INNOVATIVE SCHOOL DESIGN:

DESIGN CRITERIA BASED ON INDIVIDUAL LEARNING STYLES

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INNOVATIVE SCHOOL DESIGN:

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Introduction

Based on a 1999 study done by the federal government, 20% of the schools in the United States, grades K-12, are in less than adequate condition. A large percentage of this number is urban schools. The total cost to improve all of these schools is projected around 127 billion dollars (U.S. Department of Education). It is unclear how accurate of a number this is, but however many billion dollars it may be, these incompetent facilities represent an obstacle for students and faculty, but do serve as a potentially large market for architects.

After deciding to explore architecture’s impact on education for my thesis, I began to research existing schools as well as their curriculum and educational models. Through initial research I found that in the last several decades there has been little change in public education—in both curriculum and actual building design. The majority of public schools do not promote individualized teaching methods, in grades K-12. While the typical kindergarten and first grade curriculum lends itself more easily to individualized teaching methods, in most cases these methods are abandoned before the second or third grade. Students are most often assigned a seat, directly in front of the blackboard and are required to sit quietly and listen to the teacher’s daily lecture. (Armstrong 38) While some students have no trouble learning this way, Pay Roy in “Revisiting Cooperative Learning” suggests that students retain a much higher percent of what they discuss, experience directly, or attempt to teach others. Traditionally, the passive approach has failed to address individual student learning styles. If students do not retain enough information from this passive teaching method, they are often labeled as failures.

There have been many attempts to create an “alternative” approach to education. During the 1960’s and 70’s business oriented reformers sponsored a school that was to be more businesslike. These schools were to adopt managing and budgeting techniques as school objectives (Ravitch, 194-5) Performance contracting and teaching by machine were two other failed school reform attempts. These failed attempts had one thing in common. Each attempt had an outside agenda and neglected to research and understand the social institution as well as the educator and student’s needs (Ravitch, 194-200).
One current theoretical discussion that specifically addresses student's individual learning styles is Howard Gardner's theory of multiple intelligences.

There are eight intelligences defined by Gardner: logical-mathematical, linguistic, spatial, intrapersonal, interpersonal, musical, naturalist, and bodily kinesthetic (Existentialism, a new intelligence has been proposed by Gardner, but was not studied in this thesis). Gardner feels that each person has all eight intelligences, but individually have a much higher level of some intelligences than others. The strongest types of intelligences in individuals will most likely have the greatest influence on an individual's learning style.

While I do not feel that segregating public schools into eight different learning styles is a valid solution, I do think this pedagogical theory is a valuable tool in considering how architectural decisions can respond to the pursuit for a more effective educational system and how an architectural vocabulary, as well as curriculum changes would be most beneficial when applied to the public education system. Subsequently, this thesis will explore the architectural implications in the redevelopment of learning spaces (classrooms).
status quo of education

The Student's level of responsibility for their own education is a critical issue in the redevelopment of the learning model. If the learning process becomes more individualized, students will be forced to become more accountable for their own learning. I am not suggesting that teachers need to abandon traditional lectures; however, individualized learning should be more effectively integrated into the learning process. The images on the right provide examples of traditional learning spaces where student's desks are arranged in a grid, as they are immersed in fluorescent, artificial light.

While there has been some progression from the status quo to a brighter, healthier model, there still seems to be a lack of change in the educational system itself. Designers are providing more natural lighting, and better indirect artificial lighting. They are researching and specifying new, high-quality materials, and even creating some outdoor learning spaces—if the site design allows for it. These are all commendable steps taken by current school designers, but continue not to address, through classroom design, individual learning styles.

open plan layout (popular design in the 1970's)

gardner's theories

Howard Gardner's theory of multiple intelligences is important as it relates to creating accountability through individualized instruction. This thesis uses Gardner's ideas as a starting point for designing a learning laboratory for middle school aged students. This laboratory school is used as a tool to explore innovative learning environments that begin to address student's individual learning styles. There are eight different learning environments based directly on Gardner's theory. To explore each learning style (intelligence), Gardner researched many characteristics for each type of learner. He describes how these students learn, what they love, and also what resources they need to learn effectively. Although Gardner addresses eight unique intelligence categories, there are a few critical assumptions to keep in mind. Each person does possess all eight intelligences. Gardner's theory is not meant to determine which intelligence relates to individual students, but rather proposes that each person has "capacities in each intelligence and these function together in ways unique to each person," (Armstrong, 8).
Gardner also makes the assumption that each student has the ability to develop each of the intelligences to an adequate level. This reiterates the fact that the intelligences often work together in complex ways. (Armstrong, 9)

In the book, *Multiple Intelligences In the Classroom*, Thomas Armstrong lists simple terms that he uses to describe the eight different intelligences. Word smart is used to describe the linguistic intelligence; number or logic smart describes the logical-mathematical intelligence; picture smart, spatial; body, sports, or hand smart, bodily-kinesthetic; music smart, musical; people smart, interpersonal; self smart, intrapersonal; and nature smart is used to describe the naturalist intelligence. (Armstrong, 32) The following charts provide an understanding of how individual students, with strength in a particular intelligence, learn, how they think, and what they love.

### Eight Ways of Learning

<table>
<thead>
<tr>
<th>Children who are highly:</th>
<th>THINK</th>
<th>LOVE</th>
<th>NEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linguistic</td>
<td>in words</td>
<td>reading, writing, telling stories, playing word games</td>
<td>books, tapes, writing tools, paper, diaries, dialogue, discussion, debate, stories</td>
</tr>
<tr>
<td>Logical-Mathematical</td>
<td>by reasoning</td>
<td>experimenting, questioning, figuring out logical puzzles, calculating</td>
<td>materials to experiment with, science materials, manipulatives, trips to the planetarium and science museum</td>
</tr>
<tr>
<td>Spatial</td>
<td>in images and pictures</td>
<td>designing, drawing, visualizing, doodling</td>
<td>art, LEGOs, video, movies, slides, imagination games, mazes, puzzles, illustrated books, trips to art museums</td>
</tr>
<tr>
<td>Bodily-Kinesthetic</td>
<td>through somatic sensations</td>
<td>dancing, running, jumping, building, touching, gesturing</td>
<td>role play, drama, movement, things to build, sports and physical games, tactile experiences, hands-on learning</td>
</tr>
<tr>
<td>Musical</td>
<td>via rhythms and melodies</td>
<td>singing, whistling, humming, tapping feet and hands, listening</td>
<td>sing-along time, trips to concerts, music playing at home and school, musical instruments</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>by bouncing ideas off other people</td>
<td>leading, organizing, relating, manipulating, mediating, partying</td>
<td>friends, group games, social gatherings, community events, clubs, mentors/apprenticeships</td>
</tr>
<tr>
<td>Intrapersonal</td>
<td>in relation to their needs, feelings, and goals</td>
<td>setting goals, mediating, dreaming, planning, reflecting</td>
<td>secret places, time alone, self-paced projects, choices</td>
</tr>
<tr>
<td>Naturalist</td>
<td>through nature and natural forms</td>
<td>playing with pets, gardening, investigating nature, raising animals, caring for planet earth</td>
<td>access to nature, opportunities for interacting with animals, tools for investigating nature (e.g., magnifying glass, binoculars)</td>
</tr>
</tbody>
</table>

(Chart from *Multiple Intelligences In the Classroom*, Thomas Armstrong, 22)
Summary of the Eight Ways of Teaching

<table>
<thead>
<tr>
<th>Intelligence</th>
<th>Sample Educational Movement (primary Intelligence)</th>
<th>Sample Teacher Presentation Skill</th>
<th>Sample Activity to Begin a Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linguistic</td>
<td>Whole Language</td>
<td>teaching through storytelling</td>
<td>long word on the blackboard</td>
</tr>
<tr>
<td>Logical-Mathematical</td>
<td>Critical Thinking</td>
<td>Socratic questioning</td>
<td>posing a logical paradox</td>
</tr>
<tr>
<td>Spatial</td>
<td>Integrated Arts Instruction</td>
<td>drawing/mind-mapping concepts</td>
<td>unusual picture on the overhead</td>
</tr>
<tr>
<td>Bodily-Kinesthetic</td>
<td>Hands-On Learning</td>
<td>using gestures/dramatic expressions</td>
<td>mysterious artifact passed around the class</td>
</tr>
<tr>
<td>Musical</td>
<td>&quot;Suggestopedia&quot;</td>
<td>using voice rhythmically</td>
<td>piece of music played as students come into class</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>Cooperative Learning</td>
<td>dynamically interacting with students</td>
<td>&quot;Turn to a neighbor and share...&quot;</td>
</tr>
<tr>
<td>Intrapersonal</td>
<td>Individualized Instruction</td>
<td>bringing feeling into presentation</td>
<td>&quot;Close your eyes and think of a time in your life when...&quot;</td>
</tr>
<tr>
<td>Naturalist</td>
<td>Ecological Studies</td>
<td>linking subject matter to natural phenomena</td>
<td>bring in an interesting plant or animal to spark discussion about topic</td>
</tr>
</tbody>
</table>

(Chart from Multiple Intelligences In the Classroom, Thomas Armstrong, 42)

Thomas Armstrong’s book, which applies Gardner’s ideas to many aspects of the educational system, even suggests teaching strategies for the different intelligences. A linguistic teaching strategy might include brainstorming, tape recording, and publishing. Logical-mathematical strategies might include Socratic questioning, calculations, and qualifications. Visualization, idea sketching, and picture metaphors can be used as spatial strategies, while a bodily-kinesthetic teaching strategy might use body answers, body maps, and hands-on thinking. A music teacher could employ discographies, rhythms, songs, raps, and chants as classroom strategies. The interpersonal strategy would use peer sharing, people sculptures, and cooperative groups; the intrapersonal strategies would focus on personal connections, choice time, and goal-setting sessions. Last, but not least, the naturalist strategy might use plants as props, a nature walk, or even have a pet in the classroom.

These charts and articulated teaching strategies begin to paint a picture of possible individual learning styles, as well as begin to suggest how architecture might influence the effectiveness of the learning environment.

"Multiple Intelligence (MI) schools of the future will look less like schools and more like the real world, with traditional schools serving as temporary conduits through which students move on their way to meaningful experiences in the community.” (Armstrong, 86)
Asuming the importance of individualized learning to be true, then what are the architectural implications in the redevelopment of learning spaces? Can architectural vocabulary influence the effectiveness of student learning? Are there any innovative learning spaces to use as precedents? I did find some precedent studies that serve as good examples for innovative learning environments; however, I was not interested in the overall school design, but rather individual spaces that began to somehow address individual learning styles. The three images (left) are good examples at how architectural vocabulary might impact the learning environment.

In the Lucy Daniels Foundation and Preschool, Clark and Menefee Architects designed a unique critique space where the students can display and review their work. The large window allows natural light to illuminate the artwork, and the built-in window seat allows comfort during the presentation of student work. The window seat also clears the corridor and allows possible interaction with other students and teachers that happen to be walking by. This example begins to illustrate how architecture can begin to address different learning styles, proposed by Howard Gardner.

In the same school Clark and Menefee provide an outdoor learning space. While allowing students ample exposure to the natural elements (sunlight and fresh air), the architect took specific measures to create some enclosure with the overhead beams. This is a good example of how the students are free to interpret this learning space differently. The bottom image shows The Corinne A. Seeds University Elementary School, designed by Barton Phelps & Associates. This image depicts a flexible learning space that might allow the users to be responsible for shaping their own learning space. With movable tables, large glass exterior partitions (allowing natural light and outdoor access), and flexible ceiling/lighting grid; the user has the freedom to individually reinterpret the learning space. These examples begin to show how architectural decisions can have a dramatic impact on learning environments.
The next step of my thesis exploration was a small environmental laboratory. This was a short, 5-week project completed during the fall 2002 semester. I was mostly interested in what ways the architectural scale, material palette, organization, orientation, and detail design affected the learning process in this small (25-35 students) laboratory. By focusing on a single learning space, the laboratory, I was able to take a closer look at how the architectural vocabulary would affect the learning environment.

**Orientation.** Represented by the neutral material in the model, the north and west facades of the laboratory are a solid masonry material. These thick bearing walls will act as a barrier that blocks the winter winds. The site orientation was the driving factor for the laboratory organization. The lab entry and storage are located on the west to again, prevent winter winds from entering the activity/exploration area (shown in white museum board in the photographs). This activity/exploration area is a taller facade, constructed of steel and glass. This tall glass elevation will have operable windows to take advantage of passive cooling in the summer.
Scale. The scale throughout the environmental laboratory is varied, dependent upon the function of the space. As seen in the plan, you enter near the southwest corner of the laboratory. The entry vestibule is designed at a human scale with an 8 or 9 feet ceiling height. Once you move through the entry vestibule, you enter the main laboratory space, which is a much taller space. The ceiling slopes from 18 feet (south) down to 15 feet (north) and oversized structural trusses give the allusion of an even lower ceiling height, while attempting to provide the users with knowledge of the laboratory construction. The individual learning space adjacent to the north side of the main laboratory space are also designed around a more human scale with a ceiling height of 8 to 9 feet.

Organization. As mentioned, the laboratory organization is primarily based on site orientation factors. The individual learning spaces were placed adjacent to the main laboratory space to allow the respective users to integrate during projects or other activities.
Materials. The material palette for the environmental laboratory was intended to be diverse without detracting from the aesthetics of the space. The "solid" facades intentionally designed to block winter winds would be brick masonry. These "solid" spaces would also have a flat roof. The more transparent (main laboratory space) facades with operable windows will take advantage of the summer breezes and be primarily steel and glass. The main laboratory space will have a sloped standing-seam metal roof. The oversized metal trusses extending down in front of the individual learning spaces will connect the contrasting materials in each space. A concrete footing with brick veneer will support these trusses. The floor will be a durable material that will allow spills and extra wear and tear—probably some form of concrete.

Detail. The laboratory detailing was researched at various levels. Starting with exterior detailing, the sloped metal roof will slope back towards the individual learning space and drain onto an overhead skylight. The water will then drain out two scuppers on each side of the window below (right sketch). This will allow students to witness the laboratory's interaction with the natural elements. Another way this interaction will take place is through operable windows and sunshades. This will allow the students to control their comfort level by manipulating the amount of solar heat and passive cooling within the space.
site data

The new charter middle school will be located on Barr Street, downtown Fort Wayne, Indiana. The site is near the heart of the downtown and is within a close proximity to many valuable community resources. Directly adjacent to the urban site is St. Paul's Lutheran Church. St. Paul's Lutheran Church has a strong gothic character and is one of the well-known ecclesiastical symbols of downtown Fort Wayne, IN.

Some of the valuable community resources include the following: Fort Wayne Historical Museum (3 blocks), Embassy Theatre (3 blocks), YMCA (1/2 block), Botanical Gardens (3 blocks), Fort Wayne Museum of Art (6 blocks), Headwaters Park (6 blocks), and the Grand Wayne Convention Center (2 blocks).

The cultural context of my thesis deals with the current issues of school reform. Recently, educators, administrators, and many others have begun to question the effectiveness of today's public education system and facilities. Research currently being done is suggesting that the existing teaching/learning process is too passive, and ineffective in reaching a wide array of student's learning styles.
As today's technology, employment, and life styles are rapidly changing, our culture's belief, ethics, and values are not far behind. This has many implications in today's public education system. There are more resources and materials, presented on various types of mediums, available today than ever before. Today's students are coming from different types of socio-economic backgrounds and families. These cultural differences must somehow be addressed through educational reform. The public school system should place primary emphasis on the students and the actual learning process, not teacher's unions, budgets, and other secondary issues.
program

learning laboratories
(based on individual learning styles)

- 2-naturalist learning space
- 1-bodily kinesthetic learning space
- 4-logical-mathematical learning space
- 2-interpersonal learning space
- 2-intrapersonal learning space
- 2-linguistic learning space
- 2-spatial learning space
- 1-musical learning space

This middle school will be programmed as a theoretical urban, charter middle school in downtown Fort Wayne, Indiana. This charter school will be used to promote new teaching methods that will address a wider array of learning styles. Specifically, eight different learning styles, Howard Gardner's theory of multiple intelligences, will be represented in these learning laboratories. Each learning laboratory will contain large group, small group, and individual learning space as well as space for experimentation and long-term projects. To reduce program area, these learning laboratories will need to be accommodating to different teaching/learning styles. This urban site contains numerous community resources that are no further than 5 blocks away. Within a 3-block proximity are a YMCA, historical museum, botanical garden, theater, and a convention center. It would be very beneficial to take advantage of these community resources. This could be done by frequent "field trips" to these resources and also by programming space within the urban school that community members could use for instruction. To achieve this the administration, information center, and exploratory laboratories (community teaching spaces) will be programmatically separated from the classroom/dining spaces.
### Building Specifications

<table>
<thead>
<tr>
<th>Space</th>
<th>Area (sq. ft.)</th>
<th>#</th>
<th>Total Area(sq. ft.)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Studio (Classroom)</td>
<td>1,300</td>
<td>15</td>
<td>19,500</td>
<td>(Grades 6-8, 20-26 students/studio. Includes storage)</td>
</tr>
<tr>
<td>Computer Resource Rooms</td>
<td>850</td>
<td>2</td>
<td>1,700</td>
<td>(Keyboarding, graphic arts, writing lab)</td>
</tr>
<tr>
<td>Music Room</td>
<td>1,500</td>
<td>1</td>
<td>1,500</td>
<td>(Includes 300 sq. ft. of storage)</td>
</tr>
<tr>
<td>Student Teacher Resource Rm.</td>
<td>450</td>
<td>1</td>
<td>450</td>
<td></td>
</tr>
<tr>
<td>Small Group Resource Rm.</td>
<td>450</td>
<td>2</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>Special Education Rm.</td>
<td>1,000</td>
<td>1</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>Exploratory Lab (Art &amp; Voc.)</td>
<td>1,400</td>
<td>2</td>
<td>2,800</td>
<td>(Home Economics, Art, Other Vocational)</td>
</tr>
<tr>
<td><strong>SUB TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>27,850</strong></td>
<td></td>
</tr>
<tr>
<td>Information Center</td>
<td>2,400</td>
<td>1</td>
<td>2,400</td>
<td>(5 s.f. per student)</td>
</tr>
<tr>
<td>Info Center Support Space</td>
<td>1,500</td>
<td>1</td>
<td>1,500</td>
<td></td>
</tr>
<tr>
<td><strong>SUB TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>3,900</strong></td>
<td></td>
</tr>
<tr>
<td>Daring</td>
<td>1,800</td>
<td>1</td>
<td>1,800</td>
<td>(2-3 lunch periods)</td>
</tr>
<tr>
<td>Kitchen</td>
<td>1,500</td>
<td>1</td>
<td>1,500</td>
<td></td>
</tr>
<tr>
<td>Serving</td>
<td>400</td>
<td>1</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td><strong>SUB TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>3,700</strong></td>
<td></td>
</tr>
<tr>
<td>Principal</td>
<td>200</td>
<td>1</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Reception</td>
<td>400</td>
<td>1</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Secretary</td>
<td>150</td>
<td>1</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td>150</td>
<td>1</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Office Work Room</td>
<td>300</td>
<td>1</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Conference</td>
<td>200</td>
<td>1</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Records</td>
<td>100</td>
<td>1</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Office Storage</td>
<td>100</td>
<td>1</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Guidance Room</td>
<td>300</td>
<td>1</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Other Student Services</td>
<td>200</td>
<td>1</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Team/Office Workroom</td>
<td>200</td>
<td>3</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>Teacher Lounge</td>
<td>300</td>
<td>1</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Book Storage</td>
<td>700</td>
<td>1</td>
<td>700</td>
<td></td>
</tr>
<tr>
<td>General Storage</td>
<td>800</td>
<td>1</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>Commons</td>
<td>500</td>
<td>1</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td><strong>SUB TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>4,800</strong></td>
<td></td>
</tr>
<tr>
<td>Walls, toilets, circulation, mechanical—37%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>55,200</strong></td>
<td></td>
</tr>
<tr>
<td>Visitor Parking</td>
<td>6,000</td>
<td>1</td>
<td>6,000</td>
<td>(15 parking spaces)</td>
</tr>
<tr>
<td>Outdoor Learning/Play</td>
<td>15,000</td>
<td>1</td>
<td>15,000</td>
<td>(Playgrounds &amp; outdoor classrooms) 50 s.f./student</td>
</tr>
<tr>
<td><strong>OUTDOOR/PARKING TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>21,000</strong></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL PROGRAM AREA</strong></td>
<td></td>
<td></td>
<td><strong>76,200</strong></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL SITE AREA</strong></td>
<td></td>
<td></td>
<td><strong>81,200</strong></td>
<td></td>
</tr>
</tbody>
</table>
design process

The design process began with the exploration of the learning spaces. I wanted to first design ideal learning environments without any site or program restrictions. The design criteria for these spaces were based on how students, of a particular learning style, learn, how they think and finally, what they love. The characteristics of each learning style were captured in the sketches rendered for each of the eight learning styles.

Once the character sketches were completed for all learning styles, the effectiveness of the resulting learning space was examined and evaluated. Intrapersonal learners need time alone, self-paced projects, and freedom to choose a learning path. This suggests the intrapersonal learners may benefit from the design of individual workspaces at a human scale. Linguistic learners think in words and love reading, writing, and telling stories. A design with storytelling spaces at various scales would benefit the linguistic learners. The transition of ceiling heights could create creative storytelling niches. Spatial learners think in images and pictures. They love to design, draw, and doodle. Space for group brainstorming activities/movies/discussion along with smaller scale spaces to allow long-term creative projects will benefit spatial learning. Naturalist learners think through nature and natural forms. These students need access to nature, interaction with animals, and tools for investigating nature. A large scale, open space that has direct access to the outdoors, indoor plantings, and unconventional lecture (grass terraces) spaces will accommodate naturalist students. Interpersonal learners enjoy leading, organizing, modeling, and think by bouncing ideas off of others. These students’ learning environment should be integrated into circulation patterns, be transparent, and allow for many different types of activities to occur. Musical learning occurs through rhythms and melodies and these students love singing, whistling, and listening. A performance space where students are able to manipulate surface materials and wall planes will allow musical learners to directly experience acoustical effects of the building materials. Logical-mathematical learners think by reasoning and love experimenting, questioning, and calculating. This learning space will closely resemble a typical classroom in a current middle school, but the design will closely examine the proportions, scale, and order of building materials.
Last but not least, **bodily-kinesthetic** learners think through somatic sensations. Bodily-kinesthetic students love dancing, running, jumping, and building. Their learning space will be open and allow direct access to outdoor learning. This open volume will allow students to design their own learning environment to suit their changing needs.

**Concepts.** After exploring the individual learning styles, three overall design concepts were developed. First, **overlapping** of spaces would integrate the unique learning spaces. This was achieved through the visual, physical, and material overlapping. Second was transition at the entire building scale and the transition from public space into individual learning spaces. The Barr Street facade will address existing context with a “traditional” school facade and transition into the innovative, more transparent, learning spaces as you move east along the site. Integrating individual learning into the public spaces of the middle school will reduce any implied barriers between the public (circulation) and the student’s learning space. Third, is the idea of **solid/void.** This conceptually complements the transition from conventional to innovative. The community and service areas will be masonry and serve as anchors for the transparent academic learning spaces.
schematic floor plans...

structural study model—
  basswood indicates steel
  column and beam system
  and chipboard indicates
  shear wall system

first floor plan  (not to scale)

structural study model—
  structural steel system
  used for learning spaces,
  (south facade)

second floor plan  (not to scale)

structural study model—
  chipboard and one of
  two fire stairs (gray)
  (west facade)

third floor plan  (not to scale)

structural study model—
  elevation view showing
  two mechanical chases
  (dark gray) and the
  second fire stairs (gray)
  (east facade)
Schematic design. After designing the ideal learning environments, without contextual considerations, the overall middle school design was addressed. At a large scale, the building organization was determined by the particular use of each space. Administration and spaces accessible to community members (information center, multi-purpose room, computer resource room, and exploratory laboratories) were programmatically and physically separated from the academic functions of the middle school. These spaces were separated by the entry and also with a service core that provide restrooms, mechanical chases, and vertical circulation. The contrasting materials of each space further imply this separation. This is shown in the schematic floor plans as well as the study model images.
FINAL THESIS DESIGN

A MIDDLE SCHOOL LEARNING LABORATORY
Bodily-kinesthetic. The bodily-kinesthetic learning space needs to be a flexible, open room and provide direct access to outdoor learning/playground space. An increase in scale in this environment will accommodate the flexibility of the space and allow for a hanging ceiling grid that allows students and teachers the opportunity to manipulate the lighting. To allow for direct access to the outdoor learning/playground area, and maximum daylight; the bodily-kinesthetic learning will have a direct south orientation and be located on the first floor. Detail. The design of a 5'x5' grid of connections in the interior and exterior learning spaces will help to increase learning flexibility and enhance the effectiveness of the bodily-kinesthetic learning space. The materials will most importantly be durable, and also neutral in material finish. The floor is concrete and with exception of the south glazed wall, the interior walls will be some type of corkboard to allow for pin-ups and backdrops for performances to be easily installed, and as previously mentioned, the ceiling will be unfinished with a hanging steel grid. Due to the openness of the bodily-kinesthetic learning space, the organization of space was not a factor for this learning style.
**Interpersonal.** The building circulation patterns are important to the design of the interpersonal learning space. Limited enclosure and direct physical/visual connections to the public spaces of the middle school are also important criteria. While the orientation of this space was not a critical factor, the organization was very important. The interpersonal learning spaces were designed between an exterior circulation path and adjacency to the middle school atrium. Because of the importance of social connections for these learners, the interpersonal learning spaces were also placed on the first floor. The vertical scale of the interpersonal spaces is designed to be very human and comfortable, but glazed interior and exterior walls were used to create implied extensions of this learning space into the adjacent public spaces. Durability of materials was also important in the interpersonal spaces, but not as important as the comfort—carpet was used in the learning areas and wood flooring used for circulation. To increase the extension of the interpersonal learning space into surrounding public spaces, the design of a social gathering space in the atrium was important. This bench detail surrounded by a half-height partition will encourage classroom activities in the atrium.
**Intrapersonal.** Self-paced instruction, time alone, and planning are critical elements for intrapersonal learners. These educational needs were accommodated, architecturally through the careful organization of this learning space. Individual workstations were placed around the perimeter of the space, with larger workstations placed in the center of the space for student/teacher discussion or the creation of interest centers. The workstations were carefully detailed. Large openings between the workstations allow communication between intrapersonal learners, when desired. These openings also make it easier for the teacher to monitor the students during independent studies or self-paced instruction. The materials are very similar to the interpersonal learning space, in that durability is important, but not as important as the comfort of materials. The scale of the individual workstations is important to create a comfortable work environment. The work surface should be located at a comfortable height for students ages 12-15 and the ceiling height should not be too low, but create an intimate workspace at each individual station. Orientation of the intrapersonal learning spaces is not an important design factor.
Linguistic. Reading, writing, and storytelling are what linguistic learners love. Changes in scale are important to establish creative storytelling, and reading spaces within the linguistic learning space. The entry to the linguistic space will use a typical ceiling height, but then dramatically increase the scale with raised ceilings inside the learning space. The scale will then be dramatically lowered in various areas within the linguistic room. These lowered ceilings will create unique workspaces for student groups of various sizes. The organization will depend on the placement of the main storytelling space, and have several creative spaces adjacent to this main space. The materials will also be used creatively within the space. Carpet patterns that also “tell a story” through unique patterns and design will be used. The color scheme used in the linguistic learning space will provide more colors than other learning environments, dependent upon the colors in the carpet patterns. The orientation of the linguistic learning spaces is not the primary concern; however, many of the creative workspaces should have unique apertures for viewing the outdoors. Details such as the size and shape of the entries into small-scale reading spaces will enhance the uniqueness of this learning environment.
Logical-mathematical learners love to experiment, question, and figure out logical puzzles. One way to enhance these types of learners is to create subtle puzzles through the design details of the space itself. This can be achieved through floor patterns based on ideas of geometry and hanging-ceiling panels that are designed based on a particular proportioning system. The window mullions can even begin to divide the same windows into unique patterns of geometry. These subtle design decisions may not be apparent to every student, but will most likely cause many logical-mathematical learners to question the ideas behind these architectural decisions. The materials in this learning space will have some similarities to current middle school classrooms, but with the addition of new classroom technology and improved architectural design criteria. Orientation is not the most important factor in this learning space design, but should provide maximum day lighting. The organization is of minimal importance and should be based on the particular orientation of the space. The hanging ceiling panels should be hung at a height that creates a comfortable scale in the learning environment for most students.
Musical. Musical learners learn via rhythms and melodies. They love singing, whistling, and listening. The organization of the musical learning space will be similar to a typical music classroom, but will include an audio room to introduce students to production technology and instrument storage adjacent to the musical learning space. Orientation and scale are not important factors in the musical learning space. The architectural focus of the musical laboratory will be the materials and good detailing. Materials that can be manipulated will educate the students on the importance of acoustics in musical learning. Double-sided tiles of different materials will be fixed on a rotating axis. Each side of the tile will have a different material that has a unique effect on the acoustics. Students will be able to experiment with how different material combinations can affect things such as the sound reverberation time. Hanging acoustical ceiling panels will not be movable, but will help to increase the effectiveness of this performance space. Another detail provided in the musical learning space is movable partitions on the opposite wall from the movable tiles. The partitions will swing out, perpendicular to the wall plane and students can explore how these movable planes will affect the refraction and reflection of the sound.
Naturalist. Naturalist learners need access to nature, interaction with animals, and tools for investigating nature. The needs of the naturalist learner significantly impact the design of the naturalist space. One way to provide access to nature is by bringing nature into the learning space. In order to do this, the orientation of the naturalist space is facing south and entry to the space is on the first floor. The scale of the naturalist learning space was greatly increased to provide an abundance of natural light and also to allow for mature plant life to grow within the space. The naturalist learning space will use pivoting glass doors; a similar detail is used in the bodily-kinesthetic laboratory. These transparent doors will allow for learning activities to “spill” outdoors when weather permits and create a better transition from indoors to outdoors. The use of natural materials is important within the naturalist learning space. Grass terraces will be used for lectures, topsoil for activity areas, and a flagstone used for circulation paths. This non-traditional learning space will provide excellent resources for things naturalist students love such as gardening, raising animals and investigating nature. The organization of the naturalist space was primarily determined by orientation requirements.
Spatial. Spatial learners think with images and pictures. They also love to design, draw, and visualize. The organization of the spatial learning space provides space for the class to doodle, watch films, and present ideas. Adjacent to this group activity space are smaller spaces for individual long-term projects and small group activities. The orientation of the spatial learning spaces allows for maximum natural lighting of the individual work surfaces. The scale of the group activity space is larger than a typical classroom and then reduced by a bulkhead over the individual workspaces. The large-scale group activity space will allow for the installation of audio/visual equipment without affecting the scale of this space. The bulkhead above the individual workspace reduces the scale to create a smaller, more comfortable working environment. The materials are similar to the intrapersonal and interpersonal learning spaces with one exception. Wall surfaces will include large dry-erase boards mounted on interior wall surfaces. This will allow students to use the expansive wall surfaces as a resource for a variety of activities. While typical detailing is important in this space the only detail unique to this space is the half-height partitions separating individual workspaces.
first floor plan  not to scale
second floor plan
not to scale

third floor plan
not to scale
mechanical floor plan

not to scale

PLAN INDEX
1. study area
2. computer resource room (community)
3. information center
4. information center support
5. girl's bathroom
6. boy's bathroom
7. musical learning laboratory
8. logical-mathematical learning laboratory
9. computer resources (academic)
10. spatial learning laboratory
11. linguistic learning laboratory
12. open to naturalist learning laboratory below
13. outdoor gathering space
14. exploratory laboratory (community use)
15. intrapersonal learning laboratory
16. common reading area
17. mechanical space
south elevation  not to scale

west elevation  not to scale
west elevation studies

roof plan studies
transverse section through community/admin. not to scale

transverse section through academic not to scale
transverse section through
naturalist learning. not to scale

SECTION INDEX

1. exploratory laboratories (community)
2. outdoor gathering space
3. information center
4. study area
5. multi-purpose room
6. entry corridor
7. administration
8. intrapersonal learning laboratory
9. spatial learning laboratory
10. musical learning laboratory
11. bodily-kinesthetic learning laboratory
12. dining/common space
13. kitchen (food storage)
14. mechanical space
15. naturalist learning space
16. logical-mathematical learning laboratory
17. kitchen (food preparation)
reflection

To conclude what has been a six month exploration into education facilities, curriculum, and learning in general; I sat down to discuss my thesis with Education Professor, Scott Popplewell. As a student teacher supervisor, a former teacher, and doing some grant work for a few Indianapolis middle schools; Professor Popplewell has observed many different learning environments. He has seen the educational continuum go from more progressive to the current status, which happens to be more conservative. Current administrators are extremely concerned with standardized test results and the fundamentals of education—reading and writing. While I believe that reading and writing are very important and should be stressed at any level, I do not feel that standardized tests are always a good indicator of student's success or intelligence. My research indicates that many students simply are not good test takers, and other students have a much higher level of intelligence in areas not covered by a standardized test. Popplewell has seen this continuum change in his career and believes that a shift will also occur within the next decade. As I learn about this continuum, I begin to wonder where my research regarding individual learning styles might fit.

Is there a place is the public education system for classrooms based on an individual learning style? Although I think this would be a great experiment, I force myself to be a realist and am convinced this laboratory model I have designed would not work within the public education system. There are simply too many variables to be determined for this idea to be successful in an average sized public middle school; however, I do believe the public education system would benefit by borrowing some of the ideas I am suggesting in my middle school laboratory—both through architecture and curriculum design.

One of these ideas, suggested by Scott Popplewell, is for teachers to take time at the beginning of each year to determine which methods of instruction would be most effective to his/her current class. I am not suggesting that the teacher determines the strongest intelligence for each student, but the teacher could find out which learning styles would have the greatest impact on a particular class. Another measure teachers could take to diversify their teaching methods would be to address a specific intelligence or intelligences each week. An example might be for the teacher to plan two weeks of lessons based on a naturalist learner. This would effectively address students who cannot learn by a passive teaching method.
While there may be many other ways to address individual learning styles through redeveloping curriculum, the primary goal of this thesis was to explore architectural implications on making learning environments more effective. As I stated earlier, I in no way think public schools should be divided into eight separate learning styles, but I have found many ways that architecture can increase the effectiveness of public education. I believe one way public schools can make learning more effective is by designing schools that are more interactive. Research indicates that students retain a significantly greater amount of knowledge by experiencing directly, to practice doing, or attempting to teach other. This will make students mutually responsible for learning. If students have greater freedom to manipulate and take part in designing individual learning environments, I feel many students will enjoy learning, not view it as an obligation. Many architectural components that I have addressed in the unique learning laboratories are not specifically related to their respective learning style (intelligence). These architectural components include the scale created by hanging ceiling panels, various material textures created by using unique, quality materials, and by designing subtle geometries and patterns into many of the construction systems. This rich architectural vocabulary will begin to indirectly address many learning styles, even in a public school. I feel that individual learning styles will be addressed in public education when school designers start to see the overall school building as a learning space. The designers should explore the transitions from public space to academic space and begin to overlap the two—conceptually and literally. The transitions from interior learning spaces to exterior, natural learning spaces should also be explored.

I would like to mention that I feel very strongly about the redevelopment of public education and think administrators need to take a serious look at students' individual learning styles, but through my thesis exploration I have found that these ideas would also be useful in many other disciplines. I think individual learning styles in the workplace could have a significant impact on the worker productivity and employee retention. Addressing individual learning/working styles in the corporate field would help create a diverse, healthy work environment.

Although I do not feel that I have created a simple solution to mending the problems of public education, I am confident that the ideas mentioned in this thesis are a good starting point for the evaluation and change of public
education. I hope to continue the evaluation of the education system, and hopefully some form of redevelopment, through architectural practice. It may be naive to think that the public education system is going to be drastically restructured anytime soon, but as society as well as schools become more diverse, something must be done to address the increasing diversity through learning.
bibliography


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