



Designing indoor spaces for living and learning in early childhood education



ECE resources

An ECE environment is a place of contrasts, and requires design for children from babies to five years old, as well as for adults of varying body sizes doing physical work (with associated physical risk). It needs active, messy and occasionally noisy places, but also places to retreat, to rest, to sleep, to socialise (one to one, or group interaction), and engage in detailed, protected play. It is a space for education, but it's also a home away from home. Just as ECE outdoor spaces are not playgrounds, indoor spaces are not classrooms. Both are living spaces first, and then spaces for complex human development. Good ECE design is about quality of life¹.

It is important to consider experiences before activities, especially in full day ECE, as the day needs to encompass so much more than activities. Experiences include combinations of sensory, social and psychological factors all working together. Create lists of experiences you would like children to have, then extend it with activities and potential learning opportunities.

Good architecture and design are a blend of three main components:

- An understanding of human function and experience in the space
- Form and aesthetics
- Building technology and building-system technology

The experiences and knowledge of day to day elements of living should guide the practical as well as the aesthetic elements of centre design. There is much that can be done to enhance an ECE space using all sorts of items and decoration, although good initial design can provide great advantages for the workability of the space. This guide highlights the key elements of ECE indoor design to be considered at design stage, as well as ideas you might consider during renovations or retrofitting, or accommodations you might make by rethinking the use and set-up of existing spaces. The guide contains both concepts and practical pointers because, for some aspects of design, it is a concept that really matters and there may be many ways of making it work. For other aspects, specific physical details can really make a difference. The most important thing to do when using this guide is to integrate – to weave. All aspects of design are interrelated.

Initial considerations when thinking about design

Thinking beyond minimum requirements

When designing a new ECE centre or modifying or retrofitting an existing one, it is important not use the regulations as the basis of your design, but instead to think in terms of the experiences, activities and learning that will take place there. For example, the minimum requirement for hand basins is one basin to 15 children and is matched to the number of toilets. However, children's hand-washing needs are not limited to use of the toilet. Hand washing before meals is logistically impractical with this ratio, and there is a need to provide additional hand basins to cater for other activities such as messy play.

New Zealand indoor space standards are very low. In Australia our minimum standards would be considered overcrowding. Analysis of the effect of density on children's social behaviour reveals that densities of 3.7 m² to 4.2m² per child optimise positive social interaction. High densities of less than 2.8

m² per child can promote aggression. Children in both high-density homes and ECE centres have been found to be more susceptible to behavioural problems, as rated on a scale including hostile-aggressive, anxious-fearful, and hyperactive-distractible subscales². The crawling and first walking activities of babies and toddlers, which are essential to their development, require additional space per child. High density occupancy of indoor spaces also contributes to noise.

A child's point of view

It is important to think about spaces from a child's point of view. The easiest way to get an insight into a child's sense of scale is simply to sit on the floor. How does the room look to you? A divider one metre high is now a wall. A space bounded by these dividers (for example a bookshelf) creates a room. The space will look much bigger from a child's perspective, and a child won't perceive it in plan-view as an adult does, but rather as a three-dimensional space with a high ceiling. A loft or mezzanine provides another space that gives a child an adult height view of the room – the experience of a changed perspective with an emotional association. Your upper space can have enclosure, and any variety of colour, pattern, texture or mood, for the cost of three or four hooks. Ramps and steps are part of the experience. The underside of the mezzanine is a space of a different kind - a hideaway. As part of their physical development and development of spatial perception and associations, children have an innate drive to explore and experience 'over', 'under', and 'in'. The presence of cosy spaces is also important to meet children's need for privacy, withdrawal, and intimacy³, and argues against open plan classroom-type design.

Traffic flow and protected space

Some activities work well in exposed spaces and others in protected spaces. In design for ECE, protected space is one of the most important design considerations. Protected corners are generally 2m by 2m or larger, and some distance from a doorway. Typical room design locates doors in corners, but in many ECE spaces, the doors should be located in the middle of a wall, if possible. This provides a clear transit path through the middle of a room that does not disturb the corners. Boundaries help to reduce disruptive behaviours by distinguishing activities, limiting the number of participants in an area, and physically separating tasks⁴. While solid boundaries are useful, the boundaries do not all need to be barriers. Boundaries can also be changes of flooring that indicate pathways and zones. All boundary systems can be artistic and attractive. Cul-de-sacs are another useful concept for protected zones. A cul-de-sac is a space that does not lead to another one, so it cannot become a thoroughfare. Protected activity space is especially important for constructive play, where intricate manipulation or placement of objects (developing fine motor skills) or the creation of an imaginary world would be disrupted or destroyed by other bodies or unconnected activities in the space. Protected activity space is also important for toddlers, whose first experiments with getting around on two legs requires space to move and to fall over.

Designing spaces for different activities and experiences

Quiet and restful activity spaces

These spaces are particularly important in all day care. Restful spaces are not sleep spaces – they will include activities. A characteristic of effective restful spaces is the provision of smaller, bounded spaces that limit the local group size. There are times when a child will need an adult's undivided attention, so for these times bounded spaces are a great advantage. They are also valuable for teacher-to-small-group interactions.

Wet areas, messy play and hand washing

Areas that involve water, food, paint, and other messy materials need to be designed by considering activities and scenarios as well as access to fixtures such as basins. It can be helpful to locate all wet

and hard surface spaces in a contiguous area for efficiency of flooring layout and plumbing. For example, if a wall separates a bathroom area and a dining area, you can use back-to-back plumbing for a second wash trough on the dining side, utilising the same warm water supply and waste outlet through the wall. It's also very useful to have hand washing outside – for example, on your verandah space. Another important consideration for hand washing is the tap design. The best manual tap design for children's hands is a horizontal lever about 10 cm long with a horizontal (not vertical) action. This design is very easy for children to control and uses arm strength rather than hand strength.

Kitchen and dining space

Learning about food is a core element of early learning. Children learn through doing the things of everyday life⁵. The value of a home-like environment is well recognised for early care and education. This points to the value of locating the kitchen as a hub of the children's environment and ensuring that it is not separated spatially or visually from the dining space. This gives children the opportunity to be part of the experience of setting up for lunch - they can smell the food cooking, talk with the cook and get involved in preparation of meals. For example, they can collect vegetables from the centre's own vegetable garden, and then help wash and prepare the vegetables, making the connection between growing food, cooking food, and eating food. For older children it can be very helpful to locate a child-height hand basin next to the kitchen, alongside a child-height bench on the dining room side of the kitchen bench.

Toilet areas

Good toilet area design will treat the toilet area as a learning space in the same way as any other aspect of the environment. This means considering not only practicality but also aesthetics and cultural appropriateness. Privacy while using the toilet is a cultural norm that children will be learning, so good toilet design, for example, with 800mm high cubicle doors, will respect the need for a child's privacy while allowing supervision. Hand washing after toileting is also a learning (and in a group, a belonging) experience, that will be enhanced and reinforced if there is a mirror behind the wash trough. This is the whāriki of wellbeing, belonging, exploration and contribution taking place in one experience. Wall space is important in toilet area design to enable sufficient space for hand washing and drying. Don't put a door on the toilet area entrance, as it serves no practical purpose and interferes with wall space. Locate hand drying by the doorway where it can be seen by staff.

Nappy change and bathing

As with toileting, nappy change and even bathing need to be considered as part of a child's experience. It is also an activity for teachers that can carry high risk of back strain. Key design considerations include providing a bench that is deep and wide enough to accommodate both end-on and side-on nappy change (both of which have advantages and disadvantages). For older children, including steps to the nappy change table avoids the need to lift the child, and gives the child greater agency. Hand washing and other supplies for the nappy change should be available without the need to turn away and compromise the safety of the child.

For bathing, there are two child populations to consider - babies and children who can stand. The design needs for these two groups are completely different, which necessitates separate facilities. For a child who can stand, a really efficient system is to use the accessible toilet area modified with a wet area floor, a hand-held shower hose mounted on the wall, and a shower curtain (for some buildings this won't be an option after the initial build, especially with a concrete floor, but you can do this modification with many wooden floors). The space provided to manoeuvre a wheelchair is just the right size to accommodate the shower facility, and the shower facility does not interfere with accessibility. This arrangement is

ergonomically superior to tub-based systems that can damage teachers' backs, and it means you can keep a baby-friendly tub in your nappy change area.

Sleeping space

A sleeping space isn't only a place for sleeping. It's a place for going to sleep and waking up, as well as dozing and resting. Consider what the sleep space looks like from a child's perspective. Children often go to sleep faster and sleep longer in bunk cots⁶. While stacked cots are often perceived by teachers to be like cages in a zoo⁷, the children using them will not necessarily have this perception. Traditional cots can be bad for teachers' backs, whereas placing and settling a child in an upper level cot is much better ergonomically. The lower level also allows a mobile child to enter and exit the sleep space unassisted. The space saved by stacked cots can be used for a comfortable chair or couch for an adult, to assist settling a child, as well as providing space for a mother to breastfeed.

Children will readily accept, and may be comforted by, non-intrusive background noise and soft, low levels of light. This has been borne out like the experience of having children sleep in outdoor spaces. For example, Childspace Early Learning Centres found that children preferred sleeping on, and slept well on, a covered deck, rather than in a dark sleep room. This does not, however, mean that children should be expected to sleep in an activity space, which can have very intrusive sounds and light, but the practice of using a very dark, totally quiet sleep room, frequently interrupted with an opening door and bright light, is a recipe for sleep disturbance. Remember to think about adult presence in the room – a sleep room should always have a comfortable adult-sized chair. Finally, 2017 research has shown that it is very important to have adequate ventilation in sleeping areas that does not rely on people opening windows⁸.

Storage spaces

Good storage design can reduce stress on adult bodies and help children gain independence and learn responsibility. Separate items that children should be able to access on their own from those that require adult assistance or permission. As far as possible, items that adults only will access should be located above waist height. This design approach can be used in conjunction with the teaching of responsibility. Encourage children to take part in the tidy up at the end of the session.

Designing spaces with adults in mind

Adult furniture

Suitable furniture for adults is just as important as suitable furniture for children. Just as an office environment needs to take into account the functioning of a human body while sitting, standing or lifting, the same is true for the environment for early childhood teachers. For teachers, however, there are unavoidable actions that place strain on a human body such as lifting a child or helping them to them put on a coat or shoes. The provision of adult-sized furniture is not only about adult comfort. Comfortable adult furniture such as a couch is part of a normal, comfortable home environment in which children gather around an adult for storytelling or other activities.

Staff rooms and non-contact workspace

While early childhood teaching can be rewarding and enjoyable, it is also emotionally demanding, requiring high levels of interpersonal interaction and sensitive interpretation of children's communication, activities and needs. Comfortable and relaxed retreat space for staff is essential. The staff retreat space is a place to recharge, so it should not also be a workspace. If you can set aside a non-child access corner of the building with outside access and garden space, that can be ideal. Non-contact work time requires a dedicated office space.

Design for parents

Parents should be considered as much a part of the ECE community as children and teachers. There are three key components of design for parents. First, there is the ability to be present during a settling-in period for their child. This is space to sit near to children's activities while their child develops the necessary attachment relationships with other adults. Second, ECE needs to be a partnership with the parents, rather than a handover, so there needs to be space for conversations around the child's personality and needs, and the potential impact of the external circumstances such as family relationships. The entry to the centre should be more home-like than institutional. Third, it is important to provide space for breastfeeding. This could be a couch in a quiet activity space, or a couch or comfortable chair in a sleep room. Providing for and involving parents in this way improves the cooperative relationship between parents and teachers⁹.

Design and infrastructure

Lighting

While natural lighting is desirable, be careful of the acoustic effect of large areas of glass as well as the greenhouse effect on activity spaces. Indoor ambiance can be affected by the quality of incoming light, so consider the restfulness of dappled light from foliage near windows. Warm LED lighting is well-suited for ECE environments. Avoid fluorescent lighting as much as you can. Lighting should relate to the ambience of a home environment rather than a classroom. LED lighting can also be used to create very low levels of restful light, which can be useful in sleep rooms. There are other many alternatives to overhead lighting, including table lamps, flexible work lights, rope lights and light boxes that can provide softer and more interesting light effects. They can all be added and arranged in an existing centre if power outlets have been fitted in safe locations.

Efficient heating

The New Zealand minimum indoor temperature for ECE (16°C) appears to be the lowest specified ECE minimum temperature in the world, 2° below the WHO minimum recommended indoor temperature of 18°C. A recent study conducted in New Zealand found substantially lower infection rates in ECE centres with higher median indoor temperatures, but it also found that very few centres manage to comply with New Zealand's minimum indoor temperature standard. It is unlikely that the most commonly used systems, heat pumps, are the best heating technology for ECE main activity spaces because of their large spaces and open doors. In addition, the greatest heating need is near to floor level, requiring heat pumps to force warm air down against its natural buoyancy. Heat pumps can be good in smaller volume rooms not normally open to the outdoors. However, suspended infrared panels or other radiant systems are likely to be the best system for most ECE centres as they transmit heat directly to people, furniture and the floor which is then reradiated to the air in the room, thereby reducing open-door heat loss¹⁰.

Reducing noise

New Zealand research has found that many children in ECE experience hearing-damage level doses of noise over the duration of a day¹¹. Teachers' ability to hear and observe foundational language development may be seriously disadvantaged, while children sensitive to noise, such as those on the autism spectrum and those with hearing and language difficulties, will struggle in noisy environments¹². Noise levels can be increased by a number of factors, including the number of people in a space, density of occupancy, activity type, and the acoustic properties of the space and furniture. Open plan spaces, especially those with large group sizes and hard surfaces, are likely to exacerbate noise, whereas design elements that create smaller, intimate, and bounded spaces can reduce noise. The unpleasant and harmful effects of noise can be reduced by both absorption and diffusion. Sound absorbing surfaces, for example carpet, soft furnishings, Autex panels, or acoustic curtains, reduce the sound volume. Sound

diffusion by complex shapes breaks up the sound, producing a more pleasant sound environment, even though the sound levels may not be greatly reduced, and diffusing structures with cavities or holes 50-100mm in size can also be artistic features of a space.

Ventilation

Ventilation is an important consideration throughout indoor spaces but particularly in sleep rooms¹³. Recent research looking at full-day centres in New Zealand found concerning levels of carbon dioxide (CO₂) in sleep rooms, with only one out of 15 having acceptable ventilation. High levels of CO₂ affect brain function, but a greater risk in sleep environments arises from infection transfer due to poor ventilation¹⁴. It is very important not to rely only on openable windows in a dedicated sleep room, but to include some form of cross-flow ventilation in the room that will operate even if the windows are closed. The same is true for other spaces such as infant rooms, which may not have as much open-door time as older children's spaces.

Endnotes

¹ The understanding behind this article is drawn from a number of references, particularly Anita Rui Olds' Childcare Design Guide, but it also draws on work by the Wellington Regional Public Health Unit, particularly in the late 1990s and from 2006-2009. The Public Health Unit ECE programme developed a Te Whāriki-based blend of health science and pedagogy, with a lot of emphasis on promoting best design for children, teachers, and interaction with parents. It included a large number of interactive workshops with early childhood teachers, as well as work with centre developers from planning stage.

² Olds, A.R. (2000). Child care design guide. Blacklick, Ohio: McGraw-Hill.

³ Berti, S., A. Cigala, and N. Sharmahd, Early Childhood Education and Care Physical Environment and Child Development: State of the art and Reflections on Future Orientations and Methodologies. Educational Psychology Review, 2019. 10.1007/s10648-019-09486-0

⁴ Olds, A.R. (2000). Child care design guide. Blacklick, Ohio: McGraw-Hill.

⁵ Brownlee, P., & Crisp, K. (2016). The sacred urge to play. Thames, New Zealand: Good Egg Books.

⁶ Olds (2000).

⁷ This perception was reported by teachers participating in workshops run by Wellington Regional Public Health.

⁸ Bedford, M. (2019). Cold and crowded: The early childhood education environments (ECEE) study. Doctoral thesis, University of Otago, Dunedin, New Zealand.

⁹ Bedford, M. (2019). Cold and crowded: The early childhood education environments (ECEE) study. Doctoral thesis, University of Otago, Dunedin, New Zealand.

¹⁰ BRANZ. Radiant heaters. Level 2018 [8/12/18]. Available from: <http://www.level.org.nz/energy/space-heating/radiant-heaters/>

¹¹ McLaren, S. J. (2008). Noise in early childhood education centres - the effect on the children and their teachers. Doctoral thesis, Massey University, Wellington, New Zealand.

¹² Bedford, M.J., et al. (2019). A wellbeing-themed submission for The Strategic Plan for Early Learning 2019-29.

¹³ Childspace also observed that their rate of respiratory infections dropped considerably when the children began sleeping outside.

¹⁴ Bedford, M. (2019). Cold and crowded: The early childhood education environments (ECEE) study. Doctoral thesis, University of Otago, Dunedin, New Zealand.

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