

Making Sustainability Visible: Two Early Childhood Education Centers

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ABSTRACT: This post occupancy evaluation compares two early childhood education centers built in 2007 in two very different parts of rural Oregon by two independent Head Start organizations. Making sustainability visible was a goal for both these projects at multiple scales: building facilities that gave stability and visibility for programs for early childhood education, fostering environmental awareness and reducing energy costs. Research involved two cycles of evaluation: one in 2008 – a year after occupancy - and a second in 2012 – five years out. Methods included interviews with architects, clients and users, parent surveys and site visits for walk-throughs, observations and collection of environmental data. Findings validate key design principles necessary to the success of both projects that can inform future projects.

KEYWORDS: Head Start, preschool, post-occupancy, sustainability, children

INTRODUCTION: COMPARING TWO CENTERS FOR EARLY CHILDHOOD EDUCATION

Redwood Early Education Center and Harney County Early Childhood Center are projects of similar scale built for similar budgets - but for different clients in different contexts resulting in buildings of very different character. Both opened in 2007, designed by the same architect, using principles derived from earlier research, to support social sustainability (connecting to context and community, legible building organization, welcoming entry, open, generous and flexible classrooms, support for staff), environmental sustainability (direct classroom-playground connections, daylighting, pools of light, natural ventilation, ceiling height variety, thermal comfort, special windows) and economic sustainability (energy efficiency, straightforward, cost-efficient construction). In the wet coastal mountains of western Oregon, the Redwood Early Education Center (Fig. 1) is the result of a cooperative venture by Southern Oregon Head Start, Rogue Community College and Josephine County Early Intervention Services. Located on the wooded Redwood campus of Rogue Community College in Grants Pass, the building houses two Head Start classrooms and a multipurpose room and provides a practicum site for Rogue Community College students earning associate degrees in nursing or early childhood education. In the high desert of eastern Oregon, Harney County Early Childhood Center (Fig. 1) provides the only public preschool education in the county, drawing children from both the county seat of Burns and from scattered farms and ranches. The programs include Head Start (two classrooms), Great Start (for slightly higher income groups), and programs for Infant/Toddlers and Home-based Head Start (formerly Rural Outreach). This study compares how similar design principles are applied to different projects and evaluates how the buildings are meeting their purposes, to find out what is successful and what is not, and to inform future projects.



Figure 1: Redwood Early Education Center (left) and Harney County Early Childhood Center (right)

1.0 METHODOLOGY

Research involved two cycles of evaluation, a project review one year after occupancy and a strategic review, completed five years after occupancy (Guide to Post Occupancy Evaluation, 2006, 9). Methods were primarily qualitative with some quantitative collection and analysis of enrollment numbers, staff retention, utility bills, number and location of furnishings and environmental data.

Initial methods included literature review, background research and documentation and interviews with the architects. This was followed by two full-day visits to each project: Redwood EEC (Thursday, 11/1/2007; Tuesday, 2/26/2008); Harney County ECC (Tuesday, 11/27/2007; Monday, 2/11/2008). The fall visits included interviews with staff, walk-through and photographing the facilities and classroom observations. The winter visits also included furniture inventories, environmental data collection (light levels – illuminance readings, glare – luminance readings, temperature – HOBO data loggers, sound levels – decibel readings), child interview activities and parent interviews. Parent surveys were left for distribution and then returned. Five years later, one full-day site visit was made to each project: Redwood EEC (Thursday, October 25, 2012); Harney County ECC (Monday, November 5, 2012). The investigation techniques in 2008 were repeated except for child interview activities, which had not yielded useful data.

2.0 KEY FINDINGS

The projects were analyzed and compared at multiple scales: community impact, site and building organization, classroom design and furnishing, playgrounds, specialized rooms and support spaces, economies of construction, maintenance and durability.

2.1. Stable Head Start Programs

Primary goals of both organizations were to increase stability for their early childhood education programs and improve their community outreach. Comparisons of student enrollments over the past five years, analysis of staff retention numbers and interviews were used to assess whether these goals have been met. Over five years, both Redwood EEC and Harney County ECC have had stable enrollments – Redwood at 80 students in four classes, Harney with 60 Head Start students in four classes, 34 Great Start students in two classes and multiple clients for Home-based Head Start and Healthy Start programs, which include out of facility site visits and socialization groups within the center. In 2008-9 Redwood converted its multipurpose room into a full day classroom, increasing enrollment to 100, but for administrative reasons that program was not continued. Both Redwood EEC and Harney County ECC advertise openings at their front door as outreach, so parents know they are there. Harney County usually has a wait list, but if anyone comes in off the street and needs services, both programs will find a space. Both directors reported low staff turnover. At Redwood EEC staff retention was 30% (5/17), although staff turnover was reported lower than among other sites. One new teacher with experience at other sites in Grants Pass and in California reports she “really love[s] [this center]” (Aviles, 10/25/2012). At Harney County ECC, retention was 80% (12/15). Harney County is much less populated than Grants Pass with very few family wage jobs, so this high number is not surprising. The Harney County director reported that the building draws people in. “People drive by to look at it. Some ask for tours” (Schnitker, 11/5/2012). Another teacher stated, “We’re the envy of the town – we have a nice building” (Stampke, 11/5/2012). The relationships among Redwood’s consortium partners have changed. Josephine County Early Intervention no longer runs programs in the multipurpose room but still sends specialists to work with special needs children in the classes. The partnership with Rogue Community College has grown to 38 nursing students, four early childhood practicum students and four regular volunteers who come to the center. A Rogue Community College faculty member uses a center office three times a week to meet students. The observation room, the only one of its kind in the agency, is an asset valued by the college and is used by Head Start teachers and family advocates to reassure and educate parents and for teacher supervision and evaluation. From the administrators’ perspective, the room is underused and may not warrant the investment in equipment and space. The room could be smaller, because no more than two people observe at a time.

2.2. Welcoming | Child and Family Friendly

Welcoming children and their families is a primary goal for these facilities. Overall parent comments in 2012 (9 from Redwood EEC; 3 from Harney County ECC) were as positive as those in 2008 (15 from Redwood EEC; 13 from Harney County ECC). In all surveys from both centers, parents stated their children “love” their schools. At Redwood parents liked the entrance security systems (5), the natural playground (4), the child-size fixtures, the child-size door, that it is well-built and planned (3), that it is clean, friendly (2), the size of classrooms, having two children’s bathrooms and many different learning tools (1). Parents desired playground improvements, more parking, more security cameras and a bigger room for parent meetings. They disliked having “to go to the classrooms by going outside when it is cold.” Respondents from Harney County ECC liked the open / “simplicity” of the plan, the low windows to the outside, the large amount of natural light, the playground (2), the good size of classrooms, the bike path in the playground, and that the

building looks clean, new (1). Improvements desired included finishing the playground, adding a diaper changing station in the men's bathroom and planting more trees for shade.

A welcoming entrance is achieved in both projects by front and back porches with fully glazed windows for seeing in and out. Redwood EEC incorporates three special elements: a child-sized door, a tower room off the entry and a visible parent room. The "little door" is beloved by children and parents. Observing the little door in action for an hour in 2008 and again in 2012 showed similar patterns. Children enter through the adult door, and then go back to come through the little door; parents go through the little door; children hold open the little door for their sibling; a grandfather holds open the little door for his grandson. At the time of the building's construction, staff had concerns about the little door and the glazed nook to its side, but fears about pinched fingers and children darting out have not materialized. The tower room at the entry has been refurbished since 2007 to include seating and books, making it much more friendly and inviting. The parent room has a good location with an interior corner window along the entrance hallway. Staff report the parent room is well used, and the corner window "brings style." Harney County's budget precluded the child-size door, but the front porch and lobby are welcoming and wide enough for areas for parents to sit and chat.

Both buildings have rooms for family programs and parenting classes that support their community outreach mission. Redwood has converted the motor room to a multipurpose room for monthly parent meetings, parenting classes and training sessions. Harney County uses the Home-based and Infant-Toddlers' classrooms for parent-child socialization groups and for parenting classes. Both buildings have commercial kitchens that allow food to be served at all parent events, which is a big draw.

2.3. Understandable and Functional Layout

Redwood EEC and Harney County ECC (Fig. 2) have contrasting organizations, but both work well in the context of their sites and staffing patterns. Circulation patterns are clear. Parking for parents is adequate, and there are clear paths to the front doors. Redwood's office wing is separated from the classroom wing, with only the problem that an adult bathroom is needed in the classroom wing. At Harney County, the organization with staff offices and workspaces on one side of the hall and skylit alcoves for classroom entries on the other works equally well. The flow at Redwood has required doors with alarms, so that parents and children enter the classrooms from the back porch but can only exit through doors to the north. In Harney County, children enter from the playground as well, but then exit down the hall to the lobby.

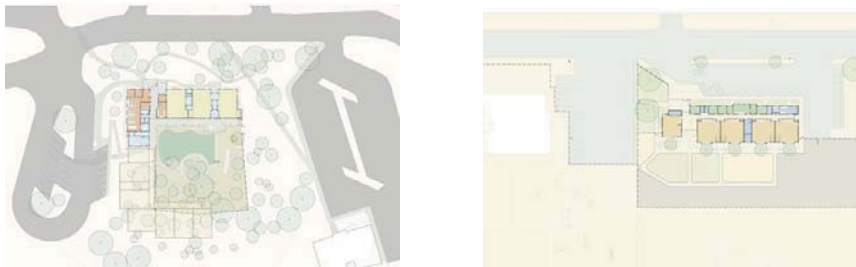


Figure 2: Site plans: Redwood EEC to the left, Harney County ECC to the right

2.4. Well-proportioned, Open and Child-centric Classrooms

Multiple characteristics are important in ensuring open and child-centric classrooms.

2.4.1. Size

The size of both classrooms at around 93 m² [1000 ft²] is good – not too large and not too small. At Redwood one teacher reported that the classrooms are large enough for putting out more activities than in other centers, but not so large as to get "runners" (Wilson, 10/25/12). The Head Start Performance Standards of 3.25 m² [35 ft²] per child would have allowed classrooms of 65 m² [700 ft²] (Redwood) or 49 m² [525 ft²] (Harney County) that would have been much too small (Head Start Design Guide, 2005, 39).

2.4.2. Daylight | Ceiling Height | Views

Daylight is admitted in both classrooms from both the north and south (Fig. 3), and because of their height both classrooms have clerestory windows to maximize daylight penetration. Both classrooms have windows with low sills that are scaled for children. Redwood's triple hung windows reach the floor with the first bar just above the scale of a child standing. One Redwood teacher, who prefers the "Green Room" because there are more windows, added a birdbath outside and writing tables by the window, so children can write about what they see. Another teacher "likes the corner view: when a child is upset, they can look at and commune

with nature, see something that takes their mind off it. ... It is gorgeous when it snows; the kids have seen rainbows” (Wilson, Wonsyld, 10/25/2012). Harney County’s low window seats on the south side are favorite places. One teacher made a “WOW” window through which children can see outside in all directions (Lovelady, 11/5/2013). Teachers use low windows as special places for reading, science, writing and art.

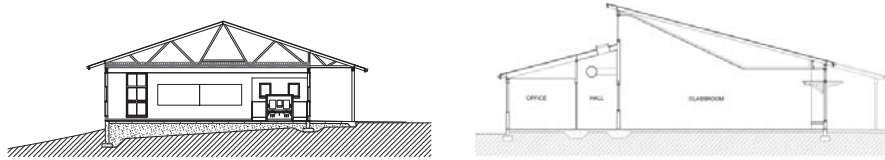


Figure 3: Sections north to south: Redwood EEC on the left, Harney County ECC on the right

2.4.3. Child-scaled Bathrooms and Sinks in the Classroom

Having children’s bathrooms with child-sized fixtures in the classroom is essential. At Redwood EEC staff felt two toilets were necessary, but privacy has been an issue. In the “Yellow” classroom, fabric drapes were added to increase privacy in 2007, but by 2012 these were replaced with cabinets on top of the wall between the stalls. At Harney County ECC teachers agree one toilet is adequate, and they have turned the inboard toilet stalls into activity areas. Adult toilets down the hall are easily accessible if a second toilet is needed. Teachers at Harney County ECC also debate the privacy issue. The latched doors are hard for children to pull open – pushing would be easier. In both centers sink countertops are too wide, so children cannot easily reach the soap or paper towel dispensers. The plastic laminate counters have not worn well. One narrow trough sink, with space for two and paper towel dispensers at the side above waste cans, might be easier for children to use and improve durability.

2.4.4. Surfaces | Color | Special Features

Teachers in every classroom display on every wall surface, including some of the windows, and hang many kinds of things from the ceiling. Balancing the number of windows and the amount of tackable wall area is a challenge. Colors in both centers are intended to be calming. The “Yellow” and “Green” rooms in Redwood are pale. The interior room with fewer windows has the lighter, yellow color. In 2012 the yellow is lighter and the green a paler blue-green than in 2008. The Head Teacher reports the nature-like colors keep things calm (Broome, 10/25/12). At Harney County the classrooms remain painted a stronger blue, but in a climate with stronger light, the color unifies each room as a calm background. Harney County was designed with interior windows and Dutch doors between the classrooms and the hallway. The interior windows are appreciated for allowing parents and staff to preview before entering the classroom. The Dutch doors are particularly useful for the Infant/Toddler and Home-based Head Start classrooms, where the lower door contains the younger children while the upper door remains open.

2.4.5. Teacher Support and Storage

The teacher’s 2.4 m [8 linear feet] of counter space in Redwood EEC is workable, even though it is split in two levels – one with the sink and the other higher. The 1.2 m [4 lf] in Harney County that includes the teacher’s work sink is inadequate. Teachers from both centers say there is never enough counter space. Built-in cabinets in both centers provide storage for supplies. Redwood has 2.4 m [8 lf] of above-and below-counter storage. Teachers also have access to two shared storage closets, one between the two classrooms and the other used for dramatic play costumes. In 2012 closed cabinets were added above the wall separating the two toilet stalls, adding 3 m [10 lf] for supplies. Harney County classrooms have 4.9 m [16 lf] of full wall built-in storage. Each classroom also has a closet for additional materials, but these can only be accessed from the hall. Teachers would prefer direct access from inside the classroom.

2.5. Playgrounds Directly Connected to the Classrooms

Direct playground-classroom connections are highly valued in both centers. Children typically enter their classrooms from the playground. In both programs, classes go outside to play almost every day, and in good weather teachers keep the doors open and use the porches outside for activities such as easel painting. The two playgrounds are similar in size but very different in character. Redwood EEC was built in a forested site, and the playground feels embedded in the woods. Construction saved as many trees as possible, and playground elements are integrated with nature: grass swales, a sand pit framed with cut logs, a stone creek bed with pumped water, playhouse cabins, a tree house area, birdhouses and a manufactured “boulder” with fall area all around. The playground was volunteer-made and funded and remains well loved by staff parents and children. From 2008-2012 the playground has continued to be improved while increasing its natural character. The trike path from 2008 was extended, and a gate added at the top of the rise to prevent trikes from barrelling down the hill. The gate itself is a fun open/shut activity.

One new shed for gardening tool storage and several planter boxes were added. Water issues have been fixed with the grading. The sandbox needs a roof to protect it from the rain and for shade on hot days.

The Harney County ECC's playground was not part of the construction budget, and the center opened with a minimal playground: fenced dirt, one deciduous tree in front of each classroom's bay window, sidewalks for trike riding, two sections of grass and a sand pit. Since then the center has raised \$121,000 in grant money for playground development. One large section now sports a large play structure on area filled in with soft-fall padding. Wood benches have been added, and three mulch areas with plantings are beginning to take hold. Most noticeably, the trees planted in 2007 have thrived – although they have yellow jacket traps hanging from them. The Harney County ECC playground was designed with a separate infant/toddler zone. That has not been further developed. Although the infant/toddlers use the playground at every session, parents accompany them, so there is lots of adult supervision. The long playground allows age separation just by distance (Yunker, 11/5/2012).

2.6. Versatility and Flexibility

Both projects were designed with a strategy for expansion, but neither has expanded. Within each building, some rooms have been used in new ways. The motor room of Redwood EEC was designed for easy conversion to a classroom, which happened during 2008-9, when the bathrooms were built out. After the full-day program was discontinued, staff were glad to have a multipurpose room back for parent meetings, training sessions, family day activities, parenting classes, rainy day recess and small group break-out activities. The large storage closet has been converted from ball storage for the motor room to an art studio. Furnished with both adult and child-size tables and chairs and audiovisual equipment and accessible from both the classrooms along the back porch and the lobby, the room works well as a multifunctional space. At Harney County ECC, the parent room, originally located at the front door, was moved down the hall, and the director's office moved into the original parent room. The lobby is large enough for parents to socialize, and the parent room was largely unused. The new parent room is smaller but outfitted as a Parent Coop with a computer, Internet access and open shelves with a lending library, clothes and canned goods. One parent was in there most of the day, using the computer (11/5 2012). The Director's office is in better location to welcome parents and children, be closer to the administrative assistant, and particularly in the summer, when she is the only employee on site, this location lets her control the door.

In both centers, the classrooms are designed as simple volumes for easy teacher supervision, while maximizing the flexibility for children to engage a variety of learning activities that can change with different furniture arrangements. Within each classroom, the Head Start curriculum has a set of activity areas: circle, writing, reading, blocks, art, dramatic play, computers, manipulative play, math, science. Interviewing teachers and recording in photos and maps the different ways different teachers have laid out the activity areas measures the flexibility of space. Teachers in 2007/8 and 2012 reported finding the classrooms in both centers had enough flexibility for them to change furniture groupings.



Figure 4: Furniture layouts: on the left, Redwood EEC Head Start classrooms in 2008 and 2012 | on the right, Harney County ECC Head Start classrooms for the 3's and the 4's in 2008 and 2012

Mapping activity areas and furnishings in 2008 and 2012 gives evidence to suggest there is more flexibility in the rectangular Redwood EEC classrooms than in the square rooms of Harney County ECC (Fig. 4). At Redwood EEC cubbies remained unchanged in the welcome area (3 m [10 lf] with two tiers of cubbies), and wet activities remained along the south wall. However, the location of circle shifted in both classrooms, and six of the eight activity centers changed location. At Harney County ECC there is less flexibility in the furniture placement, because of the position of the teacher's corner, determined by Internet connections and outlets, and its relationship with circle. The only circle that had changed was in the Home-based Head Start and that room was observed between socialization classes. To supplement the 2.4 m [eight lf] of built-in, single-tier cubbies on the north wall, each teacher has added additional cubbies in different positions around

the welcome area. The loft in the 4-years old Head Start room remains in the same place in 2012 as in 2008. It is remarkably effective in zoning the cubbies area and taking advantage of the height of the room. When first observed in 2008 the number of pieces of furniture was greater in classrooms in both projects than the architects had anticipated. In 2008 each Redwood classroom had 32 pieces of furniture. In 2012 that number had only grown to 35. In Harney County the number of pieces of furniture has generally increased. In 2008 classrooms had 20-30 pieces of furniture, but in 2012 the range goes from 32-44. While some pieces have been removed, it has proved more common for pieces to be added. Most of the additional pieces are shelves and filing cabinets for storage.

2.7. Daylighting | Pools of Light

Each of these projects was designed to maximize daylight in the classroom with balanced light from the north and south. At Redwood EEC a 3.1 m [10'3"] high ceiling allows for tall, triple-hung windows, three ganged together along the south wall and two along the north wall at opposite ends. Four pendant fluorescent troffers and a ceiling fan with a light provide electric light. At Harney County ECC the lower flat ceiling over the wet activities zone along the south wall has five in-ceiling fluorescent fixtures, and the ceiling sloping up to the north has two pendant fixtures and a fan.

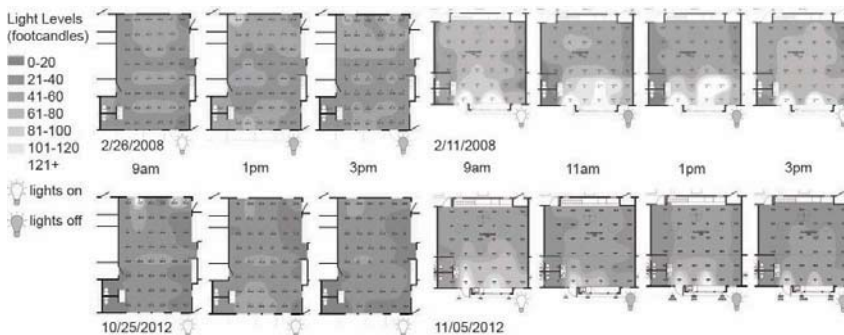


Figure 5: Illuminance measurements: Redwood EEC on the left, Harney County ECC on the right

In 2008, Grants Pass was overcast with some sun. Burns was sunny all day with snow on the ground. In 2012, both locations were overcast in the morning and sunny in the afternoon. Light levels in the main areas of the rooms were at or slightly below the recommended illuminance levels of 300-1000 lux [28-93fc] for preschool activity areas (Head Start Design Guide, 2005, 134). In both centers, light levels were lower in fall 2012 than in winter 2008 (Fig. 5), possibly because of the increased quantities of things, intended to make the room feel more “homey,” covering the windows, and in Harney County, the light shelves. Ironically, light shelves designed to maximize daylight penetration work equally well for display. Teachers reported that they prefer natural daylight and use electric lights to vary lighting conditions for pedagogical reasons. At lunch and rest times, lights are off. During free play, the lights are on, and teachers turn them off to get students’ attention. Teachers at Redwood reported that they usually only turn on half the troffers. Harney County ECC wanted blinds for the clerestory lights, because there are times they would like to darken the rooms more completely. Except for darker pockets near the walls and brighter pools next to the windows, light distribution in the classrooms in both centers was generally within a 3:1 ratio and did not exceed 5:1. Although creating pools of light with independent switchable lights was an earlier concept not realized in the final design, the only activity that seemed to need a focal light was circle. The windows create natural pools of light that vary throughout the day.



Figure 6: Luminance measurements: Redwood EEC on the left, Harney County ECC on the right

In Redwood EEC, the covered porch significantly reduces the potential for glare. The maximum luminance ratio measured was 24:1, well within the recommended maximum 40:1 luminance ratio for anywhere within the normal field of vision (Kwok, 2010, 512). In Harney County ECC the interior Venetian blinds reduce the potential for glare, and the maximum ratio measured between the main windows and the darkest part of the wall was 33:1. Two areas exceeded the recommended maximum: the windows above the light shelf, which

are not within the normal field of vision of a child in the room, and the glazed door and adjacent window, which do not have blinds and had a maximum ratio of 161:1 (Fig. 6).

2.8. Thermal Comfort and Reduced Energy Usage

The coastal climate of Grants Pass is mild and rainy, and skies are often grey. Redwood EEC heats October-May and cools August-October. The exterior HOBO readings taken over one week ranged from 2-18°C [35-65°F] in February 2008 and 6-32°C [42-89°F] in October 2012. The Head Start Design Guide gives a guideline of 21°C [69.8°F] in winter (2005, 132). With classroom thermostats set at 21°C [70°F], the interior range during hours of occupancy in 2008 was 16-22°C [60-71°F]; in 2012 it was 19-23°C [66-74°F]. Complaints about thermal comfort came from the few rooms that did not have local air vents (manager's office, interior conference room) or local thermostat control (parent room). Although the building was originally planned for radiant floor heating, value engineering resulted in a high efficiency heat pump with forced air. Ceiling fans and operable windows allow for cross-ventilation and more air flow when desired.

In contrast, the high desert climate of Burns is one of extremes with very little precipitation. The exterior HOBO readings reflect its greater range of exterior temperatures: from -7-12°C [20-54°F] in February 2008 and -11-32°C [12-89°F] in November 2012. Harney County ECC heats October-May and cools August-October and late May-June. The heating was planned with passive solar strategies - all the classrooms and their windows face south. A radiant floor system supplements passive strategies. Because the system takes six hours to heat up, it is left on with a thermostat set at 20°C [68°F]. The interior range measured in 2008 was 20-23°C [68-74°F]; in 2012, it was 21-24°C [70-75°F]. Children and staff love the warm floor and that there is little dust. Teachers frequently use the ceiling fans and operable windows for cross-ventilation. Additional cooling is needed in the hot early fall and late spring. A passive system with louvers for night flush was designed, and a swamp cooler installed. When first tried, the low louvers let in the dust of the undeveloped playground. Teachers also expressed security concerns about having low vents and have taken over the floor area near the louvers, making them inaccessible. The swamp cooler did not work for the first five years, until someone local was found who could fine-tune its motor. The night flush now works with air coming from the swamp cooler and exiting the clerestory windows. The exterior sunshades at Harney County were value engineered out, and this may contribute to heat gain. However, trees planted along the south edge of the building have grown a lot in five years and offer shade. The only classroom that really overheats is the Infant-Toddler classroom, which has windows to the south, west and north, no exterior sunshades and only one modest tree. On an early November afternoon, the room was noticeably warmer than the other classrooms. To make passive heating and cooling strategies work, they need to remain a priority throughout construction, and fine-tuning and educating the users are critical. The decisions to cut the sunshades, use a VCT floor rather than exposed concrete, and not to use the night flush vents have eroded the potential efficiency of the systems.

Table 1: Energy consumption and cost

	Building	Time Period	Energy Sources	Area m ² [ft ²]	Annual Energy MJ [kBtu]	Annual Site Energy Use Intensity MJ/m ² [kBtu/ft ²]	Annual Energy Cost \$	Annual Cost/Unit Area \$/m ² [\$/ft ²]
Grants Pass	<i>Merriman</i>	10/2011-09/2012	Electric and	678 [7300]	719,212 [681,681]	1,060 [93.3]	14,244	13.4 [1.95]
	<i>Redwood EEC</i>	10/2011-09/2012	Natural Gas	650 [6992]	583,053 [552,628]	897 [79.0]	9,344	14.4 [1.34]
Burns	<i>Old Building</i>	07/2005-06/2006	Electric and Oil	698 [7509]	474,001 [449,267]	679 [59.8]	7,913 (8,793*) *adjusted	11.3 (12.6*) [1.05 (1.17*)] for inflation
	<i>Harney County ECC</i>	07/2011-06/2012	Electric and Propane	799 [8600]	515,826 [488,909]	646 [56.8]	10,657	13.3 [1.24]

The energy costs of the two buildings were compared after analyzing utility bills (Table 1). The Redwood EEC building achieves a 51% energy reduction from the median energy consumption of a building of similar size, location, use, and equipment (EPA Energy Star Target Finder; using k-12 as the basis for comparison since there is no category for pre-k) and a 15% reduction in energy use compared to the Merriman building, another Head Start building in the agency. The Harney County building achieves a 70% energy reduction from the median energy consumption of a similar building and a 5% reduction in energy use compared to the old building. At Harney County propane was selected as the source of heating fuel, because of its low price at the time, but since then the price has skyrocketed.

2.9. Economies of Construction | Maintenance and Durability

Both of these projects were designed with very lean budgets. Redwood's sloped and wooded site with a lot of ground water meant higher construction costs for excavating and replacement with new select fill. At Harney County, the budget was even tighter, but the relatively flat and treeless site with utilities in place kept down site costs. Both projects used repeating trusses and standard construction. Redwood EEC used trusses with one plate height, except for the tower and deep roof overhangs to the south. Harney County used inverted trusses with two different plate heights, and the higher 3.7 m [12'] interior wall required additional sheer capacity. The Redwood staff was not pleased with the contractor. After five years, there is truss lift at the ceiling in the entry hall that results in periodic cracks in the sheetrock. The sprinkler system needs constant maintenance and it costs \$2,000 each time to drain the system to repair leaks. Harney County after a second bidding process was very satisfied with their contractor's performance. However, the swamp cooler that was planned to save dollars cost more to install, because it required two different subs, and only in the last year has it been effective. Both projects have regular twice-daily cleaning protocols and weekly and seasonal floor waxing and window cleaning standards. The larger carpets are shampooed and smaller carpets come in and out. Redwood EEC has repainted the interior four times, while Harney County ECC has not yet needed to repaint.

Having a kitchen at both centers has allowed them to save dollars and provide organic, low salt and low sugar meals that the children like. The kitchens prepare breakfasts, two lunches (am and pm) and afternoon snacks and also serve dinners for parent and family events. In each building design, square footage for the kitchen competed with space for classrooms, and both kitchens ended up undersized. Redwood had already expanded its kitchen subsuming an adjacent closet by 2008, but the space remains too narrow and too small. In both kitchens the need for cooling and ventilation were underestimated. Redwood's cooling problems are exacerbated by its location facing south. The overheating of the kitchen stresses the refrigerator and freezer and makes it hard to make bulk food purchases without danger of their spoiling. By 2012 Redwood had added a swamp cooler to help with kitchen's cooling. Harney County's kitchen was not outfitted and operational until 2009. Before then, food was brought in from the Youth Prison. By cooking their own meals, Harney ECC is saving enough money to use organic ingredients. The location on the north side of the building helps keep the kitchen cool, but the refrigerator and freezer had to be moved into the main space, because they generated too much heat and needed a bigger area with adequate air flow. This makes the kitchen even hotter and louder, and the swamp cooler situated to cool the kitchen has never worked. Planning for appropriately sized kitchens with adequate ventilation and cooling has long-term savings.

CONCLUSION

The federal government has been doing longitudinal studies for years on the effectiveness of the Head Start program on the lives of children. Although the government has not done post-occupancy evaluations of Head Start facilities, there are design guidelines. This post-occupancy evaluation supports many of the existing guidelines and provides evidence for design principles that can add value in their application to future projects. It makes a case for new facilities that will make Head Start programs visible and increase their sustainability as resources for children, families and communities. Both these centers demonstrate how new buildings can integrate goals for social, environmental and economic sustainability, giving Head Start programs presence and stability, fostering environmental awareness and reducing operating costs.

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REFERENCES

- Barlex, M., Blyth, A., and Gilby, A. 2006. *Guide to Post Occupancy Evaluation*. Higher Education Funding Council for England: United Kingdom.
- Dodge, D. T., and Colker, L. J. 1992. *The Creative Curriculum for Early Childhood*. Teaching Strategies Inc., Washington D.C.
- EPA Energy Star Target Finder. www.energystar.gov/index.cfm?c=new_bldg_design.bus_target_finder
- Kwok, A., Grondzik, W. 2010. *Mechanical and Electric Equipment for Buildings (MEEB) 11th edition*.
- Linehan, A. 2013. Email communication.
- National Head Start Training and Technical Assistance Resource Center. 2005. *Head Start Design Guide, A Guide for Building a Head Start Facility*. Head Start Bureau, US Department of Health and Human Services: Washington, D.C.
2003. *The GSA Child Care Center Design Guide*. Public Buildings Service: Washington, D.C.