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I, Katie Hunter, hereby submit this work as part of the requirements for the degree of:

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Environmental Psychology in Classroom Design

This work and its defense approved by:

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Environmental Psychology in Classroom Design

Principles adapted from environmental psychology can be applied to the design of a classroom to improve creative problem-solving skills in gifted children.

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Abstract

Lessons learned from environmental psychology research conducted over the past 40 years should be applied to classroom design to enhance creative problem-solving skills in students. These skills are believed to be the primary indicator of success in today’s information age economy.

Research by environmental psychologists, including Ann Taylor, Paul Gump and Carol Simon Weinstein, who have defined how the physical environment impacts learning and other skill development associated with creative problem-solving, will be reviewed and used to develop a list of design criteria for learning spaces.

Classroom areas should contain: a blend of large group, small group and individual spaces, flexible classroom layouts that encourage discussion and participation in addition to the traditional lecture-style room, colors geared toward the subject being taught, an aesthetically pleasing and unusual environment to stimulate creativity, and specialized spaces to encourage specific creative and cognitive skills. There should be plants in the classroom and a nature area on the school grounds to reduce stress and improve creativity.

A set of design criteria based on environmental psychology will be developed to create a new model for classrooms. This new model will allow for students to develop the creative problem-solving skills that are needed in today’s business environment.
Acknowledgments

This thesis is dedicated to my nephew, Daniel Hunter, and my niece, Elizabeth Hunter, who were the main inspiration behind this work. I also owe Daniel many thanks for his frequent and generous input on the process.

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Introduction

My personal philosophy about architecture is the basis for this thesis. I believe that building is actually the creation of spaces for living. In order to create superlative spaces, the architect has to understand the living that is to occur in the space. It is impossible to create a superlative building without superlative spaces.

More effective design principles can be developed through the application of environmental psychology to school classrooms in order to enhance the development of creative problem solving skills in gifted students.

Despite dramatic changes in our society and our economy since the Industrial Revolution, most classrooms designs are based on a model more than 200 years old.\(^1\) Is this really the best way to design a classroom? Or, with our modern sciences, do we have new options that are ready to be explored? Can we create classrooms that respond better to the needs of today’s students?

Business leaders today are looking for creative problem solvers who can function more effectively in the Information Age where technology is constantly changing. The ability to solve problems creatively is key to success in this economy.\(^2\)

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Research by environmental psychologists show that the traditional, formal arrangement of most elementary classrooms results in over 80% of verbal communication coming from the teacher, discouraging the verbal exchange of ideas that is necessary to creativity in education. Environmental psychologists also agree that any kind of unusual environment stimulates creativity, although unpleasant environments can cause negative emotions about a place.\textsuperscript{3}

\textsuperscript{3} Taylor, pp. 8-71.
The Call for Creative Problem-Solving Skills

During the Industrial Revolution the focus of the economy shifted away from farm produce and manual craftsmanship to standardized industrial products. Our economy is currently undergoing another revolutionary shift: from industrial products to the provision of services and, finally, to the exchange of information. The technology revolution has shifted things again. Now, the emphasis is on information, the creation, creative use, and management of information. Gone are the days when skills learned in school could be used throughout life. Today’s rapidly changing technologies force workers to constantly upgrade their skills or be left behind. Economists and business leaders are calling for creative problem-solving as the most important skill necessary for success in workers today.4

Richard Florida focuses on this phenomenon in his book, The Rise of the Creative Class.5 He describes the creative class as a group of people who crave the opportunity for creative work, are independent in nature, and who are open-minded and interested in people of other cultures, races and backgrounds. Florida describes the creative class as consisting of two components: a super-creative core including scientists, professors, writers, artists, entertainers, architects, and other cultural figures. The second component including everyone who could be

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termed a ‘creative professional,’ including people in knowledge-intensive industries like high-tech, financial services, health care, or business management.\(^6\) (graph)\(^7\)

![The Growing Creative Workforce](image)

Florida cites statistics on the steep increase in research and development spending, the sharp rise in the number of people employed in scientific or creative work, and a resultant significant rise in the number of patents issued, as evidence of the rise of the creative class. Even factories have had to learn to be more creative to compete with Japanese manufacturers such as Toyota and Matsushita where all the workers contribute their ideas as well as physical labor.\(^8\)

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\(^6\) Florida, pp. 44-53.
\(^7\) Florida, p. 47.
\(^8\) Florida, pp. 67-69.
Our new economy requires more creative problem-solving skills than ever before. Our education system and its buildings should prepare students to meet these challenges.
An Introduction to Environmental Psychology

Environmental psychology was recognized as a separate discipline in the mid-1960s. This evolution occurred because of concerns with environmental problems, urban violence, concern over natural resources, and the health effects of pollutants. In the 1970s, this interdisciplinary field became one of the “hot” psychology topics. Since then, a significant amount of scientific data has been gathered and individual branches have emerged within the umbrella of environmental psychology, including: personal space, territoriality, crowding, resource conservation, influence of culture on community, stress, learning, cognition, work environments, special populations, and violence and environment. Environmental psychology is not only studied in the United States, but also in: United Kingdom, France, Germany, and Japan, among others.\(^9\)

Most architects are aware that the environments they design affect the experience of the building’s users. However, environmental psychology is not a component of most architecture education programs, so architects base their work on past experience rather than the scientific concepts from environmental psychology.\(^{10}\)

Environmental psychology can become a tool for designing better buildings. Over 40 years of controlled scientific experiments, using tests,

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questionnaires, or metabolic monitors, research has resulted in a sizeable amount of data which can be applied to the design of a physical space to enhance the experiences and functions in them. The *Handbook of Environmental Psychology*, which provides short summaries by various experts in the field, offers nearly 1,500 pages of information alone. This wealth of information should be used to enhance our school facilities.

**Variety of Spaces**

Although traditional school buildings tend to have identical classrooms lining a long hallway, there is a possibility for variety in the spaces used for learning. Certain types of spaces have been shown to improve specific skills in students. Having a variety of materials and colors within spaces have also been shown to be stimulating. And lighting has a strong impact on the effectiveness of spaces.

**Types of Spaces**

Education can happen in noisy or quiet, interior or exterior, bright or dimly lit spaces. Some types of spaces are a better fit for some educational activities than others, such as a dramatic play area, large-motor skills area, or a library area.

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11 Stokols, pp. xi-xvi.
Environmental psychologist Anne Taylor’s primary concern is the traditional classroom which is teacher-centered and does not allow for areas for independent exploration. She decries the lack of relationship between the physical design of classrooms and the information to be taught to children. (photo)\textsuperscript{12} Taylor’s research indicates that “better environments promote better learning through improved reading, writing, concept development, and communication.”\textsuperscript{13}

Taylor recommends spaces to stimulate specific skills. Her recommendations include: dramatic play area, study space, math and science

\textsuperscript{13} Taylor, pp. 8-9.
area, listening center and library corner.\textsuperscript{14} (diagram)\textsuperscript{15}

Environmental psychologist, Carol Simon Weinstein’s research shows that an appealing, well-stocked library area encourages children to read during their free time. Judith Schickedanz’s research demonstrates that the mere existence of a library corner can significantly increase the amount of free-time children spend reading.\textsuperscript{16} Charlotte Huck, Barbara Keifer, Susan Hepler, and Janet Hickman have done studies that show the importance of including reading materials in the classroom. In separate studies, Betty Coody and Huck describe how important it is to have a well-stocked library area within the classroom. Skills developed in a

\textsuperscript{14} Taylor, pp. 48-49.
\textsuperscript{15} Taylor, p. 52.
library area include: oral and written language abilities, and interest in printed language.\textsuperscript{17}

Weinstein also suggests the inclusion of controlled large-motor skill areas within the classroom to allow children to develop motor skills and to allow an acceptable outlet for children’s energy.\textsuperscript{18} (photo)\textsuperscript{19}

An entry area in a classroom for young children can be established as a place for children to transition into school mode. Young children make the transition into school mode more successfully if the view of the classroom from


\textsuperscript{18} Weinstein, p.165.

\textsuperscript{19} Taylor, p. 40.
the entrance is familiar, inviting, and friendly. Areas such as courtyards, porches, anterooms and corridors can serve as transitional spaces where children can say good-bye to their parents and adjust to a more independent status.\textsuperscript{20}

One of the primary reasons that a variety of spaces is needed in a school is because the school must teach a wide variety of students. Because people have such wide variations in temperament, two people in the same room may be experiencing different spaces. Some individuals are ‘drawn to the life of the mind’ and require little external stimuli and do best in quiet and simple environments where they are protected from sensory overload. Other individuals, though, require a high level of external stimulation.\textsuperscript{21} Anita Olds’ research indicates precisely that: a variety of spaces, large and small, noisy and quiet, bright and dim, allows for all the different personalities to achieve a sense of belonging.\textsuperscript{22}

\textsuperscript{20} Weinstein, p. 165.
\textsuperscript{21} Gallagher, p. 74.
Materials, Colors and Textures

Perhaps one of the most obvious ways to provide interesting learning areas that stimulate creativity is the use of color, materials, and texture. Variety stimulates learning by stimulating all the senses.\textsuperscript{23} (photo)\textsuperscript{24}

Weinstein recommends: “warm colors, bright accents, textures, plants, animals, and interesting materials” to draw a child into the space and create a feeling of warmth and welcome. Variations in lighting and textures, especially those that are soft and responsive to the touch, can enhance a child’s sense of comfort.\textsuperscript{25}

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\textsuperscript{23} Taylor, pp. 60-65, 159-181.
\textsuperscript{25} Weinstein, p. 163.
variations in boundary, floor, and ceiling heights and in lighting and materials can increase a child’s sense of comfort in the classroom.\textsuperscript{26}

However, while popular wisdom holds that infants and small children thrive on a high level of stimulation, research shows that the immature brain is easily over-stimulated and overwhelmed. When a child is overwhelmed, he tends to shut out his environment instead of absorbing it and learning from it. Learning environments must be carefully designed to allow for stimulation, but not over-stimulation.\textsuperscript{27}

Although studies have shown that neither hue, lightness or color affects the perceived pleasantness of an interior space, the absence of color was considered to be a negative environmental aspect. Kuller’s study shows that subjects placed in a colorful room for a period of three hours demonstrated higher arousal (alpha component of the

\textsuperscript{26} Olds, pp. 91-138.

EEG), lower pulse rate which is thought to be a result of higher attention levels, and higher levels of emotionality.28 (photo)29

Edberg’s studies focus on textures of materials and show that there are three basic areas that draw a subject’s attention to a material: pattern, texture strength, and form of the individual texture elements. Important characteristics of textures include: depth, irregularity and fibrousness. The variation in materials in terms of these characteristics is also important in gaining subjects’ attention. Subjects were tested on a wide variety of materials including steel mesh, wood insulation board, white coarse plaster, light yellow wool, black glass, transparent cloth, oak veneer, and blue marble.30

Olds also calls for some elements in the environment to be soft and comforting. This adds warmth, welcome and interest. Pillows, plants and soft furnishings such as an upholstered couch or chairs can provide more home-like places for a child to read or dream.31

28 Kuller, Rikard. “Environmental Psychology from a Swedish Perspective.” In Stokols, p.1255.
29 Images Publishing Group, p. 153.
31 Olds, pp. 95-96.
Lighting

Daylight also has an impact on the aesthetic rating of an interior space. Important aspects of windows are size, shape, spectral transmittance and solar shielding. Research shows that the minimum acceptable window size was determined by the amount of visual information in the view. Views of nearby areas require larger windows than views of things farther away.\(^{32}\) (photo)\(^ {33}\)

While architects traditionally consider light in terms of aesthetics and visibility, some attention should also be given to the psychological impact of lighting. For example, seasonal affective disorder (SAD) is a serious psychological illness which results from deprivation of sunlight. In Alaska, residents line their windows with foil in the summer time when light is abundant.

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\(^{33}\) Photo by author.
and nearly 10 percent of the population have troubles with mania, insomnia and agitation. While architects have worked with light in the past, to create an aesthetically pleasing environment and assure visibility, buildings in New York City tend to have the same fenestration patterns as those in Miami, where only two percent of the population suffers from SAD, and as in Alaska, where people have problems from getting too many hours of light.  

A study by Erikson and Kuller showed that people lacking natural daylight had lower scores on emotional well-being as well as lower melatonin and cortisol. Artificial illumination designed to match daylight caused lower levels of eye strain than traditional fluorescent lighting. Other studies show that windows are more critical to emotional and physical health the farther north the building site is and the less stimulating the activity.

Summary

An integral part of the learning environment is stimulation. A variety of learning spaces, including a dramatic play area, math/science space, and library corner, provide opportunities for students to make connections between disciplines. Color, material variation and lighting should be used in learning areas to enhance learning by stimulating the senses. Light should be used to enhance the use of colors and materials in a learning environment and to improve the quality of the environment.

34 Gallagher, p. 74.
35 Kuller, pp. 1255-1256.
Scale Considerations

The idea that a school should be designed for children is hardly new. In 1954, William Caudill said this should be the most important concept in the design of school buildings.\textsuperscript{36} There should be a variety of size of spaces, spaces for large groups, small groups, and individual work. At least some of the spaces in the school should be designed at the child’s scale because it is a child’s building. (Photo)\textsuperscript{37}

Size of Spaces

Large spaces, small group and individual spaces fulfill different functional needs in education. Larger spaces are good for presentations and lectures, physically active learning, and large-group activities. Small group spaces are


\textsuperscript{37} Taylor, p. 14.
important to help in group interaction, to allow for more discussion and participation, and to allow the educational program to be tailored more to the students’ needs. Individual spaces allow for the student to have some privacy and to work independently from others.

Environmental psychologists recommend spaces of different sizes. Taylor recommends that children need personal and private space, that there should be private, small group and large group spaces, and that a large, open multi-use area should be included in each classroom to allow for active student movement. And materials should be stored adjacent to the areas where they will be used.\textsuperscript{38}

Density within a space also has a strong effect on what happens there. In Paul Gump’s study of grade school children, he found that children in schools with more open plans were more active, played more, and engaged in more off-task behavior than their counterparts in more traditional buildings. Meanwhile, teachers in more traditional buildings spent more time in set-up and clean-up for activities and lost more time to handling disruptions.\textsuperscript{39} Density can lead to increased conflict when children interact socially, or it can decrease interaction. Therefore, quiet areas such as lecture spaces, may function better if a higher

\textsuperscript{38} Taylor, pp. 54-57, 68.

\textsuperscript{39} Gump, Paul V. “Operating Environments in Open and Traditional Schools,” \textit{The School Review}, August 1974, no. 84, pp. 575-593.
density is achieved, while more active areas require more space to reduce conflict.40

According to research by Peter Smith and Kevin Connolly, increasing density in a learning environment did not increase aggression until space was reduced to 15 square feet per child. Reductions in resources did increase conflict even in same-sized spaces. This finding is consistent with numerous other studies cited by Smith and Connolly.41

Gump points out that research shows a need for privacy as a contributor to optimum development. He recommends that students should be able to “open and close themselves to others.”42 In a study by John Cotterell, sensitive students reported higher feelings of anxiety when working in large spaces and researchers noted a longer transition time between activities.43 Studies have shown that the large open-plan schools resulted in students having lower test scores, also indicative of the need for smaller spaces.44 (photo)45

One of Carol Simon Weinstein’s studies shows that private spaces give children a place to escape from being a part of the crowd. Fred Linn Osmon’s studies show that over-stimulated, upset or tired children need a place for retreat, quiet thought and quiet individual activities. A study by Sherry Ahrentzen and Gary W. Evans showed that when students want to be alone, they prefer to be in secluded study areas or corners. Christopher Thurber and Jon Malinowski did a study of school-aged boys showed that unhappy children were more likely to choose favorite places where they could be alone while their happier counterparts chose places to socialize. Individual spaces should be somewhat enclosed, but still allow a view out. A study by Curtis and Smith shows that spaces without a view out are less likely to be used by children. Curtis and Smith

also found that children who learn in a creative environment are more likely to be excited about the learning process.\textsuperscript{49}

Clear boundaries should be set between areas as this has been shown to decrease conflict. With boundaries, place identity improves, giving clues to students as to the intended use of the area. Studies by Elizabeth Prescott, Elizabeth Jones, and Sibyl Kritchevsky show greater task involvement with well-defined activity areas, separation of incompatible activities (messy/clean or noisy/quiet) and clear circulation paths that do not intrude upon the activity areas.\textsuperscript{50}

Small group spaces, such as a book nook, allow for differing levels of interaction with peers. Studies by Field indicate that small, bounded areas enhance feelings of safety and closeness with other children.\textsuperscript{51}

**Scale Considerations**

Scale can affect learning on several levels. Spaces and furnishings which have scales that fit a child’s size help children to feel a sense of ownership and belonging. A small school can help children feel that their efforts are significant


instead of feeling like a small cog in a big machine. (photo)\textsuperscript{52}

Taylor recommends differing levels which can reduce the authoritarian perspective of the teacher towering over the child.\textsuperscript{53} Children feel more self-confident in spaces that are scaled to their size. Weinstein’s studies indicate that as much as possible, spaces should be scaled to a child’s size and that material storage should be accessible to children and should provide space for children to keep their own things. This can increase self-esteem and a sense of ownership in the school environment.\textsuperscript{54} (photo)\textsuperscript{55}

Research also shows that students learn better in smaller schools where they feel more significant and have a greater sense of ownership. Students in smaller schools are more likely to participate in class exercises as well as in

\textsuperscript{52} Mueller, p. 67.  
\textsuperscript{53} Taylor, pp. 52-57, 68-70.  
\textsuperscript{54} Weinstein, p. 163.  
\textsuperscript{55} Weinstein, p. 195.
extracurricular activities. Another study shows that, following income level, the strongest indicator of success for students was smaller school size. In a smaller school, every student can make a difference.  

Gene Glass led a group of scholars in a review of nearly 80 years of research studies on class size and its effect on learning. Glass’ review has become the primary source of information on class size. Regardless of pupil age or the subject studied, smaller class size was associated with better learning. Nearly all of the studies comparing very small classes of 2 students to classes of 28 students showed better learning in the smaller class. In studies comparing classes of 18 or 28 pupils, 69% showed better learning in the smaller classes. And in studies comparing classes of 30 to 60 students, results were mixed. The more time students spent in the smaller class, the better their learning.

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Summary

A school should have a variety of sizes of spaces and at least some of the spaces in the school should be scaled to a child’s size. Large group, small group and individual spaces are important for different aspects of learning and development. Class size should be kept as small as possible, with the largest classes having no more than 18 students. Spaces that are scaled to a child’s size can be comforting and increase self-esteem and a sense of ownership and belonging in the school.
Flexible Spaces and Furnishings

“People feel best in settings that . . . foster a sense of control, impose few constraints, and offer multiple options.”59 (photo)60

Weinstein applies this concept to the child in his classroom. She views the child’s role in the classroom as an active participant who gains self-esteem through being able to control his environment.61

Research shows that the physical design of learning environments can foster a sense of student ownership in the learning process. A sense of student ownership includes sense of control, territoriality, involvement, and personalization. This can be accomplished by the simple effort of including

59 Gallagher, p. 74.
60 Images Publishing Group, p. 74.
61 Weinstein, pp. 162-163.
permanent places for the display of student artwork. Permanent display of this artwork has an even stronger effect on the students’ perceptions of ownership.\textsuperscript{62}

Olds focuses on the child’s need for physical movement. She discusses the developmental and emotional goals of such movement and recommends environments that support this natural phenomenon. Olds cites various research studies that demonstrates that physical activity must be performed by the individual child who cannot simply passively receive information and experiences at the same quality level.\textsuperscript{63}

**Furnishings**

Spaces that can be changed to create new environments are stimulating to students. Mobile furniture and storage systems can be used to provide environmental changes. Stanton Leggett and his team recommend flexible furnishings and storage such as: carts, wheeled cabinets, stacking chairs, and moveable room dividers.\textsuperscript{64} Sybil Kritchevsky, Elizabeth Prescott, and Lee Walling recommend that in addition to permanent furnishings and equipment, there should be mobile pieces that can change the nature of an area and help

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\textsuperscript{63} Olds, pp. 91-138.

students learn new associations and connections between areas.\textsuperscript{65} (photo)\textsuperscript{66}

Seating and Spatial Arrangements

The best seating arrangements allow for a variety of activities and the informal groupings which are preferred by children. Furniture in a classroom should be flexible to allow for various uses and configurations. Lighting also needs to be flexible so it can be varied according to the activity. The teacher’s desk should be located away from the main activity areas.\textsuperscript{67}

Studies have compared classrooms arranged randomly with classrooms arranged ‘spatially’ in order to promote specific learning outcomes. In the spatially arranged room, children learned logico-mathematical knowledge earlier

\begin{flushright}
\textsuperscript{67} Taylor, pp. 60, 66.
\end{flushright}
than in the randomly arranged room. This may improve a child’s opportunity to make connections between different learning areas\(^\text{68}\).

Chris Nash recommends that similar activities should be grouped together. “Distractibility is actually put to use, for what attracts the child’s attention can add to his present activity rather than replace it.” Nash’s observations of children in classroom environments supports this contention, demonstrating that adjacent activities can improve the connections a child makes between such activities\(^\text{69}\).

Gump recommends establishing quiet spaces and noisy spaces in different areas so the noise from one area does not disrupt the quiet activity in another area. Grouping of areas can help children to make connections between different disciplines. Learning spaces need to be inviting so children will explore them\(^\text{70}\).

Furniture placement in a classroom affects the interaction and communication levels. In a test of row-and-column seating, Koneya demonstrates that location significantly affects the quality of discussion. Central seats are associated with significantly more verbalization than seats in other areas. The research also shows that more out-going personalities tended to

\(^{68}\text{Gump, Paul V. “School and Classroom Environments,” pp. 691-732.}\)


\(^{70}\text{Gump, pp. 697-698.}\)
choose these centrally located seats. Weinstein cites research that shows it is easier for children to sit and listen if the teacher is at a different level from the students.

Raymond Adams and Bruce Biddle showed that there is an ‘action center’ area where 63% of pupil-initiated interactions occurred in testing of grade school, high school and college students. Douglas Levine, Edgar O’Neal and Peter McDonald showed that in testing where students were randomly assigned to seats, the students in front and center seats had a significantly greater participation level than students in rear or peripheral locations.

Olds also recommends that things in a learning environment should be well-organized so that children can exercise control over finding, using and replacing educational materials.

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75 Olds, pp. 98-99.
Summary

Learning areas should be flexible so they can be updated for programmatic changes. Spaces that are flexible and can be controlled by the students gives them an increased sense of ownership. Mobile furnishings and partitions can be used to create an environment that can be easily updated. This is an important factor in the design of learning spaces.
Aesthetics, Unusual Spaces, and Creativity

Research has shown that aesthetically pleasing and unusual spaces stimulate creativity in children. (photo)\textsuperscript{76} Gump cites studies which show that unusual and novel spaces enhance curiosity and creativity in children. Just going into a different kind of space has been found to be stimulating.\textsuperscript{77}

Taylor, who specialized in research on how the physical environment affects behavior and learning, believes that educational environments should be designed to enhance students’ creativity. Taylor’s studies show that more creative learning environments result in better learning in terms of reading and

\textsuperscript{76} Crosbie, Michael J. \textit{Class Architecture}. Victoria, Australia: Images Publishing, 2001, p. 11.
\textsuperscript{77} Gump, p. 703.
writing, concept development and communication. Taylor’s research indicates that “better environments promote better learning through improved reading, writing, concept development, and communication.”

People evolved to prefer environments that fulfill our hunger for knowledge. Environments should promise new information with a change in vantage point. Views that are temporarily hidden from view or paths that bend are preferred elements, according to research by Cullen and by Rachel Kaplan. Research by Jay Appleton and by Julian Edney demonstrates a preference for a partially enclosed area with a view out.

Preferred environments have legibility, mystery and refuge. Legibility is defined as being comprehensible. Mystery is when additional information can be gained if the setting is explored. And refuge is when the environment is free of threats. The most preferred landscapes include mowed grass and scattered large shade trees. Carla Rabinowitz found in her research that people paid much more attention to environments that they ranked highly for attractiveness.

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78 Taylor, pp. 8-9.
Research shows a strong correlation to the perceived aesthetics of a space and the emotional response of children. Thurber and Malinowski showed that negative emotions were associated with low environmental satisfaction.\textsuperscript{83}

Other studies show that buildings which are of intermediate height and moderately high or highly articulated were considered to be more visually pleasing. The number of surfaces and perceived depth had a greater aesthetic impact than order or complexity.\textsuperscript{84}

Janssens reported that looking time and eye movements were significantly longer for buildings whose type was hard to identify. Janssens also found that buildings which were rated as unusual were also rated as hard to identify. Windows and entrances were the most frequently looked-at parts. The connection he expected to find between ease of identification of building type and ratings of pleasantness could not be established.\textsuperscript{85}

Janssens also reported that people found more expressive buildings to be more aesthetically appealing. Buildings were rated as being more pleasant if they were ranked high for unity or high for complexity.\textsuperscript{86}

Another study by Janssen demonstrated no significant difference between environmental evaluation and looking patterns for trained architects and lay


\textsuperscript{84} Kuller, pp. 1245-1246.


\textsuperscript{86} Ibid, pp. 38-39.
people. However, architects prefer facades that are more coherent and simple while lay people prefer more complexity and ornamentation.

People have a preference for curvilinear forms and edges, gradations of shape and color, blended textures and natural elements.\(^{87}\)

Research shows that repeated exposure to visual stimulus increases its pleasantness. However, repeated exposure to unpleasant visual stimulus increases subjects’ reported displeasure with the environment. Thus, the aesthetic of an environment that is occupied habitually by the same people is important to the emotions of the people who are there.\(^{88}\)

Windows and views are an important part of the aesthetics of an interior space. Researchers showed that using a minimum of 25\% of wall space for windows was acceptable to half of the observers tested. In order to gain acceptance by 85\% of observers, a third or more of the wall space should be used for windows. Other research showed that people dislike the use of several different windows of different dimensions, a large number of narrow windows in a regular pattern, and wide mullions. In general, people prefer windows that are large, regularly arranged and horizontally oriented, although some research shows a preference for vertical orientation. The difference is apparently based on the views that are framed by the windows.\(^{89}\)

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\(^{87}\) Knopf, pp. 783-825.
\(^{89}\) Boyce, pp. 251-252.
Summary

Unusual or aesthetically pleasing spaces stimulate creativity in children. Ideally, environments should promise new information with a change in vantage point, provide legibility, mystery, and refuge, provide curvilinear forms and edges, gradations of shape, color and texture, and natural elements. Outdoor areas should have mowed grass and scattered large shade trees. Exteriors should be of intermediate height and moderately to highly articulated with 32% or more of the exterior surfaces used in fenestration. Windows should be large and regularly arranged with either vertical or horizontal orientation, based on the view being framed.
Play, Playgrounds, and Nature

In an educational facility, special attention must be given to play, playgrounds and access to nature. Play serves several important developmental goals, including creativity and social skills. Exposure to nature is necessary for stress reduction and creativity.

Play and Playgrounds

Play is a significant factor in childhood because it teaches important creative and social skills.\(^{90}\)

(photo)\(^{91}\)

Play behavior in people reflects the drive to gain control and mastery.\(^{92}\) Growth is a process of taking successive risks to expand capabilities. “When the challenge exceeds known limits, the response brings increased capacity.”\(^{93}\)

Leisure also has an important impact on mental health. It raises self-esteem, establishes identity, facilitates self-actualization, and enhances life satisfaction.\(^{94}\)


\(^{91}\) Images Publishing Group, p. 121.


Taylor recommends the inclusion of a dramatic play area which should include a ‘bedroom’ and a ‘kitchen’ would encourage symbolic play which helps to develop emotional, social and cognitive skills in children.\textsuperscript{95} Rubin and Maioni’s research demonstrated that children who participate in dramatic play had superior classification skills and logical reasoning than their counterparts.\textsuperscript{96} Golomb and Cornelius showed that children who scored low on conservation of quantity tasks had significant improvement in their scores after participating in symbolic play sessions.\textsuperscript{97}

James Christie and E.P. Johnson reviewed research on play and found that play has a significant impact on creativity, which they defined as “ideational fluency, flexibility, and originality.” Play involving the imaginary transformation of objects into other objects is very similar to the thought process used in creative thinking. Children who were ranked as more creative than their counterparts were more playful, spontaneous, and scored higher on divergent thinking tests. Other research shows that play has a significant impact on problem-solving abilities. In several different studies, children who played with materials were able to generate better solutions in a shorter time span than their peers. Other studies cited show a strong correlation between children who engage in

\textsuperscript{95} Taylor, pp. 48-49.
sociodramatic play (play that involves two types of verbal exchanges: imaginary communications for their role and communications to structure their play) and intelligence test scores. Enhancing the quality of children’s sociodramatic play is thought to improve their language test scores, but Christie and Johnsen have called for more testing on this area.\textsuperscript{98}

Other research has focused on the link between play and problem-solving skills. In a study by Debra Pepler and Hildy Ross, young children played with materials that could be put together as a puzzle (convergent play) or used as freestanding pieces (divergent play). The children who had divergent play experiences performed better when asked to solve divergent problems. Divergent materials are described as those which have no clear, correct use or solution. Inclusion of a dramatic play area and materials that encourage divergent play should be included in the classroom to enhance the development of logic skills.\textsuperscript{99}

Playgrounds can also be educational. A variety of landscaping, textures, shapes, and spaces can stimulate creativity. Playgrounds can include activity areas, interest centers, areas for large groups, small groups, and individual interests. The playground should be accessible directly from the classrooms and can contain areas such as: nature area, garden area, free play, play structures,


climbing structures, outdoor classroom area, and hard play surfaces. Playgrounds need to include areas for children of differing ages and sizes.\textsuperscript{100} Weinstein recommends that particular attention be paid to transitions between spaces and activities in playgrounds to stimulate movement between activities.\textsuperscript{101}

**Exposure to Nature**

Exposure to nature is an important part of mental health. It aids in mental clarity, self-confidence and independence. Exposure to nature also reduces stress.

Rachel Kaplan focuses on the importance of nature in urban settings. She summarizes research related to the importance of nature to people’s emotional well-being. Kaplan points out the numerous programs funded by major cities to plant more trees and create more parks in urban areas as evidence of the importance people place on nature. Kaplan’s studies show that people prefer environments that permit involvement and that make sense. Environments that are complex and promise more information with a change in view are also preferred. In addition, a natural environment has been found to be absorbing and fulfilling even in subjects whose only interaction with the environment was visual.\textsuperscript{102}

\textsuperscript{100} Taylor, pp. 72-81. (Specifics on designs can be found on pp. 82-109.)
\textsuperscript{101} Weinstein, pp. 190-193.
There is a basic need for people to experience nature both as an escape from a complex and technical society and as a touch-point for something larger and more permanent than a person’s temporary problems.\textsuperscript{103}

Exposure to “nature” can also include indoor plants and natural building materials, according to Joachim Wohlwill’s research. He discusses the emotional importance of feeling connected to nature and the cycles of the seasons and of life. His research also supports the contention that people seek access to nature as a refuge from ordinary life and stress.\textsuperscript{104}

The natural environment is unusually effective in terms of the development of mental clarity, as Stephen Kaplan found in his research. Mental clarity is important in the evolution of self-confidence and independence.\textsuperscript{105}

Jay Appleton’s research focuses on the experience of landscape. His work indicates the need for ‘prospect’ and ‘refuge,’ meaning that people desire a view out from a secure-feeling location.\textsuperscript{106}

Although he calls for more research on the subject, Gordon Orians’ research indicates that the preferred aesthetic for vegetation is similar to a tropical savannah, with short, dense grasses and short, laterally spreading


\textsuperscript{104} Wohlwill, Joachim F. “The Concept of Nature: A Psychologist’s View.” In Altman (Vol. 6), pp. 5-34.


\textsuperscript{106} Appleton, pp. 66, 262.
deciduous trees which have canopies that do not touch. Orians cites several other studies that support his contention.\textsuperscript{107}

Exposure to nature increases creativity and should be included in school spaces. Studies show that children are more active on hard-surfaced playgrounds, but that more imaginative play happens in more natural settings. Children’s activities were more diverse in a more natural play area than in an artificial one.\textsuperscript{108} Research also shows that even small exposures to nature can have a beneficial effect. Nature is also an important off-set to our ever more technical and urban daily environments.\textsuperscript{109} (photo)\textsuperscript{110}

Nature can also provide a respite from the stresses of everyday life.


\textsuperscript{108} Kuller, p. 1259, and Gallagher, p. 74.

\textsuperscript{109} Gallagher, p. 74.

Natural environments heighten the individual’s sense of control, competency and esteem. Nature is a positive experience in that it does not give negative feedback. Nature is responsive and predictable and allows people to focus on growth-oriented behavior. Testing shows that natural scenes are preferred over other scenes.111

Other research demonstrates a preference for open, spacious landscapes with a smooth ground and trees.112 Landscapes which have orderliness with mystery, sharply defined boundaries and finely textured grassy areas are also preferred.113 Hammitt’s research also shows a preference for partially screened views.114

An outdoor transition space between the classroom and the playground can provide a location for active participation in a more structured environment than the playground.115

**Summary**

In learning environments, access to nature is important because it reduces stress and improves mood. An educational facility should include: indoor plants,

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113 Knopf, p. 805.
115 Taylor, p. 71.
natural building materials, view out of a secure-feeling location, short grass and deciduous trees, natural play area, outdoor transition area.

Play is an important part of a child’s development and more creative play occurs in a more natural setting. Play is an area where children develop creative and social skills, learn control and mastery, build self-esteem, and learn problem-solving skills. Playgrounds should include a variety of landscaping, textures, shapes, and activity areas for large groups, small groups, and individual interests. The playground should be accessible directly from the classrooms and can contain areas such as: nature area, garden area, free play, play structures, climbing structures, outdoor classroom area, and hard play surfaces.
Summary of Design Concepts

Environmental psychology can be used to aid in the design of learning spaces which will enhance the process of acquiring creative problem-solving skills. The following design concepts can be drawn from the research of environmental psychologists:

- **Variety of Spaces:** An integral part of the learning environment is stimulation. A variety of learning spaces, including a dramatic play area, math/science space, and library corner, provide opportunities for students to make connections between disciplines. Color, material variation and lighting should be used in learning areas to enhance learning by stimulating the senses. Light should be used to enhance the use of colors and materials in a learning environment and to improve the quality of the environment.
- **Scale Considerations:** A school should have a variety of sizes of spaces and at least some of the spaces in the school should be scaled to a child’s size. Large group, small group and individual spaces are important for different aspects of learning and development. Spaces that are scaled to a child’s size can be comforting and increase self-esteem and a sense of ownership and belonging in the school. (photo)\(^{116}\)

- **Flexible Spaces and Furnishings:** Learning areas should be flexible so they can be updated for programmatic changes. Spaces that are flexible and can be controlled by the students gives them an increased sense of ownership. Mobile furnishings and partitions can be used to create an environment that can be easily updated. This is an important factor in the design of learning spaces.

- **Aesthetics and Unusual Spaces:** Unusual or aesthetically pleasing spaces stimulate creativity in children. Ideally, environments should promise new information with a change in vantage point, provide legibility, mystery, and refuge, provide curvilinear forms and edges, gradations of shape, color and texture, and natural elements. Outdoor areas should have mowed grass and scattered large shade trees. Exteriors should be of intermediate height and moderately to highly articulated with 32% or more of the exterior surfaces used in fenestration. Windows should be large and regularly arranged with either vertical or horizontal orientation, based on the view being framed.

- **Play, Playgrounds and Nature:** Play should be an integral part of any environment designed for children. Playgrounds should include a variety of landscaping, textures, shapes, and activity areas for large groups, small groups, and individual interests. The playground should be accessible directly from the classrooms and can contain areas such as: nature area, garden area, free play, play structures, climbing structures, outdoor classroom area, and hard play surfaces. An educational facility should include: indoor plants, natural building materials, view out of a secure-feeling location, short grass and deciduous trees, natural play area, outdoor transition area.

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\(^{116}\) Allen, p. 24.
These criteria should be used to design educational spaces or to evaluate existing spaces and program requirements. The remainder of this thesis will evaluate the Ohio School Design Manual and several precedent schools based on these criteria as well as the application of these criteria to the design of a new elementary school.
Critique of the Ohio School Design Manual

All public school buildings in Ohio are required to conform to the Ohio School Design Manual if they are to receive funds from the Classroom Facilities Assistance Program. In this section, the manual will be evaluated based on the design criteria list developed in this thesis.

The manual is intended to ensure a level of quality while guiding the application of tax dollars to buildings based on a square-foot per student ratio. The manual was created by the Ohio School Facilities Commission with the help of Fanning/Howey, an Ohio firm that specializes in school building design, and two national firms that also specialize in schools. The question remains, though: even with all the specialists helping, does the manual recommend the same things as the environmental psychologists?

Variety of Spaces and Scale Considerations

The design manual is clearly based on a model for a traditional school, (see diagram) showing rows of desks where teachers would give lectures and no separate small group or individual areas. Although the introduction mentions that high school students are expected to work in small groups, there are no recommendations for spaces for this activity and no mention of small group work for elementary or middle school students. However, the “School District Choice” section allows school districts to incorporate additional spaces at the district’s expense, though variations must be discussed with the Ohio School Facilities Commission staff. Operable partitions can also be included, apparently also at the district’s expense.

The manual does not have requirements about colors or materials in order to allow more design flexibility and for regional differences. Recommended materials were selected because of their low cost and maintenance.

Recommendations for materials for elementary schools include linoleum floors, with or without carpet and painted CMU walls. Uniform fluorescent lighting is recommended. While cost-effective, these materials hardly meet the recommendations of the environmental psychologists as they are not particularly aesthetically pleasing, unusual or visually stimulating. Use of the same materials and lighting throughout the school building does not provide the recommended variety.
The manual does not address if anything is to be sized to a child’s scale; however, it is fairly common for desks and chairs to be smaller in rooms for smaller children.

**Flexible Spaces and Furnishings**

The introduction recommends that designs should be flexible and adaptable in order to meet the requirements of future academic program changes; however, the sample rooms shown are traditional, crowded with furniture, and inflexible. (See image on page 25.) Perhaps the flexibility discussed in the introduction refers to mechanical, electrical or other systems rather than the arrangement of spaces.

**Aesthetics and Unusual Spaces**

The manual states that a school building should be “attractive,” although it does not discuss aesthetics in terms of student development. The creation of unusual spaces is not addressed.

**Play, Playgrounds and Nature**

A minimum area of 50-75 square feet per student is required for playgrounds. And play equipment for both hard and soft surface areas is funded. A variety of activities are recommended as well as the inclusion of tables and chairs or benches for outdoor classes. This appears to be completely in compliance with environmental psychologists’ recommendations for play areas and allows for flexible design options.
Site considerations include recommendations that sites should have mature trees or other green-space. This matches what environmental psychologists recommend for exposure to nature.

**Summary**

Although the Ohio School Design Manual does not expressly inhibit the application of environmental psychologists’ recommendations for school designs, it also does not encourage the application of the recommendations. Classroom layouts and recommended materials and lighting clearly do not conform to the recommendations because they are too uniform, stagnant and inflexible.
Precedent Analysis

The following analysis of precedent schools provides examples of how environmental psychologist recommendations can be applied to a real building. The three buildings selected for analysis were chosen because they show at least some of the recommendations in their designs.

Precedent Analysis: Diamond Ranch High School

Description

A clattering pile of skewed metal boxes on the hillside create a jumbled, jagged profile against a startling blue sky. The only regular geometry is at the entrances along a hill above a service road. Once the students enter the facility, they are surrounded by tilted shapes

that appear to be falling, off-center openings which beckon to the curious, and strange patterns of light and shadow. To say that the spaces created by this building are intellectually stimulating seems to be quite an understatement.

(photos)\textsuperscript{119}

This other-worldly place clearly meets the environmental psychologists’ recommendation for unusual spaces. Designed by Morphosis Architects and located in Diamond Bar, California, the Diamond Ranch High School, completed in 1993, was intended to be an unusual place. An analysis follows to examine this facility in terms of the five criteria developed based on the environmental psychologists’ recommendations.

\begin{itemize}
  \item \textbf{Variety of Spaces, Scale Considerations, Flexible Spaces and Furnishings}
  \item A variety of types of spaces and a variety of colors, materials, and textures in those spaces provide important stimulation in a learning environment. There is little
\end{itemize}

information on the interior finishes of the building; however, there are spaces of differing sizes and shapes, as seen in the floor plan (at left). Although the exact purpose of these spaces is not documented in the sources reviewed, the spaces could clearly be used for different purposes as the educational program changes.

Morphosis Architects intended to design the building to provide flexible individual spaces as well as accommodating a variety of possible future educational needs and technology changes. The spaces for grades nine and ten are designed to allow for flexible teaching and for grades eleven and twelve, allows for the students to concentrate on areas of interest in the curriculum. The design is intended to foster social groupings by providing spaces to encourage interaction in varying sizes of groups. The facility appears to meet the criteria for variety of spaces.

Because Diamond Ranch is a high school, standard scale is appropriate for all of the spaces.

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120 Stevenson, pp. 180, 182.
121 Stevenson, p. 181.
**Aesthetic and Unusual Spaces**

Aesthetically pleasing and unusual spaces help to stimulate creativity. While the building has a strongly unusual appearance, it is questionable as to how many of the students would find it to be aesthetically pleasing. Fortunately, unusual spaces have also shown to stimulate creativity.

The exterior of the building and the semi-enclosed courts and walkways are full of unusual spaces. However, the interior spaces appear to be mostly rectilinear according to the plan drawing. No images of interior spaces have been located to date.

(photo)

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The building as a whole is very unusual and stimulating. Although the interior spaces appear to be more standardized, it is possible that the very unusual exterior spaces may work to stimulate creativity here.

**Play, Playgrounds and Nature**

According to a statement from the architect, “The first goal was to take advantage of the natural beauty of the site by integrating the play fields and buildings into the surrounding hillside.”

The school is located on a beautiful site in Pomona, California, featuring rolling hills and views of the mountains. This site became the driving concept behind the building. There are a substantial number of exterior spaces and transitional spaces. Athletic fields are included on the site plan.

**Summary**

This futuristic building sits like a crown atop its site and provides very unusual and thought-provoking spaces. It has a good blend of different sizes of rooms and plenty of opportunities to enjoy natural views of the surrounding hillsides. Although some students may not find the facility to be particularly aesthetically pleasing, it does meet the main criteria established by environmental psychologists.

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123 Stevenson, p. 181.
Description

A child’s blocks tumble across the top of a hill, a mélange of pastel EIFS and red-mullioned glass which reflect blue skies and tree tops. It’s a messy pile that refuses to take on a definite form, that seems to continuously shift and tumble as though it’s going to slide down the hill into the intersection below.

Peter Eisenman, architect and theorist, designed the Aronoff Center for Design and Art at the University of Cincinnati based on shifted geometries and views.124 His concept for the 1996 building came from the topography of the site and Burnet Woods which lies across the street from the building.125 (photo)126

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126 Photo by author.
Eisenman utilized a mathematical system for shifting the modular pieces of the building and creating views within views inside the building, views which are usually at least partially obstructed.\textsuperscript{127} Eisenman said: “You can transform it into glossy color photographs, but you cannot seize it from any privileged perspective.” \textsuperscript{128} In fact, even after navigating the building for four years, I still discover new views and perspectives.

His design could be called anti-humanist since he decries the use of human scale and even refused to show people using the building in his drawings and models. And while the building can be uncomfortable and inefficient, it is unlikely to be like any other building the students there have ever experienced. Although the classroom spaces within the building are roughly rectangular, they are rarely the standard box found in other schools. The exterior EIFS and interior gypsum board, in a strange pallet of pastel shades, are placed at odd angles to each other, reminiscent, perhaps, of rock formations.

\textsuperscript{129} The building is clearly

\textsuperscript{127} Davidson, pp. 98-133.
\textsuperscript{129} Photos by author.
disorienting and the students are puzzled about what it all means. Meaning is clearly debatable. “The Aronoff Center is a machine designed to intercept familiarity and to impede its formation.”

Eisenman said that the virtual world has influenced us so strongly that our standard building types are no longer effective. He said, “Architecture can provide affect – a form of articulation that appeals to both the somatic and the articulate: to the body, the mind, and the eye at the same time. This is something that other media do not do.”

Variety of Spaces

The interior of the Aronoff Center is swathed in pastel-colored gypsum board which requires a fairly high amount of maintenance in the high traffic areas. Lighting is mostly fluorescent, but is installed in clearly intentional non-standard patterns. Most spaces are carpeted and some have composite tile which are also in unusual patterns. The Aronoff Center makes creative use of low-cost materials.

Scale Considerations

Large spaces in the building include the main staircase, which is

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130 Jameson, p. 68.

used for critiques, and the large auditorium on the 4000 level. Classrooms are provided in a variety of sizes from a room that’s a little tight for a seminar room to more traditionally-sized classrooms. Small group spaces include informal settings in the DAAP Café or on the main staircase or a more formal small group room in the DAAP library. Small group meetings also take place in studio spaces. The building does provide a good variety of sizes of spaces and a good variety of types of spaces.

(photos)\textsuperscript{132}

The scale of spaces is standard which is appropriate since the students here are adults.

**Flexible Spaces and Furnishings**

*Although the spaces in the Aronoff Center have built walls which are not moveable, the variety of size of spaces allows for individual, small group, and large group activities. For the most part, the furnishings in the*

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\textsuperscript{132} Davidson, pp. 1, 42, 46-47.
classrooms in the Aronoff Center are fairly standard pieces which can be rearranged and replaced as needed. Some of the lecture rooms and the large auditorium have seating that is attached to the floor which prevents the rooms from being used effectively for other purposes. (photos)³³³

Aesthetics and Unusual Spaces

Some of the most interesting spaces in the Aronoff Center include the main staircase and the atrium that houses the DAAP Café. In these interior spaces, in particular, Eisenman’s concept can be seen in the oddly turning shapes and the intersection between the new building and the old. The main staircase is frequently used for critiques and as a gathering and resting place in addition to being one of the main circulation areas in the building. The DAAP Café is the main gathering and resting place in the

³³³ Photos by author.
building and also has a significant amount of circulation. (photo)\(^{134}\)

Eisenman’s architectural language continues into the studios in the new part of the building. The studios feature skewed walls and typically have a lot of day-lighting. The large auditorium also continues this language with odd pieces of wall at irregular angles to each other. The classrooms spaces have some of the language developed in the rest of the building, although they tend to be much more traditional.

Although the spaces may not be aesthetically pleasing to all the students who study at the Aronoff Center, overall, the building is filled with a variety of unusual spaces.

**Play, Playgrounds and Nature**

Even young adults need some recreation and relaxation, although a playground as such is not necessary. In addition to the interior spaces of the main staircase, the DAAP Café, and studio spaces where students gather with their friends to relax, there is a space outside the 4000 level entrance which is a fairly large concrete slab topping the Brodie Parking Garage. This space is frequently used by students with skateboards, in-line skates, bicycles, hacky-sack and for gathering and relaxing with friends. Outside the 6000 level entrance on the west side of the building is a grassy area that is frequently used for Frisbee and working on projects out-of-doors.

\(^{134}\) Photos by author.
In addition, the building was constructed across Martin Luther King, Jr., Drive (MLK) from Burnett Woods which provides a near-by natural landscape for viewing and enjoyment. Although MLK has heavy traffic whenever school is in session, students utilize the park for recreation and several spaces within the building provide views of the park. One of my favorite places within the building is the DAAP library. From the windows on the 6000 level, views of the tops of trees planted to the north of the building and trees in the park across MLK are beautiful and refreshing.

The Aronoff Center does a good job of providing areas for rest and relaxation. There are natural areas adjacent to the building in addition to the park across MLK. (photo)\textsuperscript{135}

\textsuperscript{135} Photo by author.
Summary

The Aronoff Center for Design and Art does an admirable job of meeting the criteria established by environmental psychologists for learning areas that stimulate creative problem-solving. A variety of size and type of spaces, unusual materials and colors, and access to nature make the building a stimulating place to study and learn. (photo)\textsuperscript{136}

\textsuperscript{136} Photo by author.
Luginsland Kindergarten

Description

At first glance, it looks more like a pile of scrap materials than a building. Then it resolves itself into a volume and windows can be seen peeping out of the heap. Ah! It must be a playhouse! After all, only a child would pile up such disparate materials in such a fun and haphazard way. (photo)¹³⁷

The jumble of materials includes metal siding, wood siding, brightly colored fabric shades, wood and metal structural columns at odd angles, round

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windows, square windows and curtain wall glazing, all beneath a curving roof with turned up corners. It even has a flag with a rearing horse!

Clearly, the concept is to create a space for children that would reflect their vision of the world, a reflection of their art and their imagination. It, then, becomes a place for children, welcoming to them because it’s written in their language.

This is a fun place that allows kids to be kids. (photos)

The Luginsland Kindergarten in Stuttgart, Germany, was designed by Behnisch and Partner. It was designed for 56 pre-school children in four groups. The building has a timber and steel structural frame and was completed in 1990. It is a very small school for very young children and the main focus is clearly on play.

Behnisch said: “The Kindergarten . . . vineyards was built for children, not for the adults who

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often think they know what a school should be.” This unusual building is clearly an architectural success if measured in terms of several awards it has won.141

Variety of Spaces and Scale Considerations

The interior is primarily warm-colored wood with some brick and some drywall painted white. It is a collection of welcoming, though jumbled-looking, spaces. The interior walls are tall, maybe twelve feet, floor to ceiling, with windows between the wall studs that allow daylight to spill into the interior spaces.

Lighting is uneven and is used to focus attention on specific areas within the rooms. The electrical lighting is mostly incandescent, giving an additional feeling of warmth and comfort to the spaces.

The floor plans reveal that most of the major spaces are irregularly shaped, though the smaller spaces are frequently rectilinear and are also located in the western end of the building which is also rectilinear. There is a variety of sizes of spaces as well.

The center and eastern rooms are basically a casual cluster of irregular spaces with fairly simple circulation as one space opens into the next.

140 ibid.
The walls are very tall, probably about 12 feet. The height of the walls make the doors feel short, more in proportion to a child’s height. Most of the furnishings are scaled to a child’s size as well as other objects in the spaces.

Aesthetics and Unusual Spaces

As a preschool and kindergarten, the building is highly successful and fun. It really breaks out of the mold of typical school buildings. This non-traditional style building with its irregularly shaped exterior and interior spaces provides the kind of creativity-enhancing environment called for by environmental psychologists.

Flexible Spaces and Furnishings

Several of the spaces are quite
large and could be sub-divided with partitions or furnishings. The pieces of
furniture that are in the building are child-scaled and appear to be moveable as
well as flexible, offering a wide variety of arrangements and uses. (photo)

Play, Playgrounds and Nature

The entire building appears to be devoted to play. There is also play
equipment located just outside of the building. And the building is located in a
bucolic setting. It clearly meets the requirements of the environmental
psychologists for play areas and access to nature.

Summary

The Luginsland Kindergarten is an excellent example of a building
designed to stimulate creativity. It has a variety of spaces and materials, unusual
spaces and is scaled to a small child’s size.
Precedent Analysis: Conclusions

A review of three precedent schools and the Ohio School Design Manual gives some real-world ideas about the application of principles of environmental psychology to the design of learning spaces. The Diamond Ranch High School, the Aronoff Center for Design and Art, and the Luginsland Kindergarten all demonstrate non-traditional approaches to educational facilities. All of them have an unusual aesthetic, access to or views of nature, and a variety of learning areas. Their unusual materials and lighting are stimulating and enhance their aesthetic qualities. (Photo.)

144 Photo of DAAP library by author.
Design Project

Introduction and General Description

The purpose of this design project is to apply the research results of over 40 years of environmental psychology to the design of learning environments.

The Eggleston Academy is a public alternative elementary school for academically gifted children from kindergarten to grade six. As a school for academically gifted children, strong emphasis will be placed on academics in the core curriculum as well as on other areas which will help the children to develop creative problem-solving skills. Because the children will be at various different educational levels, they will be grouped in work areas based on age but will go to classes based on their educational needs. The curriculum will also focus strongly on interdisciplinary projects to encourage the children to make connections between areas as recommended by the environmental psychologists.

The program for the school will be based on the Ohio School Design Manual, which is required for all schools built in the State of Ohio receiving state funding. The requirements from the manual will be adjusted based on the recommendations of environmental psychologists, which are:

- A variety of spaces and scale of spaces will be provided for large and small groups and individual study. There will also be a variety of types of spaces: quiet/noisy, messy/clean, bright/dim, active/still. At least some spaces will be scaled to be used by children.
- Color, materials and lighting will be used to create an inviting and interesting environment.
Aesthetically pleasing and unusual spaces will be utilized to stimulate creativity.

Spaces will be designed to be flexible for multiple uses and to be changed as educational needs change. Furnishings will also be designed to enhance flexibility.

Play will be included in the program as an important element in a child’s building. Playgrounds will include educational and developmental activities. Access to nature will be an important part of the project.

A concept-driven design methodology and non-rectilinear design will be used, similar to the precedent buildings described above to create unusual and aesthetically pleasing spaces. The application of a variety of materials and the creative use of fenestration and day-lighting will be an important part of the design. However, compared to the precedents, more attention will be given to the interior spaces in terms of variety, materials and sizes.
Design Program for Elementary School

The Building Program

The program for the Eggleston Academy will be based on the Ohio School Design Manual, which is required for any schools built in Ohio which are to receive state funding. These requirements will then be adjusted to better match the recommendations of environmental psychologists. The Eggleston Academy is an elementary school for 252 students from kindergarten to sixth grade, with three classes of 12 students in each grade. The spaces required in the manual have been adjusted as follows: 145

- Because students do better in smaller classes, the students from each grade were divided into three classes of 12 students each. The academic spaces will be grouped into suites to achieve the feel of a smaller school as recommended by environmental psychologists.

- The design of the building will necessarily need to use some of the 6,700 square feet allocated to corridors in classrooms to allow for more variety and flexibility in academic spaces.

- All of the flexible space has also been included in the academic spaces for the same reason.

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145 Fisher, sections on elementary schools.
The detail program is also based on the Ohio School Design Manual and has been adjusted for recommendations from environmental psychologists as described above. The detail program includes:

### Integrated Studies:
- General Classrooms: 1,340
- Group Study Rooms (2): 280
- Main Work Rooms: 1,000

### Physical Sciences:
- Physical Education: 3,700
- Science Labs: 1,200
- Math Lab: 600

### Arts Spaces:
- Music Room & Theater: 2,300
- Art Room and Gallery: 1,400

### Dining:
- Administration: 1,560
- Lobby & Public Restrooms: 1,607

### Support Spaces:
- Mechanical Spaces: 2,500
- Receiving and Storage: 520
- Corridors: 2,813

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**Per Ohio School Design Manual**

<table>
<thead>
<tr>
<th>Space Type</th>
<th>Square Footage</th>
<th>Adjusted based on Thesis Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic spaces</td>
<td>11,140</td>
<td>Academic spaces</td>
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<tr>
<td>Administrative spaces</td>
<td>1,990</td>
<td>Administrative spaces</td>
</tr>
<tr>
<td>Media center spaces</td>
<td>2,950</td>
<td>Media center spaces</td>
</tr>
<tr>
<td>Visual arts spaces</td>
<td>1,400</td>
<td>Visual arts spaces</td>
</tr>
<tr>
<td>Music spaces</td>
<td>1,200</td>
<td>Music spaces</td>
</tr>
<tr>
<td>Physical education</td>
<td>3,700</td>
<td>Physical education</td>
</tr>
<tr>
<td>Dining &amp; food services</td>
<td>4,080</td>
<td>Dining &amp; food services</td>
</tr>
<tr>
<td>Custodial spaces</td>
<td>300</td>
<td>Custodial spaces</td>
</tr>
<tr>
<td>Building services</td>
<td>10,921</td>
<td>Building services</td>
</tr>
</tbody>
</table>

**Total Square Footage**

- Per Ohio School Design Manual: 38,512
- Adjusted based on Thesis Research: 42,230

**Footage Funded**

- Per Ohio School Design Manual: 43,000
- Adjusted based on Thesis Research: 43,000

**Flexible Space**

- Per Ohio School Design Manual: 4,488
- Adjusted based on Thesis Research: 770
The Site Program

The Ohio School Design Manual also contains requirements for the exterior spaces for elementary school facilities. Based on the recommendations of environmental psychologists, these requirements have also been adjusted to include a nature area, gardens, and outdoor classrooms:

<table>
<thead>
<tr>
<th>Per Ohio School Design Manual</th>
<th>Adjusted based on Thesis Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building footprint</td>
<td>Building footprint</td>
</tr>
<tr>
<td>Multi-purpose field</td>
<td>Multi-purpose field</td>
</tr>
<tr>
<td>Basketball courts</td>
<td>Basketball courts</td>
</tr>
<tr>
<td>Bus loading</td>
<td>Bus loading</td>
</tr>
<tr>
<td>Parking</td>
<td>Parking</td>
</tr>
<tr>
<td>Nature area</td>
<td>Nature area</td>
</tr>
<tr>
<td>Gardens</td>
<td>Gardens</td>
</tr>
<tr>
<td>Outdoor classrooms</td>
<td>Outdoor classrooms</td>
</tr>
<tr>
<td>43,000</td>
<td>37,000</td>
</tr>
<tr>
<td>20,000</td>
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<td>2,300</td>
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<tr>
<td>0</td>
<td>800</td>
</tr>
<tr>
<td>0</td>
<td>2,800</td>
</tr>
</tbody>
</table>

Total sq. footage funded 74,700
Total square footage 74,700

The building footprint will be reduced by enough space to allow for the inclusion of a nature area, gardens, and outdoor classrooms as recommended by environmental psychologists.

The program areas may be combined or subdivided from what is described above to achieve integration between program areas as recommended by environmental psychologists or provide a better fit with the design concept.
Integrated Studies

One work area will be provided for each age, kindergarten through sixth grade. These areas will be designed based on environmental psychologist recommendations and will be supplemented with a variety of spaces, including large and small group spaces as well as individual study areas, quiet and noisy areas, messy and clean areas, bright and dim areas, and active and still areas. Attention will be given to activities which are compatible and to the types of boundaries needed for activities that are not compatible. Some of the spaces should be designed at a child’s scale.

Attention will also be given to color, materials, and lighting in order to enhance the learning environment. Environmental psychologists recommend a variety of materials, colors and textures to provide visual stimulation. Aesthetic and unusual spaces are also recommended.

Work areas and classrooms will be designed to be flexible with flexible furnishings so that space can be used in a variety of ways. Furnishings that the children can manipulate will increase their sense of ownership of the spaces.

Attention will be given to the inclusion of play areas, including the playground(s) and exposure to nature as per environmental psychologist recommendations. Play and recreation will be balanced with learning to create a school that is fun and appealing to students.
**Adjacency Issues**

Some educational functions are incompatible with others and need to be separated while other functions can provide an opportunity for students to make new connections if they are adjacent. Test-taking, lectures and presentations all need to be separated from noisy activities that could disrupt these processes and require a sound barrier. Messy activities such as art, science and gardening could be located together, but should be separated from clean areas such as computers and library. The boundary between messy and clean could just be space or could be a solid boundary.

Similar programmatic areas should be grouped together to facilitate projects between areas. Art, music and drama should be located together. Similarly, physical education, science labs and math lab might be located together. Work areas for similar grades might also be grouped together.

For security reasons, spaces that are more likely to be accessible to the general public should be segregated from school-only spaces. The gymnasium, cafeteria and theater areas should be separate from classrooms and work areas.
In addition, some common-sense adjacency issues will also be addressed. Vehicular circulation will be separate from the outdoor play and class areas. The playground and outdoor class areas will be adjacent to the class suites to simplify circulation and avoid unnecessary disruptions. (Diagram.)\textsuperscript{146}

\textsuperscript{146} Diagram by author.
Design Project Site

The site selected for the Eggleston Academy is a block on Eggleston Avenue east of downtown Cincinnati, between Fourth and Fifth Streets. The site is urban in nature and has a two-lane overpass crossing the southern portion of the lot. (Photos)\textsuperscript{147}

The Eggleston site was chosen over other sites considered based on a review of recommendations from environmental

\textsuperscript{147} Photos by author.
psychologists. (Map)\textsuperscript{148} Sites were evaluated for: variety of spaces, materials, colors and sizes, boundaries and transitions and visual stimulation. Variety of spaces was determined by reviewing spaces that could be utilized for open/noisy activities, enclosed/quiet activities, amount of constraints on students, number of options for use, access to nature, room for free play, area for outdoor classrooms and sports and area for hard surface play. The sites were also evaluated for the variety of materials, colors and sizes of spaces as well as areas at a scale that could be friendly to children. The site needed clear boundaries, transitions between areas and a transition to indoors or be capable of supporting these boundaries and transitions. Visually stimulating sites were rated on being

\footnotesize\textsuperscript{148} Map created by author, based on map images downloaded from http://www.cagis.org.
aesthetically pleasing, unusual, exposure to nature and availability of a natural play area or the capability of supporting these things. The Eggleston site, assuming the inclusion of landscaping, a nature area, garden areas and outdoor classrooms, was the best of several sites considered. (Photos.)

The site is in an area with numerous overpasses which create a very unusual aesthetic.

A comprehensive site analysis was done, including sun study, wind

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149 Photos by author.
speed and direction, traffic flow/noise and views available from the site. An analysis of shadows on the site from existing structures was done for various times during the school day: 8am, noon, and 3pm. (Diagrams) The resultant shadows from each month during the school year were superimposed over an aerial photo of the site to create the images. The area directly to the north of the overpass is normally in shadow with longer shadows occurring during the winter months.

The north side of the site gets the most sunlight throughout the year.

An analysis of the best views from the site shows that the building and site plans should allow for views to the north and east of the site as well as a view along the length of the overpass and a view

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150 Aerial photographs from http://terraserver.microsoft.com were edited by author.
south from beneath the overpass. (Diagrams)\textsuperscript{151}

An analysis of traffic and noise shows that the nearby expressways, I-471 and I-71, as well as Columbia Parkway, have heavy traffic during both the morning and evening rush hours. The overpass which crosses the site is an east-bound entrance ramp to Columbia Parkway and has moderately heavy traffic during the evening rush hour. The traffic adds a relatively steady white noise background to the other sounds heard on the site which include birdsong and wind. The streets adjacent to the site have light or very light traffic throughout the day.

An analysis of the winds on the site show that the primary winds come from the southwest during the warm months. During the winter months, however, the winds change direction and blow from the northwest. The site and building design should take advantage of the winds in the warm months and should block the winds in the cold months.

Based on the site analysis and the recommendations of environmental psychologists, the site plan would include the building footprint at the northeast corner of the site to take advantage of the sunlight, to block the winter winds, and to catch the warm weather winds. In order to provide views of nature from the building, the next zone to the southwest of the building will include the nature area, outdoor classrooms, and garden area. To the southwest of the nature area, the multipurpose field will be included and then beneath and beyond the

\textsuperscript{151} Aerial photographs from http://terraserver.microsoft.com were edited by author.
overpass will be both hard-surface and soft-surface play areas and the basketball court. (Diagram)\textsuperscript{152}

\textsuperscript{152} Aerial photographs from http://terraserver.microsoft.com were edited by author.
Conclusion

Today’s business leaders are calling for more creative problem-solving skills in employees, skills that are necessary for success in today’s information-based economy. More than 40 years of research by environmental psychologists can inform the design of a school building to enhance the students’ learning environment as it is related to these skills. School buildings need a variety of spaces with a variety of materials and lighting. Scale issues should be considered so that spaces will be provided for large groups, small groups, and individual work as well as some spaces being scaled to the child’s size. Spaces and furnishings within a school building should be designed to be flexible and the students should be able to control their environment. Aesthetic and unusual spaces should also be included as these have been shown to increase creativity. And exposure to nature helps to reduce stress and improve creativity. Based on recommendations by environmental psychologists, a school building designed
with this information in mind will help students to develop creative problem-solving skills. (Photo)\textsuperscript{153}

To recap, the recommendations are:

- **Variety of Spaces:** An integral part of the learning environment is stimulation. A variety of learning spaces, including a dramatic play area, math/science space, and library corner, provide opportunities for students to make connections between disciplines. Color, material variation and lighting should be used in learning areas to enhance learning by stimulating the senses. Light should be used to enhance the use of colors and materials in a learning environment and to improve the quality of the environment.

- **Scale Considerations:** A school should have a variety of sizes of spaces and at least some of the spaces in the school should be scaled to a child’s size. Large group, small group and individual spaces are important for different aspects of learning and development. Spaces that are scaled to a child’s size can be comforting and increase self-esteem and a sense of ownership and belonging in the school.

- **Flexible Spaces and Furnishings:** Learning areas should be flexible so they can be updated for programmatic changes. Spaces that are flexible and can be controlled by the students gives them an increased sense of ownership. Mobile furnishings and partitions can be used to create an environment that can be easily updated. This is an important factor in the design of learning spaces.

- **Aesthetics and Unusual Spaces:** Unusual or aesthetically pleasing spaces stimulate creativity in children. Ideally, environments should promise new information with a change in vantage point, provide legibility, mystery, and refuge, provide curvilinear forms and edges, gradations of shape, color and texture, and natural elements. Outdoor areas should have mowed grass and scattered large shade trees. Exteriors should be of intermediate height and moderately to highly articulated with 32% or more of the exterior surfaces used in fenestration. Windows should be large and regularly arranged with either

\textsuperscript{153} Crosbie, p 87.
vertical or horizontal orientation, based on the view being framed.

- **Play, Playgrounds and Nature**: Play should be an integral part of any environment designed for children. Playgrounds should include a variety of landscaping, textures, shapes, and activity areas for large groups, small groups, and individual interests. The playground should be accessible directly from the classrooms and can contain areas such as: nature area, garden area, free play, play structures, climbing structures, outdoor classroom area, and hard play surfaces. An educational facility should include: indoor plants, natural building materials, view out of a secure-feeling location, short grass and deciduous trees, natural play area, outdoor transition area.
Bibliography


http://www.cincinnati.com/visitorsguide/.


http://www.perkinswill.com


Kuller, Rikard. “Environmental Psychology from a Swedish Perspective.” In Stokols, pp.1243-1280.


