CHILDREN'S *PHYSICAL* ENVIRONMENTS RATING SCALE[1]

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ABSTRACT

It is now known that the quality of the physical, designed environment of early childhood centers – size, density, privacy, well-defined activity settings, modified open-plan space, a variety of technical design features and the quality of outdoor play spaces – is related to children's cognitive, social and emotional development. A number of scales are in existence for assessing childcare centres and are widely used around the English-speaking world, including the Harms' et al family of Early Childhood Environment Rating Scales (ECERS, ITERS and ECERS-R) and the NAEYC Accreditation Procedures.

The new Children's *Physical* Environments Rating Scale (C*P*ERS), however, is the first tool for centre directors, early childhood educators, policy makers and regulators to assess the quality of the *physical* environment of childcare, preschool, kindergarten and other early childhood education settings.

C*P*ERS is based on a Piagetian ecological theory of child development and the environment, the research literature including our own empirical investigations in the United States, Canada and Australia, the wisdom of many leading childcare researchers, educators, directors and teachers around the world including in Scandinavia, Great Britain and throughout Europe, and childcare and preschool standards in Australia, Canada, New Zealand and the USA. It is comprised of 143 items

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organised into 13 subscales focusing on general planning principles, the overall quality of the childcare centre as a whole, modules including home bases and resource-rich activity spaces, and play yards and other outdoor areas.

Development and testing of the scale involved extensive reliability and validity testing through expert panels and field research between 1997 and early 2003 in the USA, Australia and New Zealand. Results from reliability and validity testing in the United States followed by six more phases of reliability and validity testing in Australia and New Zealand were used to refine the Children's *Physical Environments* Rating Scale prior to its international release. The final phase of findings indicated very high inter-rater and test-retest reliabilities and very high expert opinion on the validity of test items and the scale as a whole. The C*P*ERS Scale is now ready for international release.

C*P*ERS is being released through international conferences and refereed journal papers, as well as publication and availability of the scale itself through a major international test-publishing house.

This paper reports briefly on the background to the scale, the organisation and content of the scale, shows some samples of parts of the final C*P*ERS scale and reports briefly on the validity and reliability of the scale.

Research on the Quality of Child Care, Kindergarten and other Early Childhood Education Programs

Research has found that day care in early childhood centres has a positive effect on children's development. It is generally understood and accepted, based on extensive empirical evidence, that formal child care contributes to cognitive development for preschool children, especially for economically disadvantaged children, and leads to greater intellectual competence and cognitive maturity for a broad range of middle-class Western children (cf. review in Moore, 1987; Weinstein & David, 1987).

Considerable research has been conducted on the quality of early childhood educational programs, and has been reported extensively in the scientific and professional literature. Several excellent reviews of the literature are available (eg, Belsky, Steinberg & Walker, 1982; Clarke-Stewart & Fein, 1983; Katz & Walsh, 1991; Peters & Pence, 1992; Phillips, 1987). From all of these studies, a number of conclusions can be drawn, among them that the most important determinant of early education program quality are the quality of the staff, staff-child ratios, the quality of the curriculum and other characteristics of the interactions among children and adults. As stated by Bredekamp (1986), the most consistent conclusion to be drawn from this research is that positive outcomes for children, both cognitive and affective, are related to the presence of caregivers in low child:adult ratio who have specialized training in child development and early childhood education.

Such findings have been translated into many textbooks, readers and articles on programming and staffing early childhood programs. Among these are Evans, Shub and Weinstein's (1971) classic *Day Care: How to Plan, Develop, and Operate a Day Care Center,* Cohen's (1974) *Serving Preschool Children,* Dodge and Colker's (1996) *The Creative Curriculum for Early Childhood,* Arthur, Beecher, Dockett, Farmer & Death's (1997) *Programming and Planning in Early Childhood Settings*, specialized approaches like the constructivist approach of DeVries and Kohlberg's (1987) *Constructivist Early Education* and Edwards, Gandini and Forman's *The Hundred Languages of Children: The Reggio Emilia Appraoch to Early Childhood Education,* and many others.

These and other early childhood education texts are organised around chapters on such topics as philosophy and theory, developmentally appropriate practice, goals and objectives, programming and curriculum, staffing, family participation, meeting the needs of individual children, schedule and routines, and evaluation. Only some of the most recent – and for reasons explained below, some of what we think are the best – has there been any attention to the role of and organizing the physical environment. For example, a recent 343-page Australian text on programming and planning early childhood "settings" has one page on play spaces, five on physical appearance, and seven other pages on other aspects of the physical environment. While there is acknowledgement that children physically explore their environment, with photographs of spatial exploration, the translation into what should be the quality of the physical environment to support these important developments is scant at best. The "environment" in the vast majority of such texts continues to refer, as the empirical literature suggests it should, to the socio-cultural environment of staff, curriculum and child-adult interactions.

Previous Research on the Physical Designed Environment and Human Development

However, it is now also known that the quality of the *physical, designed environment* of early childhood centers – size, density, privacy, well-defined activity settings, modified open-plan space, a variety of technical design features and the quality of outdoor play spaces – is related to children's cognitive, social and emotional development.

Past research conducted in a variety of field settings around the world has found that the physical environment of early childhood centres is related to children's cognitive, social and emotional development. For instance, research has found that centres that are smaller in size and serve fewer children offer better quality childcare (e.g., Ruopp et al., 1979). Density of children has an influence on development, namely that children from crowded centres are more likely to exhibit aggressiveness, withdrawal and hyperactivity than those from uncrowded centres (Maxwell, 1996). Research also supports the benefits of small and private spaces to which children can retreat from action when they feel tired, overwhelmed or unhappy (Lowry, 1993).

The quality of the designed environment is also related to cognitive, social and emotional development. We know, for instance, that architecturally well-defined activity settings are highly related to more cognitive and social activities (Moore, 1986) and that modified open-plan centres are further related to cognitive and social activities more than either open-plan or closed-plan classroom facilities (Moore, 1987). For over twenty-five years, we have known that a variety of technical design features also impact on childcare quality (Prescott & David, 1976). Regarding outdoor spaces, adventure-type playgrounds have been found to be associated with more cognitive play while neighbourhood play settings are associated with more social play (Moore, Burger & Katz, 1979).

As a result, some texts like the 3rd edition of Dodge and Colker's (1996) *The Creative Curriculum* now have a chapter on "The physical environment" and an extensive section on "Interest areas" including for each interest area suggestions for arranging the environment, creating space and assessing the effectiveness of the area.

Four new texts intended for early childhood educators and others are devoted to the quality of the physical environment – our own *Recommendations for Child Care Centers* (Moore, Lane, Hill, Cohen & McGinty, 1994; cf also Moore, Friendly & Rubin, 1995 for the video version), Walsh's (1996) *Best Practice Guidelines in Early Childhood Physical Environments,* Greenman's (1998) *Places for Childhoods,* and Old's (2001) *Child Care Design Guide.*

The physical environment seems finally to have come of age in child development and early childhood education. But what about assessment? How do we assess the quality of the physical, designed environment to know if it is appropriate for the activities it is intended to house, stimulate and nurture? One recent text devotes several pages to assessing the effectiveness of areas, but is limited to questions like: How often is the block corner used? Have I made the area appealing and inviting, and so on, without offering any specifics about what defines an appropriate block-playing environment.

Existing Scales: Review and Lesson

A variety of scales exist for measuring aspects of the childcare and early childhood programs and are widely used in the English-speaking world. Examples include Caldwell's HOME Observation for Measurement of the Environment (Caldwell & Bradley, 1984), the NAEYC Accreditation Procedures (NAEYC, 1984; Bredekamp, 1986), the Abbott-Shim Early Childhood Assessment Profiles (Abbott-Shim & Sibley, 1992) and Trickett and Moos' Classroom Environment Scale (Trickett & Moos, 1995), among others.

The best known and most widely used of these are the Infant/Toddler Childhood Environment Rating Scales (ITERS – Harms, Cryer & Clifford, 1990) and Early Childhood Environment Rating Scales (ECERS-R – Harms, Clifford & Cryer, 1998). This family of scales are used throughout most of the Western world for assessing the quality of the curriculum, staffing and other important aspects of early childhood care. Another scale widely used in the United States is the NAEYC Accreditation Procedures (Bredekamp, 1986).

Our review of these scales has confirmed that all have moderate to high reliability and validity. Our review found, however, that none, including the ITERS and ECERS-R, are focused on the *physical* designed or architectural environment (Moore, 1994). For example, content analysis of ITERS revealed that out of 396 descriptors used in the scale, only 8.8 % pertain to the physical designed environment (Moore, 1994). The purpose of our research, therefore, was to develop, calibrate and test a new scale specifically focused on the assessment of the architectural environment of childcare and other early childhood educational environments.

Conceptualisation, Organisation and Development of C*P*ERS

C*P*ERS is based on an ecological theory of child development and the environment (Moore, 1987). Following from this theory, the physical environment of early childhood centres has been conceptualised into several parts, each of which may be evaluated independently.

The following diagram (Figure 1) illustrates the way functions in an ideal centre may be classified and grouped together. Some buildings may or may not have all these functions, and one area may be used to perform several functions.

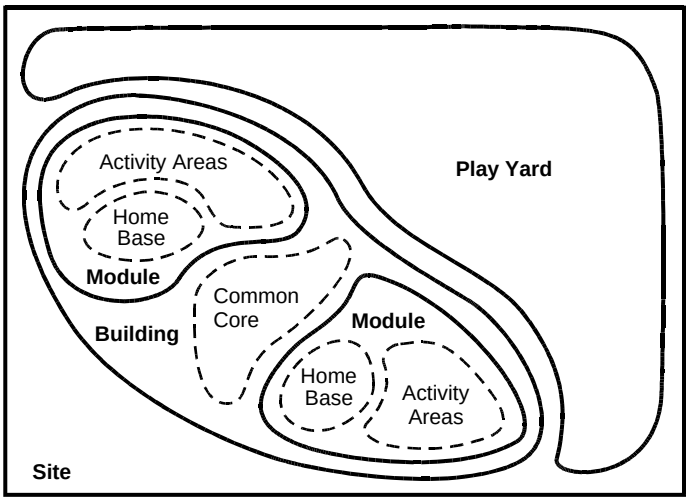

Figure 1. Conceptual diagram of the ideal organisation of an early childhood centre.

In this conceptualisation, an early childhood building is divided into a "common core" located centrally to one or more "modules." The *common core* is collection of shared facilities ideally including a reception area, administrative office, staff lounge, meeting/conference room, adults' toilets, kitchen, laundry, multipurpose area (gym) and storage. Each *module* refers to a physically and functionally separate space for children within the centre. Some centres may have two or more modules. The modules may be interconnected, semi-detached or entirely freestanding buildings on the same site. They may be called "houses," "wings" or "pods."

Each module is further divided into a "home base" surrounded by a variety of developmentally appropriate "activity areas." The *home base* provides functions related to children's basic needs, such as eating, sleeping, toilets, diaper changing and storing personal belongings. The *activity areas* provide spaces for the children's developmentally related play activities such as creative, social and physical activities including quiet and loud, clean and messy activities.

CPERS is thus organised into four parts. Part A focuses on the overall planning of a centre including its size and capacity. Part B is concerned with the quality of the building as a whole. Part C assesses the module in which children spend most of their time in the centre. Part D evaluates the outdoor areas of the centre, its play yards and the site. Each part consists of several subscales. At the time of this research, CPERS consisted of 151 items organised into 4 parts of 13 subscales (numbers in parentheses indicate the number of items included in each subscale):

Part A Planning	1. Centre Size and Modules (6)
Part B Building as a Whole	2. Image and Scale (7)
	3. Circulation (6)
	4. Common Core of Shared Facilities (12)
	5. Indoor Environmental Quality (9)
	6. Safety and Security (12)
Part C Indoor Activity Spaces	7. Modified Open-Plan Space (9)
	8. Home Bases (11)
	9a. Quiet Activity Areas (13)
	9b. Physical Activity Areas (17)
	9c. Messy Activity Areas (16)
Part D Outdoors Spaces	10. Play Yards (15)
	11. Location and Site (12)

To assess a building using CPERS, a rater indicates how well the centre satisfies the criterion items in each subscale. The response format for each item is a 5-point Likert-type scale ranging from "*Not Met"* (score of 0) to "*Fully Met"* (4). Some items ask about the existence of

particular functions in the centre, the rater being asked to choose from "*No"* (0), "*Shared"* with other functions (2) and "*Yes"* (4). The responses also include "*Not Applicable*" for some items. Below is an example of one set of items regarding the image and scale of the centre:

2.	**Image and Scale**	Not Met				Fully Met
2.1	The exterior of the center appears non-institutional and welcoming (e.g., single story, pitched roofs, verandas, use of wood, brick and stone not concrete blocks or large expanses of glass, etc).	**0**	**1**	**2**	**3**	**4**
2.2	Children can see some indoor children's activity areas from outside before entering the center (e.g., windows between inside and outside along the entrance path, etc.).	**0**	**1**	**2**	**3**	**4**
2.3	The scale of the interior appears small and cosy (e.g., low ceilings, low hanging lights, low windows that children can see through, low openings between adjoining spaces, etc).	**0**	**1**	**2**	**3**	**4**
2.4	The interior finishes appear welcoming and natural (e.g., use of carpets, warm colors, soft lighting, curtains, etc).	**0**	**1**	**2**	**3**	**4**
2.5	Furniture is child height (e.g., bookcases, display shelves, tables, chairs, etc).	**0**	**1**	**2**	**3**	**4**
2.6	Toilets, basins and mirrors used by children are child-height.	**0**	**1**	**2**	**3**	**4**

Figure 2. Sample C*P*ERS items regarding the image and scale of an early childhood education centre

9b.	**Toy and Large Block Play Area**	No		Shared		Yes	NA
9b.1	The center or module has a physical play area for infants (e.g., toys, crawling levels, etc.).	**0**		**2**		**4**	□
9b.2	The center/module has a toy and large block play area for toddlers.	**0**		**2**		**4**	□
9b.3	The center/module has at least one toy and large block play area for preschoolers.	**0**		**2**		**4**	□
		Not Met				Fully Met	NA
9b.4	The physical play area has a sufficient amount of space for 2-5 children and 1 adult.	**0**	**1**	**2**	**3**	**4**	□
9b.5	The physical play area is spatially separated from other play areas.	**0**	**1**	**2**	**3**	**4**	□
9b.6	Toy and large block play areas have appropriate furnishings and storage (e.g., flat child height work surfaces, storage shelves, display racks, etc).	**0**	**1**	**2**	**3**	**4**	□

Figure 3. Sample C*P*ERS items regarding the organisation of block play areas (the NA not applicable boxes are used if a centre does not have a dedicated block play area).

A subscale score is calculated as a mean of the applicable items in the subscale. The total score for the centre is a mean of the subscale scores, as shown in Figure 4:

Subscale				**Subscale Score**
PART A				
1. Center Size and Modules				
PART B				
2. Image and Scale				
3. Circulation				
4. Common Core of Shared Facilities				
5. Indoor Environmental Quality				
6. Safety and Security				
	Modules			
PART C	1	2	3	Average
7. Modified Open-Plan Space				
8. Home Bases				
9a. Quiet Activity Areas				
9b. Physical Activity Areas				
9c. Messy Activity Areas				
PART D				
10. Play Yards				
11. Location and Site				

Summary Score = $\frac{\text{Sum of subscale scores}}{13}$ =

Figure 4. C*P*ERS scoring system.

Validation Research: The Reliability and Validity of C*P*ERS

Space does not allow a full treatment of the extensive reliability and validity testing to which earlier versions of C*P*ERS were subjected. The methods, data collection procedures and extensive statistical analysis, initiated in the United States and continued in Australia and New Zealand, are being detailed in a pair of papers being prepared for the scientific literature.

The subscales and items which comprise C*P*ERS have been developed and refined by considering them in relation to theory, validating them against the latest research in the field, cross-instrument review and checking their content and construct validity with experts in the field, and several phases of inter-rater and test-retest reliability testing through the Alreck and Settle (1995) iterative model of development, field-testing and further refinement.

A *valid* scale is one that measures what it is intended to measure, in this case the quality of the physical environment, and is not confounded by other things. This was assessed in two ways. Content *validity* is the extent to which a test or measure provides an adequate representation of the conceptual domain it is designed to cover, i.e., the degree to which the content of the items are judged valid by experts in the field. *Construct validity* is the degree to which the scale as a whole is good measure of the quality of the physical designed environment of early childhood centres. We collected convergent evidence to determine construct validity, namely, the degree to which different sets of criteria for assessing the physical environment of a centre (assessment by C*P*ERS and expert judgment) produced similar results.

A *reliable* scale is one where measurements by the scale do not vary significantly between different users of the scale, and do not vary significantly with the same centre is assessed at two quite different times. The former type of reliability can be checked with *inter-rater reliability*; the latter type of reliability is referred to as *test-retest reliability*.

All items in the subscales, the subscales themselves and the scale in its entirely were first examined empirically through two phases of reliability and validity testing conducted in the north central USA (Moore, Hayata & Sivakumaran, 1997, 1999). Among the results were strong expert support for the intention, basic thrust and subscales of C*P*ERS, indication that the overall size of the scale was too large and long to administer, and that many of the initial items were unreliable and hard to interpret and score consistently. The scale was thus shortened significantly during these stages by removing redundant, unclear and less important items.

Subsequently, the revised scale was subjected to six additional phases focusing on a cycle of formal reliability and validity testing in a variety of field settings throughout Australia and New Zealand. Since the scale will be used in a variety of centres and by raters with different backgrounds (staff, centre mangers, researchers, policy makers and architects, etc.), it is important that the scale has high validity and reliability. A total of 46 centres in different climatic regions, in capital cities, small towns and country settings and of both larger and smaller sizes were included in the reliability testing sample. And a total of 25 experts – early childhood experts, nationally recognised centre directors and leading early childhood researchers from across Australia and New Zealand – were included in two phases of validity testing.

The data were analysed using a variety of statistical measures, including % exact agreement, 95% confidence intervals, Pearson's product-moment correlations, Cronbach's Alpha and Cronbach's Generalisabiity Coefficient G.

After each phase, based on its results, the scale and its items were refined, and retested. This iterative procedure has led to results showing that the final C*P*ERS Scale is valid and reliable.

First we looked at content validity (as judged by 12 wide-ranging experts in the field). The experts considered the 13 subscales to be relatively to highly important to the overall success of early childhood programs (mean importance 2.73 to 3.65 on a 4-point scale, with an average of 3.26 out of 4, or about 82%). The clarity of initial items ranged from only moderately clear to totally clear (0.58 to 1.00), which lead to rewriting the unclear items and in some cases deleting them if they were judged to be relatively less important and/or unclear.

The next phase of construct validity (with a different set of 13 experts) indicated very high validity as judged by experts in the discipline (correlations between their own ratings of centres followed by using the C*P*ERS Scale ranging from 0.85 to 0.92, all highly significant at the $p < .01$ level of significance, ie, only one chance in a hundred of non-significance). While some of the researchers were just a tad reserved about the validity of the scale (0.61 to 0.82) the expert early childhood educators were very convinced about the validity of the scale (0.90 to 0.94)

Regarding inter-rater reliability, after Phase 6, the C*P*ERS was found to be highly reliable (exact agreement within one point in 86% of the cases, with Cronbach's G being 0.88 [G's above 0.8 are considered very high in the literature]). Combining Phase 6 with the earlier Phase 5 results to get a larger sample size, the inter-rater reliability results are still very high and considerably higher than the international benchmarks (exact agreement within one point in 84% of the cases, in comparison, for instance, to Harms et al's ITERS of 78% and the revised ECERS-R at 71%; cf. Harms et al., 1998).

The test-retest reliability results were similarly striking, with results again over 90% accuracy (exact agreement within one point in 91% of the cases, with Cronbach's G up to 0.97). We could not find test-retest reliability statistics for our benchmark of the ECERS family of tests.

Data for the internal consistency of the items within each of the 13 subscales indicated an acceptable level of internal consistency (ranging from 0.45 for one scale to 0.90). After excluding five inconsistent items, Cronbach's alpha rose to a very acceptable range (0.69 on the low end to 0.90 on the high end, comparable to ECERS-R's 0.71-0.88).

These results indicate that both the validity and reliability of the new C*P*ERS Scale are higher than comparable statistics for the very well known and widely adopted ECERS family of tests, very comparable or higher than the published reliability and validity statistics for the NAEYC Accreditation Procedures, and all lie on the upper end of the generally accepted range for internationally published tests.

Conclusion

The results of extensive field tests in the United States, Australia and New Zealand, therefore, have revealed very acceptable levels of content and construct validity and inter-rater and test-retest reliability, thus providing strong empirical evidence for the overall validity and reliability of the new Children's *Physical* Environments Rating Scale.

We are hoping to be able to release the new scale for application and implementation through a major international test publishing house before the end of 2003.

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