Re Imagining Spaces for Tomorrow’s Thinkers
Learning Objectives

1. Understand how spatial requirements for active- or inquiry-based learning differ from traditional teaching spaces.

2. Understand how non-classroom spaces can foster informal learning between teacher-teacher, teacher-student and student-student.

3. Describe the academic and developmental benefits active- and inquiry-based learning offer students.

4. Describe the energy efficiency features that allowed the project to be considered “net zero ready” and participate in the “Path to Net Zero” program.
Health, Safety, and Welfare

1. Understanding how the change in teaching methodology to active- and inquiry-based learning improves learning outcomes. Students focus their energy on critical thinking and collaborative problem solving, two skills that will be increasingly important as technology continues to replace a larger portion of our workforce. By creating spaces that support a pedagogy which improves students’ emotional development, the architecture contributes to improving a key aspect of students’ mental health and social well-being.

2. Understanding the attributes which inspire or inhibit active learning pedagogies in building design and the attributes which build community, a key ingredient in a successful school.

3. Understanding the balanced combination of energy efficiency, daylighting, and natural building materials which can create a net zero ready healthy building for learning and teaching.

4. Preparing teachers to take full advantage of opportunities demonstrated by the architecture and with resilient communal spaces to foster a resilient community of learners in a world where culture and education are changing at an unprecedented rate.
Introduction to OES
Oregon Episcopal School

We are a PK-12 Coed Independent College Prep Episcopal School.
Purpose

Our Mission

Prepare for Lifelong Learning

Inspiring Intellectual, Physical, Social, Emotional, Artistic, and Spiritual Growth

Realize Power for Good

Citizens of Local and World Communities
Identity

Our Oregon Home

Nurturing intrinsic curiosity about complex environments and diverse people
Identity

Our Episcopal Tradition

Rhythm of Gathering and Reflection

Inclusion and Respect

Service and Social Justice

Commitment Beyond Oneself
Identity

Our School Philosophy

Open and Rigorous Inquiry

Questions with Exploration and Discovery

Theories with Scrutiny

Self with Subject
Tomorrow’s Thinkers need to be... Skilled Inquirers
Tomorrow’s Thinkers need to be . . . Skilled Inquirers, Creative Problem Solvers.
Tomorrow’s Thinkers need to be . . . Skilled Inquirers, Creative Problem Solvers, Culturally Competent
Tomorrow’s Thinkers need to be . . .

Skilled Inquirers

Creative Problem Solvers

Culturally Competent

Stewards of their Environments
Tomorrow’s Thinkers need to be . . .

- Skilled Inquirers
- Creative Problem Solvers
- Culturally Competent
- Stewards of their Environments
- Contributors to their Community
Teaching these **Values** through . . .

Evolving Approaches to Teaching and Learning
Teaching these **Values** through... 

Evolving Approaches to Teaching and Learning 

Engaging in an Inquiry Cycle
Teaching these **Values** through...

Evolving Approaches to Teaching and Learning

Engaging in an Inquiry Cycle

*Exploration*  
*Creation*  
*Connection*  
*Commitment*
Teaching these **Values** through...

Evolving Approaches to Teaching and Learning

Engaging in an Inquiry Cycle

Connecting Self to Subject - Intrinsic Motivation
Teaching these *Values* through...

Evolving Approaches to Teaching and Learning

Engaging in an Inquiry Cycle

Connecting Self to Subject - Intrinsic Motivation

Moving Students through Curiosity, Interest, Discipline
Teaching these Values through...

Evolving Approaches to Teaching and Learning

Engaging in an Inquiry Cycle

Connecting Self to Subject - Intrinsic Motivation

Moving Students through Curiosity, Interest, Discipline

Opportunities for Individual, Small Group, and Large Group Learning
Teaching these **Values** through... 

Evolving Approaches to Teaching and Learning

Engaging in an Inquiry Cycle

Connecting Self to Subject - Intrinsic Motivation

Moving Students through Curiosity, Interest, Discipline

Opportunities for Individual, Small Group, and Large Group Learning

In Depth Project-Based Learning
Develop Essential **Competencies**
by . . .

**Becoming Skilled Collaborators**
Develop Essential **Competencies** by . . .

- **Becoming Skilled Collaborators**
- **Being Courageous, Empathetic Learners**
Develop Essential **Competencies** by . . .

Becoming Skilled Collaborators

Being Courageous, Empathetic Learners
Develop Essential **Competencies** by . . .

- Becoming Skilled Collaborators
- Being Courageous, Empathetic Learners
- Responding Constructively to Set-Backs
Develop Essential Competencies
by . . .

Becoming Skilled Collaborators

Being Courageous, Empathetic Learners

Responding Constructively to Set-Backs

Cultivating Curiosity and Creativity
Develop Essential **Competencies**
by . . .

- Becoming Skilled Collaborators
- Being Courageous, Empathetic Learners
- Responding Constructively to Set-Backs
- Cultivating Curiosity and Creativity
- Imagining, Designing, and Applying Solutions
Applying
New Pedagogy
Classrooms...
Classrooms... are changing...
Classrooms... are changing
Classrooms...are changing...are *changing*
Learning tools
Learning tools are changing
The Classroom as a(n)...
The **Classroom** as a(n)...
Teacher’s Desk & Area
Storage Space
Material Cabinets
Pin-up Space
Instructional Space
Additional Space Required
Gathering Space
Pin-up Space
Individual Space
Craft and Exploration
Large Group
Small Group
Pin-up Space
Teacher’s Desk & Area
Classroom Desk
Storage Space
Instructional Space
Additional Space Required
Connection to Nature

Visual Connection

Acoustic Separation
All Spaces as Learning Spaces
A DISCOVERY-BASED PEDAGOGY

PROJECT-BASED CURRICULUM

FLEXIBLE LEARNING SPACES

NATURAL LIGHT

DISPLAY OF STUDENT WORK

ACCESS TO OUTDOORS
Typical Arrangements
Central Social Hub
Shift Block up Slope
Open up Views
Classroom Flexibility
Affinity Commons

1st Floor

2nd Floor

3rd Floor

3rd and 4th Grade Commons

5th Grade Commons

1st and 2nd Grade Commons

Primary and Kindergarten Commons

LIBRARY
Connecting to Nature . . . through Architecture
Connecting to Nature . . .

through Views
Connecting to Nature . . .

through Pedagogy
Facilities & Resiliency
Commitment to our children
Commitment

to our children
to our environment
HEALTHY BUILDING MATERIALS
Natural, long life-cycle building materials create healthy learning spaces that don’t emit toxic chemicals and ensure the building endures a long lifetime.

NATURAL VENTILATION
Operable windows and roof ventilation shafts improve occupant comfort and reduce mechanical cooling.

WATERWORKS
Water remediation as a teaching tool.

DAYLIGHT & VIEWS
All spaces have access to natural light and views out to nature.

WETLAND REMEDIATION
Zone north of loop road to be revitalized back into a natural wetland and teaching grounds.

MAXIMIZED OPEN SPACE
Building minimized to optimize open space.

THERMAL ENVELOPE
High performance envelope lowers dependency on energy to heat/cool building.

RENEWABLE ENERGY
Roof designed for future energy-producing photovoltaic panels.

REDUCE LIGHT POLLUTION
Lowered light levels reduce impact to surroundings.

STORMWATER MANAGEMENT
All rainwater run-off from parking lot travels through runnels and treated in sub-surface treatment facility.

NATURAL PLAYSCAPE
Low-intensive landscaping and natural materials have low impact on environment.

BUILDING ORIENTATION
Minimized windows on East and West facades to control glare and heat gain.

ENERGY USE INTENSITY

EXISTING

ANTICIPATED

EUI (kBTU/sf/yr)

72

72

25

25
Sustainability Summary

2030 Compliant

Net Zero Energy (NZE) Ready
Path to **Net Zero**

Creating **resilient** and **sustainable** learning environment for our children

---

**Energy Use Goal Setting**

- **Existing**: 80
- **Typical**: 70
- **Good (Code)**: 60
- **Better**: 50
- **Best**: 20

Net Zero Goal
Phase to **Net Zero**

Creating **resilient** and **sustainable** learning environment for our children

Energy Trust of Oregon

---

**Studying Energy & Design Alternatives**

Two alternatives were identified for further study. Alternative G is a passive option which employs natural ventilation during operating hours of 7 am – 5 pm, a night flush of outside air using the Dedicated Outside Air System (DOAS), and ventilation shafts to enhance airflow. Alternate I is a hybrid scenario that uses passive and active cooling. It employs the strategies listed for G while also providing mechanically cooled 60°F ventilation air during operating hours.

**Table 4:** Summary of Phase 2 Design Alternates for OES Lower School Classrooms

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-1</td>
<td>Natural ventilation during operating hours, no external shading, night flush with DOAS, exposed concrete floor (2.5”), and fan assisted ventilation shafts</td>
</tr>
<tr>
<td>G-2</td>
<td>Natural ventilation during operating hours, 3.5” external shading, night flush with DOAS, carpeted floor, and fan assisted ventilation shafts</td>
</tr>
<tr>
<td>G-3</td>
<td>Natural ventilation during operating hours, no external shading, night flush with DOAS, exposed concrete floor (2.5”), and fan assisted ventilation shafts</td>
</tr>
<tr>
<td>I-1</td>
<td>Natural ventilation during operating hours, no external shading, night flush with DOAS, carpeted floor, fan assisted ventilation shafts, and 60°F ventilation air</td>
</tr>
<tr>
<td>I-2</td>
<td>Natural ventilation during operating hours, 3.5” external shading, night flush with DOAS, carpeted floor, fan assisted ventilation shafts, and 60°F ventilation air</td>
</tr>
<tr>
<td>I-3</td>
<td>Natural ventilation during operating hours, no external shading, night flush with DOAS, exposed concrete floor (2.5”), fan assisted ventilation shafts, and 60°F ventilation air</td>
</tr>
</tbody>
</table>

In Figure 7, these alternates are compared for a typical south facing second floor classroom. Based on these results, external shading and an exposed mass surface such as a concrete floor or ceiling aid in reducing the number of hours in the upper temperature ranges for Alternate G and I.

For a more detailed look at expected space temperatures for Alternates G-1, I-1, and I-3 (the top design options considered by the owner and design team), color coded monthly heat maps of an upper floor classroom are shown in Appendix A. The heat maps indicates at which occupied hours (Monday through Friday, 7 am to 5 pm) for each month the temperature would be expected to rise above 75°F. Note that results are for the upper level of a south facing classroom which presents the worst case scenario for these spaces.

In Figures 8-13, outside and indoor air temperatures were plotted for the months of June, July, and August for Alternates G-1 and I-1. Note that this includes weekend and evening hours when the classrooms are unoccupied. During the evenings, a night flush is carried out to cool the space with outside air. During the weekends, windows are left closed and no mechanical ventilation is provided.

In Alternate G-1, during warm weekdays when natural ventilation is employed, the indoor temperature follows the outside temperature closely. Here outside air is used to cool the space which heats up due to internal loads (mainly people and equipment) and solar gains. In Alternate I-1, with the addition of conditioned ventilation air, indoor temperatures are generally able to be maintained below the peak outdoor temperatures.
Creating resilient and sustainable learning environment for our children

**Path to Net Zero**

**Conducting Energy Analysis**

![Energy Consumption by End-Use](image)

- **Baseline Energy End-Use Breakdown**
  - Space Heating: 42%
  - Plug Loads: 15%
  - Vent FANS: 15%
  - Space Cooling: 14%
  - Lights: 11%
  - DHW: 2%
  - Pumps & AUX: 2%
  - Heat Reject: <1%

- **Proposed Energy End-Use Breakdown**
  - Savings: 37%
  - Plug Loads: 15%
  - Space Heating: 16%
  - Space Cooling: 14%
  - Vent FANS: 20%
  - DHW: 8%
  - Pumps & AUX: 0%
  - Heat Reject: 0%
  - Domestic Hot WTR: 0%
Passive Strategies

- Super Insulated Envelope
- Natural Daylight from Skylight to Help Light Corridor and Classroom Interiors
- Green LED Light and Push Button to Activate Natural Ventilation
- Occupant Sensor for Lights
- Stack Heat Gain
- Natural Ventilation Stack
- Electric Cove Heater
- Manually Operable Windows
- Exposed Slab
Building as a **Learning** Tool

**Active Environment Control**

- **Passive Strategies**
  - Manually Operable Windows
  - Super Insulated Envelope
  - Electric Cove Heater
  - Natural Daylighting
  - Exposed Slab

- **Active Environment Control**
  - Natural Ventilation
  - Occupant Sensor for Lights
  - Stack Heat Gain
  - Green LED Light and Push Button to Activate Natural Ventilation
  - Skylight for Help Light Corridor and Classroom Interiors
  - Hallway and Classroom Interiors
Building as a Learning Tool

Stormwater Garden
Lessons
Lessons Learned

Identifying Key Values
Portland has a large daily temperature range in the summer months as can be seen in Figure 3. This large range indicates that Portland buildings are good candidates for a night flush strategy to help cool the spaces.

Additionally, data from a historical heat wave was used to help identify how high the temperatures could rise in the classrooms given a period of extremely hot weather. Historical data for the hottest day on record was found; this was August 10th, 1981 in which temperatures reached 106°F. This was preceded by four extremely hot days with three of the four breaking over 100°F. For several of the design options, this historical weather data was uploaded into the model in place of “typical” weather.

Figure 4 shows the hourly outdoor temperatures used for this analysis.
Lessons Learned

Visual Connection

Acoustic Separation
Lessons Learned

Acoustic Comfort
Lessons Learned

Making Students’ Learning Visible
Lessons Learned

Making Teachers’ Learning Visible