QUESTION

How can modular architecture help promote ecological sustainability in a traditional public school environment?
ECOLOGY

Relationship of organisms to one another and to their physical environment.

SUSTAINABILITY

Promotes equality between people of today and people of tomorrow. Creates balance between our ecological, social, and economic needs.

ECOLOGICAL SUSTAINABILITY

The promotion of equality amongst our people and their relationships with each other and their environment.
RESEARCH & FINDINGS

SYSTEM OF INQUIRY

STRATEGIES

TACTICS

INTERPRETIVE

QUALITATIVE

LOGICAL ARGUMENT

LITERATURE REVIEW
PERSONAL INTERVIEWS

LITERATURE REVIEW
PERSONAL INTERVIEWS

LOGICAL ITERATIONS

RESEARCH: METHODS
How can architecture promote ecological sustainability to children?

- How do children learn?
- How does the physical environment influence learning?
- What are different teaching methods?
- Are there limitations to promoting an ecological sustainability agenda?
Montessori Method of Teaching

- Developed in 1897 by Maria Montessori in Italy
- Promotes student choice and learning independently
- Mixed age classrooms
- “Prepared Environment” built to encourage discovery and learning

Source: American Montessori Society
MONTESSORI METHOD FINDINGS
DAKOTA MONTESSORI SCHOOL

CHILD DEVELOPMENT  NATURE  BUILT ENVIRONMENT

RESEARCH: MONTESSORI
Learning in Zones

In school, the notion of learning revolves around a classroom and the teaching that takes place within its walls. Montessori classrooms take a more dynamic approach to layout with multiple zones of different activity and different learning styles. Traditional public school classrooms are largely the same layout with a series of desks faced toward a central element, such as a white board or the teacher at the front. However, research shows that learning is a complicated and varied operation that requires engagement in many different ways.

According to Peter Lippmann, learning and knowledge acquisition occurs in two basic ways: active and passive. Active learning requires direct engagement in an activity. Direct participation in an activity reinforces ideas and concepts and forms meaning with the individual. Passive learning can be considered the traditional way of teaching, which would involve a teacher facilitating learning by lecturing in a large group format. Lippmann argues for the active learning approach, which shows that children learn best in a variety of different ways and in direct engagement.
“L” Shaped Classrooms

Guidelines, according to James Dyck, for the L shaped classroom include:

• It has to accommodate the formation and functioning of small learning groups while providing a sense of separation, because groups working together will experience distractions and non productive interaction.

• It has to be flexible enough to allow the continual reorganization of the whole class into large and small learning groups. This means that the space must be as free as possible from permanent obstructions.

• It has to be manageable by a single teacher who has command of the entire space. This means it must be compact and open. (Dyck, 1994, p. 44)
MONTESSORI METHOD

- Accessible to Nature
- Prepared built environment to stimulate children
- Abundant outdoor play time (where available)
- Large, spacious classrooms with mixed age groups

- Sense of community is fostered in class
- Grouped within mixed ages (3-6, 6-9, 9-12)
- Not as diverse of group of students
- Students are largely from upper middle class, upper class

- High tuition costs ($900-$10,000/year)
- Privately funded with some federal grants
- High tuition costs allows for high quality equipment and space
- Not as accessible to all income levels of families

RESEARCH: INTERPRETIVE
• Many existing/older schools have inadequate spaces and access to quality outdoor space
• Many classroom spaces, gym space, library, cafeteria, etc. However, many of these spaces may not be up to date and not as stimulating as a learning environment

• More diverse student population
• Equity in public school is an issue on the rise
• Re-segregation happening based on income/poverty, race, culture, and language

• Taxpayer funded
• “Free” for all who attend
• Occasionally school districts have little money to spend on upgrades/new construction
MICRO EXAMPLES

ENVIRONMENT
• Indoor air quality standards increase resulting in healthier children
• Learning environment designed to encourage learning rather than encourage distraction

SOCIAL
• School designed to encourage collaboration focused around a project based curriculum

ECONOMICS
• Providing opportunity for lower income students learn in a state of the art facility

MACRO EXAMPLES

ENVIRONMENT
• Positive learning environments focused towards nature and learning

SOCIAL
• Children with fewer behavioral issues at school
• Diverse student body from many backgrounds

ECONOMICS
• School districts saving money on sustainable building practices over time
KIT OF PARTS
In many places around the country, children are not learning in the most ideal environment. Schools built decades ago were built for affordability and constructibility (Lippmann), not for a child to develop and thrive. Some of these schools are now dealing with over-crowding a lack of quality space to house their classrooms. One of the cheapest and fastest solutions is acquiring portable classrooms. These spaces are considered temporary solutions, yet often become permanent fixtures on the school yard. The portables are built as temporary, and thus are not suited for the learner but rather the convenience of alleviating a problem.
KIT OF PARTS

These modular and portable classrooms and units will create a learning environment that promotes socially conscious learning techniques, enhanced emphasis on a connection to nature, and be affordable and flexible for public schools around the country. The Kit of Parts will consist of a classroom, flexible space, node, and corridors to connect them all together. Each piece has been carefully designed and programmed based off of achieving the goals of ecological sustainability and each has been influenced by the Montessori approach to learning and teaching.
TYPICAL CONSTRUCTION

The construction of each part of the kit is carefully crafted to ensure a comfortable and stimulating environment both inside and outside the structures. Structurally Insulated Panels (SIPs) are utilized for modularity and sustainability, and special Diamond Piers act as the foundation, which is a cheap option and requires minimal excavation of the sites.

SUSTAINABLE BUILDING TECHNIQUES

- Polystyrene Structurally Insulated Panels
- Diamond Pier Footing and Foundation System
- Non VOC finishes
- Portable, modular construction
- High efficiency split system heater/AC
- Low-E windows
- Water harvesting, gray water recycling
- Future proofed for Solar Panels
- Recyclable Corrugated Metal Siding
- Cedar Siding
- LED lighting
KIT OF PARTS: CLASSROOM
KIT OF PARTS: CLASSROOM
The Node piece acts both as a connecting piece and an additional learning space. Creating dynamic learning spaces that fit the needs of all students and their different learning styles is key to creating a more sustainable learning environment for everyone. The Node forms an implied “L” shape that creates a defined learning area for groups to gather. This space is defined by a change in flooring material and an engaging wall and ceiling feature that encourages gathering.
KIT OF PARTS: NODE
KIT OF PARTS: NODE
Learning spaces do not have to be exclusive to the classroom. It can take place throughout the entire facility. With corridors and other breakout areas being fully integrated into a learner centric view, the chance for knowledge acquisition and learning strengthens. School corridors have, essentially, been an area of transition. However, what if it were considered a functional area of learning? If students are to acquire practical skills, the organization of both corridors and classroom spaces need to be reevaluated as layered environments that promote individual, one to one, and small group/large group transactions (Lippmann, 2007a, 2007b, 2007c).
CORRIDOR VARIATIONS

Each type of corridor piece offers a unique function. The ‘Solar’ corridor is equipped with solar panels on the roof, the ‘Hydro’ corridor features the water harvesting system used in the classrooms, and the ‘Accessible’ corridor features the required ramp slope for ADA in the case of elevation change within the sites.
The corridors, when connected to each other, are offset 3’ apart in a jagged array for the formation of new, dynamic meeting spaces. These spaces may encourage a small group to gather or an individual to work independently on a project.
KIT OF PARTS: CORRIDORS
KIT OF PARTS: CORRIDORS
FLEX

In many schools around the country, portable classrooms are used for more than just classroom spaces. Some schools experience a shortage of “flexible” space that can include uses like an art room, music room, or a laboratory. This Flex Room is arranged in a way to accommodate whichever function that the school may need to program. An open floor plan allows for flexibility in furniture arrangements and uses. A large sink is available for a more science or art focused program. Ample amounts of storage are provided along the perimeter of the room for storing craft/art supplies, science equipment, or musical instruments.
KIT OF PARTS: FLEX
KIT OF PARTS: FLEX

SECTION

1. AIR EXCHANGER
2. 16” STORAGE BENCH
3. LAB/ART STORAGE
4. LAB SINK
MINOT, NORTH DAKOTA
“Our most urgent need is at the elementary level,” said school board president Jim Rostad. “With nine portables at Washington, our number one concern was trying to build a new elementary where we already have the land and also some safety and security issues at some of our schools that are really poorly designed.”

“Even though the need for more space at the elementary level is most urgent, Rostad said the other needs won’t go away. Within four or five years, enrollment at the middle schools will exceed capacity when there is an influx of new students.”

“We haven’t had a bond issue passed since 1969,” said Rostad. “I guess I shouldn’t have been surprised, but I was disappointed.”

“Vollmer said the board will have to meet to determine its next steps. He said one option the board might consider would be a series of smaller bond issues over a period of years, with voters asked to approve funding for projects as the need arises.”
APPLICATION: SITE SELECTION

MCKINLEY ELEMENTARY

WASHINGTON ELEMENTARY
WASHINGTON ELEMENTARY

EXISTING CONDITIONS

APPLICATION: WASHINGTON ELEMENTARY
APPLICATION: MCKINLEY ELEMENTARY
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**APPLICATION:** MCKINLEY ELEMENTARY

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THANK YOU
QUESTIONS AND DISCUSSION