Learning in Cultural Context
Family, Peers, and School

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Chapter 7

Learning Connections
A Home-School Partnership to Enhance Emergent Literacy and Emergent Math Skills in At-Risk Preschoolers

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INTRODUCTION

The consequences of neglecting to provide all children with adequate early learning experiences are sobering. Social disadvantage based on ethnicity and class is associated with lower academic readiness at the time of school entry (Jordan, Huttenlocher & Levine, 1994; Whitehurst & Lonigan, 2001) and the achievement gaps between low- and high-SES groups widen as children progress through elementary school (Alexander & Entwisle, 1988). In the past several years there has been a renewed focus, particularly at the level of governmental policy, on prevention efforts for at-risk preschoolers (Shonkoff & Phillips, 2000). This is because high-quality childcare, early intervention, and preschool programs can have marked impacts on cognitive, social, and behavioral outcomes (Barnett, 1995; Campbell & Ramey, 1994; Pfeiffer-Veitberg et al., 2000); in some cases, positive effects can still be identified in early adulthood (Barnett, 1995; Gaces, Thomas & Curie, 2000).

Unfortunately, for young children in the United States, experience in high quality early childhood education and care settings is more often the exception than the norm (Cos, Quality and Child Outcomes Study
PREMORPING THE DEVELOPMENT OF LITERACY AND MATHEMATICS SKILLS IN EARLY CHILDHOOD: THE RESEARCH BASE

Emergent Literacy

Preschool and kindergarten children with strong oral language and emergent literacy skills do better in terms of reading, writing, spelling, and overall academic performance throughout the school years (Barnhardt, 1991; Juel, 1985; Scarborough, 2001; Stanovich, 1986). Such evidence has led to a consensus among educators that developmentally sensitive emergent literacy instruction should be provided in all early childhood settings, and that this instruction should promote (a) oral language competence, (b) phonemic awareness, and (c) knowledge of the alphabet and print concepts (BPA and NAEYC, 1998; Snow, Bern & Griffin, 1996; Vellutino & Scanlon, 2011).

The quality of teacher-child conversation affects children’s oral language growth, especially conversations that occur one-on-one or in small
group settings (Decartey, 1984; Blos, DeTemple & Dickinson, 1994; Dickinson & Spigue, 2001). A technique that is well-suited to supporting rich verbal interaction is small-group dialogic reading. In this technique, adults engage children in active discussion of books during read-aloud sessions. The adult scaffolds the conversation by asking leading questions and making responsive comments that extend the conversation and draw the children in to longer and more complex discussion sequences. Dialogic reading has been used effectively by teachers and parents. When treatment fidelity is high, dialogic reading programs lead to significant and lasting gains in expressive vocabulary and the grammatical and semantic complexity of children's speech (Haggrave & Sonechol, 2000; Whitehurst, Arnold, Epstein, Angel, Smith & Fisch, 1994; Whitehurst et al., 1988).

Phonemic awareness is the ability to hear and manipulate the individual sounds (phonemes) of which words are composed (Snow et al., 1988; Whitehurst & Lonigan, 2001). Phonemic awareness is one of the most robust predictors of emergent and future literacy (Adams et al., 1998; Juel, 1988; Nation & Hulme, 1997; Stanovich, Cunningham & Feeman, 1984; children who enter school with high phonemic awareness usually learn to read and write well, regardless of the method of literacy instruction to which they are exposed (Byrne & Fielding-Barnsley, 1995; Griffith, Klesius & Kromrey, 1992). Controlled laboratory studies of phonemic awareness interventions have shown success with children from preschool through grade 1 and the more intensive interventions show positive effects on reading and writing skills one to three years later (Bradley & Bryant, 1983; Byrne & Fielding-Barnsley, 1991, 1995; Cunningham, 1990; Treiman & Saron, 1983). When phonemic awareness instruction is implemented by classroom teachers rather than research assistants, smaller but still significant child gains are found (Rachman et al., 1994; Byrne & Fielding-Barnsley, 1995; Lundberg, Feust & Petersen, 1986). In sum, there is a good research base of validated techniques for promoting preschoolers' language and phonemic awareness skills.

Other domains of early literacy instruction have received less scientific attention. Correlational evidence linking early knowledge of print concepts (e.g., book handling, print tracking) and early alphabet knowledge (e.g., letter recognition, letter naming, letter-sound correspondences with later reading is plentiful (Scarrborough, 2003; Snow et al., 1996; VeLutinen & Scarborough, 2001)). However, we were able to locate only a handful of studies that validated the causal role of print concept or alphabet knowledge using experimental methods. Short-term research designs indicate that children who are taught to identify a set of letters by name show rudimentary ability to apply this knowledge to phonetic decoding (Roberts, 2003; Treiman & Rodriguez, 1999). For example, if a child is taught the names for the letters
Emergent Mathematics

The emergent perspective in mathematics is based on the premise that mathematical universals are present in all cultures, and that children develop an impressive level of intuitive i.e., non-abstract, understanding of mathematics in the course of everyday activities (Baroody & Wilkins, 1999; Klein & Starkey, 1988; NAEYC & NCTM, 2002; Saxe, Guberman & Geary, 1987). Recent standards for early childhood mathematics instruction (NAEYC & NCTM, 2002; NCTM, 2000) make it clear that preschool mathematics involves considerably more than rote counting and the identification of basic shapes. These standards emphasize the breadth of early mathematical knowledge, including the domains of numbers and operations, geometry, measurement, data analysis, probability, algebra, problem-solving, reasoning/proof, communication, connections, and representation. There is increasing agreement among researchers in the area of early mathematics that preschool children should be exposed to purposeful and challenging math experiences, with the caveat these experiences are based in concrete, meaningful, and enjoyable activities (Baroody & Wilkins, 1999; Clements, 1999; Nelson, 1999; Siegler, 1999; NAEYC & NCTM 2002). However, teacher preparation programs and public policy initiatives relating to preschool quality (e.g., Early Reading First), devote much more
attention to issues of early literacy instruction than to improving early math instruction. Many early childhood educators receive minimal preparation in developmentally appropriate mathematics instruction (Beifanz, 1999; Nelson, 1999). Teachers may hesitate to even introduce children to math, mistakenly believing that mathematical activity necessarily involves abstract symbols and formulas.

A small, but growing number of controlled evaluations indicate that early childhood math interventions have positive effects. Griffin and Case (1996) developed an enumeration program for disadvantaged first-grade children; their program strengthened children’s numerical skills, and this outcome showed transference to enhanced performance on other mathematical tasks. Arnold, Fisher, Docktor, and Dobbs (2002) implemented a 6-week intervention in Head Start classrooms. Teachers were provided a resource book of short math activities and were asked to select 1–2 activities per day. Children showed gains on the Test of Early Mathemati
cal Abilities (effect size = 1.21) while teachers reported improvements in both children’s interest in math, and in their own attitudes about math instruction. Klein and colleagues developed a preschool math curriculum focusing on enumeration, number operations and spatial knowledge (Klein, Starkey & Ramírez, 2012). Middle-class preschoolers who received the curriculum showed stronger math skills than did a comparison group (Klein, Starkey & Wakeley, 1994), and a home-based variation of the curriculum also showed positive effects on the number and spatial skills of Head Start children (Starkey & Klein, 2000).

Content areas for the LC curriculum were drawn from this conceptual and empirical literature. Three math learning domains were selected—numbers and operations, geometry, and spatial sense. As a secondary emphasis, LC math activities were designed to also incorporate mathematical communication, reasoning, and graphing.

Teacher Professional Development

The success of any curriculum is highly dependent on the teachers who implement the program. In-service training is most effective when the training provided is (a) specifically designed for the curriculum to be implemented, (b) teachers are given ample opportunity for hands-on practice, (c) on-site observation and feedback are provided by a supportive mentor over an extended period of time and (d) teachers are encouraged to reflect on and evaluate their new practices (Bowman, Donovan & Burns, 2001; Malone, Straka & Logan, 2000; Odell, 1990). It is also important to match the content of training and supervision activities to each teacher’s developmental level (Glickman, 1991; Spodek, 1996).
When properly implemented, staff development and mentoring efforts lead to demonstrable improvements in teachers' knowledge, attitudes, and classroom practices (Farnuzzo et al., 1996; Kontos, Howes & Gallinsky, 1996; Nurs, Abbott-Shim & McCarty, 1998) For this reason, a substantial education and mentoring component was included as part of the LC curriculum package.

Parent Involvement

Parental involvement enhances children's academic outcomes (Blevins-Knabe & Musun-Miller, 1996; Reynolds, 1992; Weisberg & Greenberg, 1998) and provides an extra boost beyond the gains affected by high-quality classroom environments (Bryant et al., 1994). Parents' self-efficacy, beliefs about children's acquisition of academic skills, and their personal comfort level and interest in learning-related skills all predict the kind of learning environment that parents provide at home (DeBaryshe, 1995; DeBaryshe, Binder & Duell, 2000; Stipek et al., 1992). Low-SES children are less likely than middle class children to receive consistent, frequent home interactions and activities of the type that promote academic skills. Differences are found in the frequency, content, and complexity of adult-child speech, adult-child picture book reading, and other joint activities involving writing and number concepts (Burris & Casbergue, 1992; Feitelson & Goldstein, 1986; Hart & Risley, 1995; Payne, Whitehurst & Arnold, 1994; Phillips & McNaughton, 1990; Saxe et al., 1987). At first glance, the magnitude of these differences does not seem large—for example, reading to one's child every other day as opposed to two or three times per day (DeBaryshe, 1993; DeBaryshe 1995). But seemingly small differences in home practices can have a large cumulative impact over time.

Major barriers to parent involvement include school, home, and cultural obstacles (Lopez & Scribner, 1996). School barriers occur when the school is unwelcoming and/or resistant to parental involvement. Home barriers include time and resource constraints and mismatches between staff and parents' expectations about what the appropriate home and school roles should be. Cultural barriers occur when families and school do not share deeply-rooted beliefs, values, and expectations about social interaction and/or learning processes (Rogoff, Mistry, Concu & Mosier, 1993; Tharp, 1989).

When home-school barriers are reduced, children benefit in terms of enhanced self-perceptions, motivation and academic achievement (Arunkumar, Midgley & Udan, 1999; Tharp, 1989). One way to increase parental involvement is to invite families to serve as partners in developing learning activities that are personally and culturally meaningful and
compatible with the goals parents hold for their children (Delgado-Geitán, 1991; Holloway et al., 1995; Tharp, 1989). The LC curriculum enlists the family as active partners in their children’s learning by providing consistent home activities that were designed with parental input to be both engaging and culturally relevant. Parents also receive ongoing education and mentoring regarding family involvement.

DEVELOPMENT AND CONTENT OF THE LEARNING CONNECTIONS CURRICULUM

Educational Needs of Hawai‘i’s Multicultural Preschoolers

Hawai‘i has a unique multicultural population, which, in many ways, provides a model for the increasingly diverse face of the continental U.S. The ethnic composition of the state is 24% Caucasian, 20% Native Hawaiian/part Hawaiian, 18% multi-ethnic, 16% Japanese, 14% Filipino, 5% other Asian/Pacific Islander and 2% African American (DBEDT, 2002). Hawai‘i’s predominantly Asian and Pacific Islander (API) children do not fit the stereotype of the API “model minority.” In the most recent state assessment of school readiness, 80% of entering kindergarten children scored below age level for vocabulary, and 59% showed moderate to severe language deficiencies (Office of Children and Youth, 1993). There is also ongoing controversy regarding the effectiveness of the States’ public school system. For example, in 1998 National Assessment of Educational Progress, 55% of Hawai‘i fourth grade students scored below the basic level in reading and 47% scored below the basic level on math (compared with 39% and 38% of their peers nation-wide).

Despite these academic risks, the State’s API population exhibits many strengths. Family is central to local culture and the importance placed on family solidarity is exhibited by indicators such as high rates of intergenerational living, shared family meals and leisure time, children’s contact with grandparents, and family observation of cultural practices (Center on the Family, 1999). Although API families vary widely in terms of national origin, religion and immigration history, members of this composite ethnic group tend to share key culturally-relevant values. Distinctive API values include collectivism (emphasizing the needs of the group more than the needs of the individual), respect for parents and elders, cherishing of children, and high expectations for family obligation (Blaisdell & Mokuau, 1991; Sue & Sue, 1990; Uba, 1994). This suggests that API families may be especially receptive to efforts that promote family involvement in preschool education.
Curriculum Goals and Methods

Learning Connections is a culturally sensitive literacy and math curriculum for use in preschools serving low-income Asian and Pacific Islander children. Curriculum development was supported by a Head Start-University Research Partnership grant. For the first two years, project team members included Dr. Catherine Sophian, Melodie Vega, and the authors of this chapter. Sophian had primary responsibility for developing the learning goals, instructional materials and assessment protocols for the math portion of the curriculum; author DeBaryshe played the same role regarding the literacy portion of the curriculum. After one year of development activities, each portion of the curriculum was piloted in the 2001–2002 school year. Results indicated that language pilot classrooms tended to show the largest gains in literacy skills (DeBaryshe, 2003) and math pilot classrooms tended to show the largest gains in math performance (Sophian, 2004). Based on a combination of the pilot test results and extensive teacher feedback on each lesson, a revised, combined math and literacy curriculum was developed. The revised curriculum included roughly 75% of the pilot year literacy activities and 50% of the pilot year math activities; additional lessons were developed to replace the earlier materials that were not retained. The complete revised curriculum was tested in the 2002-2003 school year. The results of this evaluation form the core of the present chapter.

Distinctive aspects of the revised curriculum package include:

An Eclectic Theoretical Orientation to How Children Learn

The theoretical basis for the curriculum was multi-faceted. The goal of developing the learner’s knowledge base, strategic repertoire, problem-solving skills and metacognitive awareness comes from information processing theory. The careful sequencing of activities to promote successful learning is based on both social learning theory and Montessori teaching methods. A strong focus on mediated learning and scaffolding of interactions within the child’s zone of proximal development was rooted in social learning and sociocultural theories.

User Collaboration on Curriculum Development

During the development year, a committee of Head Start teachers, parents and administrators worked with the LC staff to develop learning goals and curriculum activities. Volunteer teachers and parents implemented the activities on a limited basis and provided feedback on developmental appropriateness, cultural relevance, ease of use and appeal to children and adults.
# Table 1. Curriculum Domains and Specific Learning Goals

<table>
<thead>
<tr>
<th>Oral language</th>
<th>Engages in conversations of increased length and complexity</th>
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</thead>
<tbody>
<tr>
<td>Phenomen awareness</td>
<td>Recognizes and generates rhymes</td>
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<tr>
<td></td>
<td>Recognizes and generates words with the same initial, medial and final sounds</td>
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<tr>
<td></td>
<td>Segments and blends phonemes within words</td>
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<tr>
<td>Alphabet knowledge and print awareness</td>
<td>Identifies upper and lower-case letters and knows letter-sound correspondence</td>
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<td></td>
<td>Tracks print</td>
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<td></td>
<td>Aware of environmental print</td>
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<td></td>
<td>Aware of the usefulness of print</td>
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<td></td>
<td>Spells and reads consonant-vowel-consonant words</td>
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<tr>
<td>Emergent writing</td>
<td>Attempts to convey meaning via writing</td>
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<tr>
<td></td>
<td>Strengthens fine motor muscles</td>
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<td></td>
<td>To use tools in preparation for writing and drawing</td>
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<tr>
<td></td>
<td>Shows increasingly higher levels of emergent writing</td>
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<tr>
<td></td>
<td>Begins to spell simple words</td>
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<td></td>
<td>Follows a left-to-right orientation when writing</td>
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<tr>
<td>Numbers and mathematical operations</td>
<td>Counts forwards and backwards using one-to-one correspondence</td>
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<td></td>
<td>Understands both quantities and numerals from 0-10</td>
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<td></td>
<td>Understands alternative counting units</td>
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<td></td>
<td>Understands that adding/taking away objects increases/decreases number</td>
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<tr>
<td></td>
<td>Uses manipulatives to indirectly perform addition and subtraction operations</td>
</tr>
<tr>
<td></td>
<td>Uses manipulatives to indirectly perform multiplication and division operations</td>
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<tr>
<td>Measurement</td>
<td>Distinguishes alternate dimensions of measurement, e.g., height, width</td>
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<td></td>
<td>Uses nonstandard units of measurement</td>
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<tr>
<td></td>
<td>Understands concepts of weight, volume, and area</td>
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<tr>
<td></td>
<td>Conserves volume and area</td>
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<tr>
<td>Geometry</td>
<td>Defines math vocabulary terms</td>
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<tr>
<td></td>
<td>Identifies basic shapes</td>
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<tr>
<td></td>
<td>Aware that news shapes may be made from two or more instances of a given shape</td>
</tr>
<tr>
<td></td>
<td>Identifies a given shape within a larger array</td>
</tr>
<tr>
<td></td>
<td>Counts occurrences of a specific shape</td>
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<tr>
<td></td>
<td>Compares and categorizes shapes by attribute</td>
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</tbody>
</table>

## Learning Goals Derived from the Research Literature

The curriculum was based on 33 discrete learning goals (DeBaryshe, 2003; Sophian, 2004), organized into seven more general knowledge domains (see Table 1). The learning goals and general domains were articulated with both the Head Start Performance Standards and the State of Hawai‘i Preschool Standards. A series of 85 developmentally sequenced
activities were developed for use in the preschool classroom. Each activity addressed one or more of the 33 discrete learning goals. A set of 24 family activities were also developed. These activities addressed one or more curriculum learning goals and extended the lessons that children received at school to the home setting. Finally, the LC curriculum was designed with a prospective intent (Sophian, 2004). The intent was to promote both current learning and also to address the conceptual foundation of skills that children would address in elementary school, e.g., phonics, graphing, multiplication, subtraction.

Small Group, Individualized Instruction

Teachers were provided with daily lesson plans for an introductory circle time and three or four literacy and math activities to be done during learning center stations. Each activity was conducted with small groups of one to four children, with group size changing as a function of children’s skills and needs for support. Teachers were encouraged to keep the composition of learning groups consistent. They were also encouraged to make the LC materials available to children as free-choice activities.

A teacher’s manual included detailed instructions for each LC activity, along with suggestions for individualizing the lesson to match participating children’s levels of skill. A compact documentation form was developed in order to allow teachers to collect ongoing assessment information and review each child’s progress at a glance.

Cultural Sensitivity

To be more meaningful for Hawai‘i’s multicultural population, curriculum content (e.g., concepts, vocabulary, materials) uses many examples of “local” culture. For example, both widely available rhyming books, and pidgin (aka Hawai‘i Creole English) versions of classic nursery rhymes were used to introduce the concept of rhyming. Pictures, bingo cards, and other vocabulary stimuli were made to represent a variety of familiar foods, plants, sea creatures, and articles of clothing that are common in Hawai‘i but not often represented in commercially available materials. Many of the family activities had a cultural focus, for example, compiling a simple counting book that uses objects that are unique to the family’s culture, and parents were encouraged to conduct the home activities in their heritage language.

Ongoing Teacher Mentoring

Following principles of effective professional development practices, teacher mentoring and ongoing technical assistance were integral to the curriculum package. An experienced master’s level teacher spent two full
mornings per month in each LC classroom. She used this time for technical assistance and individualized coaching. Every three to four weeks, the classroom mentor and lead researcher visited each site to provide ongoing curriculum training. The small group nature of the ongoing training allowed for considerable interaction, practice and reflective conversation.

Family Involvement and Support
The parental involvement component was designed to increase the frequency and quality of parent-child learning interactions. The family curriculum consisted of 24 weekly home activities that paralleled the lessons children received at school. Parents were given a simple written description of the activity and any needed materials. Most activities yielded a product (e.g., a home-made book, a collection of objects obtained on a scavenger hunt) that parents placed in their child’s classroom portfolio. Parents were also encouraged to borrow books on a weekly basis, and to complete ratings and comments on each week’s activity. The mentor visited each classroom on a biweekly basis, bringing a display board with examples of the next two home activities (Sophian, 2004). The mentor met informally with parents, either individually, or in small groups, as they dropped off their children. She used this time to explain the purpose of the new activities, answer parents’ questions and discuss their experiences with prior activities, and provide suggestions for making learning interactions more effective.

AN EXPERIMENTAL EVALUATION OF THE LEARNING CONNECTIONS CURRICULUM
A quasi-experimental evaluation of the revised LC curriculum was conducted in the 2002-2003 school year. It was hypothesized that:

• Children in the LC curriculum would show larger gains on vocabulary, emergent reading and writing, phonemic awareness, letter-sound correspondence, enumeration, mathematical operations, measurement, and geometry skills than children in a comparison curriculum. The only area for which no group differences were expected was letter naming, which is not emphasized in the LC curriculum.

• A close-dependent relationship would be found in which more frequent exposure to high-fidelity implementation of LC activities both at school and at home will predict greater gains among children within LC classrooms.
Methods

**Sampling and Participants**

*Classroom Selection.* Nine Head Start centers on the island of O’ahu participated in the study. These centers had a total of 11 classrooms and ran on an extended-day schedule. Experimental and control sites were matched for observed teaching quality, child demographic characteristics, and urban vs. rural location. All teachers in the study used the Creative Curriculum (Dodge, 2002) as their base curriculum, as required by their Head Start program. The control sites used the Creative Curriculum as the basis for all instructional activities. LC sites implemented LC as their language, literacy and math curriculum, and followed the Creative Curriculum for the remaining instructional areas, e.g., motor development, creativity, science.

*Participants.* Participants were 169 preschool children, their parents, and their Head Start teachers. This number represents 89% of the original sample of children who remained enrolled in the classroom throughout the 24-week study period and for whom both pre- and post-test data were collected. The children’s mean age was 47.6 months (range = 31 to 59), 53% were male, 23% were identified by their teachers as English language learners, and 5% had an identified disability. The ethnic background of the children was 29% Native Hawaiian/part Hawaiian, 20% East Asian, 12% Pacific Islander, 7% Filipino, 7% African American, 7% Hispanic, 6% Caucasian, 4% Southeast Asian and 3% not reported. The mean parental age was 31.9 years (range = 18 to 60). Twelve percent of parents had less than a high school education, 46% had a high school diploma, 35% had some college or a two-year associate’s degree and 7% had a four-year college degree. Demographic data were reported for 29 of the 35 teachers. The mean teacher age was 38.2 years (range = 22 to 63) and their mean preschool teaching experience was 12.3 years (range = 1 to 32). Teacher educational attainment was as follows: 7% high school diploma or GED, 38% child development associate certificate, 28% associate’s degree, 28% bachelor’s degree. All but one teacher was female.

*Measures*

**Child Assessment Battery**

Children were assessed on an individually-administered battery of standardized tests and structured performance measures. Oral language was assessed using the Expressive One-Word Picture Vocabulary Test (Dawson, 2000); this instrument shows high internal consistency (α = .96) and test-retest reliability (r = .85) for preschool children, as well as
convergent validity with other measures of vocabulary. The Test of Early Reading Abilities-3 Form B (Reid, Hresko & Hammill, 2001) was used to assess emergent reading. This instrument covers the domains of alphabet knowledge, print conventions, and communication of meaning. The TERA also shows high internal consistency (\( a = .91 \)) and test-retest reliability (\( r = .98 \)) with 3- to 6-year-old children; convergent validity with other measures of readingskill has been demonstrated (\( r = .52 \) to .67) when administered in the early elementary grades. Phonemic awareness was as-

essed on a 30-item task developed by the authors that included syllable recognition and the recognition and generation of rhyming and alliterative words. The rhyme and alliteration recognition items were adapted from a pre-publication version of the Preschool Comprehensive Test of Phono-

logical Processing (Lonigan, n.d.). Emergent writing was also assessed us-

ing a procedure developed by the authors. Children were asked to write their name and then, a list of "all the words or letters that you know." Both samples were scored for level of emergent writing based on Sulzby, Barnhardt & Hishima, 1989, and the list was scored for the number of unique letters and unique recognizable words. A total score was created by summing the four sub-scores. Both the phonemic awareness battery and the emergent writing sample show acceptable internal consistency (\( a = .71 \) and .74), converge with the EOW and TERA scores, and have been shown to be sensitive to intervention effects (DeBaryshe, 2003). Children's emer-

gent math skills were assessed on two instruments. The mathematics and logical operations scale of the Developing Skills Checklist (CTB/McGraw-

Hill, 1990) covers counting, numeral and shape identification, patterning, seriation, number conservation and part-whole relations. It has good in-

ternal consistency for preschoolers (KS-20 = .89) and convergent validity with the ESA math achievement scale (\( r = .59 \) to .73). A math performance battery adapted from Sophian (2004) included 11 items that were more closely aligned with concepts covered by the LC curriculum including measurement, area, volume, and spatial sense. The math performance bat-

tery converges with the DSC (\( r = .56 \)).

**Parent Surveys**

Parents were administered surveys developed for this project. Content included demographic information and self-reported frequency of home teaching interactions. Six items addressed literacy stimulation (e.g., "How often do you read aloud to your child?") and six items addressed math stimulation (e.g., "How often do you play games that use shapes, like puzzles or origami?"). Each item was rated on a 7-point Likert scale, with response options ranging from "never or rarely" to "daily." Two compo-

site variables were formed, home literacy stimulation (\( a = .88 \)) and home
math stimulation ($\alpha = .87$) by taking the mean response across component items. These composites were computed at both pre- and posttest. Parents in the experimental group were also asked six items addressing consumer satisfaction with the LC curriculum.

**Teacher Survey**

Teachers were administered a posttest survey that was developed for this project. Content included demographic information, teaching history, and, for LC teachers only, six items addressing consumer satisfaction with the LC curriculum.

**Classroom Data**

To measure treatment dosage, attendance records were collected from the Head Start administration. In LC classrooms, the mentor kept logs of the number of home activities returned by each family. In addition, LC families reported on a weekly basis the number of books borrowed from the classroom, and rated the quality of that week’s home activity (using a 4-point Likert scale ranging from “poor” to “excellent”).

**Procedure**

Pretest child assessments and parent surveys were administered at the start of the school year. Learning Connections was implemented in the experimental classrooms over a 26-week time span, including an additional 2-week review period during the winter holidays. Child posttest assessments and parent and teacher surveys were administered immediately after the implementation period ended.

**Results**

**Pretest Equivalence**

The LC and control groups were compared for pretest equivalence on all child, parent, and teacher measures. Significant pretest differences were found for only two variables. Children in the LC group had higher EOW vocabulary scores, $M = 82.77$ vs. 76.63, $t_{df} = 2.46, p < .02$, and the proportion of English language learners (ELL) was higher in the control group (35% vs 16%), $x^2 = 8.16, p < .004$.

**Treatment Fidelity**

The classroom mentor worked with teachers individually to help ensure that LC lessons were implemented with the prescribed frequency and in an appropriate manner. Overall, implementation fidelity for the parent component was moderate to good; on average, families completed
and returned 60% of the home activities. On both pre- and posttests, par-
ent reports of home literacy and math stimulation were close to ceiling
level. Although it was expected that home math and literacy stimulation
would increase for the LC families, this was not the case. Parents in both
groups reported a significant increase in literacy stimulation over time,
\( \hat{F}_{1.134} = 8.82, p < .004 \) and no change in home math stimulation.

**Group Differences on Child Literacy and Math Skills**

One-way analysis of covariance procedures were used to test the hy-
pothesis that gains in children's literacy and mathematics performance
would be higher for the LC group. Separate analyses were conducted for
each dependent measure. Group (LC vs control) served as the between-
subjects factor, and child pretest age and the relevant pretest score were the
two covariates. Both statistical significance and partial \( \eta^2 \) were computed
for the group and covariate effects. In this situation, \( \eta^2 \) represents the pro-
portion of variance in the dependent measure explained by the target effect,
adjusting for all other effects. A standard deviation-based effect size was
also computed for the group effects, using covariate-adjusted means (see Table 2).

Significant treatment effects were found for three of the six literacy out-
comes and one of the two math outcomes. Controlling for age and pretest
performance, LC children scored significantly higher than control children
on the TERA emergent reading, \( F_{1.134} = 4.95, p < .03, ES = .26 \); phonemic
awareness, \( F_{1.154} = 38.52, p < .001, ES = .81 \); letter-sound correspondence,
\( F_{1.154} = 8.72, p < .004, ES = .41 \); and TSC math measures, \( F_{1.134} = 5.23,
\ p < .02, ES = .24 \). There were no significant group differences on the EOW
vocabulary standard scores, letter naming, the emergent writing composi-
tive, or math concepts measures. (There were significant differences favoring
the LC group on EOW raw scores and the name-writing sub-score of the
writing composite.)

**Individual Differences in Developmental Gains**

Because interventions or curricula are never uniformly effective for
all participants, it is important to understand what factors are associated
with individual differences in participant change. We were particularly in-
terested in identifying possible dosage effects and child characteristics that
correspond with developmental progress. Partial correlations, controlling
for pretest performance, were used to identify correlates of child literacy
and math gains over time.

To reduce the number of variables involved, children's test data were
transformed into composite scores by standardizing and summing each
child's results on the relevant pre or post-test instruments. Two home-
<table>
<thead>
<tr>
<th>Dependent Variable/ Effect</th>
<th>F</th>
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Note: Tabled means and standard deviations are covariate-adjusted.

stabilization change measures were also computed, one measuring change in home literacy stimulation, and one measuring change in home math stimulation. These scores were computed by taking the residual of posttest literacy or math stimulation regressed on pretest literacy or math stimulation.

Literacy gains in the LC group were highest for English language learners (partial $r = .26$, $p < .01$), children with high attendance rates (partial $r = .24$, $p < .05$), and children whose families increased their level of
home stimulation above what would have been predicted based on family practices at pretest (partial $r = .37$, $p < .01$). There were no associations with age or home activity return rate. In the control group, literacy gains were higher for younger children (partial $r = -.39$, $p < .01$), and again, for children who attended school most frequently (partial $r = .29$, $p < .05$). There were no significant correlates of math gains for children in either group.

**Classroom Stability and Developmental Gains**

Analyses of classroom stability were conducted for LC classrooms only. Classroom stability was defined in two ways. In terms of learning group stability, LC classrooms were encouraged to use consistent small groups (i.e., the same teacher and 3-4 children working together) (cross the school year) when doing LC activities. Four of the six LC classrooms attempted to implement stable learning groups. Teacher stability was a factor not under staff control. The lead teachers in three LC classrooms were frequently away from their sites serving on a program-wide staff development team. Two classrooms also lost assistant teachers and had difficulty finding replacement staff. When progress within the LC group was examined, results suggested that classroom stability was associated with children's learning gains. Classrooms A and B (high on both teacher and grouping stability) scored above the aggregate mean for child gains, especially for literacy outcomes. Classrooms C and D (both were low on teacher stability, and C did not use stable learning groups) showed the smallest gains.

Finally, a natural experiment occurred within Classroom D. This classroom organized four learning groups, but was affected by the loss of an assistant teacher (whose position remained open for several months) and the frequent absence of the lead teacher. When staff members were absent, other teachers would attempt to cover for the missing teacher(s). Within Classroom D, literacy gains were significantly higher for children in the two learning groups that kept the same teacher throughout the school year.

**Consumer Satisfaction**

Consumer satisfaction with LC was high, especially for parents. The percentage of teachers who reported being "satisfied" or "very satisfied" with different aspects of the LC curriculum was as follows: mentoring and implementation support, 100%; quality of LC materials, 94%; children's learning, 94%; teacher's own mastery of LC, 94%; teacher teamwork within the classroom, 88%; parent involvement, 71%. Parents rated each LC home activity on a four-point scale, ranging from "poor" to "excellent"; the mean activity rating was 3.38 (SD = 0.42). Between 98% and 100% of parents "agreed" or "strongly agreed" that the classroom and home curricula
contributed to their child's learning, that the home activities were clearly written and fun to do, and that they would recommend LC to other parents. Two percent of parents rated the curriculum package as "poor," 28% described it as "good," and 70% rated LC as "excellent."

**DISCUSSION**

Overall, LC was an effective and well-received curriculum. Controlling for age and pretest performance, LC was found to benefit children's development in math, emergent reading, letter-sound correspondence, and phonemic awareness. Gains in all these areas were both statistically and educationally significant, with changes in phonemic awareness being particularly strong. The home component of the curriculum was largely successful in engaging parents in their children's learning and parent consumer satisfaction was especially high.

The comparison curriculum used in the evaluation project was the Creative Curriculum (Dodge, 2002), which is widely implemented in Head Start programs nation-wide. The current findings suggest that LC may be a more effective approach for literacy and math instruction. Why might this be the case? Both curricula have literacy and math learning goals that align with the Head Start Performance Standards. LC goals, however, are more numerous and specific, especially in the math domain. Other differences between the curricula are more striking. First, LC provides teachers with detailed, specific instructional activities and lesson plans that, if followed, ensure that purposeful instruction in literacy and math occurs on a daily basis. In the Creative Curriculum, teachers have latitude to design, select, and schedule activities. This provides more professional freedom, but also introduces variation in instructional content and time. Second, LC was implemented in the context of ongoing classroom mentoring and technical assistance. This is a valuable professional development resource that may be beyond the means of many early childhood programs. Third, LC includes a substantial parent curriculum, including weekly home activities and parent support. This degree of intensity in expected parental involvement is unusual for center-based programs. Because LC was implemented as a package, we cannot determine the degree to which different curriculum components contributed to the evaluation outcomes.

LC is a relatively intensive program to implement and it is legitimate to question whether the observed magnitude of child outcome gains are worth the effort it takes to implement the curriculum. Teachers had to make several changes in their classroom practices. These changes included (a) altering schedules, (b) using more small-group instruction,
(c) incorporating literacy and math content on a more frequent basis, (d) using all staff members (not just lead teachers) to implement instruc-
tional activities, and (e) conducting ongoing assessments on a weekly ba-
sis. Although these changes were not necessarily easy to do, results of
this evaluation suggest that teachers and parents felt their efforts were
rewarded.

LC was developed in part to meet the needs of Hawai‘i’s multicultu-
rual API population. Culturally responsive practices help build cultural
awareness, cultural competence, and self-esteem (Tharp, Estrada, Dalten &
Yamauchi, 2000). It has been suggested that ethnic minority children are
best served when culturally responsive teaching and educational excel-
ence are mutually supporting tenets of classroom practice (Delpit, 1995;
Ladson-Billings, 1998). By focusing simultaneously on developmentally
appropriate academic content, culturally-responsive instruction, teacher
professional development, and parental involvement, we hoped to max-
imize the benefits provided to our Head Start children. Because effec-
tive early childhood education can reduce academic risk (Barnett, 1995;
Campbell & Ramey, 1994; Peisner-Feinberg et al., 2000), a curriculum like
LC may be useful in improving the longer-term educational prospects of
at-risk preschool children. LC improves preschoolers’ academic readiness
skills, which should positively affect their success in elementary school.
In addition to strengthening children’s cognitive skills, LC strengthened
aspects of the parent-child system. By working with their children on a
regular basis, parental self-efficacy increased and parents became more
aware of their children’s capabilities. By changing parents’ behaviors, the
positive benefits of LC may be better maintained in the future. If their
families continue to hold high expectations and remain actively engaged
in their children’s learning, children should show lasting advantages in
terms of academic performance and motivation. We are currently plan-
ing a kindergarten follow-up study of LC graduates, to determine whether
the academic gains are maintained once children enter the formal school
system and whether LC has long-term effects on parents’ educational
involvement.

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