

# ***Assessing the Child's Cognitive Home Environment Through Parental Report: Reliability and Validity***

**Benard P. Dreyer\***

*New York University School of Medicine, New York, USA*

**Alan L. Mendelsohn**

*New York University School of Medicine, New York, USA*

**Catherine S. Tamis-LeMonda**

*New York University, New York, USA*

**In a series of investigations with poor minority families, we examined the reliability and validity of the StimQ, an office-based interview of children's cognitive home environment. Researchers and practitioners alike recognize the importance of assessing meaningful dimensions of children's early experiences, particularly in families where children may be at risk for later cognitive delay. To date, methodological approaches to the study of parenting have most often relied on home visits and/or labour-intensive observations and coding. Our findings suggest that valid and reliable data about the cognitive environments of poor children can be obtained through maternal report, thereby offering applied scientists a useful alternative to assessing children's early experiences. ©1996 by John Wiley and Sons, Ltd.**

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Parental sensitivity is not only expressed in the quality of parenting interactions, but might also be reflected in the ways parents structure and organize their children's cognitive experiences. For example, the cognitive environment that parents provide for their children, in the way of age-appropriate materials, responsive toys and

exposure to reading materials, and the way social interactions with such materials are organized (e.g. the allocation of time for book-reading) have been shown to exert telling influences on children's unfolding cognitive abilities. Researchers and practitioners who seek to describe, understand, predict and influence children's development must not only attend to the socioemotional supports that parents provide for their children, but must also consider the extent to which individual parents are sensitive to the environmental needs of their children in the course of everyday learning.

\*Correspondence to: Dr B. P. Dreyer, New York University Medical Center-Bellevue Hospital, Pediatric Resource Centre, 462 First Avenue, New York, New York 10016, USA. Tel: 212-562-6341. Fax: 212-562-2474. e-mail: dreyer@is2.nyu.edu.

To date, measures of parenting sensitivity have traditionally been obtained through observational techniques that most often require home visits and coding by trained investigators (e.g. Baumwell *et al.*, in press; Bornstein and Tamis-LeMonda, in press). In applied settings, such as hospital clinics, access to such data is often limited or not feasible, making alternative approaches to the assessment of early experiences critical. Assessments of the cognitive environment that parents provide for their children may not be as dependent on direct observations as measures of parental responsiveness; indeed, attempts have been made to obtain valid data on children's home environments through parental report (e.g. Casey *et al.*, 1988).

In this paper, we present a series of studies, conducted with over 300 poor urban families, in which we describe the development and validation of the StimQ, an office-based assessment of the child's cognitive home environment. These studies make two contributions to this thematic issue on early parenting. First, we extend more traditional definitions of parenting sensitivity to include organizational, physical and didactic dimensions of the construct. Parents who structure age-appropriate and cognitively stimulating environments, for example, are displaying sensitivity to the developmental needs of their children. Second, these studies offer one example of how basic research findings can address the concerns of applied researchers and practitioners who work in the fields of developmental psychology and its allied disciplines.

### THE IMPORTANCE AND ASSESSMENT OF THE CHILD'S EARLY HOME ENVIRONMENT

Bloom's (1964) ground-breaking work in the early 1960s demonstrated the importance of the child's early home environment in affecting the intellectual functioning of the individual. He theorized that several factors within the home environment, including stimulation of children's verbal development, encouragement of children's exploration and support for children's learning of new skills, play central roles in early cognitive development. During the same period, Hunt (1961) stressed the marked effects of early experience and learning on children's later cognitive functioning, basing his theories on animal models and natural experiments of early

deprivation. In the intervening three decades, there has been a myriad of research documenting relations between the child's cognitive and social environments (e.g. provision of play materials, parental involvement and sensitivity) and children's achievements in a range of areas, including language and symbolic thought (e.g. Bornstein, 1989; Bradley *et al.*, 1989; Gottfried, 1984; Moore and Dunham, 1995; Wachs, 1992).

Distal environmental factors, such as socioeconomic status (Escalona, 1982; Willerman *et al.*, 1970; Werner *et al.*, 1967; Parker *et al.*, 1988; Msall *et al.*, 1991), maternal education (Willerman *et al.*, 1970; Werner *et al.*, 1967; Parker *et al.*, 1988), stress and maternal social support (Pascoe *et al.*, 1981; Crnic *et al.*, 1983; Bee *et al.*, 1982), social risk factors (Sameroff *et al.*, 1987; Leonard *et al.*, 1990; Dreyer *et al.*, 1991; Courtlandt *et al.*, 1992) and parenting views and psychological functioning (Cohn *et al.*, 1990; Conger *et al.*, 1984; Gelfand and Teti, 1990; Goodnow, 1995; Holden, 1995; McLoyd, 1994; McLoyd and Wilson, 1990; Miller, 1988), are also important predictors of developmental outcomes in children. However, the effects of these factors have been found to be mediated by cognitive, physical and social dimensions of the environment, which are often the prime source of variance in child outcomes (e.g. Bakeman and Brown, 1980; Jordan, 1978; Caldwell and Bradley, 1984). Indeed, a supportive home environment has been regarded as a buffer or protective factor in cases of social or biological risk (e.g. parental depression, poverty, infant prematurity), often ameliorating the adverse effects of such risks on young children's current and later adaptation (e.g. Seifer *et al.*, 1992; Morrissey *et al.*, 1990).

Research documenting the role of the early environment in children's lives is not only central to theoretical models about early development but is also relevant to applied researchers and practitioners who are concerned with identifying and serving children who are in need of interventive services. Very often, however, applied researchers and practitioners face logistical constraints that impede their ability to access reliable and valid information about dimensions of the child's early experiences. For the most part, assessments of maternal sensitivity, the availability of age-appropriate materials offered to the child, parental support of children's developmental advance and so forth require visits to the child's home and/or labour-intensive coding of videotaped records.

For example, the Home Observation for Measurement of the Environment Inventory (HOME; Caldwell and Bradley, 1984), one widely used instrument, employs observation and interview techniques that require a 45–90-minute visit to the home of the target child when the child's primary caregiver is available. The Infant-Toddler version of the HOME Inventory (IT-HOME) for 0–3-year-olds has 45 items grouped into six subscales: parent responsiveness, acceptance of child, organization of the environment, learning materials, parental involvement and variety of experience. An extensive literature of research has documented the reliability and predictive validity of the HOME Inventory (Bee *et al.*, 1982; Bradley, 1993; Bradley and Caldwell, 1976, 1984; Caldwell and Bradley, 1984; Elardo *et al.*, 1975, 1977; Siegel, 1981, 1982; Van Doorninck *et al.*, 1981; Widmayer *et al.*, 1990). However, despite its apparent usefulness, the requirement of a home visit, cost in staff time, difficulties in arranging travel for staff and the required level of staff sophistication and training to ensure reliable results are often barriers to its use in applied settings. Other methods of assessing mother-child interactions, such as those requiring extensive observational coding, pose similar difficulties as they are both labour-intensive and require the use of highly trained staff.

In response to these concerns, two office-based assessment tools, the Home Screening Questionnaire (HSQ) and the Pediatric Review and Observation of Children's Environmental Support and Stimulation (PROCESS), have been developed. The HSQ is a parental self-report screening instrument for children 0–6 years of age which categorizes children as suspect or not suspect for poor home environments (Coons *et al.*, 1981), thereby identifying families for whom a full evaluation of the home environment is recommended (Frankenburg and Coons, 1986). The PROCESS is an inventory for infants between 9 and 18 months of age and consists of a parent-completed questionnaire and a physician observation scale (Casey *et al.*, 1988). It provides scores on developmental stimulation and organization in the home as well as an assessment of mother-child interaction based on the physician's observations. Unfortunately, the usefulness of these instruments is somewhat limited; the HSQ is not appropriate for most research purposes due to the dichotomous nature of its scores and the PROCESS can only be used for a limited age range of children. As yet, the predictive validity of the PROCESS has only been

demonstrated for the physician observation component (Casey *et al.*, 1993).

In an effort to extend the applied benefits of the HSQ and PROCESS, Dreyer, Mendelsohn, Tamis-LeMonda and their co-workers at New York University (Mendelsohn *et al.*, 1994; Dreyer *et al.*, 1996) developed the StimQ, an office-based caregiver interview that assesses the cognitive home environment of 12–36-month-old children. In addition to being easily administered in an office setting the StimQ: (1) provides continuous (rather than dichotomous) data on the child's home environment, (2) extends the age of application on the PROCESS to 36 months, and (3) demonstrates strong psychometric properties, including a meaningful factor structure, short-term reliability, predictive validity to the Bayley MDI and concurrent validity to the IT-HOME.

In this paper we describe the development of the initial version, StimQ-1, and the revised scale, StimQ-Toddler (StimQ-T), and then describe four studies in which we examine the structure, reliability and validity of the initial and revised versions of the StimQ. Specifically, in study 1, we overview the factor loadings and reliability of StimQ-1; in study 2, we assess the concurrent validity of the StimQ-1 using the Bayley Scales of Infant Development (2nd edn) Mental Development Index (MDI) as an outcome measure; in study 3, we describe the factor structure and reliability of the revised version, StimQ-T; and in study 4, we assess the convergent validity of StimQ-T in a comparison with concurrent IT-HOME Inventory scores.

## DEVELOPMENT OF THE STIMQ-1

The StimQ-1 was developed to measure the cognitive aspects of the home environment by assessing factors within the home that significantly correlate with children's cognitive developmental outcomes, including the quality of language stimulation, the variety of objects and experiences in the child's life and maternal encouragement of and involvement in children's developmental advance (see Bradley and Tedesco, 1982). Research by Bradley and colleagues indicates that measures of cognitive home environmental factors exert strong and direct effects on children's intellectual outcomes (see e.g. Bradley, 1989). Similarly, Stevens and Bakeman (1985) showed that the predictive validity of the IT-HOME score for 4-year IQ in a sample of inner-city African-

American families was largely explained by a factor they extracted and labelled 'support for intellectual development'. This factor was composed of items relating to toys and books available to the child, reading in the home and maternal involvement in children's developmental advance. Verbal responsiveness, corresponding to the maternal verbal responsivity subscale on the IT-HOME, was also somewhat important, perhaps due to its relation to mother's language stimulation and emotional responsiveness. Non-punitive, the third factor, drew primarily from items on the avoidance of restriction and punishment subscale of the IT-HOME, and was not predictive of later developmental outcome. Based on the theoretical constructs described above, and on the strength of the research using the HOME Inventory, the questions on the StimQ-1 were designed to capture information similar to that assessed by those subscales of the IT-HOME inventory that focused on the cognitive home environment.

### *Administration*

The StimQ-1 was designed to be administered in an office setting, therefore not requiring the expense or time commitment of a home visit. The questionnaire is administered by interviewers, making it more reliable with low SES parents who may have low reading comprehension. StimQ-1 interviewers are instructed to verify the parent's understanding and veracity by expanding every 'yes' answer given by a parent with follow-up questions (e.g. 'Tell me more about it'). In order to ensure its usefulness as a clinical tool, the StimQ-1 was designed to take only 15–20 minutes to administer and less than 5 minutes, to score; it has clear and unambiguous instructions; and it requires only 2–3 hours of training. All questions are put to the child's primary caregiver. It contains no observation-based items since such items often require more training and administration time.

### *Initial Item Development*

Items included in the StimQ-1 were based on extensive reviews of common developmental tests used in the first 3 years of life and on the parenting behaviours and associated learning materials that have been found to support the acquisition of early cognitive skills. The learning materials selected as supportive of thought processes through age 36 months were based on items available in mass market and local toy and book stores, public

libraries and department stores. Items were checked for age-labelling of packaging to verify that parents would understand those learning materials to be appropriate for their children. Eight paediatricians experienced in developmental evaluation of young children and research in early childhood development, two infancy/toddler and parenting specialists and one developmental psychologist constituted a panel of experts who reviewed all items and made necessary additions and deletions.

An inventory of the number and variety of toys and other learning materials in the home comprised the first part of the StimQ-1. Learning materials were subdivided into six categories: symbolic play, fine motor-adaptive, language, art and drawing, music and life-size (i.e. large) toys. To capture information similar to the HOME parental involvement subscale, questions about parent-child activities, including playing with the child and teaching specific skills to the child, were asked. Questions concerning reading and books were included to capture information similar to the variety of experience subscale of the HOME. Lastly, a number of questions that appeared to relate to language stimulation, learning materials or variety of experience were included. These items reflected specific questions on the HOME organization of the environment subscale (trips out of the house and a special place for toys) and the HOME parental responsivity subscale (mother names objects for child). No questions were asked to approximate the items on the acceptance of child subscale on the HOME.

### *Pilot Studies*

Further modifications to the StimQ-1 were based on field tests that were performed on a group of 30 and then 50 mothers from low SES households recruited from a general paediatric clinic in a large urban hospital. All mothers were primary caregivers of their 12–36-month-old children.

After the first wave of data collection (i.e.  $N=30$ ), unacceptable items were eliminated and others were revised after exploratory item analysis; 26 items were left. Following the second wave of data collection ( $N=50$ ) and additional item analysis, items demonstrating poor discrimination and weak association with other items were dropped. Several items showing low but positive discrimination ability were retained due to their content validity (e.g. mother encourages child to

learn the parts of the body). Four of the 26 items were dropped, leaving 22 items in StimQ-1.

The next aim of this research was to analyse the factor structure and short-term reliability of the 22-item scale in a substantially large cohort of families served by an urban paediatric clinic.

## STUDY 1

### Methods

#### Participants

Participants were 150 mothers of 12–36-month-old children (44% female) coming for health care to a large urban hospital. Inclusion criteria included normal birth history, no developmental problems in children and mother had to be the child's primary caregiver. Forty-four per cent of the children were female. Most (86%) families were from lower socioeconomic strata (Hollingshead groups IV and V; Hollingshead, 1958). Thirty-seven per cent of the mothers did not graduate from high school, 32% were high school graduates, 22% had some college education and 9% had graduated from college. One-half of the mothers were married. Seventy-seven per cent of the mothers were Latino, 11% were African-American, 9% were Caucasian and 3% were Asian.

#### Procedures

StimQ-1 was administered to all parents by trained interviewers. Fifty mothers were interviewed by four fellows in general academic paediatrics and 100 mothers were interviewed by six first- and second-year medical students (who had no experience in clinical medicine or paediatrics). Assignments to interviewers were made on a random basis. In order to measure test-retest reliability, 30 randomly selected families received a repeat StimQ-1 1–2 weeks after the first administration. One interviewer administered the first StimQ-1 and another interviewer, unaware of those results, administered the second StimQ-1.

#### Analyses

Internal consistency of items was measured by Cronbach's reliability coefficient. Corrected item-total score correlations were evaluated using point-biserial correlation coefficients. Test-retest reliability was measured using intraclass correlation coefficients (Shrout and Fleiss, 1979). Exploratory factor analysis was performed with unweighted least-squares extraction and Varimax rotation. Although many of the items are

dichotomous, traditional factor analysis was performed without tetrachoric transformation. Scrutiny of the phi coefficients of inter-item correlations and the factor loadings did not reveal any 'difficulty' factor, which is a major potential problem encountered in factor analysis of dichotomous data (Shrout and Parides, 1992). We therefore proceeded with factor analysis without transformation. The scree plot of eigenvalues indicated one major factor and the likelihood of one to two other factors.

### Results and Discussion

StimQ-1 scores averaged 14.2 with an SD of 5.14 and a range of scores from 0 to 22. The distribution of scores (see Figure 1) was skewed towards higher values, indicating that the StimQ-1 was able to differentiate between poor and adequate home environments but was less able to differentiate between adequate and enriched home environments.

Internal consistency of items was high (Cronbach's  $\alpha=0.89$ ), and all 22 items were positively correlated with the overall StimQ-1 score. Test-retest reliability on the subset of 30 mothers was strong,  $r=0.84$  (95% CI 0.69, 0.92).

Factor analysis was performed with extraction and rotation of a two-factor structure. Factor 1, availability of learning materials (ALM), had items with high factor loadings that reflected the amount and variety of learning materials provided to the child. Factor 2, parental involvement in developmental advance (PIDA), had high factor loadings on most of the teaching items and other parent-child activity items. All three items that measured reading activities loaded substantially on both factors. This observation may mean that a third factor exists (reading to child) or that reading activities reflect both ALM (e.g. children's books) and PIDA (reading to the child). A three-factor solution indicated that five items loaded predominantly on factor 3, including three reading items and two other items with loadings of 0.30 or greater on both ALM and PIDA. Therefore, it is not clear from the factor analysis of the StimQ-1 whether a distinct reading factor exists.

To summarize, results from these initial investigations indicate that the StimQ-1 is a reliable measure with a meaningful factor structure. However, the distribution of scores suggests that there is a 'ceiling effect', with some concern over the StimQ-1's ability to differentiate between an adequate and an enriched home

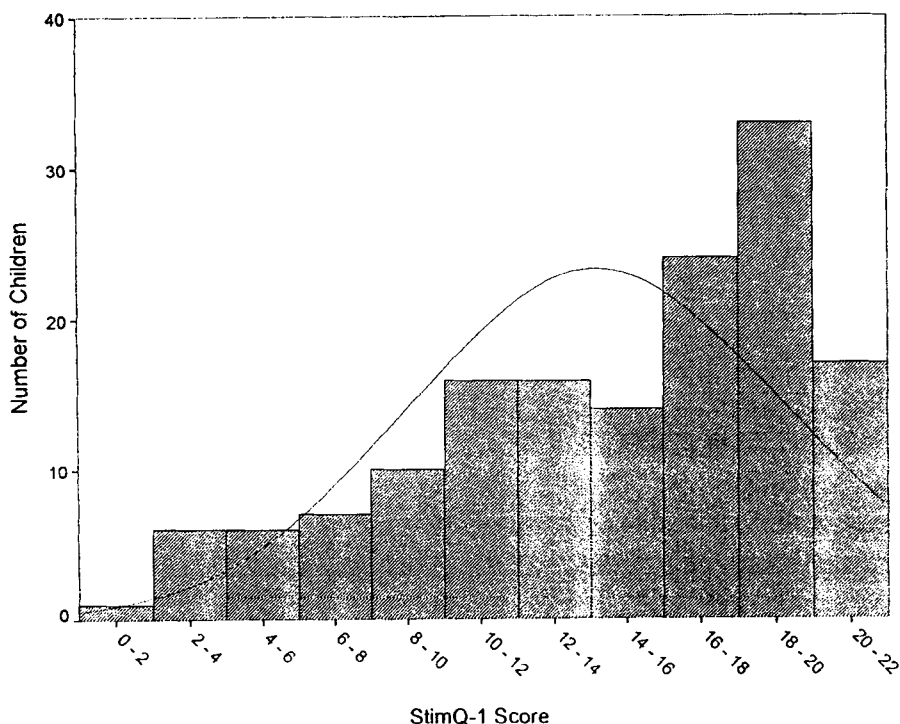


Figure 1. Histogram showing distribution of scores for StimQ-1 (N=150)

environment. In the next investigation we sought to determine the concurrent validity of the StimQ-1 by assessing whether it correlates with children's performance on the Bayley MDI.

## STUDY 2

### Methods

#### Participants

Fifty children (46% female) presented to the paediatric clinic for primary care were entered into the study. All children were 12–36 months, Latino or African-American, had been term singletons at birth, had normal birth histories, had no developmental, neurological or chronic medical problems, and had blood lead levels  $< 25 \mu\text{g}/\text{dl}$ . All mothers were the primary caregivers of their children. The demographic characteristics of this group paralleled those of study 1, except for a somewhat lower maternal educational level (mean

years in school=10.8) and exclusive minority group membership.

#### Procedures

The Bayley Scales of Infant Development (2nd edn) MDI was administered by one researcher and a second researcher, blind to the results of the Bayley, administered the StimQ-1. Maternal depression was measured with the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) and maternal intelligence with the Peabody Picture Vocabulary Test-Revised (PPVT-R; Dunn and Dunn, 1981). Because low-level lead exposure and iron deficiency are prevalent in this population, as well as associated with poor developmental outcome (Baghurst *et al.*, 1992; Bellinger *et al.*, 1987, 1991; Davis and Svendsgaard, 1987; Dietrich *et al.*, 1987, 1991; Hawk *et al.*, 1986; McMichael *et al.*, 1988; Needleman and Gatsonis, 1990; Needleman *et al.*, 1979, 1990; Schroeder *et al.*, 1985; Walter *et al.*, 1989; Yule *et al.*, 1981), a blood

lead, haematocrit and mean corpuscular volume of red blood cells (MCV) were obtained from the child to serve as covariates in analyses.

### Results

Results showed a mean Bayley MDI of 85.3 (SD=11.6) and mean StimQ-1 score of 13.8 (SD=5.4). The StimQ-1 related moderately and significantly to the Bayley MDI,  $r=0.52$  ( $p<0.001$ ). Multiple linear regression was performed to determine the relationship between StimQ-1 and Bayley MDI while controlling for children's age, and in a separate analysis, for multiple confounding factors. The StimQ-1 continued to correlate with Bayley scores (see Figure 2) after controlling for the child's age, sex, country of origin, blood lead and iron status and mother's age, education, language, depression, verbal IQ and SES in a multiple regression model (semipartial  $r=0.45$ ,  $p<0.001$ ).

### Discussion

To summarize, the StimQ-1 demonstrated a significant association with children's scores on the Bayley MDI even after controlling for possible confounding risk factors. While these data are encouraging, two limitations were apparent. First, the factor structures extracted in study 1 suggested that there might be a possible reading factor, but there were too few items evaluating reading activities on the 22-item StimQ-1 to adequately evaluate this potential factor. Second, the distribution of scores was skewed towards higher values, with StimQ-1 being less able to differentiate between adequate and enriched home environments. This ceiling effect may be of even more concern in higher SES groups, in whom higher home environment scores with narrower ranges of scores have usually been found (Lotas *et al.*, 1992). These problems led to the development of a revised and expanded version of the StimQ, the StimQ-Toddler (StimQ-T).

The StimQ-T consists of most of the items of the original 22-item scale plus additional questions.

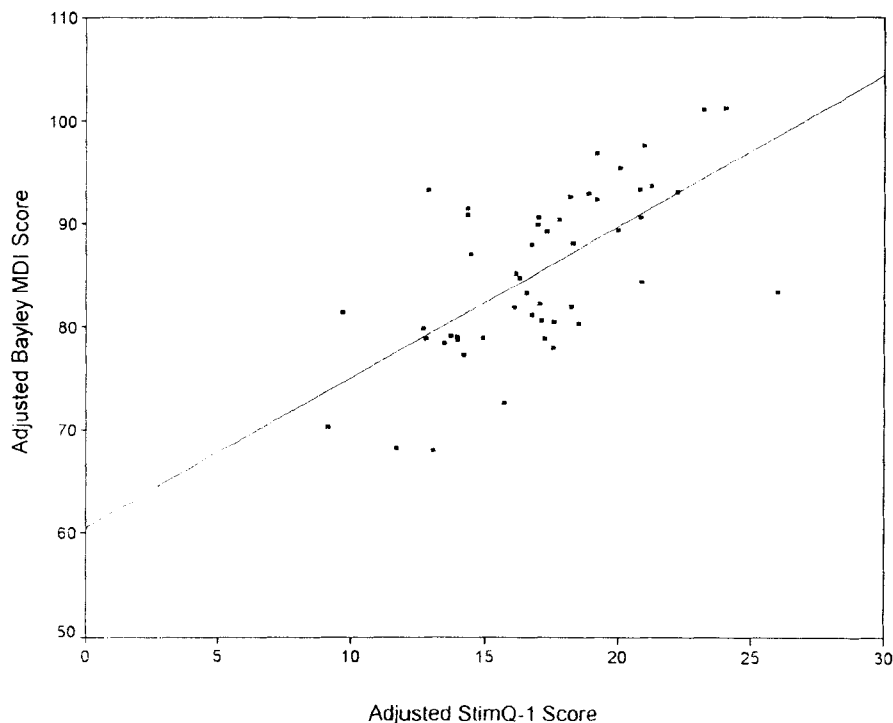


Figure 2. Partial regression plot of StimQ-1 on Bayley MDI (2nd edn) after controlling for confounders (semipartial  $r=0.45$ ,  $p<0.001$ ,  $N=50$ ).

Items from the original StimQ-1, based on poor factor loadings and/or low item-total correlations, were dropped and new questions were developed and evaluated using the same content validity and item analysis procedures as before. The revision included the following changes: (1) the inventories for symbolic, fine-motor/adaptive and visual-motor learning materials were expanded; (2) the music-learning materials inventory was consolidated with the fine-motor/adaptive inventory; (3) the categorization of each of the inventories was broadened from an inadequate/adequate dichotomy to a trichotomy of inadequate/adequate/enriched whenever the number of materials in the inventory was large (i.e. at least 10); (4) questions were added to the PIDA section; (5) new questions about reading were added; (6) the number of books read to the child was expanded from a dichotomy to a score of 0–4 points; and (7) new questions were added to assess parental verbal responsiveness (e.g. engaging in interactive play such as peek-a-boo or bath play) due to the likelihood that such verbal interactive experiences are important to children's cognitive development (e.g. Metzl, 1980). The revised StimQ-T contained 30 items with a range of possible scores from 0 to 39.

In the next series of studies we examined the factor structure, item analysis and reliability of the revised scale.

### STUDY 3

#### Methods

##### Participants

Participants were 137 mothers of children who were 12–36 months old, normal full-term singleton birth, and had no neurodevelopmental or chronic medical problems. All mothers identified themselves as the child's primary caregiver. Ninety per cent of the families were from the general paediatric clinic of a large urban public hospital and 10% from a private paediatric office. Fifty per cent of the children were female. Demographic information about the sample reveals a wide range of maternal education, with 35% of the mothers not graduating from high school, 29% being high school graduates, 13% having some college education and 23% being college graduates. The majority of the families were Latino (62% Latino, 12% African-American, 19% non-Latino Caucasian, 7% Asian) and were from low socioeconomic strata (41% Hollingshead

group V, 29% group IV, 15% group III, 4% group II, 10% group I). In 67% of the families, a significant male partner was identified by the mother as living in her household.

#### Procedures

The StimQ-T was administered to parents by three college students and five medical students who received brief (i.e. 1–2 hour) training from the research staff. Interrater reliability was established through the observed administration of five StimQ-Ts by each trainee, and monitored throughout the study by having one student administer the StimQ-T and a second randomly selected student score 26/137 of the StimQ-Ts. Interrater reliability was strong (intraclass correlation coefficient=0.98, 95% CI 0.92, 0.99; Shrout and Fleiss, 1979).

In order to measure test-retest reliability, 20 randomly selected families received the StimQ-T a second time 1–2 weeks after the first administration. One college student administered the first StimQ-T and another randomly selected college student, unaware of the results of the first StimQ-T, administered the second.

#### Results and Discussion

Data on the distribution of the StimQ-T are presented in Figure 3. As shown, the StimQ-T no longer demonstrated a ceiling effect. The mean StimQ-T score was 22.4 ( $SD=7.9$ , range=2–37). StimQ-T scores related to the Hollingshead SES,  $r=0.40$  ( $p<0.001$ ), a finding that is consistent with the correlation between the IT-HOME and SES (Caldwell and Bradley, 1984).

Exploratory factor analysis was next performed using principal factor analysis extraction. The scree plot and the eigenvalues were consistent with the presence of four factors. Equimax rotation was performed on these factors prior to interpretation. The individual items with their loadings on the factors can be seen in Table 1 (only loadings above 0.30 are indicated). Factor 1, labelled 'availability of learning materials' (ALM; worth up to seven points on the StimQ-T), consists of the items asking about toys and learning materials that the parent has made available to the child. Factor 2, labelled 'reading-verbal' (READ; worth up to 18 points), represents the amount and variety of reading that the parent provides for the child. Factor 3, labelled 'parental involvement in developmental advance' (PIDA; worth up to 10 points), involves a clustering of



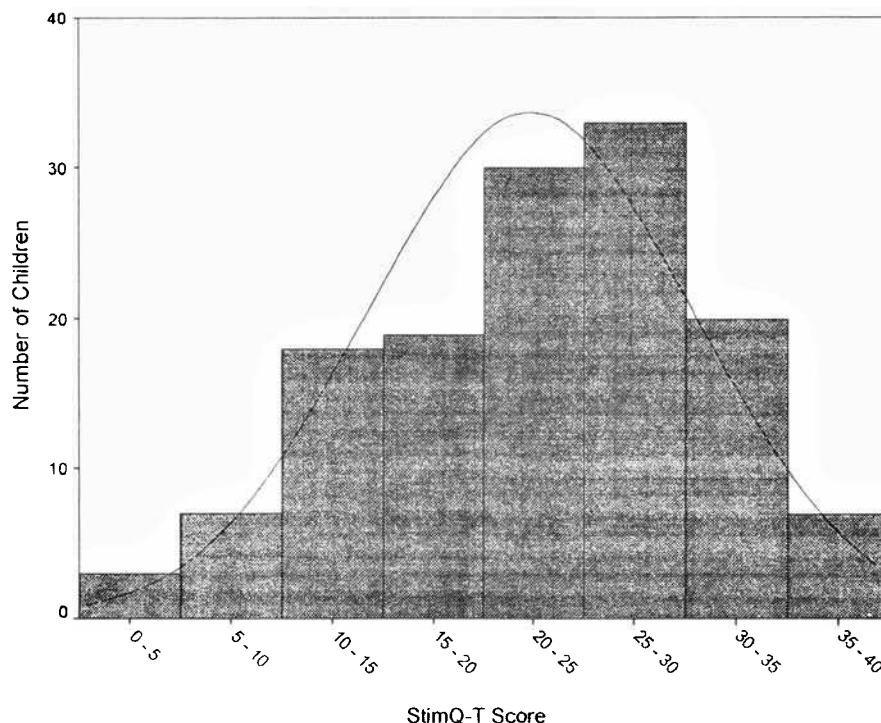


Figure 3. Histogram showing distribution of scores for StimQ-T ( $N=137$ ).

items measuring parental involvement in the child's learning of new skills and words. Factor 4, labelled 'parental verbal responsivity' (PVR; worth up to four points), represents the parent's non-structured play and verbal interactions with the child.

The factor loadings reveal 'simple structure' to a great degree, with most items loading substantially on only one factor and each factor having several items with high loadings. Only 4/30 items have relatively equivalent loadings on two factors. These three items were placed in one of the two subscales based on the content of the item. Similarly, 3/30 items with no meaningful loadings on any factor were placed on a subscale based on their content.

Item analysis was next performed to determine the effectiveness of individual items in differentiating among families with different levels of cognitive stimulation in the home environment. The point-biserial correlation coefficients were determined for the item and the total StimQ-T score corrected by subtracting the score on the item of interest. The item discrimination index ( $D$ -index) was also calculated

for each item, comparing the proportion of families answering 'yes' to an item in the upper 27% of the sample with the proportion answering 'yes' in the lower 27% of the sample (Suen, 1990). The corrected point-biserial correlation coefficients between the item and the total StimQ-T were in the moderate range for the majority of the items, and at least 0.25 for 24/30 items. No items had negative corrected point-biserial correlations with the total score. In most cases (26/30), the correlation between the item and its subscale score was greater than that between the item and the total score, supporting the item's placement in the subscale. All but one item had correlations greater than 0.25 with their subscale scores, and no items had negative correlations with subscale scores. The discriminatory power of the majority of items was good to excellent. Eighteen of 30 items had a  $D$ -index of more than 0.50, five of 30 items had a  $D$ -index of 0.35–0.50, four of 30 items had a  $D$ -index of 0.20–0.35 and only three of 30 items had a  $D$ -index less than 0.20 (the lowest being 0.16).

The measured Cronbach's  $\alpha$  for the total StimQ-T score was very strong (0.88). Cronbach's  $\alpha$  was also calculated for each of the subscales (see Table 2), and

Table 1. StimQ-Toddler factor analysis and factor loadings of items

Item name	Factor 1	Factor 2	Factor 3	Factor 4
<i>READ subscale</i>				
Number of books parent reads to child	0.72			
Parent reads book about shapes to child	0.69			
Parents reads book about numbers to child	0.69	0.35		
Days per week parent reads to child	0.68			
Parent labels pictures while reading to child	0.65			
Parent reads book about colours to child	0.63			
Parent reads book about alphabet to child	0.60	0.37		
Parent reads book of nursery rhymes to child	0.59			
Parent reads book about daily activities to child	0.58	0.32		
Number of board books parent reads to child	0.53			
Reads or tells bedtime story to child	0.45			
<i>ALM subscale</i>				
Parent provides toys about language		0.83		
Parent provides materials for drawing and art		0.58		
Parent provides fine-motor/adaptive toys		0.48		
Parent provides large-size toys and furniture		0.41		
Parent provides symbolic play toys		0.40	0.37	
<i>PIDA subscale</i>				
Parent plays pretend games with child			0.46	
Parent helps child learn to use toys with buttons/knobs			0.44	
Parent teaches child simple counting	0.35		0.43	
Parent shows child how to stack blocks			0.39	
Parent shows child how to drop blocks in container			0.38	0.38
Parent names and describes items in grocery			0.33	
Parent teaches primary colours to child			0.32	
Parent teaches alphabet to child		0.36	0.31	
Parent names and describes things in house/street				
Parent teaches child parts of body				
<i>PVR subscale</i>				
Parent plays with child in bath				0.53
Parent plays finger/rhyming games with child				0.48
Parent plays peek-a-boo or hide-and-seek with child				0.48
Parent talks about day while child is eating				
<i>Eigenvalue</i>	7.23	1.42	1.31	0.91

Note: Only factor loadings > 0.30 are shown.

Table 2. Internal consistency of StimQ-T

	No. of items	Cronbach's $\alpha$
StimQ-T total score	30	0.88
<i>Subscale scores</i>		
Availability of learning materials	5	0.71
Reading	11	0.90
Parental involvement in developmental advance	10	0.68
Parental verbal responsivity	4	0.43

was in the good to excellent range for three of the four subscales and acceptable for one subscale. Since the  $\alpha$  coefficient is positively related to the number of items in the scale, subscales with a small

number of items, such as the parental verbal responsivity subscale, are expected to have lower alphas. While the learning materials subscale only has five items, each of these items is based on an inventory containing between eight and 16 different toys and other learning materials. The number of items on each inventory serves to enhance the reliability of the learning materials subscale (Cronbach's  $\alpha=0.71$ ).

Test-retest reliability for the total StimQ-T score was high, with an intraclass correlation coefficient of 0.93 (95% CI 0.83, 0.97; Shrout and Fleiss, 1979). The subscales also demonstrated high test-retest reliability, in the range of 0.82 (95% CI 0.60, 0.92) to 0.85 (95% CI 0.67, 0.94).

In summary, the results of these investigations indicate that the expanded StimQ-T is a reliable

measure with a distribution of scores that, unlike the StimQ-1, does not indicate a ceiling effect. Moreover, it better captures multiple dimensions of the child's home environment, as indicated by the increase from two to four meaningful factors and the identification of a strong reading factor. In the next study, we evaluated the convergent validity of the StimQ-T by comparing it to the HOME Inventory. The data we present are based on preliminary findings on a first wave of participants entering a large-scale ongoing study.

## STUDY 4

### Method

#### Participants

Forty-five Latino and African-American mothers and their 12–36-month-old toddlers (50% female) have participated in this phase of our research thus far. All children were term singletons at birth and did not have neurodevelopmental or chronic medical problems. Thirty-six per cent of mothers had less than a high school education, 36% of mothers graduated from high school, 28% had some college education and none graduated from

college. All mothers spoke English, although many of the households (58%) were bilingual. The families were almost exclusively from lower socioeconomic strata, with 83% of the families in Hollingshead groups IV or V, the remainder being in group III. Thirty-eight per cent of the mothers identified themselves as married and 53% reported a significant male partner living in the household. All mothers identified themselves as the child's primary caregiver.

#### Procedures

The StimQ-T was administered to the mother in the hospital clinic by one of six trained interviewers. The IT-HOME Inventory was performed on a home visit 1–3 weeks later by another randomly selected tester unaware of the result of the StimQ-T.

#### Results

In the first stage of analyses, total and subscale scores of the StimQ-T were compared with total, subscale and alternative IT-HOME factor scores (as described by Stevens and Bakeman, 1985). As shown in Figure 4, the StimQ-T was significantly

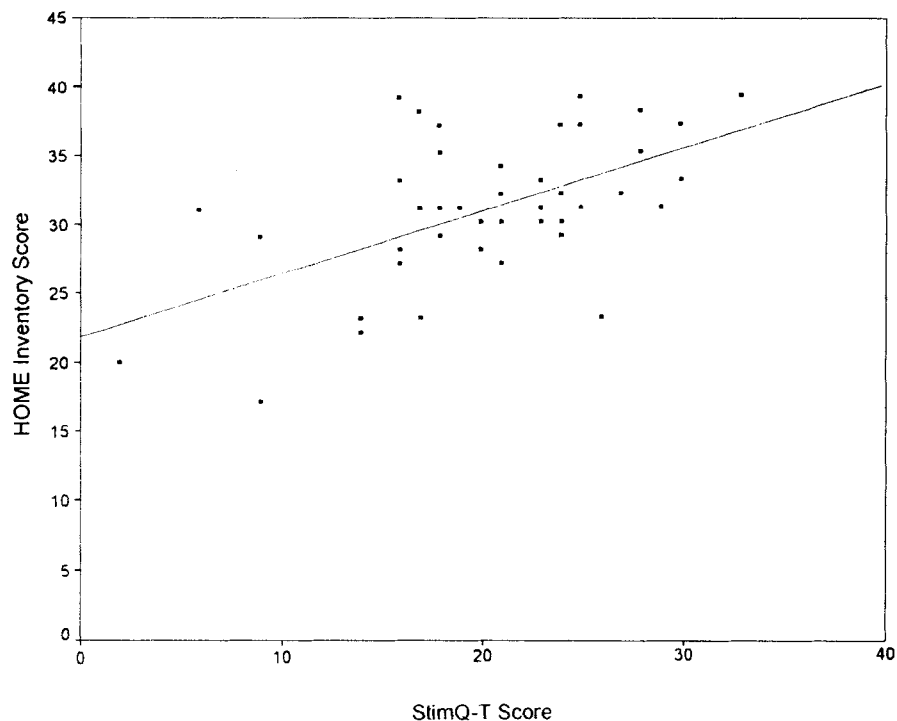


Figure 4. Simple regression of HOME Inventory score on StimQ-T ( $r=0.55$ ,  $p<0.001$ ,  $N=45$ ).

Table 3. Correlations among StimQ-T, IT-HOME and subscale scores

	StimQ-T total	StimQ-T subscale scores			
		ALM	READ	PIDA	PVR
IT-HOME total	0.55***	0.40**	0.41**	0.39**	0.33*
<i>IT-HOME subscale scores</i>					
1. Emotional and verbal responsivity					0.34*
2. Avoidance of punishment					
3. Organization		0.33*			
4. Play materials	0.54***	0.56***	0.31*	0.39**	
5. Involvement	0.41**		0.35*	0.34*	
6. Variety	0.44**		0.31*	0.40**	0.34*

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

related to the IT-HOME,  $r=0.55$ ,  $p < 0.001$ . In addition (see Table 3), the total StimQ-T was significantly correlated with the factor scores of learning materials, parental involvement and variety of experience subscales of the IT-HOME, and all four subscales of the StimQ-T correlated with the total IT-HOME score.

Closer inspection of the data in Table 3 shows that while the READ and PIDA subscales of the StimQ-T reflect the relationship of the StimQ-T total score with the IT-HOME subscale structure, relations between the ALM and PVR subscales of the StimQ-T and IT-HOME subscales are somewhat different from the overall pattern of correlations. The ALM subscale of the StimQ-T relates strongly to the learning materials subscale of the IT-HOME, while not having any significant correlation with the parental involvement and variety of experience subscales of the IT-HOME. The PVR subscale of the StimQ-T is the only subscale showing significant correlation with the parent responsivity subscale of the IT-HOME. Neither the StimQ-T total score nor any of the StimQ-T subscale scores have significant correlations with the avoidance of restriction and punishment subscale of the IT-HOME.

Similar patterns of correlations are seen in the comparison of StimQ-T total and subscale scores with the alternative three-factor structure of the IT-HOME (see Table 4). The StimQ-T total score and scores of all subscales (except the PVR) show significant correlations with factor 1, support for intellectual development. The StimQ-T total score and the PVR subscale score show significant correlations with factor 2, verbal response. Neither the StimQ-T total score nor any of the subscale scores are significantly correlated with factor 3, non-punitive.

### Discussion

This study reveals moderate relations between the StimQ-T and the IT-HOME. While the StimQ-T was designed to measure cognitive stimulation in the home environment, the IT-HOME measures social-emotional and organizational factors as well as cognitive stimulation in the home. Therefore, only moderate correlations were expected. More importantly, the StimQ-T total score is significantly correlated with the three subscales of the IT-HOME that primarily measure cognitive aspects of the environment. The specific pattern

Table 4. Correlations among StimQ-T, subscales and alternative HOME factor scores

Alternative factor structure (Stevens and Bakeman, 1985)	StimQ-T total	StimQ-T subscale scores			
		ALM	READ	PIDA	PVR
Support for intellectual development	0.59***	0.49***	0.53***	0.34*	
Verbal response	0.31*				0.34*
Non-punitive					

\* $p < 0.05$ ; \*\*\* $p < 0.001$ .

of correlations among the subscales of the two measures also supports the construct validity of the StimQ-T. For example, the ALM subscale of the StimQ-T is most strongly related to the IT-HOME learning materials subscale. This correlation would be expected, given that both subscales are constructed to measure the availability of learning materials within the home environment.

The specific association of the PVR subscale of the StimQ-T with the IT-HOME parent responsiveness subscale also supports the construct validity of the StimQ-T, as it is the only subscale designed to measure the unstructured verbal responsiveness of the parent.

No questions were incorporated into the StimQ-T to measure acceptance of the child by the parent and non-punitive parent-child interactions. We would expect no significant correlations between the StimQ-T total score, or any of its subscale scores, and the avoidance of restriction and punishment subscale of the IT-HOME, and the results of this study confirm that expectation.

The comparison of the StimQ-T total and subscale scores with the alternative three-factor structure proposed by Stevens and Bakeman (1985) is of interest because of the significant correlations between three of the StimQ-T subscales (ALM, READ and PIDA) and the total score with factor 1, designated as support for intellectual development. The support for intellectual development factor, measured at 24 months, has been shown to capture the majority of the predictive correlation of the total IT-HOME score to 4-year Stanford-Binet scores in a group of inner-city minority children (Stevens and Bakeman, 1985). The correlation of the StimQ-T with the support for intellectual development factor suggests that the StimQ-T is significantly related to the component of the IT-HOME that best predicts children's later intellectual development.

## CONCLUSIONS

The isolation of parenting dimensions that are particularly important to children's cognitive development is central to both basic and applied scientists. In this paper, we present a series of studies, conducted with poor, urban, minority families, in which we discuss the development and validation of the StimQ, a maternal report measure of the child's cognitive home environment. The StimQ is a brief office-based interview that provides information on the extent to which

parents assist and encourage developmental advance in their children through the structuring and organization of the home environment. As such, it offers an alternative approach to the assessment of children's early experiences that does not rely on home visits or extensive observation and coding.

An initial version of the StimQ (StimQ-1) was found to be a reliable and strong predictor of children's developmental status as measured by the Bayley MDI. However, although StimQ-1 differentiated among at-risk environments, there was concern over its ability to differentiate between adequate and enriched home environments. The revised version, StimQ-T, was developed to address this concern. The internal reliability of StimQ-T and its test-retest reliability were high and factor analyses yielded a clear, interpretable four-factor structure. Moreover, the StimQ-T showed a moderate correlation with the HOME Inventory (Caldwell and Bradley, 1984).

Importantly, correlational patterns between subscales of the StimQ-T and those of the HOME Inventory were highly specialized. Correlations were strongest between the StimQ-T and the subscales and factors of the HOME that reflected cognitive dimensions of the environment (such as provision of play materials and parental involvement with child). In contrast, there were fewer correlations between the StimQ and other non-cognitive subscales of the HOME (such as acceptance of child's behavior). This pattern of correlations was expected given the specific purpose of the StimQ, to assess children's early cognitive experiences.

These findings underscore the benefits the StimQ offers to investigators working in applied settings. Its ease of administration makes it available to a broad audience of researchers and practitioners. In addition, the fact that it has been standardized and normed on lower SES minority populations makes it particularly useful to investigators who work with such under-represented groups. Families such as those that participated in these studies face numerous risks at many levels which often interfere with their abilities to offer a sensitive and supportive environment to children. For example, approximately half of the mothers interviewed in these studies stated that they were single parents; over a third had not completed high school; and the majority were represented in the lowest socioeconomic strata of the Hollingshead. Instruments that validly appraise the nature of

the child's home environment in such groups and that do so in a cost- and time-efficient manner are central to early diagnosis in at-risk populations. In turn, early diagnosis enables practitioners and investigators to intervene and support the optimal cognitive development of poor children across a variety of settings, not just those limited to research.

Nonetheless, the restriction of the present investigations to under-represented groups means that the generalizability of findings may be limited. The psychometric properties of the StimQ and the evaluation of its convergent and predictive validity are as yet only applicable to the population studied, which was largely composed of poor, urban, Latino mothers of 12-36-month-old children. The usefulness of the StimQ-T in populations from other socioeconomic strata is currently being examined. In addition, the development of office-based interviews for parents of children between 5 and 12 months and between 36 and 60 months is in progress. Thus, the generalizability of these data to other ethnic groups, other socioeconomic strata, rural populations and other ages will require further study.

There may be concern that instruments such as the StimQ are primarily measuring differences in socioeconomic status. Indeed, we found that approximately 16% of the variance in StimQ is explained by SES. However, even in a population in which SES was relatively homogeneous, there was a wide distribution of StimQ scores. Furthermore, after controlling for SES and other sociodemographic factors (including children's exposure to lead), the initial version of StimQ still correlated significantly with the Bayley MDI. This suggests that the relation between StimQ and children's cognitive development is not solely explained by SES.

A final question to be asked is whether 'behavioural sensitivity', as expressed in the style of interactions parents engage in with children, relates to parents' structuring of learning experiences (as measured by the StimQ). Traditionally, investigators have focused on the 'quality' of interactions parents engage in with their children (e.g. responsiveness, see Tamis-LeMonda, Bornstein, Baumwell and Damast, this issue) as key indicators of parents' underlying sensitivity. Nonetheless, it is reasonable to speculate that mothers who are 'sensitive' to the cognitive-developmental needs of their children might be more likely to organize the physical environment in a way that is conducive to learning

(e.g. by offering symbolic toy materials to children who are developing representational skills) and to engage in didactic exchanges with their children on a regular basis (e.g. by allocating time for book-reading and by naming objects for their children). Whether StimQ relates to measures of behavioural sensitivity is another question that is being addressed in our current research.

In summary, the StimQ was developed to address the practical needs of clinicians and investigators who seek to assess dimensions of parenting in applied fields, such as clinics and preventive-intervention settings. The StimQ is easy to administer, takes only 20 minutes to complete and can be taught to non-professionals within a few hours. Furthermore, its content structure reflects constructs of parenting found to play a key role in children's unfolding cognitive competences. These characteristics, along with its strong psychometric properties (including its factor structure and short-term reliability), construct and convergent validity (i.e. specialized relations to the HOME) and predictive validity (i.e. prediction to the Bayley MDI) indicate that StimQ offers both clinicians and investigators a valid maternal report index of children's early learning experiences.

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