance: 1,050 net square feet



Middle Grades

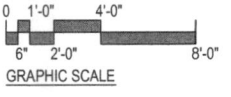
800 square foot classroom with 3 centers and adjoining shared Project / Technology room (250 sf)

Sample Classroom Layout



Middle Grades

870 square foot classroom 2 centers, one large technology center and alcove for self-directed or group work. Lockers outside of classroom.



Sample Classroom Layout

CHAPTER 8

High School Classroom Design

• Grades Nine Through Twelve

At the secondary school level considerable time is spent concentrating on one subject at a time and moving from classroom to classroom. High school students often learn in 4-6 rooms a day. Teachers often occupy several classrooms during the course of the day and teach a multitude of students. Students can be sedentary for most of the classroom period and move from classroom to classroom to study different subjects. In more dynamic longer class periods students move, re-group and interact more within the classroom during the teaching period.

Scheduling is done using several different methods. One method - block scheduling consists of 45, 60 or 90 minutes ("blocks" of time) spent in one room, with one teacher, studying one subject. This allows for more extended amounts of time on a subject and the ability to do several activities which reinforce the lesson. Students may be engaged in many different activities throughout the teaching period. In most schools that have a block schedule, lecture style teaching may encompass only one small part of the block; the rest of the time may be devoted to individual research and/or reading activities and group or pair work.

Lucy Chen Photography

Ipswich Middle / High

The flexibility of the room should be the first priority due to these varied activities. The room configuration and size should be conducive to many types of furniture arrangements, with ample circulation space around each desk or group of desks. Teachers may teach in more than one classroom throughout the building, and therefore may not have a single classroom as a home base. A teacher area should be provided in the classroom consisting minimally of a desk, chair, computer and locked storage for personal belongings. As more classrooms are utilized 100% of the school day, the concept of teacher planning/ work rooms or office-based workstations will become more prevalent.

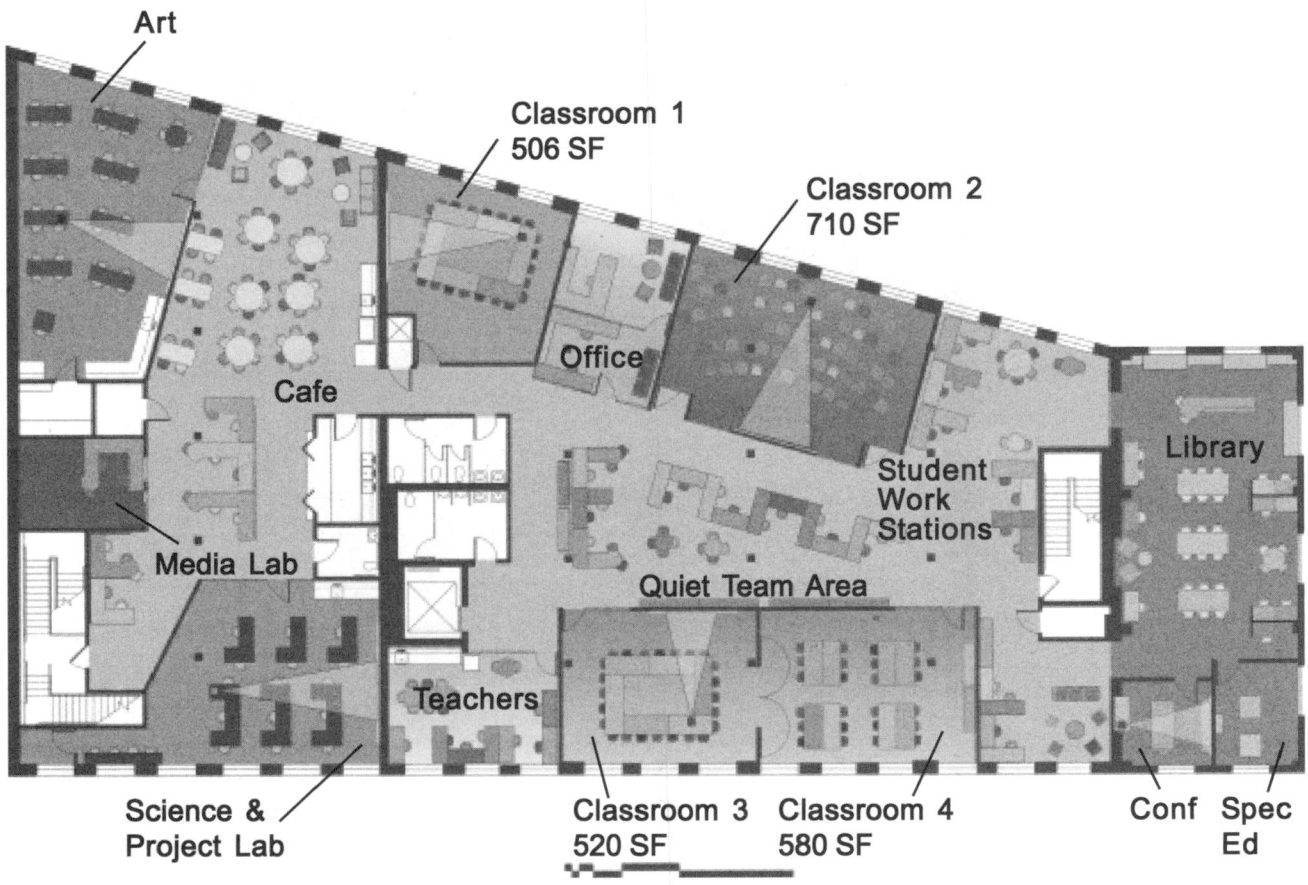
High school education is primarily focused on the preparation of the students for life beyond the classroom, whether it is in the world of work or further education. Several methods of accomplishing this preparation are shown in the following classroom layouts.

"The real purpose of public education has never been to prepare students for the classroom, but for the world beyond it."
Nancy Grasmick (April 2, 2002)

- **Example #1**
  Innovative Learning

Individual workstations are provided for each student similar to workstations in an open plan office building. This allows the student to personalize a work/study space within a larger environment, test out new identities, and gain self-confidence. Teacher's roles are defined as facilitators. Students take a more active role determining their educational course.

Harbor City International School

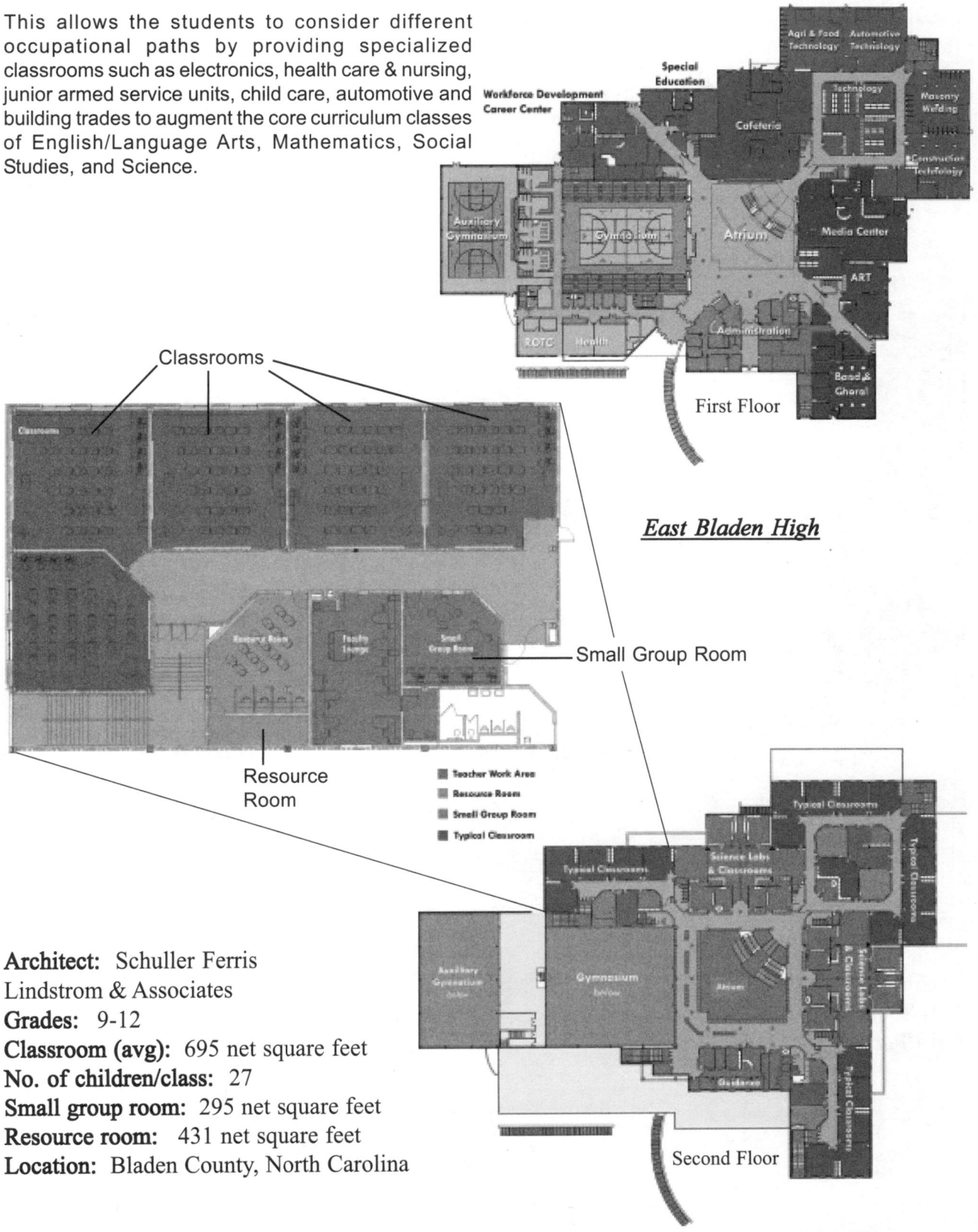


Architect: Randall Fielding & Scalzo Architects
Classroom (avg): 535 net square feet
Location: Duluth, Minnesota

Grades: 9 -12
No. of children/class: 24

- **Example #2**
  Comprehensive Education

This allows the students to consider different occupational paths by providing specialized classrooms such as electronics, health care & nursing, junior armed service units, child care, automotive and building trades to augment the core curriculum classes of English/Language Arts, Mathematics, Social Studies, and Science.



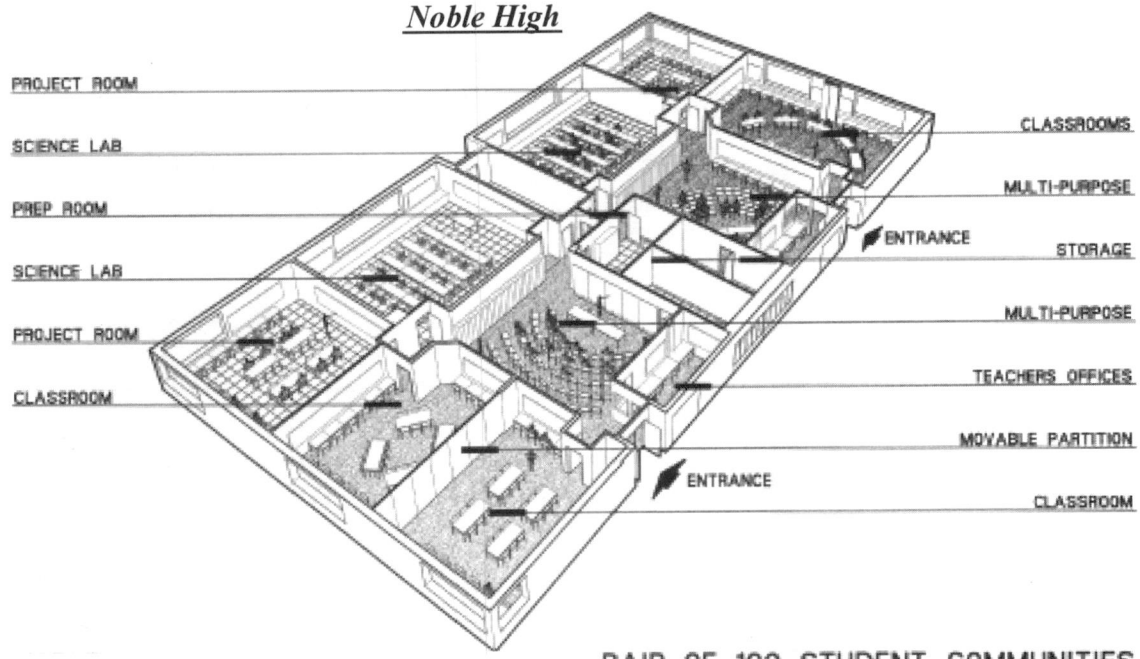
East Bladen High

Architect: Schuller Ferris Lindstrom & Associates
Grades: 9-12
Classroom (avg): 695 net square feet
No. of children/class: 27
Small group room: 295 net square feet
Resource room: 431 net square feet
Location: Bladen County, North Carolina

- **Example #3**
  Learning Communities

This allows the building to be broken up into individual smaller communities of 150-250 students. The students circulate from class to class in a smaller corridor layout which includes all of their core subjects. This allows for teachers to know a smaller and more recognizable group of children and the group gains a more cohesive community awareness. A commons area for the gathering of all the children in the group (or community) can be provided as a large instructional space. The most important concept of the commons is to provide maximum visibility into the commons areas from all of the main teaching areas. Smaller instructional spaces such as computer labs, project rooms or auxiliary instructional spaces could also be provided with the same visibility. **Note: study rooms and project rooms should have visibility from main teaching area.**

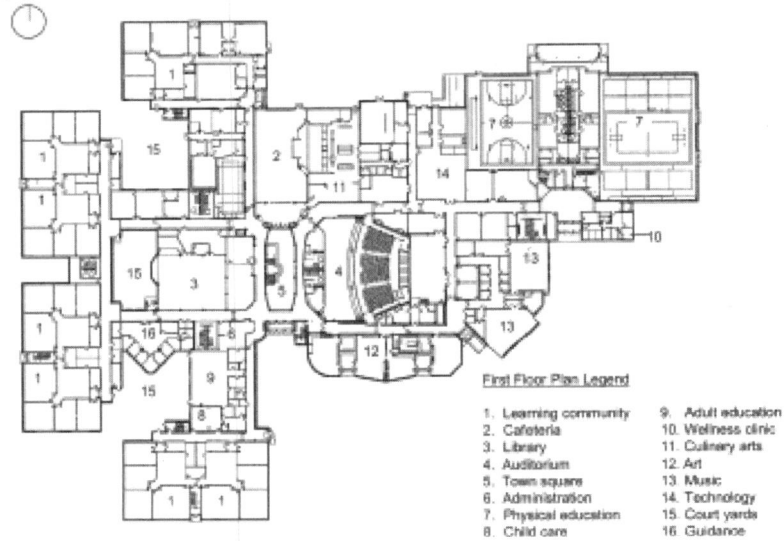
Noble High



PAIR OF 100 STUDENT COMMUNITIES

Architects: Harriman Associates
Classroom: 700 net square feet
Project Room: 830 net square feet
Location: North Berwick, Maine

Grades: 9-12
No. of children/class: 20-25
Multipurpose Room: 1,240 net square feet



Student Belongings

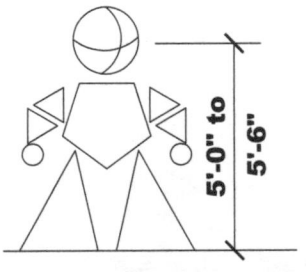
Often, at this age level students carry books and supplies from one class to another, utilizing either book bags, back packs or some other sort of carrier. Providing a series of hooks at the entry way of each classroom may be a solution for hanging back packs and book bags in clear sight of the entire class. This also removes the backpacks from backs of chairs where they can fall on the floor (tripping hazards are a teacher's nightmare). Providing a table, shelf or area for book bags in the classroom, out of the way of traffic is also an option. Deep open faced lockers (10" wide x 16" deep x 20" tall) are also a solution; these can accommodate the current trend - rolling book bags.

Recommended Minimums for High School Classrooms

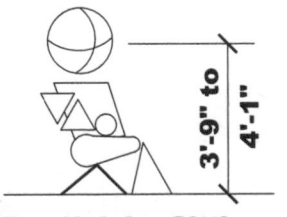
Refer to worksheet on page 46 and 47 for calculating individual rooms

Component	Characteristics	Comments
Square Feet/Student	30-32 Square Feet minimum	750 sf = minimum room size for class size of 25 students
Chalkboard/Markerboard*	24 Linear Feet	Bottom mounted at 34"aff, provide flag holders and map rails
Tackboard (approximately 4'-0" high)	8-12 Linear Feet	
Tack Strips (ranging from 2" to 1'-0" tall)	12-16 Linear Feet	
Television		
Projection Screen		
Book Shelving (assuming book shelf is 2 shelves high; each LF of bookshelf = 2 LF of shelving)	16 Linear Feet	Multiple widths and adjustable heights preferred
Walk-in Storage	25-45 Square Feet/ Classroom	Storage room can be shared by all classrooms in a department, cluster, or grade level in close proximity to classroom
Storage Cabinets for supplies	20 Square Feet	Full height, upper and lower cabinets and walk-in combined
Storage Cabinets for teacher belongings (lockable)	10-12 Square Feet	Full height cabinets or comparable to accommodate coats, tall items, etc.
Counter	6 Linear Feet	Sink is optional
Sink		Optional
Light Fixtures	With dimmers or provide a separate switching of lights	

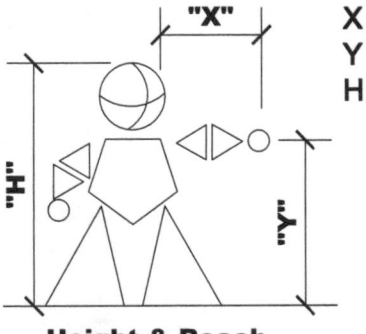
*These two can be used together or separately depending on individual school system preference.



Eye-Height, Standing



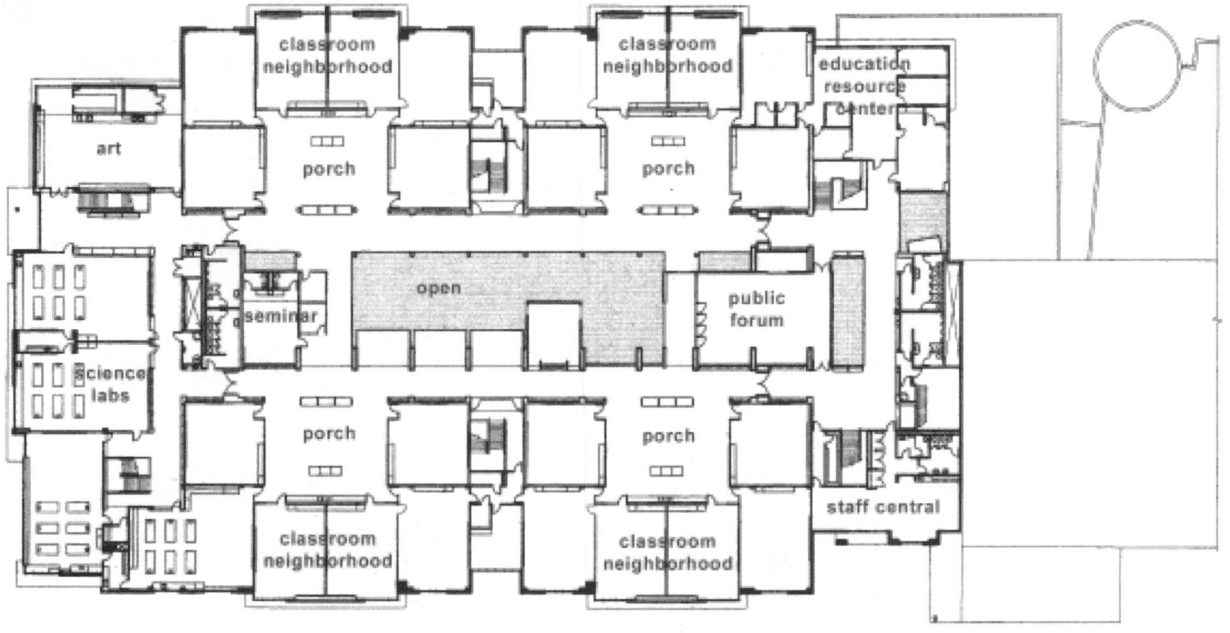
Eye-Height, Sitting



Height & Reach

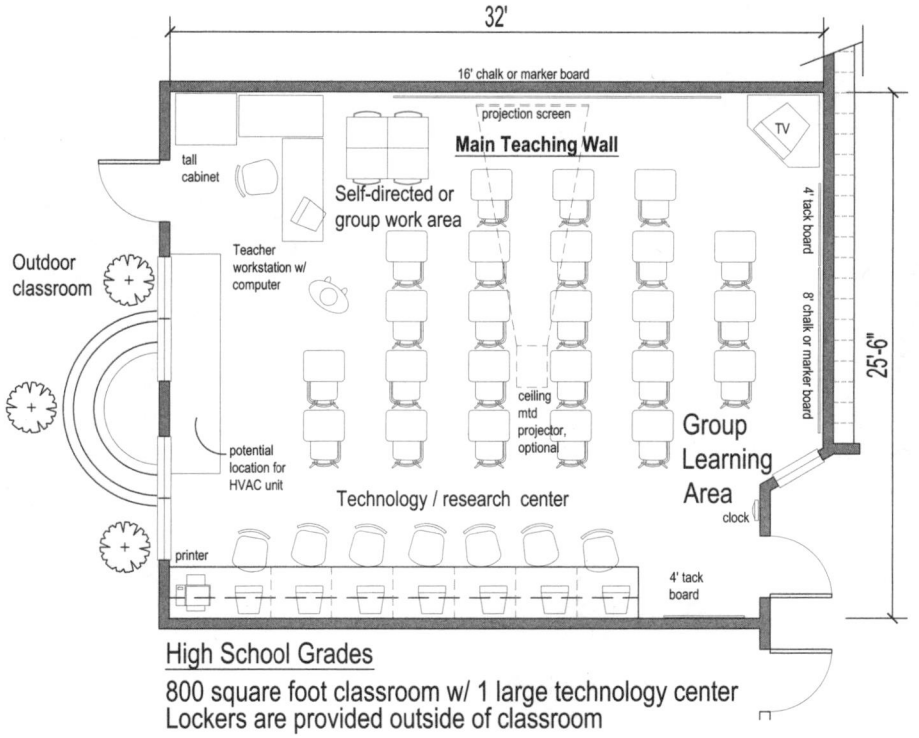
X = 2'-4" to 2'-8"
Y = 4'-4" to 5'-0"
H = 5'-3" to 6'-0"

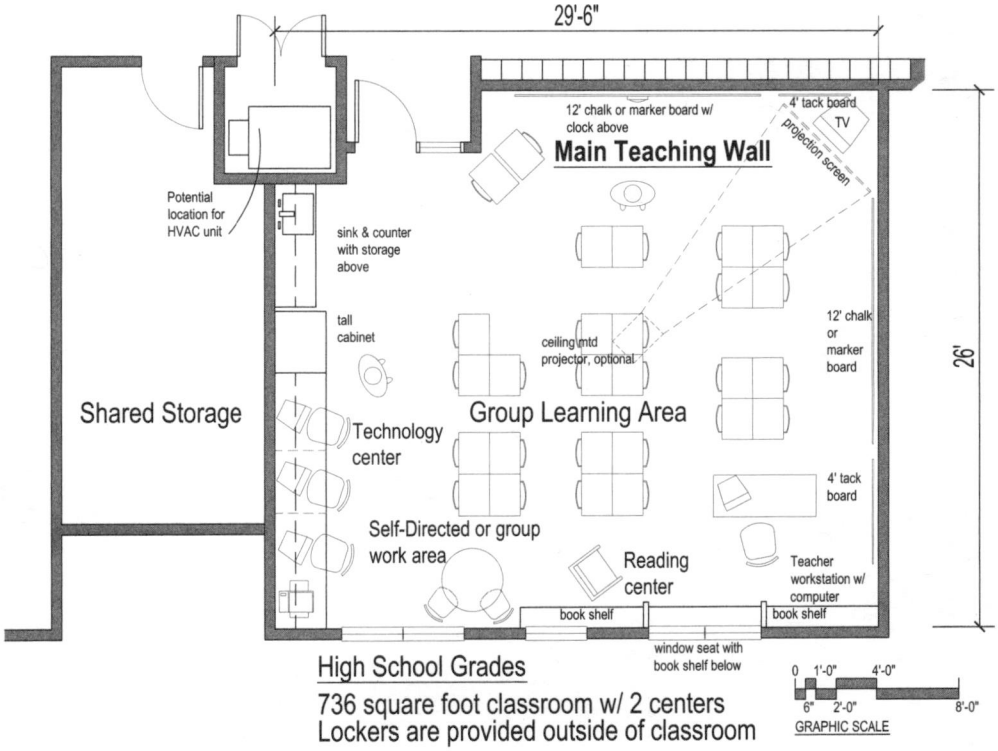
West Linn High School



Architect: Dull Olson Weekes Architects
Classroom: 900 net square feet
Location: West Linn, Oregon

Grades: 9 -12
No. of children/class: 39





Sample Classroom Layout

SUMMARY

A common denominator in all grade levels is the need to have enough space to teach, circulate through the room and have direct contact with all students. The classroom must have room for students to work in groups of 2, 3 or 4, and to work on projects and large format items.

What is the goal of the general classroom environment?

Consider the theory of motivation and the heirarchy of human needs proposed by Abraham Maslow. First the utilitarian needs of humans must be met... then at the next level, we need a sense of community and on toward a satisfaction of the self-esteem need and finally self actualization. "We shall call people who are satisfied in these needs basically satisfied people, and it is from these that we may expect the fullest (and healthiest) creativeness." (Maslow, 1943)

Good classroom design should provide the following:

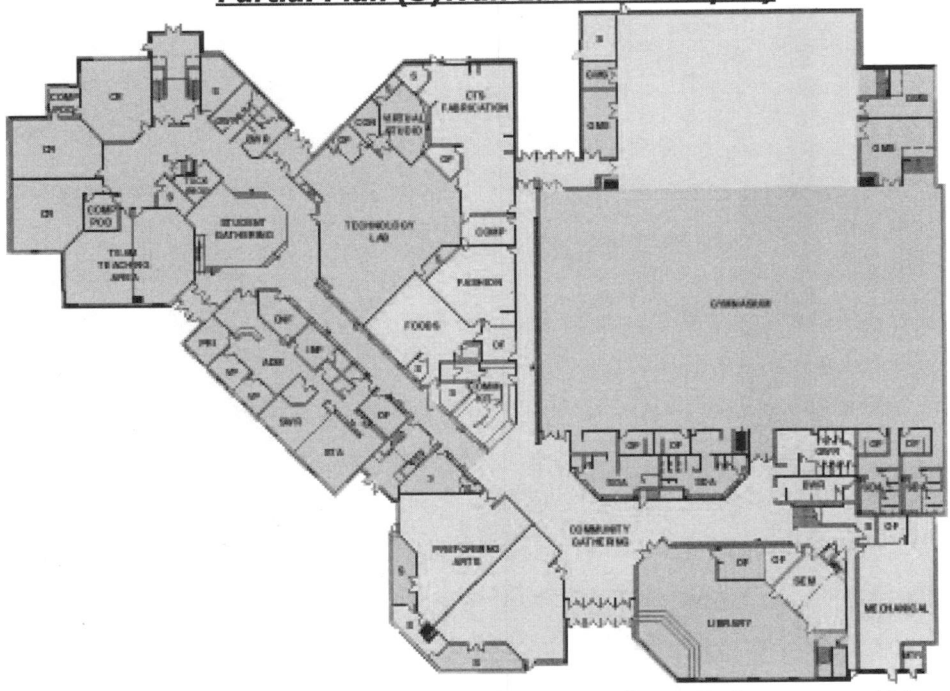
- A place of comfort and order for all inhabitants. (addressing utilitarian needs)
- A safe place to interact with peers and teachers. (providing a safe environment, structurally, environmentally and emotionally, fostering a sense of community)
- A place where students can take risks without the fear of embarrassment and an atmosphere where failure is viewed as an aspect of learning and growth. (addressing the need for self-actualization)

The basic needs of human beings haven't changed so much, through the ages. In the times of antiquity, a Roman, named Vitruvius, wrote the first book on architecture called "The Ten Books on Architecture" which provided one of the the first known definitions of architecture. Architecture is to provide:

- Commodity (addressing utilitarian, physical needs)
- Firmness (providing safety and a sense of community)
- Delight (promoting self-actualization)

Schooling is to develop the whole child, physically and intellectually and socio-emotionally. The purpose of architecture designed for education is to support learning - body, mind and soul.

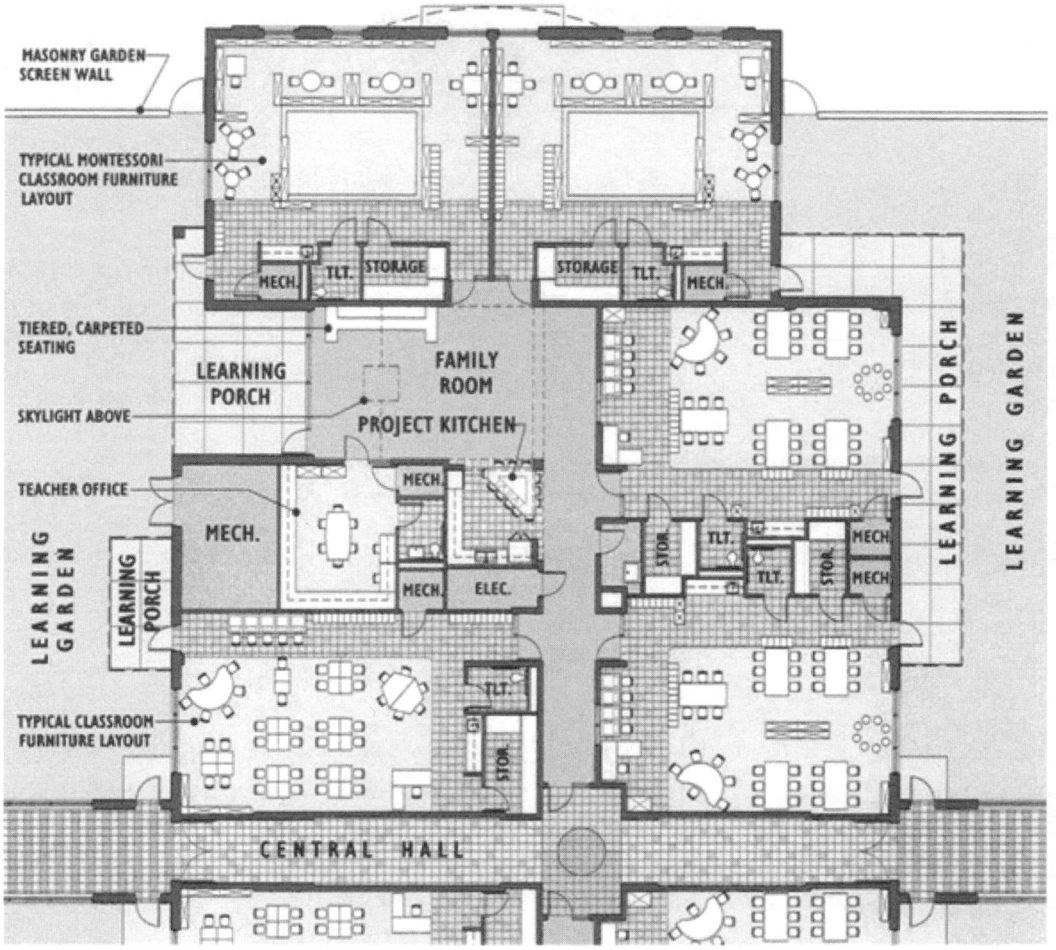
Fox Run School/Mother Teresa School K-9
Partial Plan (Sylvan Lake Tri Campus)



Architects: Group 2 Architecture Engineering Interior Design
Classroom: 786 net square feet (average)
Location: Sylvan Lake, Alberta Canada

Comp Pod: 136 net square feet
Student Gathering: 1,240 net square feet
No. of students/class: 25

McWillie Elementary



NORTH

Typical Learning House

Architects: Dale and Associate Architects
Classroom: +/- 950-960 net square feet
Location: Jackson, Mississippi

Grades: K - 2
Family Room: 659 net square feet
Project Kitchen: 152 net square feet
No. of students/class: 25

Winstead Photography

Results of the Council of Educational Facility Planners, International/ Maryland State Department of Education Classroom Design Workshops

April 2, 2003

This one day workshop, sponsored by the Northeast Region of the Council of Educational Facility Planners, International (CEFPI) and the Maryland State Department of Education (MSDE) explored the design of the general classroom for today's elementary school students.

Participants included educators, facility planners and architects. The morning session consisted of presentations on current trends in educational programs and delivery, given by educators and education professionals. The topics presented were, "Brain Research and Learning in the Classroom" given by Mariale Hardiman; "Special Needs Student Populations" given by Allen Abend; "A New Kind of Room with a New Kind of View" given by Trudy Collier; and, "Toward a Constructivist Community of Learners" given by Jim and Vonnie Ryland.

Eight teams worked together to develop statements of educational activities based on the information discussed and the design problem statement. The following sketches are the result of a four hour brainstorming work session with team members from both the educational fields and the design fields. **These sketches are not meant to be fully developed designs for a classroom but are useful in discussing concepts of design for an elementary school classroom.**

REFP Workshop - Design Teams

April 2, 2003

Key after names: A = architect, E = educator, F = facilitator, P = planner, S = school facility representative, X = presenter for group

Team A
1. James Bartlett (A)
2. Janet Castellini (S)
3. Mariale Hardiman (X/E)
4. Ed Kirkbride (X/P/A)
5. Thom Leonard (A)
6. John Riegel (E)
7. Kathy Sanner (S)
8. Ed Scott (S)
9. William Thomas (A/F)
10. John Sole (S)

Team B
1. Steve Bates (A)
2. Joyce Craig (A)
3. Thomas Kidd (Sales)
4. Cheryl Logan (X/E)
5. Kris McGee (X/E)
6. JoAnne Murray (A)
7. Lisa Seaman-Crawford (A/F)

Team C
1. Dave Copley (A)
2. Tom Gilbert (A)
3. Mr. Burns (Jake's Father)
4. Jake Burns (Student)
5. Maria Pryor (A)
6. Vonnie Ryland (X/E)
7. Pat Skebeck (S/E)
8. David Stevens (E/F)
9. William Strauss (A)

Team D
1. Anthony Aldinger (S/E)
2. Brad Furey (A)
3. Donn Hicks (X/E)
4. Beth Pasierb (S)
5. Jeanne Perantoni (A)
6. Scott Prisco (A)
7. Young Pryor (A)
8. Bill Richardson (P/F)

Team E
1. David Anstrand (S/X)
2. David Gaudreau (A/F)
3. Julia Van Hook (E)
4. Dennis McGee (S)
5. Jay Perantoni (A)
6. Ritchard Sherman (A)
7. Henry Khuu (Student)

Team F
1. Stacy Arnold (E)
2. Janet Jones (X/E)
3. Janet Johnson (E)
4. Frank Locker (A)
5. Carole Mark (A/F)
6. Alberto Treves (A)
7. Lori Walls (Marketing)
8. Bruce Watts (A)

Team G
(team did not exist during workshop)

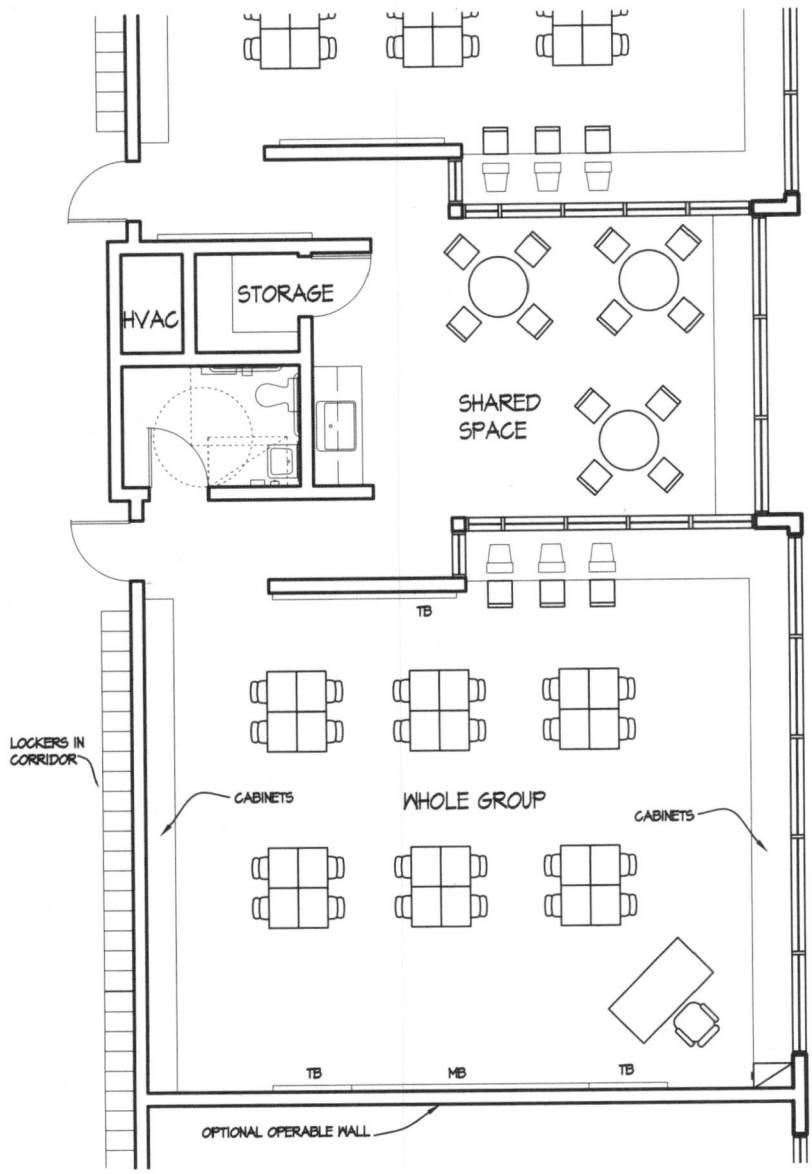
Team H
1. Barbara Bice (A/F)
2. Rich Croke (A)
3. Al Eilbacher (X/S)
4. Avery Gretton (A)
5. Richard Moretti (S/E)
6. Jim Ryland (E/F)
7. Joe Skinner (A/P)
8. Paul Taylor (A/P)

Team I
1. Paul Abramson (P)
2. Karl Alt (A)
3. Sandra Carpenter (A)
4. Ran Ilkovitch (A)
5. Wendy Kunz (A/P/F)
6. Laura McCanna (E)
7. Harry J. Pettoni (A)
8. Ed Waldron (X/E)

Apologies to any team members who may have been inadvertently excluded.

CLASSROOM DESIGN WORKSHOP

GROUP A



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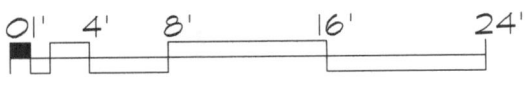
SHARED SPACE: 400 NSF



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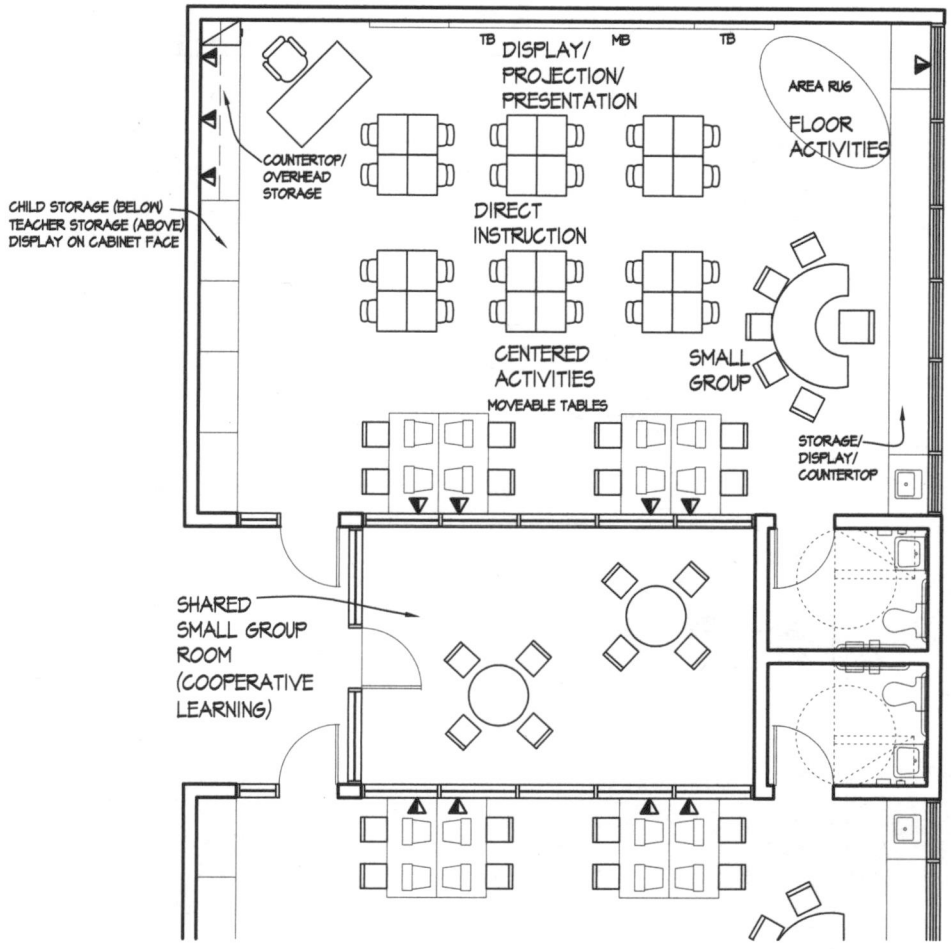

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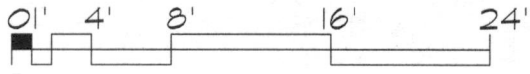
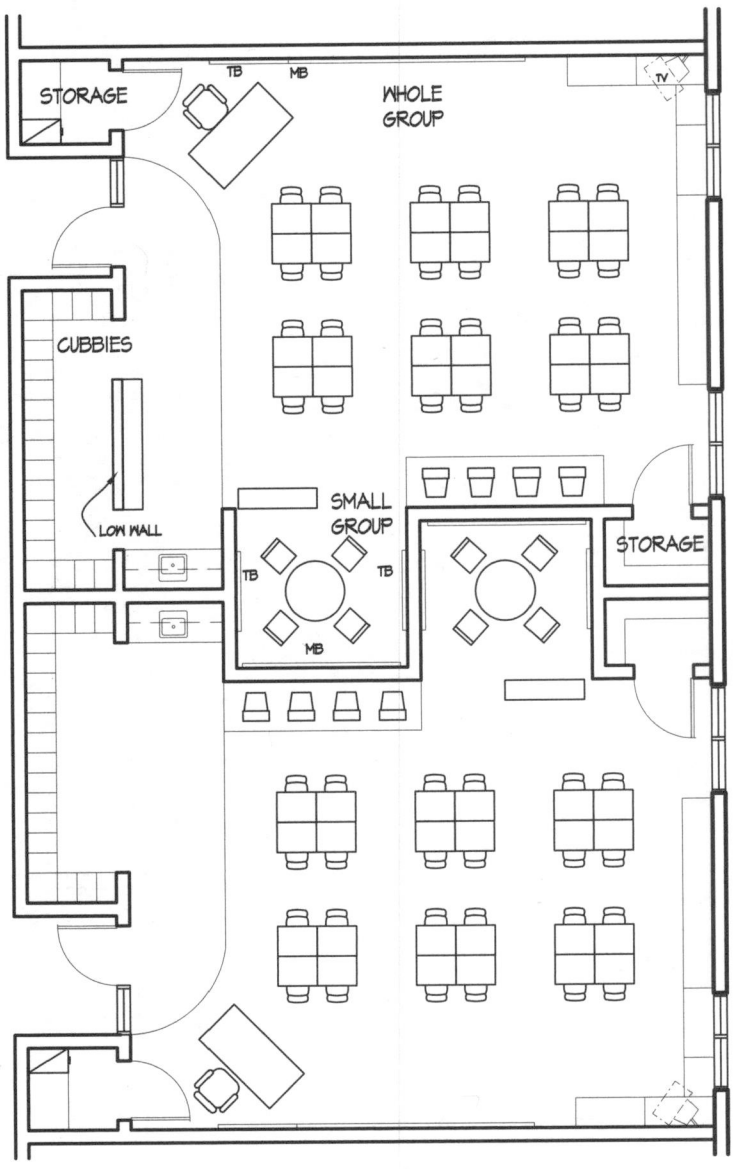


CLASSROOM DESIGN WORKSHOP

GROUP C



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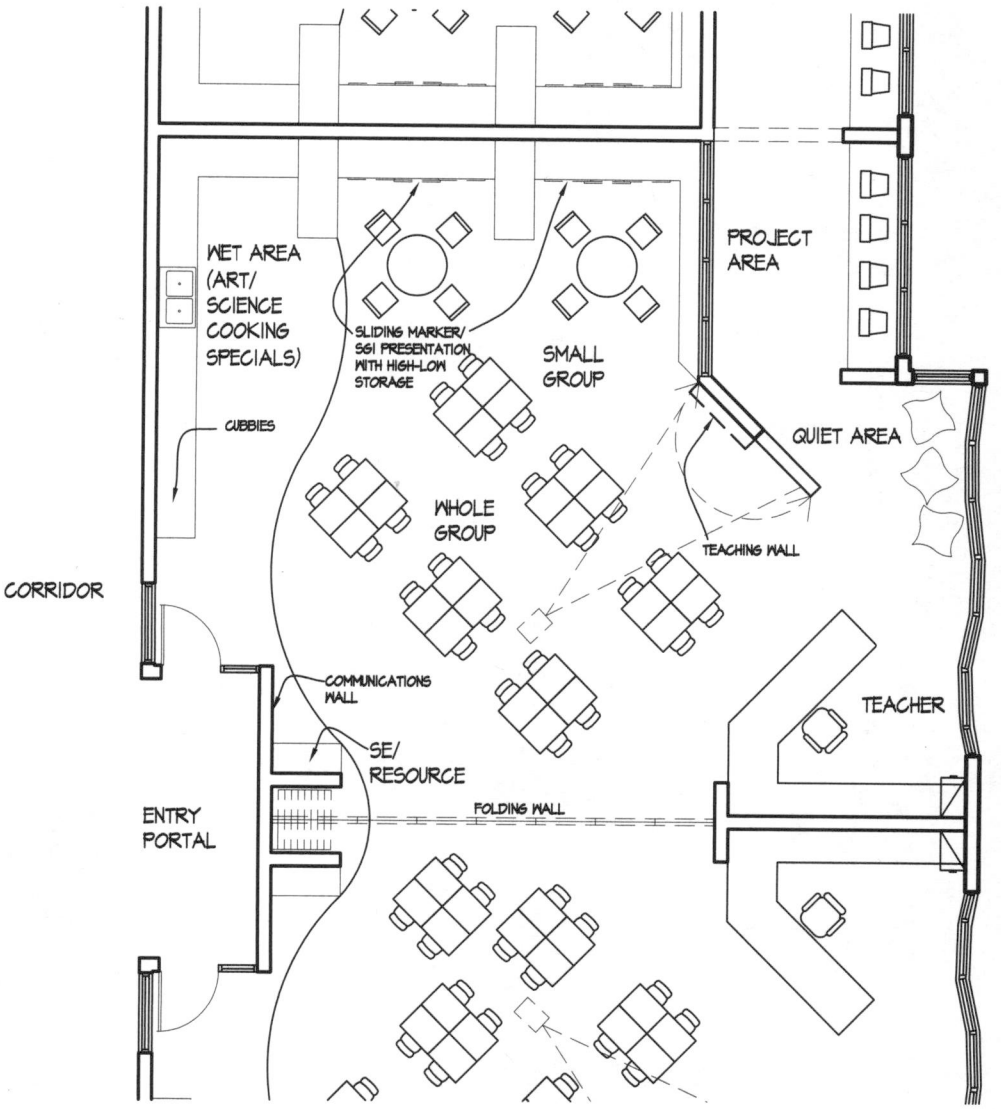
CLASSROOM DESIGN WORKSHOP

GROUP D



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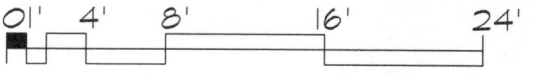
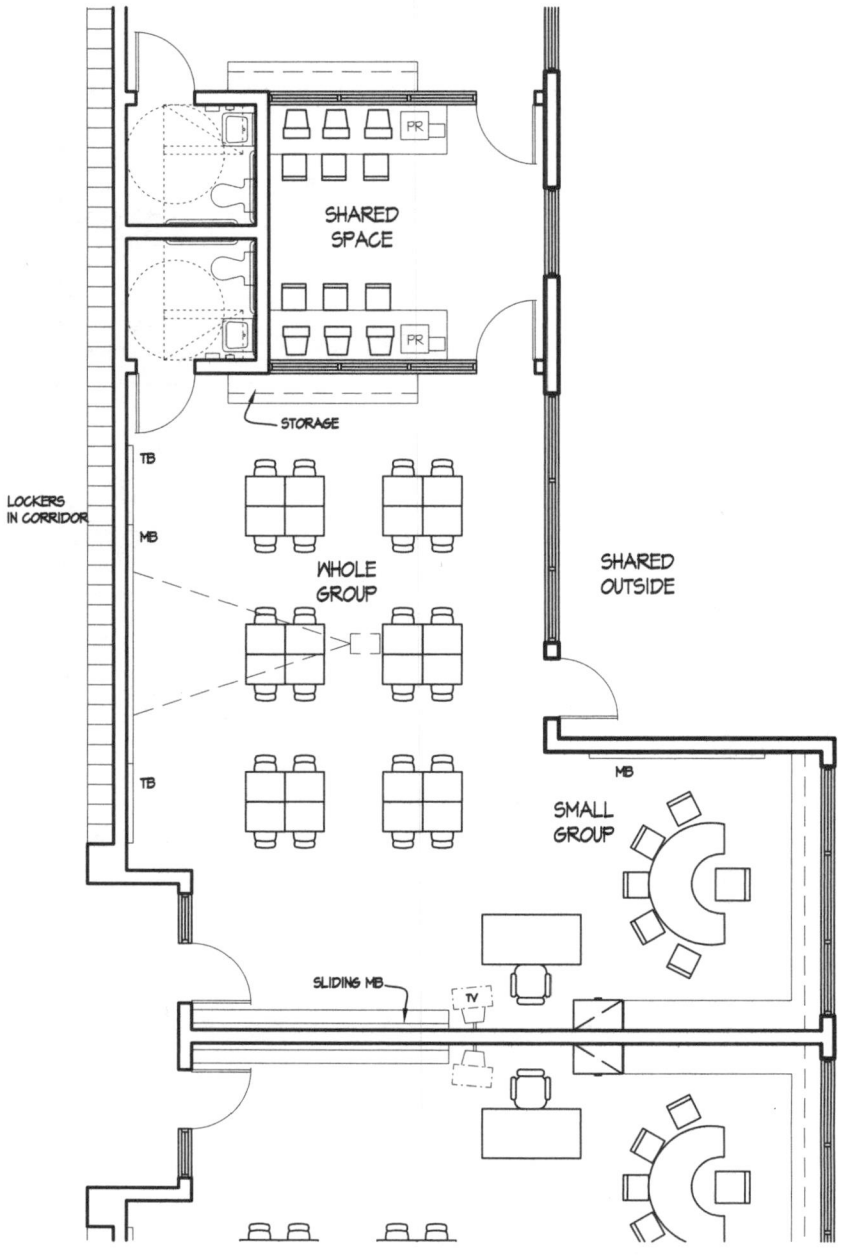
PROJECT AREA: 105 NSF

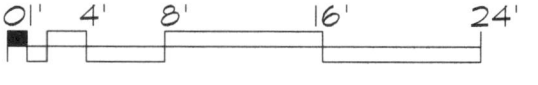


CLASSROOM DESIGN WORKSHOP

GROUP E



CLASSROOM: 873 NSF (EXCLUDING TOILET)
SHARED SPACE: 180 NSF



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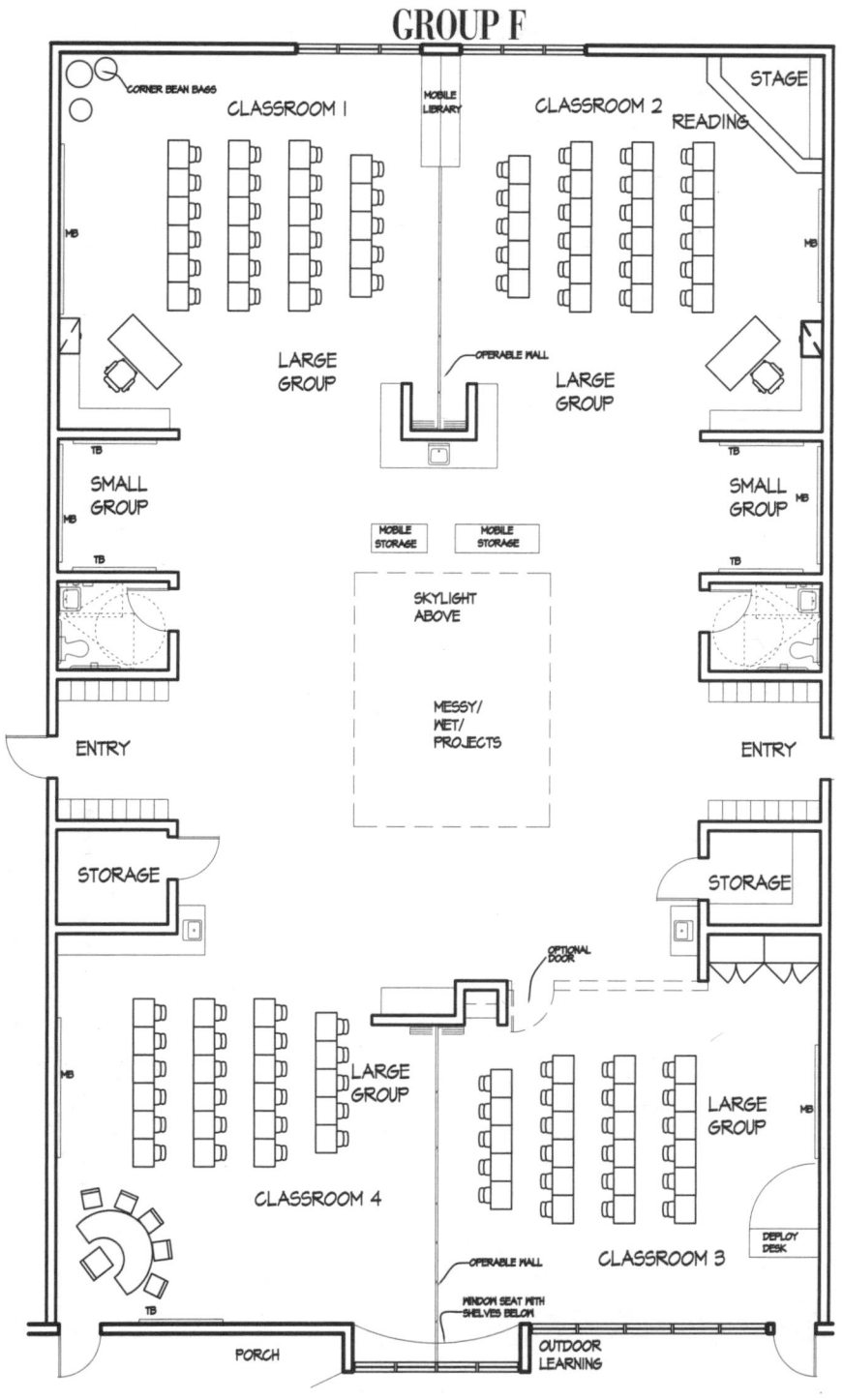
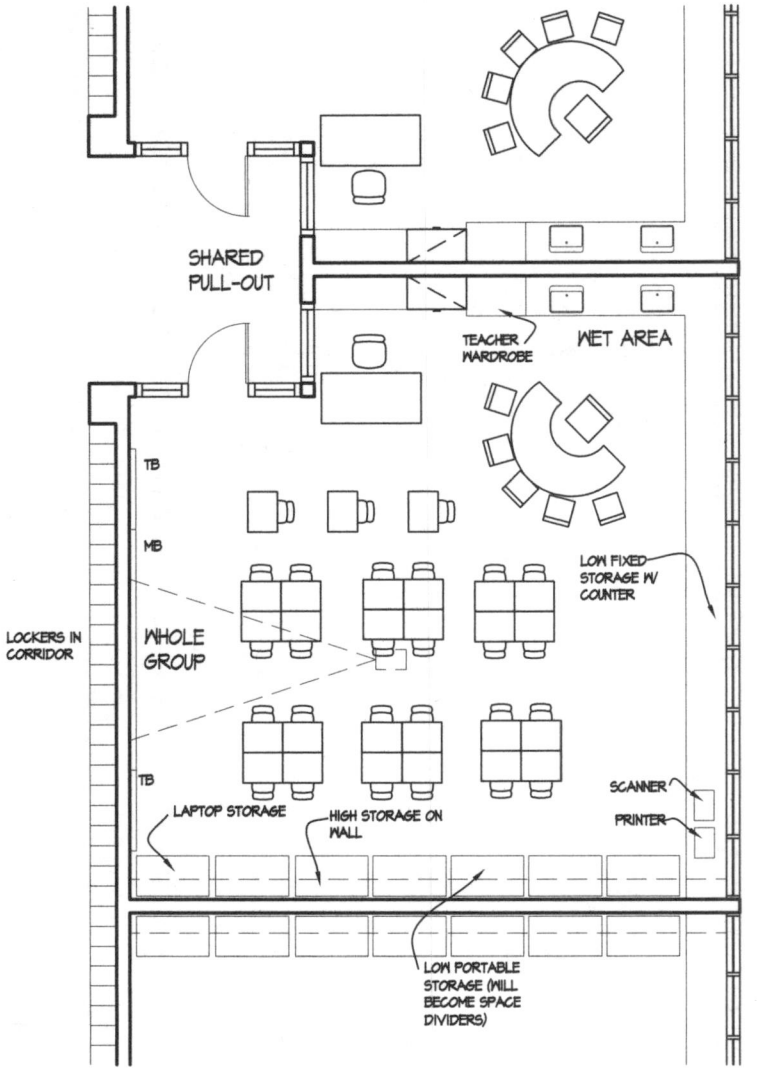


CLASSROOMS: 726 NSF (EXCLUDING TOILET)
SHARED SPACE PER CLASSROOM: 494 NSF

0 2' 8' 16'

CLASSROOM DESIGN WORKSHOP

GROUP H



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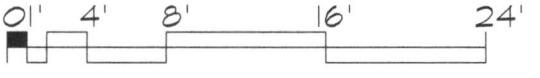
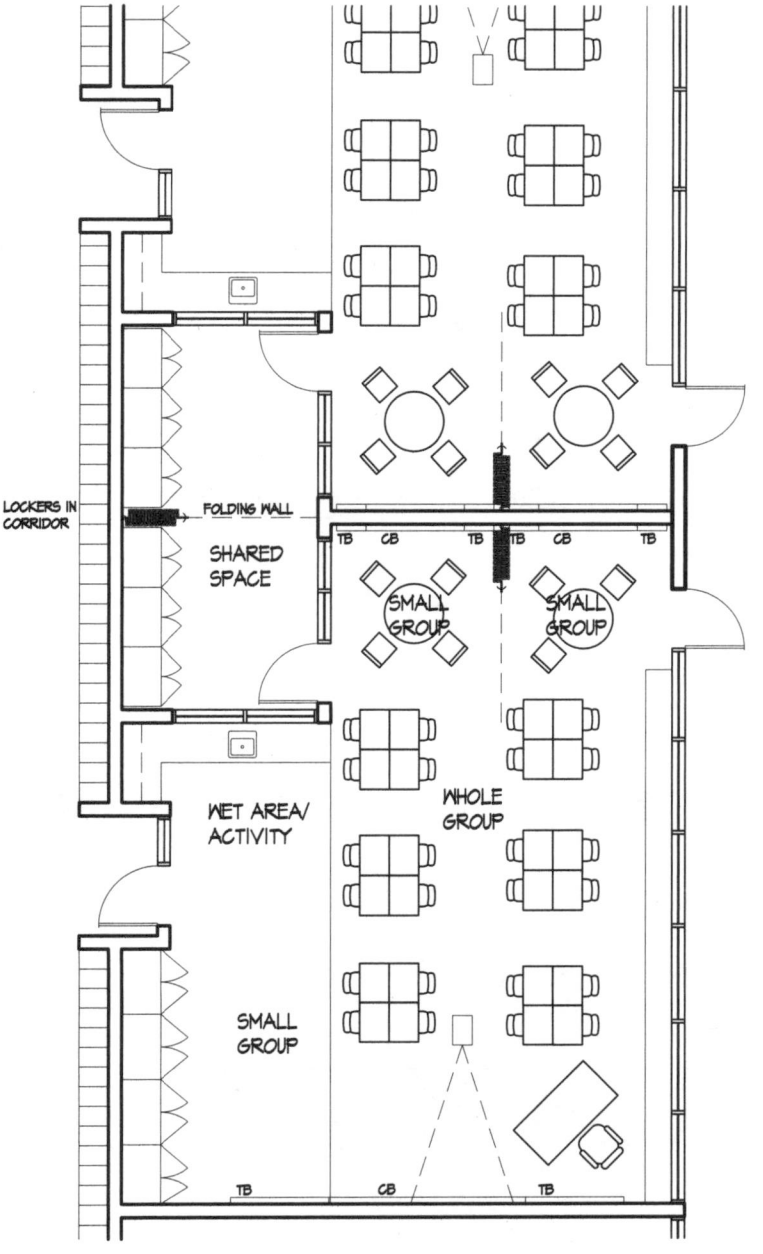


CLASSROOM DESIGN WORKSHOP

GROUP I



CLASSROOM: 835 NSF
SHARED SPACE: 96 NSF

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Photographs

KEY - Page #; School Name; Location / County; Architect; Photographer (If Applicable).

CHAPTER 1

Page 1; CEFPI Conference; Participants.
Page 8; Hollywood Elementary; St. Mary's County, Maryland; Grimm & Parker Architects.
Page 12; Mt. Savage Elementary/Middle; Allegany County, Maryland; Bushy Feight Architects, Inc.

CHAPTER 2

Page 16; Samuel W. Tucker Elementary; Alexandria, Virginia; Grimm & Parker Architects.
Page 17; Roland Park Elementary/Middle; Baltimore City, Maryland; Edmunds & Hyde.
Page 19; Roland Park Elementary/Middle; Baltimore City, Maryland; Edmunds & Hyde.
Page 20; Wilde Lake High; Howard County, Maryland; Cochran, Stephenson & Donkervoet, Inc.
Page 20; Wilde Lake High; Howard County, Maryland; Cochran, Stephenson & Donkervoet, Inc.
Page 20; Garnett Elementary Learning Center; Kent County, Maryland; Becker Morgan Group.
Page 21; William Paca Elementary/Middle; Baltimore City, Maryland; Buchart Horn Inc.
Page 21; Hollywood Elementary; St. Mary's County, Maryland; Grimm & Parker Architects.
Page 21; Selinsgrove Intermediate; Selinsgrove, Pennsylvania; Hayes Large Architects; Larry LeFever.
Page 21; Glenelg High; Howard County, Maryland; Johannes, Murray & Associates.
Page 24; Shrewsberry Elementary; Shrewsberry, Pennsylvania; Crabtree, Rohrbaugh & Associates.
Page 26; Crosswinds Arts and Sciences Middle; Woodbury, Minnesota; Cunningham Group Architecture, P.A.; Don Wong.

CHAPTER 4

Page 51; Detroit Country Day Preschool; Bloomfield Hills, Michigan; TMP Associates, Inc.; Beth Singer.
Page 52; Hollywood Elementary; St. Mary's County, Maryland; Grimm & Parker Architects.
Page 56; Roland Park Elementary/Middle; Baltimore City, Maryland; Edmunds & Hyde.
Page 56; Judy Hoyer Center, Garnett Elementary; Kent County, Maryland; Becker Morgan Group.
Page 56; Sparks Elementary; Baltimore County, Maryland; Murphy & Dittenhafer, Inc.

CHAPTER 5

Page 60; William Paca Elementary/Middle; Baltimore City, Maryland; Buchart Horn Inc.

CHAPTER 6

Page 71; Fearn Elementary; North Aurora, Illinois; Perkins and Will Architects; Greg Murphy.

CHAPTER 7

Page 77; Margaret Brent Middle; St. Mary's County. Maryland; Belinky & Schick.

CHAPTER 8

Page 84; Ipswich Middle/High; Ipswich, Massachusetts; Flansburgh Associates, Inc.; Lucy Chen.

SUMMARY

Page 92; McWillie Elementary; Jackson, Mississippi; Dale & Associates Architects, PA, & J. Lackney -Educational Planning Consultant, Educational Design Institute, Mississippi State Univeristy; Winstead Photography.